

BHARATHI WOMEN'S COLLEGE (AUTONOMOUS), CHENNAI - 108**M.Sc. CHEMISTRY**

(CBCS Syllabus for PG students admitted from the academic year 2019-20)

SEMESTER I

Course Component	Code	Title of the paper	Credit	Hrs /week	ESE	CIA	Total
Core T-1	19MCA	Inorganic Chemistry-I	5	6	75	25	100
Core T-2	19MCB	Organic Chemistry-I	5	6	75	25	100
Core T-3	19MCC	Physical Chemistry-I	5	6	75	25	100
Core P-1	19MC1	Organic Chemistry Practical	-	4	-	-	-
Core P-2	19MC2	Inorganic Chemistry Practical	-	4	-	-	-
Core Elective-1(Any one)	19EC1	Industrial Chemistry	4	4	75	25	100
	19EC2	Food Chemistry and Technology	4	4	75	25	100
	19EC3	Forensic Chemistry	4	4	75	25	100
Soft Skill-1	19MS1	Essentials of Language and Communication Skills	2	-	75	25	100

SEMESTER II

Course Component	Code	Title of the paper	Credit	Hrs /week	ESE	CIA	Total
Core T-4	19MCD	Inorganic Chemistry- II	5	5	75	25	100
Core T-5	19MCE	Organic Chemistry - II	5	5	75	25	100
Core T-6	19MCF	Physical Chemistry -II	5	5	75	25	100
Core P-1	19MCI	Organic Chemistry Practical	4	4	60	40	100
Core P-2	19MC2	Inorganic Chemistry Practical	4	4	60	40	100
Core Elective-2 (Any one)	19EC4	Spectroscopic Methods	4	4	75	25	100
	19EC5	Strategic management of Pharma Industry	4	4	75	25	100
	19EC6	Cheminformatics	4	4	75	25	100
Supp. Course-I	19SC1	Environmental Chemistry	3	3	75	25	100
Soft Skill-2	19MS2	Life and Managerial Skills	2	-	75	25	100

SEMESTER III

Course Component	Code	Title of the paper	Credit	Hrs /week	ESE	CIA	Total
Core T-7	19MCG	Inorganic Chemistry - III	5	5	75	25	100
Core T-8	19MCH	Organic Chemistry - III	5	5	75	25	100
Core T-9	19MCJ	Physical Chemistry- III	5	5	75	25	100
Core P-3	19MC3	Physical Chemistry Practical	-	4	-	-	-
Core P-4 Core Elective-3 (Any one)	19MC4	Inorganic Chemistry Practical - II	-	4	-	-	-
	19EC7	Nuclear Chemistry	4	4	75	25	100
	19EC8	Molecular Modeling & Drug Design	4	4	75	25	100
	19EC9	Basics of Computer Programming in C and it's Applications in Chemistry	4	4	75	25	100
Supp. Course-2	19SC2	Biological Chemistry	3	3	75	25	100
Soft Skill-3	19MS3	Essentials of Spoken and Presentation Skills	2	-	75	25	100
Internship	19MS5	Internship	2	-	100	-	100

SEMESTER IV

Course Component	Code	Title of the paper	Credit	Hrs /week	ESE	CIA	Total
Core T-10	19MCK	Organic Chemistry- IV	5	6	75	25	100
Project/AOP	19MC5	Project	6	6	60	40	100
Core P-3	19MC3	Physical Chemistry Practical	4	4	60	40	100
Core P-4	19MC4	Inorganic Chemistry Practical - II	4	4	60	40	100
Core Elective-3 (Any one)	19EC10	Bio Inorganic Chemistry	5	5	75	25	100
	19EC11	Scientific Research Methodology	5	5	75	25	100
	19EC12	Medicinal Chemistry	5	5	75	25	100
Core Elective-3 (Any one)	19EC13	Nanoscience and Green Chemistry	5	5	75	25	100
	19EC14	Agriculture and Leather Chemistry	5	5	75	25	100
	19EC15	Textile Chemistry	5	5	75	25	100
Soft Skill-4	19MS4	Computing Skills - Advanced	2	-	75	25	100

BHARATHI WOMEN'S COLLEGE (AUTONOMOUS), CHENNAI – 600108.

M.Sc CHEMISTRY

INORGANIC CHEMISTRY – I

(For the students admitted from the year 2019-2020)

HOURS PER WEEK : 6

CREDITS : 5

SEMESTER : I

SUBJECT CODE : 19MCA

(90hrs)

Objectives

- To provide knowledge of basic and advanced concepts in bonding and enable the students to identify the structure and bonding of simple molecules.
- To provide an understanding of the various types of solid state packing and the types of chemical forces
- To enable students appreciate the structure of inorganic chain and cluster compounds.
- To provide knowledge of the structure and bonding in boron compounds.

UNIT I : STRUCTURE AND BONDING

(18hrs)

Valence Bond(V.B) approach to bonding-Hitler-London, Pauling and Slater refinements, Concept of hybridization and structure of molecules, VSEPR theory, shapes of molecules. Molecular Orbital(M.O) approach to covalent bonding – symmetry and overlap of atomic orbitals – symmetry of molecular orbitals – sigma and pi bonding – energy levels in homo and hetero nuclear diatomic systems – bond length, bond order and bond energy.

Application to small molecules - BeCl_2 , BCl_3 and CCl_4 , SF_4 . Ionic character in a covalent bond - The concept of multicentre bonding.

Pseudo halogens: Structure and bonding in ClF_3 , BrF_3 , BrF_5 , IF_5 , IF_7 . Oxides and oxyacids of halogens.

Bonding in Noble gas compounds – XeCl_2 , XeF_4 , XeOF_4 , XeF_6 .

UNIT II: CHEMISTRY OF SOLID STATE I: STRUCTURE

(18hrs)

Weak Chemical forces: Vander Waals forces, Hydrogen bonding, Close packing of atoms and ions, HCP and BCC types of packing voids. Radius ratio – derivation – its influence on structures. Lattice energy – Born-Landé equation - Madelung constant.

Representative structures of AB and AB₂ types of compounds - rock salt, cesium chloride, wurtzite, zinc blende, rutile, fluorite, antiferite, cadmium iodide and nickel arsenide. Structure of graphite and diamond.

Spinel - normal and inverse types and perovskite structures.

UNIT III: CHEMISTRY OF SOLID STATE II: DIFFRACTION METHOD

(18hrs)

Band theory of solids- non-stoichiometry- point defects – linear defects- effects due to dislocations-electrical properties of solids-conductor, insulator, semiconductor-intrinsic-impurity semiconductors-optical properties-lasers and phosphors.

Magnetic properties of solids – dia magnetic, para magnetic, ferro magnetic, antiferromagnetic & Ferrites, Hysteresis, Garnets.

X-ray diffraction by single crystal, powder diffraction. Neutron and Electron diffraction – principle, comparison with X-ray Diffraction studies.

UNIT IV: BORON COMPOUNDS AND CLUSTERS

(18hrs)

Chemistry of boron – boranes, higher boranes, borazines, boron nitrides, STYX numbers, Wade's rules. Carboranes- Types such as nido-closo, arachno-preaprtion properties and Structure.

Metallocarboranes-a general study.

Metal clusters: Chemistry of low molecularity metal clusters only, Structure of Re₂Cl₈; multiple metal-metal bonds.

UNIT V: INORGANIC CHAIN AND CLUSTER COMPOUNDS

(18hrs)

Types of inorganic polymers, comparison with organic polymers, silanes, higher silanes, multiple bonded systems, silicon nitrides, siloxanes. Structure of silicates - applications of Pauling's rule of electrovalence – isomorphous replacements in silicates – ortho, meta and pyro silicates – one dimensional, two dimensional and three dimensional silicates.

P-N compounds, cyclophosphazenes and cyclophosphazanes. S-N compounds – S_4N_4 , (SN) $_x$. Isopoly and heteropoly acids – Structure and bonding of 6- and 12 – isopoly and heteropoly anions.

Books for Study:

1. A.G. Sharpe, Inorganic Chemistry, Pearson Education, 2008.
2. A. R. West, Basic Solid State Chemistry, John Wiley, 1991.

Books for Reference:

1. D. E. Douglas, D.H. McDaniel and J. J. Alexander, Concepts and Models in Inorganic Chemistry, 3rd Ed, 1994.
2. M. C. Day, J. Selbin, Theoretical Inorganic Chemistry, 2nd Ed, East West Press, 1985.
3. L. Pauling, The Nature of the Chemical Bond, 3rd Ed., Cornell University Press, 1960.
4. F. A. Cotton, G. Wilkinson, Advanced Inorganic Chemistry, 4th Ed, John Wiley & Sons, 1986.
5. D.F. Shriver, P.W. Atkins, Inorganic Chemistry, 3rd Ed, 1999.
6. E. L. Muetterli, Polyhedral Boranes, Academic Press, NY, 1975.
7. James E. Huheey, Inorganic chemistry, Principle of structure and reactivity.

Website

1. <https://chem.utah.edu>
2. <https://www.pcc.edu>
3. www.byui.edu
4. www.newcastle.edu

Outcome of Learning

Students are able

- To identify the bonding types,
- To understand the structure and packing in solids
- To appreciate the structure of boranes, carboranes, metal clusters and inorganic polymers.

BHARATHI WOMEN'S COLLEGE (AUTONOMOUS), CHENNAI – 600108.

M.Sc CHEMISTRY

ORGANIC CHEMISTRY – I

(For the students admitted from the year 2019-2020)

HOURS PER WEEK : 6

CREDITS : 5

SEMESTER : I

SUBJECT CODE : 19MCB

(90 Hrs)

Objectives

- Understanding the fundamental mechanism involved in electrophilic reactions, nucleophilic reactions and reactions that involve transient species.
- Understanding the basic aspects of stereochemistry such as chirality, nomenclature, stereoselectivity Vs stereospecificity and Asymmetric synthesis.
- Understanding the conformational analysis of six member ring systems.

UNIT I : ALIPHATIC NUCLEOPHILIC SUBSTITUTION

(18hrs)

Mechanism of nucleophilic substitution reaction: SN1, SN2 and SNi mechanisms. Solvent and leaving group effects and neighbouring group participation (NGP). Substitution at carbonyl, vinylic and bridgehead system. Substitution with ambident nucleophiles- “O” Vs “C” alkylation. Role of LDA, crown ethers and phase transfer catalysts (PTC) in nucleophilic substitution reactions.

Generation of enolates, enolate selectivity (Kinetic Vs Thermodynamic), alkylation of enolates and stereochemistry of enolate alkylation. Mechanism of ester hydrolysis (only BAc2, AAc2 and AAl1). Alkylation of active methylene compounds. Asymmetric alkylation (Evans, Enders and Meyers procedures). Preparation and synthetic utility of enamines, Finkelstein reaction, Wurtz coupling.

UNIT II: AROMATICITY

(18 hrs)

Aromaticity of benzenoid, heterocyclic & non-benzenoid compounds. Huckel's rule – aromatic systems with pi-electrons, other than 6 - non-aromatic (cyclo octa tetraene, etc.,) and

anti-aromatic systems (cyclo butadiene, etc.,) – systems with more than 10 pi-electrons.
(18)annulene (synthesis of all these compounds is not expected)

UNIT III : AROMATIC ELECTROPHILIC AND NUCLEOPHILIC

SUBSTITUTIONS

(18hrs)

Aromatic electrophilic substitution: Mechanism of nitration, sulfonation, Friedel-Crafts alkylation and acylation reactions. Synthesis of di- and tri-substituted benzenes from benzene or mono-substituted benzenes. Hammett and Hammett-Taft equation. Haworth reaction (for naphthalene), Scholl reaction, Vilsmeier-Haack formylation, Gattermann reaction, Reimer-Tiemann and Bischler-Napieralski reactions.

Aromatic nucleophilic substitution: Aryl halides by Meisenheimer complex mechanism and benzyne mechanism. Reactions of aryl diazonium salts. Zeigler alkylation, Vicarious Nucleophilic Substitution (VNS), Chichibabin and Schiemann reactions.

UNIT-IV: REACTIVE INTERMEDIATES

(18hrs)

Organic reactive intermediates: Generation, stability and reactivity of carbocations, carbanions, free radicals, carbenes, carbenoids, benzyne and nitrenes.

UNIT-V: STEREOCHEMISTRY

(18hrs)

Chirality, Symmetry elements, Asymmetric and Dissymmetric chiral molecules. Calculation of number of optical isomers. Stereochemistry of mono and di-substituted cyclopropane, cyclobutane, cyclopentane and cyclohexane. Stereochemistry of tri-substituted cyclopentane, trisubstituted pentane and tetra-substituted hexane.

Description of various types of optically active compounds including allenes, cumulenes, spiranes, biphenyls, trans-cyclooctene. Compounds containing two asymmetric centers; Erythro and threo isomers. Conversion of Fischer projection into perspective forms. Erythro and Threo-Inter conversion of Fischer to Sawhorse and Newman projections. Zig-Zag representation of glucose.

Interpretation of homotopic, enantiotopic and diastereotopic atoms and faces. Pro-chiral carbon. Concept of Re and Si- faces. R & S nomenclature of simple compounds, allenes, spiranes and biphenyls.

Stereospecific and Stereoselective reactions. Asymmetric Synthesis-Cram's rule and Felkin-Anh model. Conformational analyses of cyclohexane, di-substituted cyclohexanes and decalin.

Books for Study:

1. E. Eliel, S. H. Wilen and L.N. Mander, , Stereochemistry of carbon compounds, 2nd edition, John Wiley & sons, Newyork. 1994
2. P.S. Kalsi, Stereochemistry and mechanism through solved problems, Wiley Eastern Ltd. 1994.
3. F. A. Carey and R.J. Sundberg, advanced organic chemistry, Part A & B, 4th edition, Plemum press, Newyork, 2001.
4. Jerry March, Advanced organic chemistry, 4th edition, John Wiley and sons, Singapore, 1992.

Books for Reference:

1. D. Nasipuri, Stereochemistry of organic compounds, 2nd edition, Wiley Eastern Ltd. New Delhi. 1994.
2. Niel Isaacs, Physical organic chemistry, ELBS publications, 1987.
3. R. Bruckner, Advanced organic chemistry, reaction mechanism, Elsevier, New Delhi, 2002.
4. T.L. Gilchrist and C.W Rees, carbenes, nitrenes and arrenes, Thomas Nelson & sons Ltd., London.
5. T.L. Gilchrist, Heterocyclic chemistry, 2nd edition, Longman, essex, England, 1992.
6. J.A. Joule and K. Mills, heterocyclic chemistry, 4th edition, Backwell science publishers, England, 2000.

Website

1. www.kfupm.edu
2. www.justonly.com
3. <https://chem.utah.edu>
4. <https://www.anadolu.edu>

Outcome of Learning

- To enable the students to understand various types of reaction mechanisms involved in synthetic organic transformation.
- To enable the students to understand basic stereochemistry concept in a proper perspective.
- To enable the students to understand the concept of asymmetric synthesis.

BHARATHI WOMEN'S COLLEGE (AUTONOMOUS), CHENNAI – 600108.
M.Sc. – CHEMISTRY
PHYSICAL CHEMISTRY – I
(For the students admitted from the year 2019-2020)

HOURS PER WEEK : 6
CREDITS : 5

SEMESTER : I
SUBJECT CODE : 19MCC

(90 Hrs)

Objectives

- To know the limitations of classical thermodynamics in the evaluation of macroscopic properties.
- To understand the chemical kinetics and explore the reaction kinetics of fast reactions
- To learn the various techniques and mechanism involved in catalysis.
- To understand the concepts of group theory
- To apply group theory for determining vibrational modes of hybrid orbitals
- To determine the selection rules for spectral transitions, energies and molecular orbitals

UNIT-I: THERMODYNAMICS

(18hrs)

Fugacity–Determination of fugacity of gases by graphical method-Variation of fugacity with temperature and pressure -Lewis Randal rule-Duhem- Margules equation. Determination of activity and activity coefficient of non-electrolyte (e.m.f method)-Excess functions.

Nernst heat theorem-Third law of thermodynamics-Applications of third law-Entropy change-Calculation of absolute entropies-Apparent exceptions to third law.

Non-equilibrium thermodynamics-Basic concepts- Entropy production-Clausius inequality-Phenomenological equations-Onsager reciprocity relations- Coupled reactions. The principal of microscopic reversibility, the Onsager reciprocal relations – verification.

UNIT-II: CHEMICAL KINETICS AND CATALYSIS

(18hrs)

Absolute reaction rate theory -Thermodynamic terms-Significance of entropy and volume of activation. Reactions in solution: factors determining reaction rates in solutions, effect of dielectric constant and ionic strength, - Bronsted –Bjerrum equation-Primary and

Secondary salt effect, influence of solvent on reaction rates. Acid base catalysis-Bronsted relations, catalytic coefficients and their determination.

Enzyme catalysis and its mechanism, Michaelis-Menten equation, effect of pH and temperature on enzyme catalysis, Mechanism of enzyme inhibition kinetics of surface reactions-unimolecular reactions.

UNIT III : THEORIES OF REACTION RATES (18hrs)

Collision theory, absolute reaction rate theory (ARRT) – effect of temperature on reaction rates – collision cross sections – effectiveness of collisions –significance of reaction co-ordinate, transmission co-efficient .

Theories of unimolecular , bimolecular and termolecular reactions from the point of view of collision, transition state theory -Probability and steric factors – Eyring equation – estimation of free energy, enthalpy and entropy of activation and their significance.

UNIT IV :GROUP THEORY-I (18hrs)

Symmetry elements; symmetry operations, Abelian group-point groups-determination of point group- Group multiplication table - Matrix representation of symmetry operations-Similarity transformations; Space groups of crystals-Mulliken symbols-reducible and irreducible representations; Symbols and rules of irreducible representations-reduction formula-direct product representation; Great orthogonality theorem; character table-construction of character tables C_{2v} , C_{3v} and D_{2h} .

UNIT V: GROUP THEORY-II (18hrs)

Applications of group theory- Determination of representations of vibrational modes in nonlinear molecules such as water, ammonia, BF_3 , CH_4 and XeF_4 .Determination of Hybrid orbitals in non-linear molecules – Examples: H_2O , NH_3 , BF_3 , CH_4 and XeF_4 . SALC procedure-evaluation of energies and molecular orbitals for systems like ethylene and butadiene.Selection rules for spectral transitions. Electronic spectra of formaldehyde and ethylene.

Books for Study:

1. K. J. Laidler, Chemical Kinetics, Harper and Row, New York, 1987.
2. J. Rajaram and J.C. Kuriakose, Thermodynamics for students of chemistry, Lal Nagin Chand, New Delhi, 1986.
3. Swarnalakshmi, Group Theory,

Books for Reference:

1. S. Glasstone, Thermodynamics for chemist, Affiliated East West press, NY., 1980.
2. R. G. Frost and Pearson, Kinetics and Mechanism, Wiley New York, 1961.
3. C. Capellos and B. H. J. Bielski, Kinetic Systems, Wiley Interscience, New York, 1968.
4. R. G. Frost and Pearson, Kinetics and Mechanism, Wiley New York, 1961.
5. G. M. Harris, Chemical Kinetics, D. C. Healthand Co, 1966.
6. G. L. Agarwal, Basic Chemical Kinetics, Tata McGraw Hill, 1990.
7. F. A Cotton, Chemical Applications of Group Theory, Wiley Publication, 3rd Edition.

Website

1. <https://www.chem.iastate.edu>
2. <https://www.acs.org>
3. <https://pubs.acs.org>
4. <https://chem.utah.edu>

Outcome of Learning

- To know the limitations of classical thermodynamics in the evaluation of macroscopic properties.
- To understand the principles of activity and fugacity.
- To understand and explore the reaction kinetics of fast reactions
- To learn the theory, kinetics and mechanism of enzyme catalysis.
- To understand the rules and concepts of group theory
- To apply group theory for determining vibrations and hybrid orbitals

BHARATHI WOMEN'S COLLEGE (AUTONOMOUS), CHENNAI – 600108.

**M.Sc CHEMISTRY
CORE ELECTIVE – I
INDUSTRIAL CHEMISTRY**

(For the students admitted from the year 2019-2020)

HOURS PER WEEK : 4

CREDITS : 4

SEMESTER : I

SUBJECT CODE : 19EC1

(60Hrs)

Objectives

- To know the importance of chemistry in industrial field.
- To know the importance of electro chemical methods and coatings
- To study the importance of water analysis

UNIT I : WATER

(12hrs)

Characteristic of water, types of impurities in water – hard water, soft water – removal of hardness – internal method – external method – lime soda process – zeolite process – ion exchange process – Desalination of brackish water – reverse osmosis and electrophoresis – problems on hardness of water.

UNIT II : ELECTROCHEMICAL METHODS

(12hrs)

Introduction – advantages of electrochemical methods – Industrial applications of electrolysis – electrolysis of melts – electrode materials – requirement for electrode materials – cathode materials – anode materials – polarisable and non-polarisable electrodes – Aluminium - raw materials – quantitative requirements – carbon electrodes – manufacture of aluminium.

UNIT III : CORROSION

(12hrs)

Introduction – types of corrosion – Dry or chemical corrosion – wet (electrochemical) corrosion – chemical corrosion – factors affecting chemical corrosion – theories of wet corrosion – Galvanic corrosion – concentration corrosion – different types of concentration corrosion – pitting corrosion – intergranular corrosion – waterline corrosion – stress corrosion – corrosive agents – prevention of corrosion .

UNIT IV : METALLIC COATINGS

(12hrs)

Introduction –electro deposition of metals from solution –general procedure, coating process, hot dipping-metal cladding-electrode position or electroplating –applications of electroplating –Factors influencing the nature of deposit –preparation of materials for electroplating- electroplating of some metals-displacement or immersion plating – impregnated coating –vapour deposition.

UNIT V: DYES AND PIGMENTS

(12hrs)

Classification of dyes –acidic dyes,basic dyes,direct or substantive dyes-mordant or adjective dyes,vat dyes,pigment dyes-classification of dyes based on chemical constitution – nitroso dyes-nitro dyes-azo dyes-mordant azo dyes –diphenyl methane dyes-Xanthene dyes – Anthroquinone dyes-Application of dyes.

Textile processing- Bleaching-Dyeing- Printing. Uses of dyes- Vat dyes, Reactive dyes and Pigment dyes.

Pigments: characteristics of pigments –physical properties-Uses-Titanium dioxide-manufacture. Blue and red pigments –properties-manufacture and uses.

Books for Study:

1. A. Ravikrishnan, Engineering chemistry , Krishna Publications, 2007.
2. B.K. Sharma, Industrial chemistry, Krishna's educational publishers, 2014.
3. V. A Shenai, Technology of textile processing, Volume 5.

Books for Reference:

1. M.G. Arora, Industrial chemistry, Anmol publications, 2002.
2. S.S. Dara and S. Chand,Text book of engineering chemistry, 2004.
3. George.T. Austin, Shreve's chemical process industry, McGraw Hill, 1984.
4. Jayashree ghosh, S. Chand, Fundamental concepts of applied chemistry, 2010.

Website

1. <https://www.soci.org>
2. <https://en.m.wikipedia.org>
3. <https://chem.utah.edu>

Outcome of Learning

- To know about physical and chemical processes towards the transformation of raw materials into products.
- To study about a organometallic chemistry in industry and industrial applications.
- To learn about link between the chemicals in research and industrial field.
- To learn about commercial manufacturing process technology of various chemicals and solvents.

BHARATHI WOMEN'S COLLEGE (AUTONOMOUS), CHENNAI – 600108.

M. Sc CHEMISTRY

FOOD CHEMISTRY AND TECHNOLOGY

(For the students admitted from the year 2019-2020)

HOURS PER WEEK : 4

CREDITS : 4

SEMESTER : I

SUBJECT CODE : 19EC2

(60Hrs)

Objectives

This skill based course provides

- Students the basic knowledge in Food Chemistry and modern trends in the industry.
- To provide the practical training to the students in the food analysis

UNIT I: INTRODUCTION

(12hrs)

Food: source, functions of food –food guide –usage of the food guide – food in relation to health – objectives of cooking..

Water: Purification processes – Ion exchangers, reverse osmosis, activated charcoal treatment. Use of chlorination, ozone, and UV light disinfection. Specification of drinking water. Water borne diseases – microbiological examination. Sources and detection.

Milk: Fat content in milk, whole and skimmed.Effect of cooking and heat processing of milk – pasteurization. Preservation of milk. Deep freeze preservation, dairy products – cheese, butter, ghee and kova. Spray drying technique – milk powder, infant food preparation.

UNIT II: NUTRITION AND BALANCED DIET

(12hrs)

Nutrition – calorific value of food stuff – RQ of food (Respiratory quotient of food) – basal metabolic rate – factors influencing BMR, specific dynamic action (SDA) of food.

Thermogenic effect – energy requirements of individuals – diet and its components – the protein requirements – biological value of proteins, supplementary value of proteins.Diseases associated with protein malnutrition.

UNIT III: CONSTITUENTS OF FOODS

(12hrs)

Proteins: amino acids – peptides – proteins, modification of food products through heat processing. Effect of cooking – steaming or cooking under pressure of legumes. Detoxication.

Analysis of proteins – principles in the determination of moisture content, ash content, nitrogen content – Kjeldahl's method. Separation of amino acids by paper chromatography, separation of proteins by electrophoresis.

Carbohydrates: Classification, structure and reactions of monosaccharides, glucose, fructose, structure of sucrose, maltose, lactose and starch. Artificial sweetening agents. Effect of cooking on the nutritive value of rice and of baking of wheat – bread and biscuit, processing and storage of carbohydrates. Principles involved in the analysis of carbohydrates – analysis of glucose, starch, Benedict method, Anthrone method, Neilson–Somoyogi method, analysis of crude fibers – estimation of carbohydrates in wheat flour

Minerals and vitamins: Sources, functions, bioavailability and deficiency of the following minerals (calcium, iron, iodine, fluorine, sodium and potassium (elementary treatment). Vitamins - classification, sources, functions and deficiencies of fat- soluble vitamins – A, D, E and K, water-soluble vitamins – C, thiamin, niacin, riboflavin, B complex, - B6, Folic acid and B12. Fortification with vitamins and minerals. Effect of cooking on vitamins and minerals – different methods of cooking of vegetables, fruits – dehydrated fruits, canned fruit, canned fruit juices. Estimation of thiamine and riboflavin (fluorimetry), Estimation of metals in tea dust – principles.

UNIT IV: FOOD ADULTERATION AND HYGIENE (12hrs)

Adulterants: Common adulterants in different foods – milk and milk products, vegetable oils, and fats, spices and condiments, cereals, pulses, sweetening agents and beverages. Contamination with toxic chemicals – pesticides and insecticides. Principles involved in the analysis of detection and prevention of food adulteration.

Food preservation and processing : Food deterioration, methods of preservation and processing.

Quality control: Specifications and standards: PFA, FPO, FDA, drug license, WHO standards, ISI specifications, packing and label requirements, essential commodities act, consumer protection act. AGMARK.

UNIT V: FOODS AND FOOD ADDITIVES:

(12hrs)

Food additives: Artificial sweeteners – saccharin, cyclamate, aspartame – food flavours

– esters, aldehydes and heterocyclic compounds. Antioxidants. Food colours – changes in cooking. Restricted use.

Modern food: Mushroom cultivation and types, spirulina composition. Snack foods. Production of bread, bun and biscuits. Raw materials, methods and machinery required. Candy manufacturing. Caramellisation, Fast foods. Instant foods. Dehydrated foods.

Beverages: Soft drinks, soda, fruit juices and alcoholic beverages. Composition of soft drinks. Excessive use leading to urinary bladder stones. Preservation of tetrapak. Nitrogen preservation and packing of fruit juices. Coconut water.

Books for Study:

1. Shakuntala Manay N. and Shadaksharaswamy M. FOODS: Facts and Principles. New age International Pvt. Ltd. Publishers, II ed. 2002
2. Swaminathan M. Text Book on Food chemistry, Printing and Publishing CO., Ltd., Bangalore. 1993.
3. Owen R Fennema, Food Chemistry, Marcel Decker Inc., New York. 1996.
4. Srilakshmi B., Food Science, New age International Pvt. Ltd. Publishers, III ed. 2003.

Books for Reference:

1. Lillian Hoagland Meyer, Food Chemistry, CBS publishers and distributors, New Delhi. 1994.
2. Swaminathan M. Advanced Text Book on Food and Nutrition , volume I and II Printing and Publishing CO., Ltd., Bangalore. 1993.
3. Ramakrishnan S., Prasannam K.G and Rajan R –Principles. Text book of medical biochemistry. Orient Longman Ltd. III ed. 2001.
4. Siva Sankar B., Food Processing and Preservation. Prentice – Hall of India Pvt. Ltd., New Delhi. 2002.
5. Norman N. Potter , Food science, CBS publishers and distributors, New Delhi. 1994.

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M.Sc CHEMISTRY

FORENSIC CHEMISTRY

(For the students admitted from the year 2019-2020)

HOURS PER WEEK : 4

CREDITS : 4

SEMESTER : I

SUBJECT CODE :19EC3

(60hrs)

Objective:

- To know about history and development of forensic chemistry crime detection, forgery, counterfeit, misuse of drugs, cybercrime

UNIT I: INTRODUCTION

(12hrs)

Definition, History, Development and Scope of Forensic Science. Divisions of Forensic Science and Laboratory Set up. Forensic Chemistry: Introduction, Conventional methods of chemical analysis, presumptive tests (colour & spot); Drugs of Abuse: Introduction and classification; Forensic Toxicology: Introduction and General Methods of chemical analysis for alcohol, Classification of Poisons.

UNIT II: CRIME DETECTION

(12hrs)

Accidental explosions during manufacture of matches and fire-works (as in Sivakasi). Human bombs, possible explosives (gelatin sticks, RDX). Metal detector devices and other security measures for VVIP. Composition of bullets and detection of powder burns. **Scene of crime:** finger prints and their matching using records. Smell tracks and police dogs. Analysis of blood and other body fluids in rape cases. Typing of blood. DNA finger printing for tissue identification in 55bodies. Blood stains on clothing. Cranial analysis (head and teeth).

UNIT III: FORGERY AND COUNTERFEITING

(12hrs)

Detecting forgery in bank cheques / drafts and educational records (mark lists, certificates), using UV- light. Alloy analysis using AAS to detect counterfeit coins. Checking silver line water mark in currency notes. Jewellery: detection of gold purity in 22 carat ornaments, detecting gold plated jewels, authenticity of diamonds (natural, synthetic, glassy).

UNIT IV: MEDICAL ASPECTS: AIDS

(12hrs)

Cause and prevention. Misuse of scheduled drugs. Burns and their treatment by plastic surgery. Metabolite analysis, using mass spectrum – gas. Detecting steroid consumption among athletes and race horses.

UNIT V: IDENTIFICATION AND DETECTION

(12hrs)

Identification and detection of biological fluids (Blood, Semen, Saliva and Urine) and their Medico- logical importance. Personal Identification through somatometry and Somatoscopy; Study and hair and fibers. Examination of skeletal remains-identification of bones, differentiation between human and non human, determination of age, sex and height from skeletal remains. Modern Developments and their concepts (Nacre analysis, Brain fingerprinting, DNA Profiling, voice identification, Cyber crime, Forensic Odontology and Bitemarks).

Outcome:

- To be well versed in development and scope of forensic science
- To clearly explain the general methods of chemical analysis for alcohol and classification
- of poisons
- To understand the concept of crime detection
- To know the concept of DNA finger printing for tissue identification in bodies
- To clearly explain the forgery and counterfeiting
- To clearly understand burns and their treatment by plastic surgery
- To clearly explain the concept identification and detection of biological fluids and their
- Medico-logical importance
- To be well versed in modern developments and their concepts

Books for Study:

1. B.R. Sharma: Forensic Science in Criminal Investigation and Trials, Central Law Agency, Allahabad (2003).
2. S. Nath: An Introduction to Forensic Anthropology, Gian Publishing House, N. Delhi (1989).

Books for Reference:

1. K. S. Narayan Reddy, The Essentials of Forensic Medicine and Toxicology, 12th ed., Sri Lakshmi Art Printers, Hyderabad, 1990.
2. R. Saferstein: Criminalistics, Prentice Hall (1998).
3. W.G. Eckert: Introduction of Forensic Science, CRE Press, Bock Raton (1997).

4. I.P. Singh and M.K. Bhasin: A Laboratory Manual of Biological Anthropology, K.R. Enterprises, N. Delhi (2005).
5. S. Nath: Personal Identification through Fingerprints, Shree Publisher & Distributors, New Delhi (2006).

BHARATHI WOMEN'S COLLEGE (AUTONOMOUS), CHENNAI – 600108.

M. Sc CHEMISTRY

INORGANIC CHEMISTRY – II

(For the students admitted from the year 2019-2020)

HOURS PER WEEK : 5

CREDITS : 5

SEMESTER : II

SUBJECT CODE : 19MCD

(75hrs)

Objectives

- To understand the importance of co-ordination compounds in the energy fields
- To know the thermodynamic and stereochemical aspects of complex formation
- To learn about various theories of complexes and their magnetic properties
- To understand term symbols and energy level diagram of weak and strong field ligands, charge transfer spectra and spectral properties of lanthanides and actinides.
- To learn about various mechanisms of substitution and electron transfer reactions.
- To study the recent development in the catalysis

UNIT I: STABILITY OF COMPLEXES

(15hrs)

Stability of complexes - Factors affecting stability of complexes, Thermodynamic aspects of complex formation, Stepwise and overall formation constants.

Determination of stability constant and composition of the complexes- Bjerrum's half method, Spectrophotometric method, Job's method. Stereochemical aspects- Stereoisomerism in inorganic complexes- Isomerism arising out of ligand distribution and ligand conformation, Macrocyclic ligands- Porphyrins, Cryptands, Schiff's bases, crown ethers.

UNIT-II: METAL LIGAND BONDING

(15hrs)

Crystal field theory: Splitting of d orbitals under various geometries - factors affecting splitting, CFSE, uses of CFSE, spectrochemical series, Application of CFT – Magnetic and spectral properties . Limitations of CFT, Jahn Teller distortion – Dynamic and Static J.T. effect, Jahn Teller effect and chelation.

MOT – MO theory and energy level diagrams, concept of weak and strong fields, sigma and pi bonding in octahedral, square planar and tetrahedral complexes. Nephelauxetic effect. Comparison of CFT and MOT of bonding in octahedral complexes.

UNIT-III: ELECTRONIC SPECTRA OF COMPLEXES (15hrs)

Spectroscopic term symbols for d^n ions – derivation of term symbols and ground state term symbol, Hund's rule, Selection rules – breakdown of selection rules, spin orbit coupling. Orgel diagram for weak field O_h and T_d complexes, limitations of Orgel diagram, Tanabe–Sugano(T-S) diagrams – Evaluation of Dq and B values for d^2 – d^8 complexes and charge transfer spectra. Comparison between d-d bands and CT bands.

UNIT IV: ANALYTICAL TECHNIQUES (15hrs)

Thermogravimetric analysis - Instrumentation and its applications – Differential thermal analysis – Instrumentation and applications – Differential scanning calorimetry – Instrumentation, types and applications.

Chromatography – principles – Gas chromatography – basic parts of gas chromatography – methods of measurement of peak areas – Liquid chromatography – types of liquid chromatography – Column chromatography – Thin layer chromatography – Paper chromatography – high pressure liquid chromatography(HPLC) – Amino acid analysis.

UNIT-V: ESR AND MÖSSBAUER SPECTROSCOPY (15hrs)

ESR spectroscopy-Introduction, presentation of ESR spectra g and A parameters, spin densities, Mc-Connel relationship, factors affecting the magnitude of g and A . Zero field splitting, Kramer's degeneracy, ESR spectra of $V(II)$, $Mn(II)$, $Fe(II)$, $Co(II)$, $Ni(II)$, $Cu(II)$ complexes, bis(salicylaldehyde)copper (II), $[(NH_3)_5Co-O_2-Co(NH_3)_5]^{5+}$.

Mössbauer spectroscopy –Introduction, principle, instrumentation, recoil energy, Doppler effect, number of MB signals, isomer shift, quadrupole splitting, magnetic hyperfine splitting applications to ^{57}Fe , ^{119}Sn and ^{129}I compounds.

Books for Study:

1. U. Malik, G.D. Tuli and R. D. Madan, Selected topics in inorganic chemistry, 1992.
2. J. D Lee, Co-ordination chemistry.
3. J. E. Huheey, Inorganic chemistry - Principles, structure and reactivity, IV edition, Harper Collins, NY., 1993.

4. D.A. Skoog and D.M. West, Fundamental of analytical chemistry, IV edition, Old Reinhord and Winston publication, 1982.
5. V.K. Srivatsava and K. Kishore, Introduction to Chromatography.

Books for Reference:

1. F.A. Cotton and J. Wilkinson, Advanced inorganic chemistry – A Comprehensive Text, V edition, John Wiley and sons, 1988.
2. D.F. Shrivvers, P.W. Atkins and C. H. Langford, Inorganic chemistry, C. H. Langford. OUP., 1990.
3. S.F.A. Kettle, Co-ordination chemistry, ELBS., 1973.
4. K. Burger, co-ordination chemistry, Burtterworthy, 1973.
5. Willard Merit, Dean and Settle, Instrumental methods of analysis, VI edition, CBS Publ., 1986.
6. A.I. Vogel, Text book of qualitative inorganic analysis, III edition, ELBS., 1976.
7. Paul Monk, Fundamentals of electro analytical chemistry.
8. A. R. West, Solid State Chemistry.

Website

1. <https://www.unf.edu.chem>
2. <https://www.sciencedirect.com>
3. <https://www.nature.com>
4. www.newcastle.edu

Outcome of Learning

- Students gain knowledge about
- Stability constant, types of macrocyclic ligands and nomenclature of chiral complexes
- Evaluating the value of Dq and B values with the help of Orgel diagrams
- Distortion in co-ordination complexes concept of sigma and pi bonding in complexes,
- Application of substitution reactions in the synthesis of Platinum and Cobalt complexes
- The use of catalytic activity of co-ordination complexes in the synthesis of organic compounds.

BHARATHI WOMEN'S COLLEGE (AUTONOMOUS), CHENNAI – 600108.

M.Sc CHEMISTRY

ORGANIC CHEMISTRY – II

(For the students admitted from the year 2019-2020)

HOURS PER WEEK : 5

CREDITS : 5

SEMESTER : II

SUBJECT CODE : 19MCE

(75 Hrs)

Objectives

- To understand the aromatic nature of organic compounds
- To appreciate the concept of addition, elimination reactions, their mechanism and synthetic utility.
- To Understand rearrangement and name reactions along with their mechanism and synthetic utility.

UNIT-I: ADDITION TO CARBON-CARBON DOUBLE BOND

(15 hrs)

Electrophilic addition to carbon-carbon double and triple bonds. Nucleophilic addition to carbon-carbon multiple bonds. Generation and addition of carbenes-Michael addition and Robinson annulation. Hydroxylation of olefinic double bonds (OsO_4 , KMnO_4); Woodward and Prevost oxidation. Epoxidation using peracids including Sharpless epoxidation, Ozonolysis. Hydrogenation (homogenous and heterogeneous) and Transfer hydrogenation. Hydration of carbon-carbon double and triple bonds.

UNIT-II: ADDITION TO CARBON-OXYGEN DOUBLE BOND

(15 hrs)

Nucleophilic addition to $\text{C}=\text{O}$ bond. A study of Mannich, benzoin, Darzen's glycidic ester, Stobbe and Knoevenagel condensation reactions; Wittig, Wittig-Horner olefination reactions; Sulfur and Sulfonium ylides and their reactions, Julia olefination & Peterson alkene synthesis. Asymmetric reduction of carbonyl functions (Corey's procedure).

UNIT-III: ELIMINATION REACTIONS

(15 hrs)

Elimination reactions: E_1 , E_2 , $\text{E}_{1\text{cb}}$ and E_{i} -elimination. Conformation of mechanism – effect of solvent, substrate, leaving group - Saytzeff's Vs Hoffman elimination; Stereochemistry of E_2 eliminations, Elimination in cyclohexane ring system; Mechanism of pyrolytic

eliminations. Examples: Chugaev reactions and Cope elimination, Hoffmann degradation and pyrolysis of esters.

UNIT-IV: MOLECULAR REARRANGEMENTS

(15 hrs)

A study of mechanism of the following rearrangements: Beckmann, Curtius, Hofmann, Schmidt, Lossen, Wolff, Pinacol, Wagner Meerwin, Dienone-Phenol, Favorski, Benzidine, Claisen, Cope and Sommet-Hauser rearrangements.

A study of the following name reactions: Dieckmann cyclization, Hofmann-Löffler Freytag reaction, Shapiro reaction, Eschenmoser-Tanabe and Ramburg-Backlund reactions.

UNIT V : GEOMETRICAL ISOMERISM AND CONFORMATIONAL ANALYSIS

(18hrs)

E, Z nomenclature of olefins, Geometrical and optical isomerism of disubstituted cyclopropane, cyclobutane and cyclopentanes. Identification of enantiotopic, homotopic, diastereotopic hydrogens and pro-chiral carbons in compounds containing upto 10 carbons only.

Conformation of some simple 1,2 – disubstituted ethane derivatives. Saw-horse and Newmann projections. Conformational analysis of di-substituted cyclohexanes and their stereochemical features (geometrical and optical isomerism shown by these derivatives). Conformation and reactivity of substituted cyclohexanols. conformation and stereochemistry of cis & trans – 9 methyl decalin.

Books for Study:

1. F. A. Carey and R.J. Sundberg, Advanced Organic Research, part A & B, 4th edition, Plenum Press. Newyork, 2001.
2. E. Eliel, S. H. Wilen and L.N. Mander, , Stereochemistry of carbon compounds, 2nd edition, John Wiley & sons, Newyork. 1994
3. P.S. Kalsi, Stereochemistry and mechanism through solved problems, Wiley Eastern Ltd. 1994.

Books for Reference:

1. S. N. Sanyal- Reactions, Rearrangements and reagents
2. W. Carruthers, Some Modern Methods of Synthesis, 3rd edition, Cambridge University Press, 1993.
3. S. M. Mukherji and S.P. Singh, Reaction mechanism.

4. D. Nasipuri, Stereochemistry of organic compounds, 2nd edition, Wiley Eastern Ltd. New Delhi. 1994.

Website

1. <https://www.organicchemistry>
2. <https://www.masterorganicchemistry.com>
3. <https://www.chemistryguide.org>
4. <https://en.m.wikipedia.org>

Outcome of Learning

- To enable the students to understand reaction mechanisms involved in additions, and elimination reactions.
- To enable the students to understand reaction mechanisms involved in rearrangements as well as name reactions along with their synthetic utilities.
- To enable the students to understand various types of oxidation and reduction reactions along with their synthetic utilities.

BHARATHI WOMEN'S COLLEGE (AUTONOMOUS), CHENNAI – 600108.

M.Sc CHEMISTRY

PHYSICAL CHEMISTRY – II

(For the students admitted from the year 2019-2020)

HOURS PER WEEK : 5

CREDITS : 5

SEMESTER : II

SUBJECT CODE : 19MCF

(75 Hrs)

Objectives

- To learn the principles of quantum mechanics of simple systems and multi electron atoms.
- To understand the photo reactions and its applications.
- To understand the basic concepts of surface chemistry and colloids.

UNIT I:QUANTUM CHEMISTRY -I

(15hrs)

Black body radiation-Planck's quantum theory-Wave particle duality-Uncertainty Principle. Operators-linear, commutation, Hermitian and Hamiltonian operators. Eigen functions and Eigen values-Postulates of quantum mechanics.

Derivation of Schrodinger's time-independent wave equation and its application to particle in a one dimensional box, particle in a three dimensional box, harmonic oscillator, rigid rotor and hydrogen atom.

UNIT-II: QUANTUM CHEMISTRY-II

(15 hrs)

Born-Oppenheimer approximation-Hydrogen molecule ion. LCAO-MO and VB treatments of the hydrogen molecule.Antisymmetry and Pauli's exclusion principle. Term symbols and spectroscopic states-Russell Saunders coupling.

The variation theorem and Perturbation theory.Applications of variation method and perturbation theory to the helium atom. Hybridization-determination of bond angles of sp , sp^2 and sp^3 hybridizations.Huckel pi electron (HMO) theory and its applications to ethylene, butadiene and benzene.

UNIT – III : PHOTOCHEMISTRY I

(15 hrs)

Absorption and Emission of radiation, Franck – Condon principle – Decay of electronically excited states – radiative and non-radiative processes – fluorescence and phosphorescence – spin forbidden radiative transition. Internal conversion and inter system crossing – energy transfer processes, excimers and exciplexes- static and dynamic quenching. Stern – Volmer equation.

UNIT IV: PHOTOCHEMISTRY II

(15 hrs)

Experimental methods – quantum yield and life time measurements, steady state principles, chemical actinometry, photo physical processes and kinetics of photochemical reactions –photo catalysis - photosensitized reactions, photovoltaic and photo galvanic cells, photo electrochemistry, photo assisted electrolysis of water. Applications in polymers. Aspects of solar energy conversion using perovskites.

UNIT V: ADSORPTION

(15 hrs)

Fundamental concepts – surface tension, curved surfaces, capillary action. Adsorption-factors affecting adsorption. Unimolecular adsorption – Freundlich, Langmuir – simple, dissociation, competitive and non-ideal adsorption.

Multimolecular adsorption: Brunauer- Emmett and Teller, Harkins-Jura equations. Types of adsorption isotherms. Adsorption from solution- Gibbs adsorption isotherm, surface films.

Kinetics of bimolecular reactions on surfaces: Eley- Rideal and Langmuir-Hinshelwood mechanisms .

Books for Study:

1. Rohatgi and Mukherjee, Fundamentals of photochemistry, WileyEastern Ltd., London, 1978.
2. J. Rajaram & C. Kuriakose, Kinetics and mechanism of chemical transformation, Mcmillan India Ltd.,1993.
3. R. K. Prasad, Quantum chemistry, Wiley Eastern, New Delhi, 1992.

Books for Reference:

1. D.A. McQuarrie, Quantum chemistry, University science books, Mil Valley, California, 1983.
2. Ira N. Levine, Allyn and Bacon, Boston, Quantum chemistry, 1983.

3. R. Anantharaman, Fundamentals of Quantum chemistry, Mcmillan India Ltd., 2001.
4. R. G. Frost and Pearson, Kinetics and mechanism, Wiley, Newyork, 1961.
5. W. J. Moore and R. G. Pearson, Kinetics and mechanism, 1981.
6. J. Goodman, Contemporary Quantum chemistry - an introduction, Plenum press, 1997.
7. H. Eyring, J. Walker and G. Gimball, Quantum chemistry, John Wiley & sons, 1944.
8. L.S. Pauling and F.B. Wilson, Introduction to Quantum Mechanics, McGraw Hill Book company, Newyork, 1935.
9. P.W. Atkins, Molecular Quantum mechanics, Oxford University Press, Oxford, 1983.
10. G. Calvert and J. N. Pitts Wiley, Photochemistry London, 1966.
11. N. J. Turro, Benjamin, Cummings, Menlopark, Calofornia, Modern molecular photochemistry, 1978.
12. R.P. Wayne, Butterworths, Photochemistry, London, 1970.
13. P. W. Atkins, Physical chemistry, Oxford University Press, 1990.

Website

1. <https://www.whatis.techtargt.com>
2. <https://www.nature.com>
3. <https://www.sciencedaily.com>
4. <https://chem.utah.edu>

Outcome of Learning

After completing this course, the students will

- Learn the principles and postulates of quantum mechanics of simple systems.
- Learn the quantum mechanical treatment of multi electron systems.
- Learn the photosensitized reactions and its importance.
- Learn the importance of monolayer and multi layer adsorption.

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M.Sc CHEMISTRY

CORE ELECTIVE – II, SPECTROSCOPIC METHODS

(For the students admitted from the year 2019-2020)

HOURS PER WEEK : 4

CREDITS : 4

SEMESTER : II

SUBJECT CODE : 19EC4

(60hrs)

Objectives

- To understand the quantization of energy and interaction of electromagnetic radiation with matter.
- To understand the fundamentals of different branches of spectroscopy.
- To elucidate the structures of molecules using different spectral techniques.

UNIT I: IR SPECTROSCOPY

(12hrs)

Basic Principles–Instrumentation - FT-IR-sampling techniques, vibrational frequencies - Factors influencing vibrational frequencies-applications of IR-identity by Finger Print region and functional groups,ATR ,IR,RAIR.

UNIT II : RAMAN SPECTROSCOPY

(12hrs)

Theory – Rayleigh and Raman Scattering – Stokes and Anti-stokes lines – Instrumentation – Polarization measurements – Comparison of Raman with IR spectroscopy – Applications,SERS.

UNIT III: NMR SPECTROSCOPY

(12hrs)

Parameters of NMR - chemical shift, shielding and deshielding, factors affecting chemical shift-inductive effect, anisotropy, hydrogen bond. Region of proton chemical shift inorganic molecules, chemical shift equivalence and magnetic equivalence. NMR of paramagnetic compounds: Shift reagents in NMR. Spin-spin splitting - mechanism and application to structure determination. Coupling constants: mechanism of coupling, first order

patterns, second order effects, examples of AB, AX, ABX systems, geminal coupling, vicinal coupling, variation of coupling constants with bond angle.

Fourier Transform (FT) and 2D NMR spectroscopy : Principle of FT-NMR, Free induction decay (FID). Introduction of 2D techniques: Correlation spectroscopy (COSY), Nuclear overhauser effect spectroscopy (NOESY) and Hetero-COSY. ^{13}C , ^{19}F and ^{31}P NMR spectra of typical examples.

UNIT IV: ESR SPECTROSCOPY

(12hrs)

Theory – ‘g’ value – spin density and McConnell relationship - hyperfine splitting – coupling constants, zero field splitting – selection rules – spectra of Mn(II), Cu(II) complexes, ESR spectra of methyl radical, benzene radical. Double Resonance Techniques –ENDOR, ELDOR.

UNIT V: MASS SPECTROMETRY

(12hrs)

Origin, basics and bloc diagram of Mass spectrum-Variety of Ionization techniques-Stability of Molecular ions, Meta stable ions. Base peaks and Isotope peaks. Fragmentation patterns of organic molecules such as benzenes, phenyl halides, phenols, benzyl alcohols, benzyl halides, aliphatic alcohols, aliphatic and aromatic aldehydes, ketones, acids, esters and amides.

Fragmentation patterns of aliphatic/aromatic nitro and amine compounds. Fragmentation patterns of heterocyclic compounds (furan, pyrrole and pyridine only). McLafferty rearrangements of organic molecules.

Books for Study:

1. B.K. Sharma, Spectroscopy Goel publishers, 1998.
2. P.S. Kalsi, Spectroscopy of organic compounds, Wiley Eastern Ltd, 2002.
3. William Kemp, Organic Spectroscopy Palgrave MacMillan, 3rd edition, 1991.

Books for Reference:

1. C.N.R. Rao, J.R. Ferraro, Spectroscopy in inorganic chemistry, Vol I & II, Academic Press, 1970.
2. G.Arul Dhas, Molecular structures and spectroscopy, Prentice Hall.

3. M.F. Lippert , Physical inorganic chemistry - Inorganic electron spectroscopy, 1968.
4. Russel Drago, Physical methods in Inorganic chemistry, Reinhold publishers, 1968.
5. R.M. Silverstein, G.C. Bassler and Morrill, Spectroscopic Identification of Organic Compounds, 5th edition, John Wiley and sons, NY, , 1991.
6. P.S. Kalsi, Spectroscopy of organic compounds, Wiley Eastern Ltd, 2002.
7. William Kemp and Palgrave, Organic Spectroscopy MacMillan, 3rd edition, 1991.
8. Willard, Merritt, Dean and Settle, Instrumental methods of Analysis, CBS Publishers and Distributors, 6th edition, 1986.
9. D. A. Skoog, D.M West, F. J Holler, Fundamentals of Analytical Chemistry, 7th edition, Harcourt College Publishers ,Singapore. (Page 523-665)
10. C. N Banwell and E. M McCash, Fundamentals of Molecular Spectroscopy, 4th edition, Tata McGraw-Hill ,New Delhi ,1994.
11. R. Wilfred Sugumar, Molecular and Atomic Spectroscopy, M.J.P. Publishers, 2008.

Website

1. <https://www.spectroscopynow.com>
2. <https://www.rsc.org.collections>
3. <https://www.nmrdb.org>
4. <https://www.nature.com>

Outcome of Learning

- To enable the students to correlate the UV absorption values as well as IR stretching frequencies of organic compounds with their functional groups.
- To enable the students to interpret the ¹H as well as ¹³C NMR spectra of organic compounds with individual nuclei (protons/carbons).
- To enable the students to understand NMR spectral techniques such as decoupling, NOE and MRI.
- To enable the students to interpret different types of carbons (CH, CH₂, CH₃ and quaternary C) using ¹³C NMR spectral editing and ¹³C NMR DEPT techniques.
- To enable the students to interpret 2D-NMR techniques such as HSQC, HMBC and NOESY.
- To enable the students to determine the structure of simple organic compounds from UV, IR, NMR and Mass spectral data.

BHARATHI WOMEN'S COLLEGE (AUTONOMOUS), CHENNAI – 600108.

M. Sc CHEMISTRY

STRATEGIC MANAGEMENT OF PHARMAINDUSTRY

(For the students admitted from the year 2019-2020)

HOURS PER WEEK : 4

CREDITS : 4

SEMESTER : II

SUBJECT CODE : 19EC5

(60hrs)

Objectives:

- To know about pharma industry, technology opportunity for innovation, project evaluation, intellectual property protective and business strategy.

UNIT I: INTRODUCTION AND TECHNOLOGY EVOLUTION (12hrs)

Pharma industry-Specifics, Importance and role in health sector; the Global scenario and Positioning of Indian Pharma industry ; Specific challenges of the Pharma industry versus the general industrial matrix; Understanding technological change; Need for technology strategy as step towards innovation and competitive advantage; Defining technological innovation and benefits.

Technology S- curves and management; Number of firms in the industry, Process obsolescence and Reverse Engineering; Innovative synthetic routes and atom economy dovetailing aspects of Green chemistry; Technology adoption and diffusion; Forecasting demand and confronting substitution.

UNIT II: OPPORTUNITY FOR INNOVATION (12hrs)

Technological, Political and Regulatory changes, Diversification, Demographic changes; Research and Development (R&D); Investment in R&D and return on investment – a profit centre; Linking of Research and Development for leverage; Cost reduction exercises.

UNIT III: PROJECT EVALUATION (12hrs)

Managing uncertainty, Analytical hierarchy process, Net Present Value(NPV), Internal Rate of Return(IRR), scenario analysis and decision tree; Portfolio Management, customer-friendly solutions; Product pricing ; Market segmentation and market research.

UNIT IV: INTELLECTUAL PROPERTY PROTECTION

(12hrs)

Role of IP protection in knowledge era; Patents- process and Product and the patenting process; Lead molecule development and cost; ANDA; Patent litigation; Non-disclosure agreement; Expiry of patents and generic drugs marketing and issues in IP.

UNIT V: BUSINESS STRATEGY

(12hrs)

Networking; Joint venturing; Licensing; Contract manufacturing; Outsourcing; Human resource management of technical professionals- R&D personnel, Product Development team, Cross-Functional team, Internal communication, Organization structure- decentralizing R&D, acquisitions.

Outcomes:

- To know the various pharma industry and their role in health sector.
- To understand technological change, innovation and benefits.
- To learn the evolution in technology.
- To understand how to invest in R and D and its return on investment.
- To familiarize the evaluation of project.
- To know the role of IP protection in knowledge era.
- To understand the expiry of patents, generic drugs marketing and issues in IP.
- To know the strategy involved in business.

Books for Study:

1. Technology Strategy For Managers And Entrepreneurs-Scott Shane, Ind .ed. Dorling Kindersley India Pvt. Ltd. , 2009.
2. Entrepreneurship and Small Business Management-C.B.Gupta and S.S.Khanka, Sultan Chand & Sons, New Delhi, 2012.

Books for Reference:

1. Jean Michel Peny, Pharma Market insight and strategy, Smart Pharma Consulting, First edition, 2013.

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**M.Sc CHEMISTRY
SUPPORTIVE ELECTIVE – I
ENVIRONMENTAL CHEMISTRY
(For the students admitted from the year 2019-2020)**

HOURS PER WEEK : 3

CREDITS : 3

SEMESTER : II

SUBJECT CODE : 19SC1

(45hrs)

Objectives

- To know the importance of environmental issues
- To study the toxic effects of pollution on environment and its control measures

UNIT I: TOXICOLOGY-I

(9hrs)

Chlorofluorocarbons- chemical composition, nomenclature, production and application as solvents- mechanism of ozone depletion/ hole – effect of CFC compounds- present controversy about these compounds.

UNIT II: TOXICOLOGY -II

(9hrs)

Heavy metallic environmental toxicants- detailed study- occurrence and properties - poisoning with heavy metals like arsenic, cadmium, chromium, mercury, lead and tin.

UNIT III : ENVIRONMENTAL POLLUTION

(9hrs)

Definition – causes, effects and control measures - Air pollution – Water pollution – Soil pollution – Marine pollution – Noise pollution – Thermal pollution –Nuclear pollution.

UNIT IV :WASTE AND DISASTER MANAGEMENT

(9hrs)

Solid waste management – causes – effects and control measures of urban and industrial waste, Role of an individual in prevention of pollution – pollution case studies – Disaster management : floods, earthquake, cyclone and landslides.

UNIT V: SOCIAL ISSUES AND THE ENVIRONMENT

(9hrs)

From unsustainable to sustainable development – Urban problems and related to energy – Water conservation, rain water harvesting, watershed management – Resettlement and rehabilitation of people; its problems and concerns – Case studies.

Environmental ethics – Issues and possible solutions – Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust – Case studies. Wasteland reclamation – consumerism and waste products – Environmental Protection act – Air (Prevention and Control of Pollution) Act – Water (Prevention and Control of Pollution) Act – Wildlife Protection Act – Forest Conservation act – issues involved in enforcement of environmental legislation – Public awareness.

Books for Study:

1. A.K.De, Environment chemistry, New Age International(p) Ltd New Delhi third edn,1996.
2. Miller ,G, Environmental science. Tayler Brookes/Cole, Thomas Learning Inc. USA, 8th edn , 2001.

Books for Reference:

1. W. Cunningham and M. A Cunningham, Principles of Environmental science , Tata Mcgraw Hill Publication ,New Delhi ,2003.
2. A. R. W Jackson and J. M Jackson, Environmental science Longman group Ltd 1998.
3. Soumitro Ghose, Environmental chemistry.
4. G.S. Sodhi, Fundamental concepts of environmental chemistry.
5. H.Kothandaraman, Environmental chemistry.
6. Anil kumar.D, Environmental chemistry.

Website

1. <https://www.pacificu.edu>
2. <https://environmentalscience.org>
3. <https://en.m.wikipedia.org>
4. <https://www.nature.com>

Outcome of Learning

- To study on the presence of impact of chemicals in soil , surface water and ground water.
- To study the effect of contaminants on eco system, animals and human health.
- To study on the main reason of pollution that causes acid rains , green house effects,
- Global climate changes , ozone layer depletion and damaging fertile lands.

BHARATHI WOMEN'S COLLEGE (AUTONOMOUS), CHENNAI – 600108.

M. Sc CHEMISTRY

INORGANIC CHEMISTRY – III

(For the students admitted from the year 2019-2020)

HOURS PER WEEK : 5

CREDITS : 5

SEMESTER : III

SUBJECT CODE : 19MCG

(75hrs)

Objectives

- To learn the photo electron spectroscopy of inorganic compounds.
- To study the theory, determination of structure, growth of crystals.
- To study the applications of IR, Raman and NMR spectroscopy in inorganic compounds
- To learn the detail study of synthetic organometallic complexes and their reactivity.
- To understand ESR and Mössbauer spectroscopy in the inorganic applications.

UNIT I: INORGANIC REACTION MECHANISM

(15hrs)

Electron transfer reactions – Inner sphere (ISET) and outer sphere (OSET) electron transfer processes. Role of bridging ligand with ISET reaction – tunneling transfer. Complimentary and non complimentary ET reactions.

Types of ligand substitution reactions – mechanism : Dissociative mechanism (D), Associative mechanism (A) interchange mechanism (I), Labile and Inert complexes. Substitution Reaction in octahedral complexes.

General mechanism, general rate law for A,D and I - replacement of coordinated water, mechanism of acid hydrolysis, base hydrolysis – DCB mechanism – direct and indirect evidences in favour of the mechanism. Anation Reactions. Substitution in square planar complexes – General mechanism, Trans effect, influences of entering and leaving groups. Application of

trans effect – synthesis of isomers of Pt(II) complexes – theories of trans effect and cis-trans isomerisation reaction.

UNIT-II: CATALYSIS

(15hrs)

General principles of catalysis – basic reactions involved in the catalysis by organometallic compounds. Hydrogenation of olefins (Wilkinson's catalyst) ; Hydroformylation of olefins using Cobalt or Rhodium catalysts (OXO process); oxidation of olefins to aldehydes and ketones (Wacker process) Monsanto acetic acid synthesis from methanol. Cycloligomerisation of acetylene using Ni catalyst (Reppe's catalyst) Synthetic gasoline by using ZSM-5 catalyst (Fischer-Tropsch and Mobil process) polymerization of olefins (Ziegler – Natta Catalyst), polymer bound catalyst.

UNIT-III: ORGANOMETALLIC CHEMISTRY

(15hrs)

Types of organometallic compounds on the basis of the nature of M-C bond. EAN rule: 18e- and 36e- rules – determinant of oxidation state, configuration, coordination number of the metal centre – Types and application 18e- rules. Carbonyls – isolated concept.- Structure of carbonyls (simple and polynuclear) Nitrosyls – bridging and terminal nitrosyls, bent and linear nitrosyls.

Dinitrogen compounds donors – Alkyl and Aryl – preparation and properties; chain carbon donors – olefins, acetylene and allyl complexes – synthesis, structure and bonding; cyclic carbon donors – (metallocene, ferrocenes) – synthesis, structure and bonding.

UNIT-IV: INORGANIC PHOTOCHEMISTRY AND PHOTOELECTRON

SPECTROSCOPY

(15hrs)

Unimolecular charge-transfer photochemistry of cobalt(III) complexes – mechanism of CTM, photoreduction – ligand-field photochemistry of chromium(III) complexes – Adamson's rules, photoactive excited states, V-C model – photophysics and photochemistry of ruthenium – polypyridine complexes, emission and redox properties.

Photoelectron Spectroscopy PES - Theory, Types, origin of fine structures - shapes of vibrational fine structures – adiabatic and vertical transitions, PES of homonuclear diatomic molecules (N_2 , O_2) and heteronuclear diatomic molecules (CO , HCl) and polyatomic molecules (H_2O , CO_2 , CH_4 , NH_3) – evaluation of vibrational constants of the above molecules, Koopman's theorem- applications and limitations.

UNIT-V: APPLICATIONS OF IR, RAMAN AND NMR SPECTROSCOPY TO INORGANIC COMPOUNDS

(15hrs)

IR spectroscopy- Introduction, selection rules, stretching frequency of some inorganic ions- effect of coordination on the stretching frequency- sulphato, carbonato, sulphito, aqua, nitro, thiocyanato, cyano, thiourea, DMSO complexes. Raman spectroscopy – Introduction, combined applications of IR and Raman spectroscopy in the structural elucidation of N_2O , NO_3^- , ClO_4^- , metal carbonyls.

NMR spectroscopy- Application to inorganic systems of the following – NMR – chemical shift, factors contributing to magnitude of chemical shift, spin–spin coupling, application of spin–spin coupling to structure determination, contact shift, comparison of ^1H & ^{13}C NMR, ^{19}F & ^{31}P NMR to simple inorganic molecules (ClF_3 , HPF_2 , HPCl_2 , Methyl dimethyl Phosphonate, phosphorous and hypo-phosphorous acid, WF_6 , SOF_4 , P_4S_3).

Books for study

1. U. Malik, G. D, Tuli, R. D. Madan, Selected topics in inorg.chem., 1992.
2. J.E. Huheey, Inorganic chemistry, Principles, structure and reactivity, 4th edition, Pearson pub. N.Y. 1993,
3. F.A. Cotton and G.Wilkinson. Advance inorg. Chem. – A comprehensive text, 5th Edition, John Wiley and sons, 1988.
4. B.K. Sharma, Spectroscopy, Goel publishers, 1998.

Books for Reference:

1. K. F.Purcell and J. C Kotz, Inorganic chemistry, Saunders, 1977.
2. Douglas, Macdaniel and Alexander, Concepts and models in inorg.chem., 2nd edition – John Wiley, 1983.
3. N.N. Greenwood and Earnshawchemistry of the elements, Pergamon press – N.Y., 1984.
4. F.A. KettleCo-ordination chem., ELBS.,1973.
5. K. Burger, Co-ordination chem., Burtter worthy, 1973.
6. W.E. Addison. Structural principles in inorg.chem., Longman., 1961.

7. H.A.O Hill and P.Day, Physical methods in Advanced inorg.chem., - John wiley, 1968.
8. C.N.R. Rao, J.R. Ferraro, Spectroscopy in inorg.chem., Vol I & II, Academic Press, 1970.
9. G.Arul Dhas, Molecular structures and spectroscopy – Prentice Hall, 2004.
10. M.F. Lappert – Physical inorg.chem.,Inorganic electron spectroscopy, 1968.
11. G.Coates, M.L. Green and K. Wade, Principles of organo metallic chemistry, Springer Pub., 1998.
12. P.Powell, Principles of organo metallic chemistry, Chapman and Hall, 1998.
13. Drago, Physical methods in chemistry, Reinhold publishers, 1968.

Website

1. <https://www.unf.edu.chem>
2. <https://www.nature.com>
3. <https://www.sciencedaily.com>
4. <https://www.internetchemistry.com>

Outcome of Learning

At the end of the course the learners should able to

- Use photo electron spectroscopy to inorganic compounds.
- Predict the crystal structure.
- Apply and interpret the IR, Raman and NMR spectroscopic data of simple inorganic compounds.
- Synthesize the organometallic complexes which are very useful in the modern era.
- Use ESR and Mössbauer spectroscopy to characterise inorganic and organometallic compounds.

BHARATHI WOMEN'S COLLEGE (AUTONOMOUS), CHENNAI – 600108.
M.Sc CHEMISTRY
ORGANIC CHEMISTRY – III
(For the students admitted from the year 2019-2020)

HOURS PER WEEK : 5
CREDITS : 5

SEMESTER : III
SUBJECT CODE : 19MCH

(75Hrs)

Objectives

- To understand the basic concept of retro synthetic analysis.
- To enable the students to understand reaction mechanisms involved in photochemical and pericyclic reactions.
- To enable the students to understand synthesis and reactivity of five member and six member heterocycles.

UNIT I : RETRO SYNTHESIS I

(15hrs)

Preliminary planning: Known and unknown of the synthetic system studied. Retrosynthetic analysis of the complex and interrelated carbon network or framework into simple rational precursor, alternative synthetic routes. Synthesis of organic mono and bifunctional compounds via disconnection approach.

Key intermediates, available starting materials and resulting yields of alternative methods, convergent synthesis. Synthesis base on umpolung concepts of seebach. Control elements, regiospecific control elements. Use of protective groups, activating groups and bridging elements. Stereospecific control elements. Functional group alteration and transposition.

UNIT II : RETRO SYNTHESIS II

(15hrs)

C – C disconnection approach and C – X disconnection. One group C – C disconnection – alcohols and carbonyl compounds, region – selectivity, alkene synthesis, olifination of carbonyl compounds – McMurry's method- use of acetylenes and aliphatic nitro compounds in organic synthesis. Two group C – C disconnection – Diels – Alder reaction, Michael addition, Robinson annulation, Stark –enamine reaction. One group C – X and two group C – X disconnection, chemo selectivity, reversal of polarity, umpolung cyclization, amine synthesis.(Functional group inter – conversion involving C=O, -CHO, -OH, -

SH, -COOH, -C=C-, -NH₂, -COOR, -CONHR, -CCl and -CBr. Protection and deprotection of reactive sites).

UNIT-III: OXIDATION AND REDUCTIONS REACTIONS (15hrs)

Oxidation with Cr (including PCC, PDC, Jones) and Mn (including MnO₂ and BaMnO₄) reagents; Oxidation with LTA, DDQ and SeO₂; Oxidation using DMSO either with DCC or Ac₂O or Oxaloyl chloride; Oxidation using IBX and Dess-Martin Periodinane (DMP) reagent. Reduction with NaBH₄, NaCNBH₃, Zn(BH₄)₂, LiAlH₄, Li(tBuO)₃AlH, DIBAL-H, Red-Al, Et₃SiH and Bu₃SnH; Reduction using selectrides; Birch reduction.

UNIT-IV: ORGANIC PHOTOCHEMISTRY (15hrs)

Principles of Photochemistry and Photochemical reactions: Norrish type I & II reactions. Paterno-Büchi reaction; Photochemistry of enones and dienones: [2 + 2] photochemical cycloaddition; Photo Fries, di- π methane, oxa & aza di- π methane rearrangements.

ORBITAL SYMMETRY & PERICYCLIC REACTIONS

Selection rules (Woodward and Hoffmann rules) and stereochemistry of electrocyclic reactions, cycloadditions and Sigmatropic reactions-FMO approach, Correlation diagram approach, Huckel-Mobius approach and perturbation molecular orbital approach.

UNIT-V: HETEROCYCLICS (15hrs)

Structure, synthesis and their reaction of the following systems; a) One heteroatom - Pyrrole, Furan, Thiophene, Pyridine; b) Benzo fused Heterocycles - Indole, Quinoline; c) Two heteroatom - Pyrazole, Imidazole, Pyrimidine, Pyrazine.

Oxygen Heterocyclic compounds :chemistry and synthesis of Flavones, Isoflavones,

Books for Study :

1. W.Carruther, Modern methods of organic synthesis. F. A.Carey and R.J. Sundberg (Ed IV), part B – Advanced organic chemistry, Klower academic pub 2000.
2. L.A. Pacquette, Benjaminl, P rinciples of Modern Heterocyclic Chemistry, Cummings Publishing Co., London, 1978.
3. J. March,Advanced Organic Chemistry, 4th edition, Singapore, 1992.

Books for Reference :

1. I. L. Finar, Organic chemistry, Vol. II, 5th edition, ELBS Publication, 1986.

2. H. Depuy and Orville, Charles, L.Chapman, Molecular reaction and photochemistry, Prentice Hall of India Pvt. Ltd., New Delhi.
3. F.A. Carey and R.J. Sundberg, Advanced Organic Chemistry, 4th edition, Plenum Press, New York, 1990.
4. Neil.S. Issacs, Physical Organic Chemistry, ELBS Publication, 1987.
5. Text book of Organic Chemistry, P.S. Kalsi, Mcmillan India Ltd, 1999.
6. Roger . S. Macomber, Modern NMR Spectroscopy Johnwiley & Sons, 2014.
7. Roger . S. Macomber, S. N. Sanyal, Reactions, Rearrangements and Reagent Bharathi bhavan Pub, 2013.
8. R. Carruthus, Modern methods of Organic synthesis Cambridge Univ. Press, 4th edition, 2004.
9. Jagadamba Singh & Jaya Singh, Photochemistry and Pericyclic Reactions., New Age International Pvt. Ltd., 2005.
10. H. Pine, Organic Chemistry. ACS publication, 4th edition, 1987.

Website

1. <https://www.chemistryguide.org>
2. <https://www.quora.com>
3. <https://www.recertbox:muni.cz.index.en>
4. <https://www.datbootcamp.com>

Outcome of Learning

- To enable the students to understand reactions in terms of donors and acceptor synthons.
- To enable the students to understand retro-synthetic analysis for simple organic compounds.
- To get clear idea about alternative synthetic route
- To enable the students to understand reaction mechanisms involved in photochemical and pericyclic reactions.
- To enable the students to understand synthesis and reactivity of five member and six member heterocycles.

BHARATHI WOMEN'S COLLEGE (AUTONOMOUS), CHENNAI – 600108.

M.Sc CHEMISTRY

PHYSICAL CHEMISTRY – III

(For the students admitted from the year 2019-2020)

HOURS PER WEEK : 5

CREDITS : 5

SEMESTER : III

SUBJECT CODE : 19MCJ

(75 Hrs)

Objectives

- To know the limitations of classical thermodynamics in the evaluation of macroscopic properties.
- To gain on understanding of the Ionic activity, ionic interactions, Debye-Hückel-Bjerrum model, Debye-Hückel limiting law.
- To study the th Debye-Hückeleory of strong electrolytes. To study the Electrical double layer, electrocapillary phenomena, surfactants.
- The design and applications of the batteries and Fuel Cells, Corrosion and its Protection.
- To learn the principles, instrumentation, interpretation and applications of micro wave, IR and Raman spectroscopy.

UNIT-I: STATISTICAL THERMODYNAMICS -I

(15 hrs)

Objectives of statistical thermodynamics, Concept of distributions, Types of ensembles. Thermodynamic probability, Most probable distribution Law- Derivation of distribution functions of Maxwell- Boltzmann (MB) statistics, Bose-Einstein (BE) statistics and Fermi-Dirac (FD) statistics. Partition functions- Translational, rotational, vibrational and electronic partition function. Expressions of thermodynamic functions (internal energy, entropy, work function, pressure, Gibb's free energy and enthalpy) in terms of partition function- Relationship between equilibrium constant and partition function.

UNIT – II : ELECTROCHEMISTRY I

(15 hrs)

Deviation from ideal behaviour.ion-solvent and ion-ion interactions. Debye-Hückel-Bjerrum model, Ion association and triple ion formations. Expression for the mean activity coefficient. Debye-Hückel limiting law and its applications -Diverse ion effect. Van't Hoff

factor and its relation to colligative properties. Debye-Hückel theory of strong electrolytes. Debye-Hückel length and potential around a central ion, its interpretation.

Transport of ions in Solution: Electrolytic conduction- Debye - Hückel-Onsager treatment of strong electrolytes- ionic atmosphere- Anomalous conductance of non aqueous electrolytes.

UNIT III: ELECTROCHEMISTRY- II

(15 hrs)

Electrical double layer - Electrocapillary phenomena - Surfactants - Lipmann's equation, Electrokinetic phenomena. Zeta potential and its applications. Structure of electrical double layer – Helmholtz-Perrin, Guoy-Chapmann and Stern models. Butler-Volmer equation for one electron transfer reaction - equilibrium and exchange current densities- and symmetry factor – transfer coefficient. Cyclic voltammetry and Stripping voltammetry - principle – instrumentation- Corrosion and passivation of metals - Pourbaix diagram - Evans diagram – Batteries and Fuel cells-Ion selective electrodes.

UNIT IV : CHEMICAL DYNAMICS

(15 hrs)

Potential energy surfaces-Dynamics of unimolecular reactions-Lindemann Hinshelwood, Rice-Ramsperger- Kassel(RRK) theory. Rice-Ramsperger-Kassel -Marsus (RRKM) theory.

Study of fast reactions by stopped flow techniques- relaxation method, flash photolysis and the nuclear magnetic resonance method.

Linear free energy relationship-Hammett equation, Taft equation-Separation of polar, resonance and steric effects.

UNIT V : MACRO MOLECULES

(15 hrs)

Polymerisation in homogeneous and heterogeneous phases - kinetics and mechanism of polymerization – addition and condensation, chain initiation, propagation, termination- chain transfer - Inhibition and retardation, co-ordination polymerization using Ziegler- Natta catalyst.

Molecular weight of polymers-molecular weight determination – Osmometry, ultra centrifugation, Gel permeation chromatography- properties of polymers- crystallinity of polymers - Degree of crystallinity- Effect of crystallinity on the properties of polymers-Glass transition temperature (GTT) - Definition- Factors influencing GTT- Importance of GTT

Books for study:

1. J. Rajaram and J.C. Kuriakose, Thermodynamics for students of chemistry, Lal Nagin Chand, New Delhi, 1986.
2. J.O.M. Bockris and A.K.N Reddy, Electrochemistry vol. I & II, Plenum, Newyork, 1977.
3. C. N. Banwell, Fundamental of molecular spectroscopy Mc Graw Hill, Newyork, 1966.
4. Fred. W. Billmeyer, Text book of polymer science.

Books for Reference:

1. S. Glasstone, Thermodynamics for chemist, Affiliated East West press, NY., 1980.
2. Mordechay Schlesinger, Modern Aspects of Electrochemistry: Issue 43, Springer, Netherlands, 2009.
3. Philip H. Rieger, Electrochemistry ,2nd Edition, 2010.
4. Keith Oldham, Jan Myland and Alan Bond, Electrochemical Science and Technology:
5. V. R. Gowariker, N.V. Viswanathan and Jayadev Sreedhar, Polymer chemistry New age international Pvt. Ltd. Publishers, New Delhi, 2001.
6. John M Brown, Rotational spectroscopy of diatomic molecules, Cambridge press.
7. James Wollrab, Rotational spectra and molecular structure.

Website

1. <https://engineering.purdue.edu>
2. <https://www.researchgat.net>
3. <https://www.ika.com>
4. <https://www.electrochem.org>

Outcome of Learning

- Learn about the various applications of Quantum Statistics.
- Understand concepts of Ionic interactions, theory of electrolytes, double layer models, Debye-Hückel limiting law.
- Understand the designs of Batteries, Fuel cells and ion selective electrodes
- Learn fast reactions and macromolecules

BHARATHI WOMEN'S COLLEGE (AUTONOMOUS), CHENNAI – 600108.

M.Sc CHEMISTRY
CHEMINFORMATICS**

(For the students admitted from the year 2019-2020)

HOURS PER WEEK : 4
CREDITS : 4

SEMESTER : II
SUBJECT CODE : 19EC6

(60hrs)

Objectives:

- Students completing this paper should be able to understand concepts of molecular chemistry that are basic to cheminformatics.
- This course will train the students to use QSAR, docking etc.

UNIT I : MATHEMATICS PROCESS

Graph theory and molecular numerology; Logic, sets and functions; Algorithms, integers and matrices; Mathematical reasoning, induction and recursion; Counting; graphs, trees and sets, basic probability and statistics; Markov processes

UNIT II: BASICS OF STEREOCHEMISTRY

Basic Stereochemistry, Amino acids and Proteins and Properties; pKa, pH and ionization of acids and bases; Protein structure - Primary structure, Secondary structure - helix & sheet; Tertiary structure; Quaternary structure; covalent and non-covalent forces that maintain structures.

UNIT III: CHEM INFORMATION

History of scientific information communication-chemical literature-chemical information- chemical information search-chemical information sources-chemical name and formula searching-analytical chemistry-chemical history-biography-directories and industry sources

UNIT IV: BIOLOGICAL DATABASES

Introduction; Experimental sources of biological data; Publicly available databases; Gene expression monitoring; Genomics and Proteomics; Metabolomics; Visualisation of sequence data; Visualization of structures using Rasmol or SPDB Viewer or CHIME; Genetic basis of disease; Personalised medicine and gene-based diagnostics.

UNIT V: Drug Design

Introduction to drugs, structure-based drug design. QSAR and 3D-QSAR Methods. Pharmacophore Design, Ligand-Based Design and *De Novo* Drug Design Virtual screening/docking of ligands. Protein structure, Drug action & enzymes. Drug action & receptors. Prediction of Binding Modes, Protein–Ligand binding free energies, Fragment-Based Drug Design, ADMET prediction.

Outcome:

- To understand basis of group theory and its applications
- To study Logics, sets and functions
- To get a clear idea on the principles and theories of algorithms, induction Basics and process of photosynthesis
- To understand the Basics of stereochemistry and structure of proteins
- To study History of science and chemical information
- To discuss the biological database and Gene expression
- To visualize the structure of different biological structures
- To understand the genetic basis of diseases
- To get a clear knowledge about drugs and their structure and functions
- To study drug actions and enzymes

Books for Study:

1. P. Shanmughavel, “Principles of Bioinformatics”, Pointer publishers, 2005.
2. Arfken, "Mathematical Methods for Physicists" Academic Press, 1985
- 3.

Books for Reference:

1. P. Shanmughavel, “Trends in Bioinformatics”, Pointer publishers, 2006
2. Francis A. Carey and Richard J. Sundberg, “Advanced Organic Chemistry-Part A & B” Third Edition, 1990.

**** 100%change in syllabus**

BHARATHI WOMEN'S COLLEGE (AUTONOMOUS), CHENNAI – 600108.

M.Sc CHEMISTRY

CORE ELECTIVE – III NUCLEAR CHEMISTRY

(For the students admitted from the year 2019-2020)

HOURS PER WEEK : 4

CREDITS : 4

SEMESTER : III

SUBJECT CODE : 19EC7

(60hrs)

Objectives

- To know the structure and bonding in inorganic chains, rings, and cages.
- To identify ligands of main group elements and complexing agents for main group metals.
- To identify specific reagents of main-group elements used in synthesis.
- To understand theory of radioactivity and applications of radioisotopes.
- To know the working principle and safety features of nuclear reactors.

UNIT I : RADIOACTIVITY

(12hrs)

Rays from radioactive minerals – radioactive disintegration – half life period – average life period – transmutation of elements – Soddy-Fajan Displacement law – radioactive series – radioactive equilibrium.

UNIT II : NUCLEAR THEORY AND DETECTION OF RADIATION

(12hrs)

Nuclear forces – salient features of the liquid drop and the shell model – packing fraction – Mass defect – binding energy of the nucleus – artificial transmutation of elements – preparation of trans-uranic elements.

Modes of radioactive decay – orbital electron capture – nuclear isomerism – internal conversion – detection and determination of activity – Geiger-Muller – Scintillation – Cherenkov counters.

UNIT III : TYPES OF NUCLEAR REACTIONS

(12hrs)

Reaction cross section Q values – threshold energy – compound nuclear theory – nuclear fission and fusion – spallation reaction – thermonuclear reactions – Stellar energy – photonuclear reactions – Szilard-Chalmer's process.

UNIT IV :RADIATION CHEMISTRY

(12hrs)

Passage of radiation through matter – units for measuring radiation absorption – radiation dosimetry – radiolysis of water – free radicals in water radiolysis – chemical dosimetry : Radiolysis of Fricke dosimeter solution – radiation – induced color centres in crystals – Effects of radiation with matter : Radiation of inorganic gases, organic gases, organic compounds, solids, and polymers.

UNIT V : APPLICATION OF RADIOACTIVITY

(12hrs)

Radiochemical principles in the use of tracers - study of structure and mechanism –chemical investigations, analytical application - neutron activation analysis(NAA) – Isotope dilution analysis(IDA)– carbon and rock dating – nuclear reactors – nuclear fuel – moderators – concept of moderators – reflector – absorber – heat exchangers – Breeder reactor – radioisotopes as source of electricity – nuclear medicines.

Books for Study:

1. H. J. Arniker, Essentials of Nuclear chemistry, new Age International, 2009.
2. R. Gopalan, Nuclear Chemistry, Vishal Publishers, 2009.

Books for Reference:

1. S. Glasstone, Source book of atomic energy, MacMillan, 1954.
2. G. Frienlander J. W. Kennedy and J.M. Miller, Nuclear and radiochemistry, Wiley Publishers, 2013.
3. K. H. Liesier, Nuclear and Radio chemistry, 2nd revised ed., Wiley – VCH, Berlin 2001.

Website

1. <https://wps.prenhall.com>
2. <https://www.visionlearning.com>
3. <https://www.sas.upenn.edu>
4. <https://www.chemlibretexts.org>

Outcome of Learning

- Study of nuclear reactions that are used both to generate electricity and to create weapons of massive destruction
- Understand the factors that determine the biological effects of radiation, absorbed dose and penetrating ability.
- Study the effects of positron emission and converting a proton to neutron

BHARATHI WOMEN'S COLLEGE (AUTONOMOUS), CHENNAI – 600108.

M. Sc CHEMISTRY

MOLECULAR MODELLING & DRUG DESIGN
(For the students admitted from the year 2019-2020)

HOURS PER WEEK : 4

CREDITS : 4

SEMESTER : II

SUBJECT CODE : 19EC8

(60hrs)

Objectives:

- To know the modeling of coordinate system using computer hardware and soft ware
- To calculated the bond stretching, bonding nature and bond angles
- To predict the molecular structure and drug designing

UNIT I: INTRODUCTION TO MOLECULAR MODELLING (12hrs)

Introduction. Useful Concepts in Molecular Modelling: Coordinate Systems. Potential Energy Surfaces. Molecular Graphics. Surfaces. Computer Hardware and Software. The Molecular Modelling Literature.

UNIT II: FORCE FIELDS (12hrs)

Fields. Bond Stretching. Angle Bending. Introduction to nonbonded interactions. Electrostatic interactions. van der Waals Interactions. Hydrogen bonding in Molecular Mechanics. Force Field Models for the Simulation of Liquid Water.

UNIT III: ENERGY MINIMIZATION AND COMPUTER SIMULATION (12hrs)

Minimization and related methods for exploring the energy surface. Non-derivative method, First and second order minimization methods. Computer simulation methods. Simple thermodynamic properties and Phase Space. Boundaries. Analyzing the results of a simulation and estimating Errors.

UNIT IV: MOLECULAR DYNAMICS & MONTE CARLO SIMULATION (12hrs)

Molecular Dynamics Simulation Methods. Molecular Dynamics using simple models. Molecular Dynamics with continuous potentials. Molecular Dynamics at constant temperature

and pressure. Metropolis method. Monte Carlo simulation of molecules. Models used in Monte Carlo simulations of polymers.

UNIT V: STRUCTURE PREDICTION AND DRUG DESIGN: (12hrs)

Structure prediction - Introduction to comparative Modeling. Sequence alignment. Constructing and evaluating a comparative model. Predicting protein structures by 'Threading', Molecular docking. Structure based de novo ligand design, Drug Discovery – Chemoinformatics – QSAR.

Books for Reference:

1. A.R. Leach, Molecular Modelling Principles and Application, Longman, 2001.
2. J.M. Haile, Molecular Dynamics Simulation Elementary Methods, John Wiley and Sons, 1997.
3. Satya Prakash Gupta, Q

BHARATHI WOMEN'S COLLEGE (AUTONOMOUS), CHENNAI – 600108.

B.Sc CHEMISTRY

BASICS OF COMPUTER PROGRAMMING IN C

AND IT'S APPLICATIONS IN CHEMISTRY

(For the students admitted from the year 2019-2020)

HOURS PER WEEK : 4

SEMESTER : III

CREDITS : 4

SUBJECT CODE : 19EC9

(60 Hrs)

Objective:

- To introduce the basics of computers.
- To learn C language and its applications in solving problems in Chemistry.

UNIT I: BASIC COMPUTER ORGANISATION

Processor and Memory – Main Memory, Secondary
Storage Devices and Storage Hierarchy. Software – Relationship between Hardware and
Software – Types of Software. Planning the Computer Program – Algorithm and Flowcharts -
Basics of Operating
Systems.

UNIT II: COMPUTER LANGUAGES

Machine Language, Assembly Language, Assembler, Compiler, Interpreter and
Programming Languages. C language – Introduction - C Compiler - Operating Systems and
Preprocessor Directives. Variables, Constants, Operators, Input and Output Functions.

UNIT III: CONTROL STRUCTURES

Conditional, Looping, Goto, Break, Switch and Continue Statements, Functions, Arrays
And Pointers.

UNIT IV: APPLICATIONS IN CHEMISTRY

Calculation of the Radius of the first Bohr orbit for an Electron. Calculation of Half-
life Time for an integral order reaction - Calculation of Molarity, Molality and Normality of a
solution. Calculation of Pressure of Ideal Gases and Van der Waal's gases - Calculation of
Electronegativity of an Element using Pauling's relation.

UNIT V: APPLICATIONS IN CHEMISTRY

Calculation of Empirical Formulae of Hydrocarbons - Calculation of Reduced Mass of a few Diatomic Molecules. Determination of the Wave Numbers of Spectral lines of Hydrogen atom - Calculation of Work of Expansion in Adiabatic Process. Calculation of pH, Solubility Product and Bond Energy using Born-Landé equation - Calculation of Standard Deviation and Correlation Coefficient.

Books for Reference:

1. Computers in Chemistry, K. V. Raman, 8th Edition, Tata McGraw Hill Publishers, 2005.
2. Programming with C, Venugopal and Prasad, 11th Edition, 1971. .
3. Programming in C, E. Balaguruswamy, 2nd Edition, 1989.

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**M.Sc CHEMISTRY
SUPPORTIVE ELECTIVE – II
BIOLOGICAL CHEMISTRY**

(For the students admitted from the year 2019-2020)

HOURS PER WEEK : 3

CREDITS : 3

SEMESTER : III

SUBJECT CODE : 19SC2

(45 Hrs)

Objectives

- To have a knowledge about protein metallo biomolecules and the role of metal ions in biological process.
- To learn about chemical toxicology and uses of inorganic compounds as therapeutic agents.
- To learn about storage and transport of metal ions in biological system
- To learn about polymeric bio-organic molecules such as carbohydrates, proteins and nucleic acids.
- To learn about the structure, stereochemistry and synthesis of antibiotics and vitamins.
- To learn about various types of separation techniques for organic and biomolecules.

UNIT I : CARBOHYDRATES

(9 hrs)

Carbohydrates: Synthesis of glycosides, amino sugars, sucrose and maltose.

Biological importance of glycosides, amino sugars, sucrose, maltose cellulose, starch, glycogen, dextran, hemicellulose, pectin, agar-agar, chitosan, and chrysin.

Carbohydrate metabolism: glycolysis and gluconeogenesis, pentose phosphate pathway, Carbohydrate in plants and bacteria, tricarboxylic acid (TCA) cycle. Relation between glycolysis and respiration.

UNIT II : LIPIDS AND PROTEINS

(9 hrs)

Lipids: synthesis and degradation of neutral lipids, Phospho lipids (lecithines, cephalins, plasmalogens) and glycolipids. Lipid Metabolism: Oxidation of glycerol – β -oxidation of fatty acid.

Fatty acid metabolism: Regulation of fatty acid metabolism: Allosteric regulation.

Separation and purification of proteins – dialysis; gel filtration - electrophoresis.

Catabolism of amino acids: transamination, oxidative deamination and decarboxylation.

Biosynthesis of proteins.

UNIT III : NUCLEIC ACID

(9 hrs)

Role of nucleic acids. Amino acid metabolism; the urea cycle. Structure and synthesis of nucleosides and nucleotides; Structure of RNA and DNA, Watson-Crick model; Solid phase synthesis of oligonucleotides. DNA intercalators; Chemical synthesis of DNA; Catalytic RNA, siRNA; micro RNA; Synthesis and Application of Unnatural Nucleosides; Fluorescently Labeled Nucleosides and oligonucleotide probes; Single Nucleotide Polymorphism (SNPs).

UNIT IV : HORMONES AND ANTIOXIDANTS -I

(9 hrs)

Hormones: Introduction, classification, Sex hormones: Androgens and estrogens. Synthesis and functions. Adrenocortical hormones: Cortisone and aldosterone. Non steroidal Hormones: Adrenaline and thyroxine. Effects of hormone activity on biological functions.

Antioxidants: Nutrients with an antioxidant role, the need for biological antioxidants, pro-oxidant activity of biological antioxidants, Nutrients associated with endogenous antioxidant mechanisms, Nutrients with radical-quenching properties, β -Carotene and other carotenoids, requirement for antioxidant nutrients- polyphenols.

UNIT V : ANTIOXIDANTS -II

(9 hrs)

Free radicals induced damages, lipid peroxidation, measurement of free radicals, disease caused by radicals, reactive oxygen species, antioxidant defence system, enzymic and non-enzymic antioxidants, role of antioxidants in prevention of diseases, phytochemicals as antioxidant -ROS mechanism.

Books for Study:

1. T. K Lindhorst, Essentials of Carbohydrate Chemistry and Biochemistry, Wiley VCH, North America, 2007.
2. G. K. Chatwal, Organic Chemistry on Natural Products, Vol. 1, Himalaya Publishing House, Mumbai, 2009.
3. O. P. Agarwal, Chemistry of Organic Natural Products, Vol. 1, Goel Publishing House, Meerut, 1997.
4. I. L. Finar, Organic Chemistry Vol-2, 5th ed., Pearson Education Asia, 1975.

Books for Reference:

1. I. L. Finar, Organic Chemistry Vol-1, 6th ed., Pearson Education Asia, 2004.
2. Pelletier, Chemistry of alkaloids, Van Nostrand Reinhold Co, 2000.
3. Shoppe, Chemistry of the steroids, Butterworths, 1994.
4. I. A. Khan, and A. Khanum. Role of Biotechnology in medicinal & aromatic plants, Vol 1 and Vol 10, Ukkaz Publications, Hyderabad, 2004.
5. M. P. Singh. and H. Panda, Medicinal Herbs with their formulations, Daya Publishing House, Delhi, 2005.
6. V. K. Ahluwalia, Steroids and Hormones, Ane books pub., New Delhi, 2009

Website

1. <https://appbiochem.springeropen.com>
2. <https://www.nature.com>
3. <https://librarymed.utah.edu>
4. <https://chem.libretext.org/biology>

Outcome of Learning

- To enable the students to understand the importance of Fe, Mg and Cu-containing proteins.
- To enable the students to understand the importance of trace elements in biological system and also the toxicity of metal ions.
- To enable the students to understand the role of metals in medicine.
- To enable the students to understand the importance of transport and storage metals in biological systems.
- To enable the students to understand the structure and importance of biomolecules such as proteins, nucleic acids and carbohydrate.
- To enable the students to understand the structure and importance of antibiotics and vitamins.
- To enable the students to learn the various types of separation techniques involved in organic as well as bio-organic molecules.

BHARATHI WOMEN'S COLLEGE (AUTONOMOUS), CHENNAI – 600108.

**M.Sc CHEMISTRY
ORGANIC CHEMISTRY - IV**

(For the students admitted from the year 2019-2020)

HOURS PER WEEK : 6

CREDITS : 5

SEMESTER : IV

SUBJECT CODE : 19MCK

(90hrs)

Objective

- To gain knowledge about novel reagents in modern synthetic methodology
- To understand and appreciate the importance of natural products

UNIT I : NOVEL REAGENTS AND ASYMMETRIC SYNTHESIS (15hrs)

Role of palladium and nickel catalysts in organic reactions including Pd(0), Ni(0), Pd(II) and Ni(II) complexes. Typical reactions involving Heck, Negishi, Suzuki-Miyaura, Kumada, Sonogashira, Stille and Hiyama coupling for carbon-carbon bond formation reactions. Buchwald- Hartwig coupling for the carbon-heteroatom bond formation reactions.

Asymmetric oxidation [dihydroxylation, epoxidation Sharpless, Jacobsen, Shi] and Asymmetric reduction (Noyori, Corey, Pfaltz)-Boranes reduction.

UNIT - II NATURAL PRODUCTS (15hrs)

Alkaloids : Structural elucidation and synthesis of Morphine, Cocaine and Quinine. Biosynthesis of cholesterol and bile acid, conversion of cholesterol to progesterone, estrone, testosterone.

Terpenoids: Methods of structure elucidation and synthesis-zingiberine and abietic acid.

UNIT - III : MODERN SYNTHESIS METHODOLOGY (15hrs)

Synthesis of simple organic molecules using standard reactions like acylation and alkylation of enamines and active methylene compounds, Grignard reactions, phosphorous and sulphur ylides. Robinson annulation. Formation of C-C and C=C bonds.

UNIT IV : USE OF REAGENTS IN ORGANIC SYNTHESIS

(15hrs)

Protection and deprotection of functional groups (R-OH, R-CHO, R-CO-R, R-NH₂ and R-COOH). Uses of the following reagents: DCC, Trimethyl silyl iodide, 1,3- dithiane (Umpolung) di-isobutyl aluminium hydride (DIBAL), 9BBN, Trimethylsilyl chloride.

Application of synthetic methodology for the synthesis of simple cyclic and acyclic molecules- target molecules- synthesis of cubane, 5-hexenoic acid and bicyclo (4,1,0) hepten-2-one.

UNIT V : FREE RADICAL REACTIONS

(15hrs)

Long lived and short lived free radicals, methods of generation of free radicals. Addition of free radicals to olefinic double bonds. Aromatic radicals substitutions - decomposition of diazo compounds, phenol- coupling, Sandmeyer reaction and Hunsdieker reaction. Detection of free radicals by ESR.

Book for Study:

1. I. L. Finar, Organic chemistry, 5th edition, Vol.II, ELBS Publication, 1986.
2. Agarwal, Chemistry of Organic Natural products, Goel publishing house.

Book for Reference:

1. L. Smith, Robert L. Hill. I. Robert Lehman, Robert J. Iet Rowitz, Philp Handler and Abraham white, Principles of Bio-Chemistry General aspects, 7th edition, Mcgraw Hill Int.
2. L. Stryer, W.H. Freeman and Co.,Bio-Chemistry, NY.
3. B. I. Smith, C, Organic synthesis, hatman and Hall, NY. 1980.
4. Francis.A. Carey, Richard.J. Sundberg, Advanced Organic chemistry, 4th edition, Plenum Press, NY, 2001.
5. Pine Advanced Organic chemistry,.
6. Advanced Organic Chemistry. Francis.A. Carey.
7. Advanced Organic Chemistry, J. March, 4th edition, Singapore, 1992.

Website

1. <https://www.organicchemistry>
2. <https://www.organicdivision.com>
3. <https://www.datbootcamp.com>
4. <https://www.quora.com>

Outcome of Learning

- To enable the students to understand the isolation, classification, structural elucidation and synthesis of terpenes.
- To enable the students to understand the structural elucidation and biosynthesis of steroids and alkaloids.

BHARATHI WOMEN'S COLLEGE (AUTONOMOUS), CHENNAI – 600108.

**M.Sc CHEMISTRY
CORE ELECTIVE – IV**

BIOINORGANIC CHEMISTRY

(For the students admitted from the year 2019-2020)

HOURS PER WEEK : 5

CREDITS : 5

SEMESTER : IV

SUBJECT CODE : 19EC10

(75Hrs)

Objectives

- To have a knowledge about protein metallo biomolecules and the role of metal ions in biological process.
- To learn about chemical toxicology and uses of inorganic compounds as therapeutic agents.
- To learn about storage and transport of metal ions in biological system
- To learn about polymeric bio-organic molecules such as carbohydrates, proteins and nucleic acids.
- To learn about the structure, stereochemistry and synthesis of antibiotics and vitamins.
- To learn about various types of separation techniques for organic and biomolecules.

UNIT I METALLO ENZYMES – I

(15hrs)

Enzymes: Classification, active sites, effect of pH, temperature on enzyme reactions. Metallo enzymes - carboxy peptidase and carbonic anhydrase, vitamin B₁₂, catalase, peroxidase, superoxide dismutase and copper proteins.

Biological redox systems: cytochromes – classification, cytochrome a, b & c. cytochrome- P.450 iron – sulphur proteins – rubredoxin and ferredoxin.

UNIT II : INORGANIC PHOTO CHEMISTRY II

(15hrs)

Primary process in Photo synthesis – Photo systems I and II – Light absorption (energy acquisition) – Exciton Transport (direct energy transfer)- Charge separation and electron transport.

UNIT III : METALLO PROTEINS

(15hrs)

Iron containing proteins: Hemein - Metalloporphyrins-Haemoglobin and myoglobin – Structures and work functions – Non heme oxygen carriers Magnesium containing Proteins: Chlorophyll – structure – photosynthetic sequence. Copper containing proteins: Classification – blue copper proteins – hemocyanin, iron containing proteins – hemerythin.

UNIT IV : NITROGEN FIXATION

(15hrs)

Introduction, types of nitrogen fixing micro organisms, Nitrogenase enzyme – metal clusters in nitrogenase – redox property – dinitrogen complexes – nitrogen fixation via nitride formation and reduction of dinitrogen to ammonia. Essential and trace metal ions (Na, K, Ca and Cu).

UNIT V : ANTIBIOTICS AND VITAMINS

(15hrs)

Biomolecules: Antibiotics and vitamins: A detailed study of structure, stereochemistry and synthesis of penicillin, cephalosporin. Chemistry and physiological action of ascorbic acid, thiamin, riboflavin and pyridoxine – Elementary aspect of vitamin A, E, K and B₁₂.

Metal deficiency and diseases – role of metal ions in diagnosis and treatment – radio isotopes, MRI agents and anti-cancer agents. Toxicity of Hg, Cd, Cr, Zn, Pb, As and Sb.

Books for Study :

1. K. Husaain, Reddy – Bio-inorg.chem. – New age international Pvt. Ltd., 2007.
2. J. E.Huheey, Inorganic chemistry, 3rd edition, Harper & Row publishers, Singapore.

Books for Reference:

1. D. R Williams, Introduction to bio-inorganic chemistry, Spring field III., Thomas, 1976.
2. F. M Fiabre, and D. R Williams, The principles of bio-inorg.chem., Royal society of chem.,monograph for teachers – 31.
3. G.N. Mugharjee and Arabinda Das – Elements of Bio-inorganic Chemistry, Dhur and sons Pvt. Ltd., Kolcotta, 1993.
4. M. Satake and Y.Mido – Bio-inorg.chem., Discovery publishing house, New Delhi, 1996.
5. Asim. K. Das – Bio-Inorganic Chemistry, Books and Allied Ltd., 2013.
6. D.F. Shrivvers, P.W. Atkins and C.H.Langford, Inorganic Chemistry. 1990.
7. Douglas, Macdaniel, Alexander, Concepts and models in Inorganic Chemistry, 2ndedition – John Wiley, 1983.

8. N.N. Greenwood and Earnshaw, chemistry of the elements, Pergamon press – N.Y., 1984.
9. Purcell and Kotz, Inorganic Chemistry, W.B.Saunders Company, Philadelph
10. S.J. Lippard and J.M. Berg , Principles of Bioinorganic Chemistry, Panima Publishing Company, New Delhi,1997.
11. W.Kaim and B. Schewederski, Bioinorganic Chemistry : Inorganic Elements in the Chemistry of lif , John Wiley & Sons, New York, 1994.
12. G.L. Eichorn,Inorganic Biochemistry, Volumes 1 &2 , 2nd ed., Elsevier Scientific Publishing Company, New York, 1973.
13. H.Siegel, Metal ions in Biological Systems, Vol 1-15, Taylor, Francis, 1988.
14. M. Satake and Y. Mido – Bioinorganic chemistry, Discovery publishing house, New Delhi, 1996.
15. R. W. Hay, Bio Inorganic Chemistry (Chemical Science series) Ellis Horwood Ltd., 1984.
16. T. Devasena, Enzymology, Oxford Press, 2010.
17. Rosette Malone, Bio Inorganic Chemistry, Wiley blackwel Pub., 2002.

Website

1. <https://www.hindaw.com>
2. <https://www.nature.com>
3. <https://www.sciencedirect.com>
4. <https://en.m.wikipedia.org>

Outcome of Learning

- To enable the students to understand the structure and functions of various types of metallo enzymes.
- To enable the students to understand the structure and importance of antibiotics and vitamins.

BHARATHI WOMEN'S COLLEGE (AUTONOMOUS), CHENNAI – 600108.
M.Sc CHEMISTRY
SCIENTIFIC RESEARCH METHODOLOGY
(For the students admitted from the year 2019-2020)

HOURS PER WEEK : 5
CREDITS : 5

SEMESTER : IV
SUBJECT CODE : 19EC11

(75hrs)

UNIT-1:LITERATURESURVEY

(15hrs)

Print: Sources of information: Primary, secondary, tertiary sources; Journals: Journal abbreviations, abstracts, current titles, reviews, monographs, dictionaries, text-books, current contents, Introduction to Chemical Abstracts and Beilstein, Subject Index, Substance Index, Author Index, Formula Index, and other Indices with examples.

Digital: Web resources, E-journals, Journal access, TOC alerts, Hot articles, Citation index, Impact factor, H-index, E-consortium, UGC infonet, E-books, Internet discussion groups and communities, Blogs, Preprint servers, Search engines, Scirus, Google Scholar, ChemIndustry, Wiki- Databases, Chem Spider, Science Direct, SciFinder, Scopus.

Information Technology and Library Resources: The Internet and World Wide Web. Internet resources for chemistry. Finding and citing published information.

UNIT-II: METHODS OF SCIENTIFIC RESEARCH AND WRITING SCIENTIFIC PAPERS:

(15hrs)

Reporting practical and project work. Writing literature surveys and reviews. Organizing a poster display. Giving an oral presentation. Writing scientific papers – justification for scientific contributions, bibliography, description of methods, conclusions, the need for illustration, style, publications of scientific work. Writing ethics. Avoiding plagiarism.

UNIT-III : CHEMICAL SAFETY AND ETHICAL HANDLING OF

CHEMICALS:

(15hrs)

Safe working procedure and protective environment, protective apparel, emergency procedure and first aid, laboratory ventilation. Safe storage and use of hazardous chemicals, procedure for working with substances that pose hazards, flammable or explosive hazards, procedures for working with gases at pressures above or below atmospheric – safe storage and disposal of waste chemicals, recovery, recycling and reuse of laboratory chemicals, procedure

for laboratory disposal of explosives, identification, verification and segregation of laboratory waste, disposal of chemicals in the sanitary sewer system, incineration and transportation of hazardous chemicals.

UNIT-IV:DATAANALYSIS

(15hrs)

The Investigative Approach: Making and Recording Measurements. SI Units and their use. Scientific method and design of experiments. Analysis and Presentation of Data: Descriptive statistics. Choosing and using statistical tests. Chemometrics. Analysis of variance (ANOVA), Correlation and regression, Curve fitting, fitting of linear equations, simple linear cases, weighted linear case, analysis of residuals, General polynomial fitting, linearizing transformations, exponential function fit, r and its abuse. Basic aspects of multiple linear regression analysis.

UNIT-V:ELECTRONICS

(15hrs)

Basic fundamentals of electronic circuits and their components used in circuits of common instruments like spectrophotometers, typical circuits involving operational amplifiers for electrochemical instruments. Elementary aspects of digital electronics.

Books for Study:

1. Dean, J. R., Jones, A. M., Holmes, D., Reed, R., Weyers, J. & Jones, A. (2011) Practical skills in chemistry. 2nd Ed. Prentice-Hall, Harlow
2. Hibbert, D. B. & Gooding, J. J. (2006) Data analysis for chemistry. Oxford University Press
3. Topping, J. (1984) Errors of observation and their treatment. Fourth Ed., Chapman Hall, London.
4. Harris, D. C. Quantitative chemical analysis. 6th Ed., Freeman (2007) Chapters 3-5

Books for Reference:

1. Levie, R. de, How to use Excel in analytical chemistry and in general scientific data analysis. Cambridge Univ. Press (2001) 487 pages.
2. Chemical safety matters – IUPAC – IPCS, Cambridge University Press, 1992
3. OSU safety manual 1.01.

BHARATHI WOMEN'S COLLEGE (AUTONOMOUS), CHENNAI – 600108.

M.Sc CHEMISTRY

MEDICINAL CHEMISTRY

(For the students admitted from the year 2019-2020)

HOURS PER WEEK : 5

CREDITS : 5

SEMESTER : IV

SUBJECT CODE : 19EC12

(75hrs)

Objectives:

- To learn the basic idea of Drugs and Names of Common Drugs, Blood, Blood Pressure, Diabetes, AIDS, Vitamins, Indian Medicinal Plants and First Aid.

UNIT-I

(15hrs)

Clinical Health and Biochemical Analysis - Definition of Health - WHO standard.
Sterilisation of Surgical Instruments - Biochemical Analysis of Urine and Serum.
Blood –Composition of Blood - Blood grouping and Rh factor.

UNIT-II

(15hrs)

Common Drugs - Antibiotics, Antipyretics and Analgesics - Examples, Uses and Side effects. Anti-inflammatory agents, Sedatives, Antiseptics and Antihistamines - Examples, Uses and Side effects. Tranquilizers, Hypnotics and Antidepressant drugs
Definition Examples, uses and side effects

UNIT-III

(15hrs)

Vital Ailments and Treatment - Blood pressure - Hypertension and Hypotension.
Diabetes, Cancer, AIDS - Causes, Symptoms and Treatment. Vitamins – Classification of Vitamins – Sources and Deficiency diseases caused by Vitamins.

UNIT-IV

(15hrs)

Indian Medicinal Plants - Palak, Vallarai, Kizhanelli and Thumbai - Chemical Constituents and Medicinal Uses. Hibiscus, Adadodai, Thoothuvalai Chemical

Constituents and Medicinal Uses.Nochi, Thulasi, Aloe Vera - Chemical Constituents and Medicinal uses

UNIT-V

First Aid and Safety - Treatment of Shock, Haemorrhage, Cuts and Wounds. Burns Classification First Aid. Asbestos, Silica, Lead Paints, Cement, Welding fumes and Gase Hazard alert and Precautions for Safety.

Books for study:

1. Applied Chemistry, Jayashree Ghosh - S. Chand and Company Ltd., 2006
2. Biochemistry, S. C. Rastogi - Tata McGraw Hill Publishing Co., 1993.

Books for Reference:

1. Medicinal Plants of India, Rasheeduz Zafar - CBS Publishers and Distributors, 2000.
2. Hawk's Physiological Chemistry, B. L. Oser - Tata-McGraw Hill Publishing Co. Ltd.
3. Practical Pharmaceutical Chemistry, A. H. Beckett and J. B. Stenlake - Vol. I – CBS Publishers and Distributors, 2000.

BHARATHI WOMEN'S COLLEGE (AUTONOMOUS), CHENNAI – 600108.
M.Sc CHEMISTRY
CORE ELECTIVE – V
NANOSCIENCE AND GREEN CHEMISTRY
(For the students admitted from the year 2019-2020)

HOURS PER WEEK : 5
CREDITS : 5

SEMESTER : IV
SUBJECT CODE : 19EC13

(75hrs)

Objective

- To introduce and give an insight into the fascinating area of nano materials and its applications
- To appreciate the techniques involved in environment friendly organic synthesis

UNIT I : SYNTHESIS OF NANO PARTICLES

(15hrs)

Introduction –importance and characterization of nano materials- metal nanoparticles(Au, Ag, Cu nanoparticles- physiochemical properties metal nanoparticles- physiochemical properties of semiconductor nanoparticles(CdS, CdSe, TiO₂)- band gap energy vs size of the nanoparticles-synthesis of metal and semiconductor nano particles - Physical methods: Laser ablation,Evaporation, sputtering and solvated metal dispersion. Chemical methods: Thermolysis, **sonochemical** approach. Carbon clusters – discovery of C₆₀ – Carbon nanotubes – nanowires – applications.

UNIT II : CHARACTERIZATION OF NANOMATERIALS

(15hrs)

Techniques for characterization of nanoscale materials - Principles of Atomic Force Microscopy (AFM), Transmission Electron Microscopy (TEM)- Scanning Electron Microscopy (SEM), X ray diffraction (XRD), UV-Vis technique, X-ray Photoelectron Spectroscopy (XPS), Energy Dispersive X-ray spectroscopy (EDX).

UNIT III : INTRODUCTION TO GREEN CHEMISTRY

(15hrs)

Green chemistry- relevance and goals - Twelve principles of green chemistry –Tools of green chemistry - alternative starting materials, reagents ,catalysts, solvents and processes with suitable examples.

UNIT IV : MICROWAVE MEDIATED ORGANIC SYNTHESIS (MAOS) (15hrs)

Microwave activation- advantage of microwave exposure-specific effects of microwave – neat reactions – solid support reactions – Functional group transformations – condensation reactions – oxidation – reduction reactions – multi-component reactions- solid state synthesis- hydrothermal synthesis

UNIT V : IONIC LIQUIDS AND PTC

(15hrs)

Introduction – synthesis of ionic liquids - properties – applications in alkylation – hydroformylations - epoxidation – Friedel–crafts reaction – Diels-Alder reaction – Knoevengal condensation – Wittig reaction – Phase Transfer Catalyst – synthesis – applications.

Books for Study:

1. Guozhong Cao – Ying wang, Nano Structures and Nanomaterials, synthesis, properties and applications,.
2. M.S. Ramachandra Rao, Shubra Singh, Nanoscience and Nanotechnology, fundamentals to frontiers.
3. A. S Edelstein and R. C CammaRata, Nanomaterials, synthesis, properties and applications.

Books for Reference:

1. C.P. Poole,Jr: F.J.Owens, Introduction to NanotechnologyWiley Interscience,New Jersey, 2003
2. Kenneth J. Klabunde (Ed) ,Nanoscale materials in chemistry , Wiley – Interscience, Newyork , 2001
3. T. Pradeep, Nano: The Essentials in understanding Nanoscience and Nanotechnology.

4. V.K.Ahluwalia, Green Chemistry – Environmentally Benign reactions, Ane BooksIndia (publisher).2006
5. Paul T. Anastas & Tracy C. Williamson, Green Chemistry – Designing Chemistry for the Environment Second Edition,1998.
6. Paul T. Anastas and Tracy C.Williamson, Green Chemistry – Frontiers in Benign chemical synthesis and processes oxford University Press,1998.
7. Rashmi Sanghi and M.M. Srivastava. Green Chemistry – Environment friendly alternatives Narora publishing house, 2003

Website

1. <https://www.understandingnano.com>
2. <https://www.worldscientific.com>
3. <https://www.migreenchemistry.org>
4. <https://www.epa.gov>greenchemistry>

Outcome of Learning

- Understand the synthesis and characterization techniques of nanomaterials.
- To enable the students to learn the principles of green chemistry, green synthesis and isolation of bioactive compounds, green catalysis and renewable energy systems.

BHARATHI WOMEN'S COLLEGE (AUTONOMOUS), CHENNAI – 600108.
M.Sc CHEMISTRY
AGRICULTURE AND LEATHER CHEMISTRY
(For the students admitted from the year 2019-2020)

HOURS PER WEEK : 5
CREDITS : 5

SEMESTER : IV
SUBJECT CODE : 19EC14

(75hrs)

OBJECTIVE:

- To learn about Soil fertility and Productivity, Soil Chemistry, Insecticides, Leather Industry and Treatment of Tannery Effluents

UNIT-I : SOIL CHEMISTRY

(15hrs)

Soil – Introduction - Classification - Properties of Soil – Physical properties – Components – Structure and Texture - Soil-Water, Soil-Air and Soil-Temperature. Chemical properties - Soil Minerals, Soil Colloids, Soil Reaction and Buffering – Analysis of Soil - Soil pH – Determination of Soil pH – Effect of pH on Plants – Buffering of soil - Soil acidity, Soil salinity and Soil alkalinity. Soil Fertility – Carbon and Nitrogen cycle - Acid, Alkaline and Saline soils – Their Formation - Reclamation – Liming agents.

UNIT-II : FERTILISERS AND MANURES

(15hrs)

Fertilisers – Definition - Classification – Requirements of a Good fertiliser - Nitrogen fertiliser – Urea – Preparation and Uses – Potash fertiliser – KCl, K₂SO₄ and KNO₂ - Preparation and Uses – Phosphorus fertiliser – Phosphatic slag, Superphosphate of lime and Triple Superphosphate - Preparation and Uses- NPK fertiliser - Advantages– Role of Micronutrients. Manures – Compost – Composting - Methods of Composting - Farmyard Manure, Vermicompost, Composted Coconut Coir Pith, Press mud and Poultry manure –Applications. Types of pollutions caused by Fertilisers - Ill effects of Fertilisers and their Control.

UNIT-III: INSECTICIDES AND FUNGICIDES

(15hrs)

Insecticides – Definition - Classification of Insecticides - Stomach poisons - Contactpoisons and Fumigants - Insecticides - Organic Insecticides - DDT – Gammexane-Malathion – Parathion. Fungicides – Inorganic Fungicides – Sulphur compounds – Copper compounds –Mercuric compounds – Organic Fungicides – Dithiocarbamates–DithaneM–Bordeaux mixture. Herbicides - Rodenticides - Pesticides in India- Adverse Environmental Effects of Pesticides.

UNIT- IV : LEATHER CHEMISTRY

(15hrs)

Introduction - Constituents of Animal Skin - Preparing Skins and Hides – Leather processing – Process before Tannage – Flaying, Curing, Drying, Pickling, Cleaning and Soaking - Liming and Degreasing. Manufacture of Leather - Leather Tanning methods – Vegetable Tanning Chemistry of Chrome Tanning and Mineral Tanning – Deliming. Dyeing of Leather and Fat Liquoring - Leather Finishing - Oil Tanning - By products.

UNIT- V :TANNERY EFFLUENTS

(15hrs)

Tannery effluents - Pollution and its control - Water pollution and Air pollution - Waste Management. Treatment of Tannery Effluents - Primary, Secondary and Tertiary treatment Pollution Prevention. Effect of Tannery Effluents on Agriculture – Organic Amendment. Reclamation of Tannery Effluents Affected Soil.

Books for Study:

- Industrial Chemistry by B. K. Sharma - Goel Publishing House, Meerut.
- Applied Chemistry by K. Bagavathi Sundari, MJP Publishers, 2006.
- Fundamental Concept of Applied Chemistry by Jayashree Ghosh, S. Chand & Company Ltd.,
- The Nature and Properties of Soils - IX Edition - Nyle. C. Bready - S. Chand.

Books for Reference:

- Soils and Soil Fertility - Louis M. Thompson - and Frederick. R. Troch - Tata Mc Graw Hill Publishing Co.
- Text Book of Soil Science - T. D. Biswas and S. K. Mukerjee - II Edition.
- Soil Science - A. Sankara.
- Fundamentals of Leather Science - Wood roffe Publications of CLRI - Chennai.
- Nature and Properties of Soils - Harry, O. Buckman

BHARATHI WOMEN'S COLLEGE (AUTONOMOUS), CHENNAI – 600108.

**M. Sc CHEMISTRY
TEXTILE CHEMISTRY**

(For the students admitted from the year 2019-2020)

HOURS PER WEEK : 5

CREDITS : 5

SEMESTER : IV

SUBJECT CODE : 19EC15

(75hrs)

Objective:

- To impart knowledge about the Production, Properties and Applications of Natural and Synthetic Fibres, Colour and Constitution, Classification of Dyes and Concept of Dyeing in Textile Industry.

Objective:

- To impart knowledge about the Production, Properties and Applications of Natural and Synthetic Fibres, Colour and Constitution, Classification of Dyes and Concept of Dyeing in Textile Industry.

UNIT I: FIBERS

(15hrs)

General Classification of Fibers – Chemical structure – Production – Properties – Count, Denier, Tex, Staple Length, Spinning Properties, Strength, Elasticity and Creep. Applications of the following Natural Cellulose Fibres (Cotton and Jute). Natural Protein Fibres (Wool and Silk) – General characteristics.

UNIT II: TYPES OF FIBERS

(15hrs)

Chemical Structure, Production and properties of the following Synthetic Fibres - Man-made Cellulose Fibres (Rayon and Modified cellulose fibres). Polyamide Fibres (Different types of Nylons) - Preparation – Nylon degradation – Polyester Fibres – Preparation - Degradation – Polyacrylonitrile fibre - Preparation and Properties – Viscose fibre - Preparation and Properties. Identification tests for Cellulose, Cotton, Wool, Silk, Rayon, Acrylic, Viscose, Polyamide and Polyester Fibres.

UNIT III : METHODS OF BELCHING

(15hrs)

Impurities in Raw Cotton and Grey Cloth, Wool and Silk. General principles of the Removal, Scouring - Purpose, Alkali Scouring and Acid Scouring – Bleaching (Methods - Hypochlorite, Peroxide and Bleaching Powder) - Desizing (Hydrolytic and Enzymatic), Kier Boiling and Chemicking. Dyeing of Polyester and Blends – Functions of Dispersing agents - Fibre swelling – Carrier dyeing - High temperature dyeing - Selection of dyestuff.

UNIT IV: COLOUR AND CONSTITUTION

(15hrs)

A general treatment – Chromophores – Auxochromes - Bathochromes and Hypsochromes. Classification of dyes – Acidic, Basic, Direct, Mordant, Azoic, Ingrain, Vat and Reactive Dyes - Classification as per Chemical constitution – Azo dyes – Triphenyl Methane Dyes, Phthalein Dyes, Indigo and Anthraquinone Dyes. Structure, Preparation and Uses – Methyl Orange, Phenolphthalein and Malachite Green.

UNIT V: DYEING

(15hrs)

Dyeing of Wool and Silk – Fastness properties of dyed materials. Dyeing of Nylon, Terylene and other Synthetic Fibres – Finishing – Finishes given to Fabrics – Mechanical finishes on Cotton, Wool and Silk. Method used in process of Mercerizing – Anticrease and Antishrink finishes – Water Proofing.

Books for Study:

1. Chemical Technology of Fibrous Materials - F. Sadov, M. Horschagin and A. Matetshy, Mir Publishers.
2. The Identification of Textile Fibres - Bruno Nuntak.
3. Introduction to Textile Science - 3rd edition, Maryory L. Joseph.
4. Textile Chemistry – Vol. II, R. H. Peters, Elsevier, Amsterdam.

Books for Reference:

1. Dyeing and Chemical Technology of Textile Fibres – 5th Edition, E. R. Trotman, Charles Griffin & Co Ltd.
2. Chemistry of dyes & Principles of Dyeing – V. A. Shenai, Sevak Publications.
3. Scouring and Bleaching, E. R. Trotman, Charles Griffin & Co Ltd.
4. Text Book of Applied Chemistry - K. Kapur.

M.Sc., CHEMISTRY

ORGANIC CHEMISTRY PRACTICALS

SUB. CODE: 19MC1

HOURS PER WEEK: 8

CREDITS : 4

1. Qualitative Organic Analysis of a two component mixture. Characterization of the components and preparation of their derivatives.
2. Preparation of any four organic preparations involving two stages.

INORGANIC CHEMISTRY PRACTICALS – I

SUB. CODE: 19MC2

HOURS PER WEEK: 8

CREDITS : 4

1. Semi-Micro Qualitative Analysis of a mixture containing two common and two rare cations – W, Mo, Ti, Te, Se, Ce, V & Li.
2. a. Colorimetric Analysis – visual and photo-electric determination of Iron, Nickel and copper.
b. Complexometric titration using EDTA – Estimation of Zinc, Ca & Mg.

PHYSICAL CHEMISTRY PRACTICALS

SUB. CODE: 19MC3

HOURS PER WEEK: 8

CREDITS : 4

1. Determination of the rate constant and order of the reaction for the reaction between potassium persulphate and potassium iodide.
2. Determine the relative strength of two acids by comparing kinetics of acid catalyzed hydrolysis of ester.
3. Construction of a phase diagram. Simple binary system.

4. Distribution law:
 - a. Distribution Co-efficient of iodine between water and carbon tetrachloride.
 - b. Equilibrium constant of the reaction $\text{KI} + \text{I}_2 \leftrightarrow \text{KI}_3$
 - c. Determination of the concentration of given KI solution.
5. Determination of the equivalent conductance of a weak acid at different concentrations and verify Ostwald's dilution law and calculate the dissociation constant of the acid.
6. Conductometric titrations of only mixtures of Hydrochloric acid and Acetic acid against sodium hydroxide.
7. Determine the strength of given KCl or KI and mixture of KCl & KI by the titration with Silver nitrate.
8. Determine the pH of the given solution by EMF method using Quinhydrone electrode.
9. Determine the strength of the given solution of KI by potentiometric titration against standard KMnO_4
10. Determination of dissociation constant of a weak acid by potentiometry.

INORGANIC CHEMISTRY PRACTICAL - II

SUB. CODE: 19MC4

HOURS PER WEEK: 8

CREDITS : 4

1. Quantitative analysis of mixtures of
 - a. Fe & Mg
 - b. Fe & Ni
 - c. Cu & Ni
 - d. Cu & Zn
2. Preparation of complexes
 - a. Trithiourea Copper I Chloride
 - b. Potassium trioxalato Chromate III trihydrate
 - c. Tetrammine Copper II sulphate
 - d. Potassium bisoxalato-diaquo Chromate III complex (cis)
 - e. Potassium bisoxalato-diaquo Chromate III complex (trans)
 - f. Hexa-ammine Cobalt III Chloride

BHARATHI WOMEN'S COLLEGE (AUTONOMOUS), CHENNAI – 108.

P.G. DEPARTMENT OF CHEMISTRY

M.Sc., CHEMISTRY - MODEL QUESTION PAPER

Time : 3 Hrs

Marks : 75

SECTION – A

Answer **ALL** the questions:
(Without omitting any unit)

10X2=20

SECTION – B

Answer any **FIVE** questions out of seven:
(Atleast one question from each unit)

5x5=25

SECTION – C

Answer **TWO** questions – internal choice:

2x15=30

(Without omitting any unit)

BHARATHI WOMEN'S COLLEGE (AUTONOMOUS), CHENNAI – 108.

P.G. DEPARTMENT OF CHEMISTRY

P.G –CORE AND SUPPORTIVE ELECTIVE - MODEL QUESTION PAPER

Time : 3 Hrs

Mark : 75

SECTION – A

Answer any **FIVE** questions out of eight:

5x5=25

(Atleast one question from each unit)

SECTION – B

Answer any **FIVE** questions out of eight:

5x10=50

(Atleast one question from each unit)

BHARATHI WOMENS COLLEGE, CHENNAI-600108

2019-2020

PATTERN FOR SOFT SKILL (19MS1, 19MS2, 1339MS3)

Max Marks	:	100
Internal Assessment	:	25
Written Exam	:	50
Individual Activity/Oral	:	25

Question Paper Pattern

Max Marks : 50

Duration : 2 hours

SECTION-A

Answer **ALL** the questions:

10x2=20

SECTION-B

Answer any **FIVE** questions out of **EIGHT**

5x6=30

BHARATHI WOMENS COLLEGE, CHENNAI-600108

2019-2020

PATTERN FOR SOFT SKILL (19MS4- Computing Skills)

Max Marks	:	100
Internal Assessment	:	25
Written Exam	:	50
Practicals	:	25

Question Paper Pattern

Max Marks : 50

Duration : 2 hours

SECTION-A

Answer **ALL** the questions:

10x2=20

SECTION-B

Answer any **FIVE** questions out of **EIGHT**

5x6=30

PAPER- V INTERNSHIP (Training Programme)

Code: 19MS5

Credit: 2

Internship is intended to gain practical knowledge related to the study. The duration is for 4-6 weeks for 2 credits and it should be carried out in an organization recommended by the department during the summer vacation (or) semester holidays of the first year.

A report must be prepared and submitted to the HOD concerned for evaluation and grading. Internship is optional and is left to the discretion of the concerned department. In case of a student not opting for internship, he/she must take one more soft skill 2/3 credits to fulfill the total credits requirement of 10/15 credits.

PATTERN FOR INTERNSHIP

Max. Marks: 100

Training report: 50 marks

Note: Attendance certificate with training report should contain 10-15 pages

Viva : 50

BHARATHI WOMEN'S COLLEGE (AUTONOMOUS), CHENNAI – 600108.

M.Sc CHEMISTRY

PROJECT

(For the students admitted from the year 2019-2020)

HOURS PER WEEK : 6

CREDITS : 6

SEMESTER : IV

SUBJECT CODE : 19MCL

Objectives

- To make the student to understand and present a research finding on a topic in the subject related to Chemistry under the guidance of a department staff.

TESTING

The student will be tested both in subject matter of the report and the mode of presentation in a review meeting to be held in the middle of the semester, with a panel of three senior staff of the department. This progress reporting will carry 20% marks. Upon submission of the project report to the office of the Controller of Examinations, the viva-voce examination will be conducted by the supervisor and the external expert suggested by the supervisor. The project report and the viva-voce will be evaluated for 80% marks.

PROJECT REPORT:

60 Marks

Standard of subject and plan

Preparation and mastery

Originality and logical development

Summary and references

VIVA-VOCE

40 Marks

Economy of time

Communication

Blackboard use and teaching aids

Language and diction

Answer to questions