PERIYAR UNIVERSITY

SYLLABUS FOR M.Sc. CHEMISTRY

DEGREE OF MASTER OF SCIENCE

CHOICE BASED CREDIT SYSTEM

(For candidates admitted in the colleges affiliated to Periyar University from 2021-2022 onwards)

REGULATIONS

1. OBJECTIVES OF THECOURSE:

The objectives of this course are the following:

(a) To impart knowledge in advanced concepts and applications in various fields ofChemistry.

(b) To provide wide choice of elective subjects with updated and new areas in various branches of Chemistry to meet the needs of allstudents.

2. COMMENCEMENT OF THISREGULATION:

These regulations shall take effect from the academic year 2021-2022, that is, for students who are admitted to the first year of the course during the academic year 2021-2022 and thereafter.

3. ELIGIBILITY FORADMISSION:

A candidate who has passed B.Sc., Chemistry degree of this University or any other University accepted by the Syndicate equivalent thereto, subject to such condition as may be prescribed therefore are eligible for admission to M.Sc., Degree Programme and shall be permitted to appear and qualify for the Master of Science (M.Sc.) Degree Examination in Chemistry of this University.

4. DURATION OF THECOURSE:

The programme for the degree of Master of Science in Chemistry shall consist of two Academic years divided into four semesters.

5. EXAMINATIONS:

The examination shall be of three hours duration for each course at the end of each semester. The candidate failing in any subject(s) will be permitted to appear in the subsequent examination.

The practical / project should be an individual work. The University examination for practical / project work will be conducted by the internal and external examiners jointly at the end of every year.

COURSE OF STUDY AND SCHEME OF EXAMINATION

S. No.	Course (Paper)	Subject Title	Hours / Week	Marks Lecture (Hrs)	Exam Hours	University Examination			Credits
						Internal (25%)	External (75%)	Total	
I SEMESTER									
1.	Core -I	Organic Chemistry - I	5	75	3	25	75	100	5
2.	Core - II	Inorganic Chemistry -I	5	75	3	25	75	100	5
3.	Core - III	Physical Chemistry - I	5	75	3	25	75	100	5
4.	Elective - I	Polymer Chemistry / Nano and Green Chemistry	5	75	3	25	75	100	4
5.	Core Practical - I	Organic Chemistry Practical –I	4	60	-		-	-	-
6.	Core Practical - II	Inorganic Chemistry Practical -I	3	45		-	-	-	-
7.	Core Practical - III	Physical Chemistry Practical - I	3	45		-	-	-	-
		TOTAL	**30**	**450**				**400**	**19**
II SEMESTER									
1.	Core - IV	Organic Chemistry - II	5	75	3	25	75	100	5
2.	Core – V	Physical Chemistry - II	5	75	3	25	75	100	5
3.	Elective - II	Spectroscopy	5	75	3	25	75	100	4
4.	EDC	Extra Disciplinary course	4	60	3	25	75	100	4
5.	Core Practical - I	Organic Chemistry Practical -I	3	45	6	40	60	100	3
6.	Core Practical - II	Inorganic Chemistry Practical -I	3	45	6	40	60	100	3
7.	Core	Physical Chemistry	3	45	6	40	60	100	3

	Practical - III	Practical - I							
8.	Common Paper	Human Rights	2	30	3	25	75	100	-
9.	Add-On Course	Internship Training	-	-	-	-	-	-	-
		TOTAL	**30**	**450**				**800**	**27**

S. No.	**Course (Paper)**	**Subject Title**	**Hours / Week**	**Weeks Learned (Hours)**	**Exam Hours**	**University Examination**			**Credits**
						Internal (25%)	**Ext (75%)**	**Total**	
		III SEMESTER							
1.	Core - VI	Organic Chemistry - III	5	75	3	25	75	100	5
2.	Core - VII	Inorganic Chemistry - II	5	75	3	25	75	100	5
3.	Core - VIII	Physical Chemistry - III	5	75	3	25	75	100	5
4.	Elective - III	Experimental methods in Chemistry/Electroanalytical Techniques	5	75	3	25	75	100	4
5.	Core Practical-IV	Organic Chemistry Practical – II	3	45	-	-	-	-	-
6.	Core Practical - V	Inorganic Chemistry Practical – II	4	60	-	-	-	-	-
7.	Core Practical-VI	Physical Chemistry Practical - II	3	45	-	-	-	-	-
		TOTAL	**30**	**450**				**400**	**19**
		IV SEMESTER							
1.	Core - IX	Inorganic Chemistry - III	5	75	3	25	75	100	5
2.	Elective – IV	Medicinal Chemistry	5	75	3	25	75	100	4
3.	Core Practical-IV	Organic Chemistry Practical - II	3	45	6	40	60	100	3

4.	Core Practical - V	Inorganic Chemistry Practical - II	3	45	6	40	60	100	3
5.	Core Practical-VI	Physical Chemistry Practical - II	3	45	6	40	60	100	3
6.	Project	Dissertation/Project work	11	165	-	-	-	200	7
		TOTAL	**30**	**450**				**700**	**25**
		GRAND TOTAL	**120**	**1800**				**2300**	**90**

The students can choose the Elective Paper from the choice given.

Note: I

Core Papers	:9
Core Practicals	:6
Elective papers	:4
EDC	:1
Human Rights	:1
Internship Training	:1
Project	:1

Note : II

Distribution of Marks
Theory

UniversityExamination(External)	:	75 marks
InternalAssessment	:	25marks

Distribution of Internal Assessment mark

Test : 10marks
Attendance: 5 marks
Assignment: 5 marks
Seminar : 5marks

Total 25marks

Passing Minimum: Internal Assessment: 50% - 12 marks
Passing Minimum: External Assessment: 50% - 38 marks

Total Passing Minimum - 50marks

Practicals

University Examination (External) : 60 marks

Internal Assessment : 40 marks

Calculation of Internal Assessment mark

Number of Experiments : 10marks

Experimental skill : 10marks

Test : 20marks

Total : 40marks

Passing Minimum: Internal Assessment: 50% - 20 marks

Passing Minimum: External Assessment: 50% - 30 marks

Total Passing Minimum - 50marks

Everything should be supported by proper record separate passing minimum is necessary for Internal and External

Question Paper Pattern

Theory

Time:3Hours Max. marks :75

Part - A: 15 X 1 = 15

(Answer all questions)

(Three multiple choice questions from each unit)

Part - B: 2 X 5 = 10

(Answer any two questions) (

one question from each unit)

Part – C: 5X 10 = 50

(Answer all questions)

(one question from each unit with internal choice)

Practical

Distribution of marks for practical

.

Experiment	: 45 marks
Viva-voce in practical	: 10 marks
Record	: 5 marks
Total	: 60 marks
Duration	: 6 Hours

Project

Dissertation / Project	: 150 marks
Viva - voce	: 50 marks
Total	: 200 marks

M.Sc. CHEMISTRY SEMESTER - I

CORE I - ORGANIC CHEMISTRY – I

(75 Hours)

OBJECTIVES

1 To learn about the stereochemistry of organic compounds and ORD and CD.
2 To learn about the formation, stability and structure of intermediates and the mechanism of aliphatic electrophilic substitution.
3 To learn about the effect of structure on reactivity.
4 To learn about the mechanism of aliphatic nucleophilic substitution reactions.
5 To learn about the structural elucidation of alkaloids, flavones, isoflavones and anthocyanins.

UnitI Stereochemistry, ORD and CD (15Hours)

Wedge, Fischer, Newmann and Saw-horse formulae and their inter conversion, R and S notation, axial chirality (biphenyls, allenes and spiranes), planar chirality (cyclophanes, ansa compounds and trans cyclooctene), chirality due to helical shape, stereo selective and stereo specific reactions, asymmetric synthesis- Cram's rule. Homotopic, enantiotopic and diastereotopic atoms,groups in organic molecules. ORD & CD curves, octant rule, cotton effect, axial halo ketone rule and its applications

UNIT II Reaction intermediates and aliphatic electrophilic substitution (15 Hours)

Reaction intermediates - Formation, stability and structure of carbonium ions, carbanions, carbenes, nitrenes and free radicals

Aliphatic electrophilic substitution- SE1, SE2 and SEi mechanisms and electrophilic substitution by double bond shift, hydrogen electrophile-keto-enol tautamerism, halogen electrophile-halogenation of aldehydes and ketones, nitrogen electrophile- aliphatic diazonium coupling, sulphur electrophile-sulphonation and carbon electrophile- Stork-enamine reaction

Unit III Effect of structure on reactivity (15 Hours)

Resonance and field effects, resonance and steric effects, quantitative treatment- the Hammett equation- linear free energy relationship, substituent constant and reaction constant and limitations of Hammett equation, Taft equation, thermodynamically and kinetically controlled reactions, Hammond's postulate, Non- kinetic methods of determining mechanism- isolation, trapping and detection of intermediates, isotopic labeling, crossover experiments, product analysis, stereo chemical evidence, kinetic method -kinetic isotope effect

Unit IV Aliphatic nucleophilic substitution (15 Hours)

The SN1, SN2, SNi and neighbouring group mechanisms, the neighbouring group participation by pi and sigma bonds, Non classical carbocations, nucleophilic substitution at an allylic, aliphatic trigonal and vinylic carbon. Reactivity- effect of substrates structure, attacking nucleophile, leaving group and

reaction medium. Ambident nucleophile, Swain- Scott, Grunwald-Winstein relationship, phase transfer catalysis.

Unit V Alkaloids and Anthocyanins (15 Hours)

Synthesis and structural elucidation of morphine,quinine, papaverine and reserpine. General nature of anthocyanins,structure of anthocyanidins, synthesis of pelargonidin chloride, cyanidin chloride, delphinidin chloride and peonidin chloride. Synthesis and structural elucidation of flavones andisoflavones.

TEXT BOOKS

1. Jerry March, Advanced Organic Chemistry-Reactions, Mechanisms and Structure, Fourth Edition, John Wiley & Sons1992
2. Gould, Mechanism and structure in organic chemistry, Rinehart and Winston, INC,1960.
3. Jagdamba Singh and Yadav, Advanced Organic Chemistry, Pragati Prakashan Publications, 6th Edition,2010.
4. Francis A. Carey, Organic Chemistry, Third Edition,The McGraw-Hill Companies, Inc.,1996.
5. P.S. Kalsi, Organic Reactions and Mechanisms, Second Edition, New Age International Publishers,2002.
6. Ernest L. Eliel, Stereochemistry of Carbon Compounds, T.M.H Edition, Tata McGrawHill Publishing Company,1995.
7. P.S. Kalsi, Stereochemistry – Conformation and Mechanism, 6th Edition, Wiley Eastern Limited,2005.
8. I.L. Finar, Organic Chemistry, Volume II, Fifth Edition, First Indian reprint, Pearson Education Asia Pvt. Ltd.,2000.
9. O.P. Agarwal,Chemistry of Organic Natural Products, Volume I and II, Goel Publishing House,1988

REFERENCE BOOKS

1. P.S. Kalsi, Stereochemistry and Mechanism through solved problems, Second Edition, New Age International Publishers,1994.
2. D. Nasipuri, Stereochemistry of Organic Compounds, 2nd Edition, New Age International Publishers,1994.
3. S.M. Mukherji and S. P. Singh, Reaction Mechanism in Organic Chemistry, 1st Edition, Macmillan,1976.
4. R.T. Morrison and R.N. Boyd, Organic Chemistry, 6th Edition, Prentice-Hall,1992.R.O.C.
5. Norman, Principles of Organic Synthesis, Second Edition, Chapman and Hall,1978.

M.Sc. CHEMISTRY SEMESTER – I

CORE II - INORGANIC CHEMISTRY – I

(75 Hours)

OBJECTIVES

1. To learn about the basic concepts of structure and bonding in Inorganic polymers and polyacids
2. To understand the different metals used in Bioinorganic Chemistry
3. To learn the basics of nuclear chemistry and different types of nuclear reactions

UNIT I Structure and Bonding (15 Hours)

Hard and Soft acids and bases-classifications, Acid-Base strength, hardness,symbiosis, Theoretical basis of Hardness and Softness, applications of HSAB.

Rings-Phosphazenes- Structure, Craig and Peddock model, Dewar model, polyorgano phosphazenes, Polysulphur –nitrogen compounds.

Inorganic polymers-Silicates-structure,Pauling's rule, properties, correlation and application; Molecular sleves.

Polyacids- Isopolyacids of V, Cr, Mo and W; Heteropolyacids of Mo and W (only structural aspects)

UNIT II Bioinorganic chemistry (15 Hours)

Bioinorganic chemistry- Biological significances of metals- alkali and alkaline earth metals, Na/K pump, Transition metal storage and transport of Fe, Cu, Zn, Biological oxygen transport systems, Structure and function of heme and non- heme proteins (Mb, Hb, Hc, Hr), Non-redox metalloenzymes-carboxy peptidase and carbonic anhydrase. Functions of Fe,Cu, Fe, sulphur proteins, cytochrome C and cytochrome P-450, Fundamental reactions of metals with nucleic acids and nitrogen fixation.

UNIT III Boron compounds and Clusters (15 Hours)

Boron hydrides – polyhedral boranes, hydroborate ions – a general study of preparation, properties and structure, styx numbers, Wade's rules.

Carboranes-types such as closo and nido- preparation, properties and structure. Metallocarboranes – a generalstudy.

Metal clusters– Chemistry of low molecularity metal clusters only –structure of Re_2Cl_8; multiple metal –metal bonds.

UNIT IV - Nuclear Chemistry – I (15 Hours)

The nucleus-subatomic particles and their properties-mass defect - binding energy - n/ p ratio in stable and metastable nuclei-Different types of nuclear forces-Liquid drop model and shell model.

Modes of radioactive decay-Theory of alpha decay, beta decay and gamma radiation, Orbital electron capture, nuclear isomerism-internal conversion.

Detection and determination of activity-GM, Scintillation and Cherenkov counters. Particle Accelerators: Linear accelerator- cyclotron, synchrotron, betatron and bevatron

UNIT V - Nuclear Chemistry – II (15 Hours)

Nuclear Reactions: Q-value, columbic barrier- nuclear cross section-different types of nuclear reactions-projectile capture-particle emission, spallation, fission and fusion-product distributions - Theories of fission, use of fission products, fissile and fertile isotopes - U-238, U- 235, PU-239, Th232 -stellar energy-synthesis of new elements.

Radio-Isotopes: Applications-isotopes as tracers - neutron activation analysis and isotopic dilution analysis - uses in structure and mechanistic studies - Carbon dating – Radio pharmacology, Radiation protection and safety precautions - Disposal of nuclear waste.

TEXT BOOKS

1. F.A Cotton & Wilkinson, Advanced Chemistry
2. Emelius and Sharpe, Modern Aspects of Inorganic Chemistry.
3. J.D. Lee, Concise Inorganic Chemistry.
4. S.F.A. Kettle, Physical Inorganic Chemistry, Oxford University
5. J.E.Huheey, E.A.Keiter and R.L.Keiter, Inorganic chemistry-principles of structure and reactivity, 4th edition, Pearson-Education,2002
6. H.J. Arnikar, Essentials of nuclear Chemistry,2nd edition, Wiley easternCo.,1987.
7. S. Glasstone, Source Book on Atomic Energy.

REFERENCE BOOKS

1. H.A.O. Hill and P.Day, Physical methods in advanced Inorganic chemistry, JohnWiley.
2. G.S. Manku, Inorganic Chemistry, T.M.H. Co.,1984.
3. K.F. Purcell and J.C. Kotz, Inorganic Chemistry, WB Saunders Co., USA1977.
4. G. Friedlander, J.W.Kennedy and J.M. Miller, Nuclear and Radio Chemistry, Wiley.,1964.
5. Aayjay kumarbhagi and G.R.Chatwal,Bioinorganic and Supramolecular Chemistry,Himalaya PublishingHouse.,2003.
6. Gurdeep Raj, Advanced Inorganic Chemistry-II Goel PublishingHouse,1996-97.
7. M.N.Hughes,The Inorganic Chemistry and Biological Processes,Wiley London,IIEdition.198
8. A.K. Srivatsava and P.C. Jain, Elements of Nuclear Chemistry, S.Chand and Co.,1989

M.Sc. CHEMISTRY
SEMESTER – I
CORE III - PHYSICAL CHEMISTRY – I
(75 Hours)

OBJECTIVES

i) To study in detail the basic concepts of classical thermodynamics and statistical thermodynamics

ii) To learn about theories of reaction rates and kinetics of reactions in solution phase

ii) To understand the principles of quantum chemistry and group theory

UNIT I Classical Thermodynamics – I (15 Hours)

Concept of chemical potential-Determination of chemical potential -Direct Method and Method of Intercepts – variation of chemical potential with temperature and pressure-Fugacity –Methods of determination of fugacity – Variation of fugacity with temperature and pressure. Standard states for gases, liquids, solids and components of solutions. Solution of electrolytes – Concept of ionic strength -.mean ionic activity and mean ionic activity coefficient – determination of activity coefficient from freezing point, EMF and solubilitymeasurements.

UNIT II –Statistical Thermodynamics – I (15 Hours)

Concept of Mathematical probability and thermodynamic probability - States of maximum thermodynamic probability of systems involving energy levels. Distinguishable and indistinguishable particles-microstates and macrostates. Ensembles– definition- microcanonical, canonical and grand canonical ensembles. Maxwell's distribution law of molecular velocities - Evaluation of average velocity, root mean square velocity and most probable velocity from distribution law of molecular velocities - molecular velocities and energies of an ideal gas.

UNIT III Chemical Kinetics – I (15 Hours)

Theories of reaction rates-Hard sphere collision theory and transition state theory of reaction rates– Comparison of collision theory and activated complex theory – Lindemann and Hinshelwood theories of unimolecular reaction rates-Potential energy surface -Reactions in

solutions – comparison between gas phase and solution reactions – cage effect-influence of solvent, ionic strength, and pressure on reactions in solution – Kinetic isotope effects.

UNIT IV Quantum Chemistry – I (15 Hours)

Planck's theory of black body radiation – Photoelectric effect; de – Broglie equation – Heisenberg uncertainty principle – Compton effect; operators and commutation relations – quantum mechanical postulates – Schrodinger equation and its solution to the problem of a particle in one and three dimensional boxes – the harmonic oscillator.

UNIT V Group Theory – I (15 Hours)

Symmetry elements and symmetry operations – Point groups – identification and representation of groups – comparison of molecular and crystallographic symmetry – Reducible and irreducible representation – Direct product representation – Great orthogonality theorem and its consequences – Character table and its uses.

TEXTBOOKS

1. S.Glasstone, Thermodynamics for chemists, Affiliated East West press, New Delhi,1960.
2. J. Rajaram and J.C. Kuriacose, Thermodynamics for students of chemistry, Lal Nagin Chand, New Delhi,1986.
3. J. Rajaram and J.C. Kuriacose, Kinetics and mechanism of chemical transformation, Macmillan India Ltd.,1993.
4. K.J.Laidler, Chemical Kinetics, Harper and Row, Newyork,1987.
5. R.K. Prasad, Quantum Chemistry, Wiley Eastern, New Delhi,1992.
6. V.Ramakrishnan and M.S.Gopinathan, Group theory in chemistry, Vishal Publications,1988.
7. K.V.Raman, Group theory and its application to chemistry, Tata McGraw Hill Publishing Co., 1990.
8. Gurudeep Raj, Advanced Physical Chemistry, Goel Publishing House,Meerut

REFERENCE BOOKS

1. W.J. Moore, Physical Chemistry, Orient Longman, London,1972.
2. J.W. Moore and R.G. Pearson, Kinetics and Mechanism,1981.
3. A.K. Chandra, Introductory Quantum Chemistry, Tata Mc GrawHill.
4. P.W.Atkins, Molecular Quantum Mechanics, Oxford University Press, Oxford.,1983
5. I.N.Levine, Quantum chemistry, Allyn and Bacon, Boston,1983.
6. F.A. Cotton, Chemical Application of Group Theory, John Wiley and Sons Inc., Newyork, 1971.

M.Sc. CHEMISTRY
ELECTIVEI
Paper I – POLYMERCHEMISTRY
(75 Hours)

OBJECTIVES

1. To study the basic concepts in Polymer chemistry.
2. To study the determination of molecular weight and properties of polymers.
3. To know about the polymer processing and polymerization techniques.
4. To learn about the synthesis and applications of commercial polymers and conducting polymers.

UNIT I Basic Concepts (15 Hours)

Monomers, repeat units, degree of polymerization, Linear, branched and network polymers, Addition polymerization, Condensation polymerization, Mechanism of free radical, cationic and anionic polymerization and co-ordination polymerization. Ziegler-Natta catalyst. Kinetics of free radical, cationic, anionic and co-polymerisation. Determination of Reactivity ratio, Reactivity ratio and co-polymerisation behavior.

UNIT II Molecular Weight and Physical Properties (15 Hours)

Concept of Average molecular weight, number- average, weight- average molecular weight and viscosity-average molecular weights. Determination of molecular weight - viscosity, light scattering, osmotic and ultracentrifugation methods. Physical properties- crystalline melting point, glass transition temperature, relationship between Tm and Tg and Determination of Tg.

UNIT III Polymer Processing and Polymerization Techniques (15 Hours)

Polymers processing- Plastics, elastomers and fibres. Compounding, Processing techniques- calendaring, die casting, injection molding, thermofoaming and fibre spinning. Polymerization techniques- Bulk polymerization, solution polymerization, suspension polymerization, emulsion polymerization and melt polycondesation.

UNIT IV Commercial Polymers (15 Hours)

Synthesis and applications of polyethylene, polyvinyl chloride, polyamide, polyester, phenol resins, epoxy resins, silicone polymers, polybenoxazoles, polyimidazole, polyurethane, polymethylmethacrylate, poly (tetrafluoro ethylene) and polyacrylonitrile.

UNIT V Conducting Polymers (15 Hours)

Conducting polymers- Introduction, Electrochemical doping, Electrochemical synthesis and applications of polypyrrole, polythiophene, polyindole, polyaniline, polyacetylene and poly(p-phenylene).

REFERENCE BOOKS

1. F.W. Billmeyer, Textbook of Polymer Science, Wiley Student Edition, 3rdEdition.
2. L. Gupta, Pragathi PrakashanPolymer Science, Publication.
3. V.R. Gowariker, N.V. Viswanathan, J. Sreedhar, Polymer Science, NewAge International Private Limited,1986.
4. P.J. Flory, Principles of Polymer Chemistry, Asian Books, 1st Edition,2006.
5. George Odian, Principles of Polymerization, John Wiley, 4th Edition,2007.
6. V.K.Ahluwalia & Anuradha Mishra, Polymer Science: A Text Book, Ane Books, 1st Edition,2008.
7. A. Skotheim, L. Elsenbaumer, R.Reynolds, Handbook of Conducting Polymers, Second Edition,1997.
8. Hari SinghNalwa, Textbook of Organic Conductive Molecules and Polymers.

M.Sc. CHEMISTRY SEMESTER - I
ELECTIVE I
Paper II - NANO AND GREEN CHEMISTRY
(75 Hours)

OBJECTIVES

1. To learn about the synthesis, properties and applications of Nanomaterials.
2. To learn the tools for Characterisation of Nanomaterials.
3. To understand the green concept of organic reactions.

UNIT I Introduction and Synthesis of Nano materials (15 Hours)

Definition - Classification –Historical perspective -synthetic approaches –physical methods – electric arc method –laser ablation – physical vapour deposition – sputtering - chemical methods – reduction of metal ions - solvo thermal synthesis – photo chemical synthesis – electro chemical methods (anodic and cathodic process) –thermolysis – sono chemical routes – synthesis of semiconductor nano materials –sol – gel methods and biological methods of synthesis.

Unit II Properties and applications of Nanomaterials (15 Hours)

Nanoclusters- Catalytic, electrical and optical and magnetic properties of nanomaterials. Applications- Nano catalyst-Nano sensors-Nano medicines- Bioimaging with quantum dots, Cancer Therapy-nano particles in environmental remedy-Removal of toxins- water treatment.

UNIT III Tools for Characterisation of Nano Materials (15 Hours)

Electron microscope – SEM –TEM –STM –AFM – X-ray Diffraction.

Spectroscopy: UV-visible spectroscopy- FTIR –Raman spectroscopy-x-ray photo electron spectroscopy-Luminescence-Photoluminescence

Tools for nano structures: Nanolithography-Electron beam-Ion beam- Nano sphere-self- assembled monolayers – Coreshell–Nanoshells

Unit IV Introduction to Green chemistry (15 Hours)

Choice of starting materials, Choice of reagents, Choice of catalysts- biocatalyst, polymer supported catalysts, Choice of solvents. Synthesis involving basic principles of green chemistry,examples-SynthesisofAdipicacid,Methylmethacrylate,Paracetamol.Ultrasoundassisted reactions- Esterification, Reductions, Coupling reactions, Strecker synthesis and Reformatsky reactions.

Unit V Solvent free organic synthesis (15 Hours)

Reactions on solid supports, Phase transfer catalysis, Solvent free esters saponifcation, Reactions without support or catalyst- examples, Microwave assisted reactions in water- Oxidation of toluene to benzoic acid, Microwave assisted reactions in organic solvent- Diel's - Alder reaction, Coupling reactions (Stille, Suzuki, Heck, Sonogashira), Solvent free microwave assisted organic synthesis, Microwave activation and heating, Advantages of microwave exposure and specific effects of microwaves, Organic synthesis under microwaves- benefits and limitations.

REFERENCE BOOK

1. T. Pradeep, NANO: The Essentials, Tata McGraw Hill Education Private Limited,2012
2. B. S. Murty, P. Shankar et al, Textbook of Nanoscience and Nanotechnology, Universities Press (INDIA) Private Limited ,2012
3. Sulabha K. Kulkarni, Nanotechnolgy: Principles and Practices, Springer,2015
4. RashmiSanghi, M.M.Srivastava, Green chemistry, Environment friendly Alternatives, Narosa Publishing house,2007.
5. V.Kumar,AnIntroductiontoGreenchemistry,VishalPublishingCo.Jalandhar,2007.

M.Sc. CHEMISTRY SEMESTER - II
CORE IV - ORGANIC CHEMISTRY – II
(75 Hours)

OBJECTIVES

1 To understand the basic concepts of aromaticity

2 To learn the mechanism of Elimination reaction and free radical reactions.

3 To study the mechanism of Aromatic electrophilic and Nucleophilic substitution reactions

4 To know the effects of light in organic reactions.

5 To study the basic concepts of the pericyclic reactions

Unit I Aromaticity (15 Hours)

Aromaticity- Aromaticity in benzenoid, non-benzoid, (2, 6, 10 & 18 electrons systems) and hetero cyclic compounds. NMR concept of Aromaticity and non-aromaticity, systems of 10 electrons and more than 10 electrons (14, 18) annulunes, concept of antiaromaticity and homoaromaticity, antiaromaticity in (12, 14) annulunes, non- aromaticity, alternate and non-alternant hydrocarbons, Aromaticity in fullerenes, Mobius Aromaticity.

Unit II Elimination and Free radicals (15 Hours)

The E1, E2,E1CB mechanisms, orientation of the double bond- Hofmann, Zaitsev's and Bredt rules, competition between Elimination and substitution, mechanism of pyrolytic elimination, Chugaev and Cope Elimination reactions.

Reactions of free radicals- polymerization, addition, halogenation, aromatic substitution and rearrangement. Reactivity - reactivity on aliphatic, aromatic substrate, reactivity in the attacking radical and effect of solvents.

Unit III Aromatic electrophilic and nucleophilic substitution (15 Hours)

The arenium ion mechanism, orientation and reactivity in monosubstituted benzene ring-o, m, p-directing groups, ortho, para ratio, ipso attack, Vilsmeier- Haack, Jacobson and Scholl's reactions. The SNAr,SN1 and benzene mechanisms, Reactivity - effect of substrate structure, leaving group and attacking nucleophiles.

UNIT IV Organic Photo chemistry (15 Hours)

The fate of excited molecules, Jablonski diagram, Norrish type I and type II reactions, photo reduction of ketones, Paterno-Buchi reactions, photo chemistry of arenes, photo oxidation (formation of peroxy compounds), photo isomerisation (cis- trans), photo addition of olefin and amines to aromatic compounds. Fries, di-pi methane rearrangements, rearrangement of 4,4-diphenyl cyclohexadienone.

Unit V Pericyclic reactions **(15 Hours)**

Classification, basic concept of orbital symmetry, Woodward- Hofmann rules. Electrocyclic reactions- concept of con and disrotation, cyclisation of butadiene and 1,3,5 - hexatriene- correlation diagram and FMO approach. Cycloaddition reactions- superafacial and antarafacial addition, theory of (2+2) and (4+2) cycloaddition reactions- correlation diagram and FMO approach. Sigmatropic migration of hydrogen and carbon, Sommelet- Hauser, Cope and Claisen rearrangements.

TEXT BOOKS

1. Jerry March, Advanced Organic Chemistry-Reactions, Mechanisms and Structure, Fourth Edition, John Wiley & Sons(1992)
2. Francis A. Carey, Organic Chemistry, Third Edition, The McGraw-Hill Companies, Inc.,1996.
3. P.S. Kalsi, Organic Reactions and Mechanisms, Second Edition, New Age International Publishers,2002.
4. Charles H.Depuy, molecular reactions and photochemistry, Orville L.Chapman.Prentice Hall of India Pvt Ltd. New Delhi1988.
5. S.M. Mukherji and S.P. Singh, Reaction Mechanism in Organic Chemistry, IIIEdn. MacMillan,1984.
6. V.K. Ahluwalia, Organic Reaction Mechanism, Narosa Publishing House, 4th Edition,2013.

REFERENCE BOOKS

1. S. H. Pine, J.B. Hendrickson, D.J. Cram and G.S. Hammond, Organic Chemistry, IV Edn., McGraw Hill Company,1980.
2. R.T. Morrison and R.N. Boyd, Organic Chemistry, Prentice-Hall,1992.
3. R.O.C. Norman, Principles of Organic Synthesis, Second Edition, Chapman and Hall,1978.
4. L.F.FieserandM.Fieser,OrganicChemistry,AsiaPublishingHouse, Bombay, 2000.
5. R.K. Bansal, Organic Reaction Mechanism, Tata McGraw Hill Publications, 3rd Edition,2006.

M.Sc. CHEMISTRY

SEMESTER - II

CORE PAPER V - PHYSICAL CHEMISTRY – II

(75 Hours)

OBJECTIVES

1. To gain knowledge about the distribution laws in statistical thermodynamics and partition function
2. To study about the kinetics of complex and fast reactions
3. To understand the principles of quantum chemistry and group theory

UNIT I Statistical Thermodynamics-II (15Hours)

Classical statistics-Stirling's approximation formula, Maxwell Boltzmann distribution law-assumptions, derivation for the system having non- degenerate and degenerate energy levels. Quantum statistics: Bose-Einstein and Fermi-Dirac statistics - comparison of Maxwell Boltzmann, Bose Einstein and Fermi – Dirac statistics - entropy of boson - Application. Entropy of fermions, Applications - electron gas, fermi energy of free electrons at absolute zero.

UNIT II Partition functions (15 Hours)

Definition explanation- molecular partition function- molar partition function- Relationship between partition function and thermodynamic properties- internal energy, entropy, enthalpy, equilibrium constant, molar heat capacities of ideal gas molecules – translational, rotational, vibrational, and electronic partition functions- Sackur- Tetrode equation

Equipartition of Principle of Energy: Calculation of heat capacities of ideal gases, Einstein and Debye theory of heat capacities of solids.

UNIT III Chemical Kinetics – II (15 Hours)

Kinetics of complex reactions – reversible reactions, consecutive reactions – Parallel reactions and Chain reactions – Rice–Herzfeld mechanism for hydrogen-bromine, gas phase pyrolysis of methane and formation of phosgene reactions- explosion limits. Study of fast reactions: Relaxation methods-temperature and pressure jump methods - Stopped flow technique, flash photolysis and Crossed molecular beam method.

UNIT IV Quantum Chemistry –II (15 Hours)

Application of Schrödinger equation to rigid rotator and hydrogen atom –origin of quantum numbers – probability distribution of electrons. Approximation methods – Perturbation and Variation methods – Slater determinant -application to hydrogen and helium atom — Spin - orbit interaction – LS coupling and JJ coupling – ground state term symbols for simple atoms.

UNIT V Group Theory – II (15 Hours)

Symmetry selection rules for vibrational, Electronic and Raman Spectra – determination of vibrational modes in non-linear molecules such as H_2O, NH_3, CH_4 and XeF_4, – symmetry of hybrid orbitals in non-linear molecules (H_2O, NH_3, CH_4, XeF_4 and PCl_5) 2 Electronic spectra of formaldehyde.

TEXT BOOKS :

1. Gurdeep raj, Advanced Physical Chemistry, Goel PublishingHouse,Meerut.
2. M.C. Gupta, Statistical Thermodynamics,Wiley Eastern Publications, 1st edition, 1990.
3. Ashley, Classical and Statistical Thermodynamics Pearson Education2012
4. J. Rajaram and J.C. Kuriacose, Kinetics and mechanism of chemicaltransformation, Macmillan India Ltd.,1993.
5. K.J.Laidlar, Chemical Kinetics, Harper and Row, Newyork,1987.
6. R.K. Prasad, Quantum Chemistry, Wiley Eastern, New Delhi,1992.
7. V.Ramakrishnan and M.S.Gopinathan, Group theory in chemistry,Vishal Publications,1988.
8. K.V.Raman, Group theory and its application to chemistry, Tata McGrawHill Publishing Co.,1990.

REFERENCE BOOKS

1. W.J. Moore, Physical Chemistry, Orient Longman, London,1972.
2. J.W. Moore and R.G. Pearson, Kinetics and Mechanism,1981.
3. A.K. Chandra, Introductory Quantum Chemistry, Tata Mc GrawHill.
4. P.W.Atkins, Molecular Quantum Mechanics, Oxford University Press, Oxford.,1983
5. I.N.Levine, Quantum chemistry, Allyn and Bacon, Boston,1983.
6. F.A. Cotton, Chemical Application of Group Theory, John wiley and SonsInc., Newyork,1971

M.Sc. CHEMISTRY SEMESTER - II

ELECTIVE II SPECTROSCOPY

(75 Hours)

OBJECTIVES

1 To study in detail about UV-VIS, IR, NMR, 13C NMR, EPR, Mossbauer spectroscopic and Mass spectrometry techniques

2 To develop problem solving skills from various types of spectra

UNIT I UV-VIS ANDIRSPECTROSCOPY (15Hours)

UV-VIS- The nature of the electronic excitations, origin of UV band structure and the principle of absorption, chromophores and auxochromes, factors affecting intensity- solvent effects and position of absorption bands- dienes, polyenes and enones Woodward- Fisher rules for dienes, enones and aromatics-calculation of λmax for organic molecules- applications of UV spectroscopy.

IR : IR absorption process, modes of stretching and bending vibrations, bond properties and their relations to absorption frequencies, Characteristic group frequencies of aliphatic and aromatic organic molecules, carbonyl, carboxylic acid, ester, alcohol, phenol and amides. Factors influencing vibrational frequencies, interpretation of IR spectra of organic molecules-applications of IR spectroscopy.

UNIT II NMR SPECTRSCOPY – I (15 Hours)

1H NMR- principle - Shielding and deshielding - chemical shift, factors influencing chemical shift – magnetic anisotropy- Spin – spin splitting- (n+1rule), Coupling constant

–Pascal's triangle, calculation of coupling constants, mechanism of coupling (one bond, germinal, vicinal and long range coupling), First order & non first order spectra - Chemical & magnetic equivalence, shift reagents, NMR instrumentation –Applications

UNIT III NMR SPECTROSCOPY – II (15 Hours)

13C NMR - The C 13 nucleus – Chemical shifts –Modes of couplings and multiplicity- proton coupled 13C spectra, Homonuclear & heteronuclear decoupling – NOE- Broad band decoupling – Off resonance decoupling –intensity of signals, Chemical shift equivalence, equivalent carbons, chemical shifts of 13C nuclei, DEPT technique, comparison of 1H and 13C NMR, 2D NMR-COSY and HETCOR techniques-simple molecules and applications of 13C NMR.

UNIT IV EPR AND MOSSBAUER SPECTROSCOPY (15 Hours)

EPR – introduction, factors affecting the g-value, limitations, instrumentation, electron nucleus interaction, hyperfine interactions-isotropic and anisotropic coupling constants

– spin Hamiltonian -applications

Mossbauer spectroscopy –Principle, Instrumentation, Doppler shift, Isomer shift, Quadrupole splitting, Magnetic interaction, Magnetic hyperfine splitting and selection rules. Applications-Mossbouer spectra of high and low spin Fe and Sn compounds.

UNIT V MASS SPECTROMETRY AND SPECTROSCOPIC APPLICATIONS (15 Hours)

Mass spectra- Basic principle, molecular ion peak, base peak, meta stable ion peak, isotopic peaks, Nitrogen rule, ring rule, Mc-Lafferty rearrangement, rules for fragmentation pattern, Examples of mass spectral fragmentation of organic compounds (alkanes, aromatic hydrocarbons, alkyl halides, aldehydes, ketones, alcohols, acids and esters).

Spectroscopic applications: Structural elucidation of simple organic molecules using UV-VIS, IR, 1H NMR spectroscopy and Mass spectrometry.

REFERENCE BOOKS

1. William Kemp,Organic Spectroscopy, 3rd edition, ELBS Publications,1975.
2. Jag Mohan, Organic Spectroscopy, Narosa Publishing House, 2nd Edition,2009.
3. B.K.Sharma, Spectroscopy, Goel Publishing House,2011
4. G.W.Ewing, Instrumental methods of chemical analysis, Mcgraw Hillpub,1975
5. P.S. Kalsi, Spectroscopy, New Age International (P) Ltd, reprint2009
6. D. L. Pavia, G.M. Lampman & G.S.Kriz Introduction to Spectroscopy, 3rd Edition, Brooks/Cole Publications,2008,
7. R.S. Drago,Physical Methods in Inorganic Chemistry, Reinhold SaundersCollege Publishing,1977
8. R.M. Silverstein, F.X. Webster, Spectrometric Identification of Organic Compounds, 6th Edition, John Wiley Publications,2009.

M.Sc. CHEMISTRY SEMESTER - II

CORE PRACTICAL I - ORGANICCHEMISTRYPRACTICAL-I

OBJECTIVES

To develop analytical skill in

1. Separation of organic mixture
2. Organic qualitative analysis
3. Preparation of organic compound involving in single stage.

I. Identification of components in a two component mixture and preparation of their derivatives. Determination of boiling point/melting point for components and melting point for their derivatives.

II. Preparation.

1. Beta naphthyl methyl ether from beta-naphthol
2. s-Benzyl isothiuronium chloride from benzylchloride
3. Beta glucose penta acetate from glucose
4. ortho-Benzoyl benzoic acid from phthalicanhydride
5. Resacetophenone from resorcinol
6. Para - nitrobenzoic acid from para nitrotoluene
7. Meta - nitroaniline from meta dinitrobenzene
8. Methyl orange from sulphanilic acid
9. Anthraquinone from anthracene
10. Benzhydrol from benzophenone.

REFERENCE BOOKS

1. B.S.Furniss, A.J.Hannaford, P.W.G.Smith and A.R.Tatchell, Vogel's Practical Organic Chemistry.5th Edn., ELBS,1989.
2. Raj K.Bansal, Laboratory manual of Organic Chemistry, III Edn., New Age International (P)Ltd.1996.
3. Gnanapragasam, Ramamurthy, Organic lab Manual, Viswanathan, S., Printers & Publishers Pvt Ltd, 2009.

M.Sc. CHEMISTRY
SEMESTER - II
CORE PRACTICAL II-INORGANIC CHEMISTRY PRACTICAL I

OBJECTIVES

1. To improve the skill in the qualitative analysis of mixture of four cations containing two common and two rare.
2. To impart the skill in estimation of metal ions by colorimetric method.

Part I

Semimicro qualitative analysis of mixtures containing the following cations to be tested W, Tl,

Pb, Se, Te, Mo, Cu, Bi, Cd, Tl, Ce, Th, Zr, V, Cr, Fe, Ti, Zn, Ni, Co, Mn,

Ca, Ba, Sr, Li and Mg.

Part II

Colorimetric analysis

Visual and Photometric determination of Iron, Nickel, Manganese and Copper

REFERENCES BOOKS

1. G.Svehla, Vogel's qualitative Inorganic analysis, VI Edition, Orient Longman,1987.
2. V.V.Ramanujam, Inorganic Semimicro Qualitative analysis, National PublishingCo., 1971.

M.Sc. CHEMISTRY SEMESTER-II
CORE PRACTICAL –III
Physical chemistry Practical-I

OBJECTIVES

Enable the students to

1) Understand the principle of conductivity experiments and carry out conductometric titrations.
2) Determine the rate constant for acid and base hydrolysis of esters.
3) Learn the kinetics of adsorption of oxalic acid on charcoal.

List of experiments

Conductivity Experiments

1. Determination of equivalent conductance of a strong electrolyte & the verification of DHO equation.
2. Verification of Ostwald's Dilution Law & Determination of pKa of a weak acid
3. Verification of Kohlrausch's Law for weak electrolytes.
4. Determination of solubility of a sparingly soluble salt.
5. Acid-base titration (strong acid and weak acid vs NaOH)
6. Precipitation titrations (mixture of halidesonly)
7. Determination of hydrolysis constant of aniline hydrochloride.
8. Saponification value of ethylacetate by conductivity measurements.
9. Comparison of the relative strength of chloroacetic acid and acetic acid by conductance method

Kinetics

1. Study the kinetics of acid hydrolysis of an ester, determine the temperature coefficient and also the activation energy of the reaction
2. Study the kinetics of the reaction between acetone and iodine in acidic medium by half life method and determine the order with respect to iodine and acetone

Phase diagram

Construction of phase diagram for a simple binary system (naphthalene-pheanthrene or benzophenone- diphenyl amine)

Adsorption

Adsorption of oxalic acid on charcoal & determination of surface area (Freundlich isotherm only.

REFERENCES BOOKS

1. Practical Physical Chemistry, A.J. Findlay, Kitchener, 9thEdition.
2. Practical Physical Chemistry, B. Viswanathan, P.S. Raghavan, 3rdEdition.

M.Sc. CHEMISTRY
SEMESTER II
EXTRA DISCIPLINARY COURSES

LIST OF EXTRA DISCIPLINARY COURSE PAPERS

I. Industrial Chemistry

II. Agricultural Chemistry

III. Food and Medicinal Chemistry

IV. Water Chemistry

M.Sc. CHEMISTRY
SEMESTER II
EXTRA DISCIPLINARY COURSE
PAPER I - INDUSTRIAL CHEMISTRY

(60 Hours)

OBJECTIVES

1. To learn the basic concepts of Glass, Ceramics and Cement and its manufacture.
2. To gain the knowledge of Dyes, Paints, Synthetic fibers, Plastics, Oils, Fats and Waxes and their applications.

UNIT I Glass and Ceramics (12Hours)

Glass: Introduction- Raw materials, manufacture and applications. Some special glasses-fused silica glass, optical glass, glass wool, photosensitive glass-composition and uses.

Ceramics: Definition, Manufacture and applications.

UNIT II Cement (12Hours)

Cement: Introduction, Types of cement- High alumina cement, Slag cement, Acid resisting cement, White cement, Types of Portland cement, Raw materials, Manufacture of cement, Setting of cement, factors affecting quality of cement, Cement industries in Tamilnadu.

UNIT III Dyes and Paints (12Hours)

Dyes: Classifications of dyes, application of dyes in other areas-medicine, chemical analysis, cosmetics, colouring agents, Food and beverages.

Paints: Constituents of paints, Manufacture of paints, Setting of paints, requirement of a good paint, paint failure.

UNIT IV Synthetic fibres and Plastics (12Hours)

Synthetic fibres: Difference between natural and synthetic fibres, Synthesis and applications of Rayon, Terylene, Nylon and Taflon.

Plastics: Classification, properties and applications of plastics.

UNTIV Oils, Fats and Waxes (12Hours)

Classification of oils, fats and waxes, distinction between oils, fats and waxes, Uses of essential oils and fats. Soap and its manufacture -toilet and transparent soaps, cleansing action of soap. Detergent – classification and uses.

TEXT BOOKS

1. B.K. Sharma, Industrial Chemistry, Goel Publishing House Pvt Ltd.1999.
2. M.G. Arora and M. Sing, Industrial Chemistry. Anmol Publications, 1st edition,1994.
3. G.N.Pandey, A Textbook of Chemical Technology. Vol. I and II, Vikas Publishing House Pvt Ltd.1997.

REFERENCE BOOKS

1. B.K. Chakrabarty, Industrial Chemistry, Oxford &IBM Publishing CO. Pvt Ltd.1991.
2. V.Subrahmaniyan, S.Renganathan. K.Ganesan, S.Ganesh. Applied Chemistry. Scitcch Publications,1998.
3. J.E. KuriaCose and J.Rajaram, Chemistry in Engineering & Technology. Vol.1 &II , Tata Mc Craw Hill.1984.

M.Sc. CHEMISTRY
SEMESTER II
EXTRA DISCIPLINARY COURSE
PAPER- II- AGRICULTURAL CHEMISTRY

(60 Hours)

OBJECTIVES

1. To learn the Analysis of Water and Soil.
2. To gain the knowledge of Soil treatment, Irrigation Fertilizer, Pesticides and Insecticides.

UNIT I Water source for Agriculture (12 hours)

Water treatment and water analysis-acidity, alkalinity, pH, Biological oxygen demand (BOD). Chemical oxygen demand (COD) and their determinations, Recycling of water, water management.

UNIT II Chemistry of soil (12 Hours)

Definition, classification and properties of soil, Soil fertility, Soil organic matter and their influence on soil properties, Soil reactions- soil pH, acidity, alkalinity, buffering of soils and its effect on the availability of N, P, K, Ca and Mg.

UNIT III Soil treatment and Irrigation (12Hours)

Soil treatment-Soil erosion- causes and prevention,soil reclamation, alkali soil, saline soils, methods for soil reclamation, Environmental degradation-causes and prevention, Methods of irrigation and Irrigation projects.

UNIT IV Fertilizers (12Hours)

Fertilizers- Effect of Nitrogen, potassium and phosphorous on plant growth. Secondary nutrients– micronutrients- their functions in plants classification of fertilizers, natural fertilizers, artificial fertilizers, phosphate fertilizers; Manufacture of urea and triple superphosphate

Manures: Bulky organic manures- Farm yard manure- handling and storage, oil cakes. Blood meal, fish manures.

UNITV Pesticides and Insecticides (12Hours)

Pesticides-Classification of Insecticides, fungicides, herbicides as organic and inorganic, general methods of application and toxicity, safety measures when using pesticides.

Insecticides: Plant products-Nicotine, pyrethrin, Inorganic pesticides-borates organic pesticides - D.D.T and BHC.

Fungicide: Sulphur compounds, copper compounds, Bordeaux mixture,
Herbicides: Acaricides- Rodenticides- Attractants- Repellants-Preservation of seeds.

TEXT BOOKS

1. B.K. Sharma, Industrial Chemistry, Goel Publishing House, 14th Edition,2008.

2.N.C. Brady, The nature and properties of soils, Eurasia publishing House, New Delhi, 1977.

3.V.S, Jones. Fertilizers and soil fertility, Prentice Hall of India, New Delhi, 1993.

4.D.E.H. Freer, Chemistry of pesticides, D. Van Nostrand Co, Reinhold, 1969.

5. A.K. De. Environmental Chemistry, Wiley Eastern, 1989.

REFERENCE BOOKS

Sankara. SoilsScience.

2. R.C. Palful. K. Goel. R.K. Gupta, Insecticides, Pesticides and Agro basedIndustries.

M.Sc. CHEMISTRY

SEMESTER II

EXTRA DISCIPLINARY COURSE

PAPER- III- FOOD AND MEDICINAL CHEMISTRY

(60 Hours)

OBJECTIVES

1. To understand the importance of Food, its constituents, Food poisoning, Food preservatives, Vitamins and Minerals.
2. To gain the knowledge of various types of Drugs, AIDS and Medicinal plants.

UNIT I Food and its constituents **(12 Hours)**

Sources of food, types, advantages and disadvantages, constituents of foods, carbohydrates, proteins, fats and oils, colours, flavours, natural toxicants. Food poisoning- Sources, causes and remedy. Causes and remedies for acidity, gastritis, indigestion and constipation and food adulterations. Food spoilage- causes of food spoilage, types of food spoilage, food preservation.

UNIT II Vitamins and minerals (12Hours)

Vitamins: Sources, requirement, deficiency diseases of A, B,C, H and K. Minerals: Mineral elements in food-principal mineral elements - Source- Function - Deficiency and daily requirements- Na, K, Mg, Fe, S, P and I.

UNITIIIAntibiotics, sulphonamides and analgesics (12 Hours)

Antibiotics: Definition, Classification as broad and narrow spectrum, mode of action and uses of penicillin, Chloramphenicol, tetracyclines, ciphalosporin, ampicillin and erythromycin. Sulphonamides: Mechanism and action of sulpha drugs, preparation and uses of sulphadiazine, sulphathiazole, sulphapyridine and sulphafurazole. Analgesics- definition- narcotic and non- narcotic- morphine and its derivatives- pethidine and methodone - pharmacological action- uses and abuses. Heroin and codinine. Antipyretic analgesics- Preparation and uses of aspirin and paraacetamol.

UNIT IV Antiseptics, Disinfectants and anaesthetics (12 Hours)

Antiseptics and disinfectants- definition and distinction- phenol coefficient, phenol as disinfectant, chlorhexidine, formaldehyde and nitrofurazone-uses.

Anaesthetics- definition- classification- local and general- volatile, nitrous oxide,ether, chloroform, cyclopropane- uses and disadvantages- nonvolatile- intravenous thiopental sodium, methohexitone, propanidid, local anaesthetics- cocaine and benzocaine- uses and disadvantages.

UNITV (12Hours)

Drugs affecting CNS- Definition and one example for tranquilisers, sedatives, hypnotics, psychedelic drugs- chlorpromazine and barbitone-uses.

Hypoglycemic agents- Diabetes- types- causes- symptoms- Insulin- uses. Oral hypoglycemic agents- sulphonyl ureas- action and uses.

Antineoplastic drugs- Causes of cancer, Antineoplastic agents, cytotoxic. anti-metabolites, plant products, harmones- one example and uses

AIDS-causes, prevention and control. Indian medicinal plants and uses- tulasi, kilanelli, mango, semparuthi, adadodai and thoothuvalai.

TEXT BOOKS

1. Seema Yadav. Food Chemistry. Anmol publishing (P) Ltd, New Delhi. 2.B.Sirlakshmi,

Nutrition Science, 6th Edition, New Age International Publishers.

3. S. Lakshmi. **Pharmaceutical Chemistry,** Sultan Chand & Sons, NewDelhi.

4. AshutoshKar, Medicinal Chemistry, New Age International Publishers,1996.

REFERENCE BOOKS

1. B. Sivasankar, Food Processing and Preservation-PHI Learning Private Ltd., NewDelhi.
2. A. Singh and V.K. Kapoor, **Organic PharmaceuticalChemistry.**
3. I.L. Firnar, **OrganicChemistry,**VoI-II.
4. Albert Lehninger. **BioChemistry.**
5. G.R. Chatwal, **Pharmaceutical Chemistry Organic.**Vol-II,
6. G.R. Chatwal, **Pharmaceutical Chemistry Inorganic,**Vol-I.

M.Sc. CHEMISTRY SEMESTER II
EXTRA DISCIPLINARYCOURSE
PAPER VI- WATERCHEMISTRY

(60 Hours)

OBJECTIVES

1. To gain the knowledge of Characteristics of water, Analysis of water, Treatment of industrial water and Treatment plants

Unit I Introduction (12Hours)

Sources of Water; Physical and chemical characteristics of water; Water analysis; Potable water – WTO standard: uses of water

Unit II Water Pollution (12Hours)

Water pollution – wastewater generation - classification of water pollutants; constituents and characteristics of wastewater; measurement techniques – sampling, colour & odour, dissolved oxygen, BOD, COD, TOC, N & P, suspended solids and bacteriological measurements.

Unit III Waste water Treatment (12Hours)

Wastewater treatment: Pretreatment – screening, grit removal and pre-chlorination; Primary treatment – settling and sedimentation; Secondary treatment – trickling filter process, activated sludge process; Aeration.

Unit IVIndustrial Wastewater Treatment (12Hours)

Industrial wastewater treatment: Activated sludge treatment plants – mass balances, with and without recycle plants; Types of plants – single tank, contact stabilization, biosorption plants.

Biofilters: Hydraulic film diffusion, two component diffusion; Types of plants – trickling filters, submerged filters and rotating disc; removal of particulate organic matter.

Unit V Treatment Plants (12Hours)

Treatment plants for nitrification – mass balances, nitrifying plants and types of plants.

Treatment plant for denitrification - mass balances, denitrifying plants and types of plants; redox zones in the biomass.

Anaerobic wastewater treatment: Plant types – pretreatment, plant with suspended sludge and filter process.

TEXT BOOKS

1. A.K.De, Environmental Chemistry, Wiley Eastern,1989.

2. S.K.Banerji, Environmental Chemisty, Prentice Hall of India, New Delhi,2003.

REFERENCE BOOKS

1. L.Winther, Wastewater Engineering, PolytekniskForlag, Lyngby,1978.

2. M.Henze, P.Harremoes, J.C.Jansen and E.Arvin, (Ed.), Wastewater treatment, Springer Verlag, New York,1995.

3. P.Harremoes, Water Chemistry, PolytekniskForlag, Lyngby,1989.

M.Sc. CHEMISTRY
SEMESTER II
Internship Training

Objectives

1. Students should undergo Internship training to enrich their knowledge about Industry.
2. Students can select nearby Industry/Soil testing/Water testing/Research Laboratory for their internship training under the guidance of Faculty members.
3. The training will commence soon after second semester Examinations.
4. Industry/Laboratory for the internship training must be confirmed before the commencement of second semester.
5. Student has to spend minimum of 15 working days in the Industry/Laboratory.
6. Students should maintain a work dairy and prepare report of their internship training.
7. Students should submit their report with a letter of completion from the organization duly signed by the authorities.
8. The reports will be used to evaluate the students performance.

M.Sc. CHEMISTRY

SEMESTER - III

CORE VI - ORGANIC CHEMISTRY – III

(75 Hours)

OBJECTIVES

1 To learn the mechanism of addition to Carbon - Carbon and Carbon - Hetero atom multiple bonds.

2 To learn the mechanism of molecular rearrangements.

3 To study the mechanism of oxidation and reduction reactions.

4 To study the structural elucidation of steroids.

5 To learn the uses of reagents in organic synthesis.

Unit I Addition to carbon-carbon and carbon-hetero multiple bonds (15 Hours)

Electrophilic addition to carbon-carbon multiple bonds- Hydroboration, Addition of NOCl to olefins, Michael addition, 1,3-dipolar addition, carbene and their addition and Diel's-Alder reaction

Nucleophilic addition to C=O bond-Mechanism and application of Mannich, Stobbe, Darzenglycidic ester condensation, Benzoin condensation, Peterson olefination, Wittig, Wittig- Horner Thrope, Ritter and Prins reactions

Unit II Molecular rearrangements (15 Hours)

Study of the following rearrangements with mechanism Wagner-Meerwin, Demjanov, Dienone-phenol, Favorski, Baeyer-Villiger, Wolff, Stevens, Von-Richter, Beckmann, Smiles, Neber and Hofmann- Martius

Unit III Oxidation and reduction reactions (15 Hours)

Study of the following reactions with mechanism- Oxidation of alcohols by CrO_3, $K_2Cr_2O_7$, CrO_2Cl_2, DCC, $KMnO_4$, MnO_2, DMSO alone, DMSO in combination with DCC, Acetic anhydride and oxalyl chloride, Oxidation of aryl methane, oxidation of methylene group alpha to carbonyl, allylic oxidation of olefins, oxidative cleavage of glycols, ozonolysis, hydroxylation of olefins -OsO_4, $KMnO_4$, Prevost and Woodward dihydroxylation.

Catalytic hydrogenation, Homogenous and heterogenous catalytic reductions, Dissolving metal reductions including Birch reduction, Bouveault-Blanc reduction, Metal hydride reductions- $NaBH_4$, $LiAlH_4$, LTBA, BH_3, Bu_3SnH and Sodium cyano borohydride.

Unit IV Steroids and steroid hormones (15 Hours)

Structural elucidation of cholesterol, ergosterol, oesterone, testosterone and progesterone. Conversion of cholesterol into oesteron, testosterone and progesterone. Artificial hormones- stilbestrol and hexoestrol.

Unit V Reagent in organic chemistry (15 Hours)

Reagents and their uses – LDA, DCC, DDQ, DBU, DIBAL, 9-BBN, NBS, 1,3- dithiane (umpolug), trimethylsilylchloride, trimetylsilyliodide, Baker's yeast, Gilman's reagent and Wilkinson's catalyst

TEXT BOOKS

1. Jerry March, Advanced Organic Chemistry-Reactions,Mechanismsand Structure, Fourth Edition, John Wiley & Sons(1992)
2. Francis A. Carey, Organic Chemistry, Third Edition, The McGraw-Hill Companies, Inc., 1996.
3. P.S. Kalsi, Organic Reactions and Mechanisms, Second Edition, New Age International Publishers,2002.
4. I.L. Finar, Organic Chemistry, Volume II, Fifth Edition, First Indian reprint, Pearson Education Asia Pte. Ltd.,(2000)
5. G. Chatwal, Organic Chemistry of Natural Products, Vol I & II, Himalaya Publishing House, 1988.
6. V.K.Ahluwalia, Organic Reaction Mechanism, Narosa Publishing House, 4th Edition, 2013.
7. Mary Fieser and Louis Fieser, Reagents in Organic Synthesis, Wiley Interscience, Volume 26,2011.

REFERENCE BOOKS

1. S. H. Pine, J.B. Hendrickson, D.J. Cram and G.S. Hammond, Organic Chemistry, IV Edn., McGraw Hill Company,1980.
2. S.M. Mukherji and S. P. Singh, Reaction Mechanism in Organic Chemistry,Macmillan,1984.
3. R.T. Morrison and R.N. Boyd, Organic Chemistry, Prentice-Hall, VI Edition,1992.
4. Neil Issac, Physical Organic Chemistry, J. Wiley, New York,1987.
5. Paul de Mayo, Molecular Rearrangements, Vol I, Vol II, Interscience, NY.1963.
6. Fisher and Fisher, Steroids, Reinhold,1959.
7. O.P. Agarwal, Chemistry of Organic Natural Products, Vol I & II, Goel Publishing House, 1988.
8. R.O.C.Norman, Principles of Organic Synthesis, 2nd Edition, Chapman andHall,

M.Sc. CHEMISTRY CORE PAPER-VII

SEMESTER – III INORGANIC CHEMISTRY – II (75 Hours)

(SOLID STATE &COORDINATION CHEMISTRY)

OBJECTIVES

1. To develop the basic concepts of solid state.
2. To understand the different studies used in solid state chemistry.
3. To learn the various theories of coordination compounds
4. To study the various reaction of coordination compounds

Unit I Solid State - I (15 Hours)

Electrical properties of solids: Conductors and non-conductors, Conductivity in pure metals and alloys– superconductors –Occurrence of superconductivity- BCS theory-Type-I and Type-II and High temperature (HT) superconductors- Preparation of HT superconductors-critical temperature– persistent currents-Meissner effect.

Magnetic properties – dia, para, ferro, antiferro and ferrimagnetism; hysterisis; Optical properties –solid – state lasers and Inorganic phosphors.

Reactions in solid state and phase transitions – diffusion coefficient, diffusion mechanism, vacancy and interstitial diffusions, formation of spinels; solid solutions, order-disorder transformations and super structure.

Unit II Solid State–II (15Hours)

Types of solids-close packing of atoms and ions-bcc, fcc and hcp, voids and their types- Goldschmidt radius ratio-derivation-its influence on structures.

Structures of NaCl, NiAs, CdI_2 ,Pervoskite, rutile, fluorite and antifluorite-zinc blende and wurtzite.

Defects in solids- Point defects, line defects and surface defects; Dislocations-Non-stoichiometric compounds; Use of X-ray powder data in identifying inorganic crystalline solids.

Unit III Theories of coordination compounds (15 Hours)

VB theory-CFT-Splitting of d orbital in ligand field and different symmetries-CFSE-Factors affecting the magnitude of 10 DQ-Evidence for crystal field stabilization (Structural and thermodynamic effects) - Spectrochemical series – Site selection in spinels - tetragonal distortion from octahedral symmetry-John Teller distortion - Nephelauxetic effect-Mo theory octahedral-tetrahedral and Square planar complexes-pi bonding and molecular orbital theory- experimental evidence for pi bonding.

UNIT IV Stability andStereochemicalAspects (15Hours)

Stability of complexes - thermodynamic aspects of complex formation, factors affecting stability, stability correlations, statistical and chelate effects; Determination of stability constants - polarographic, photometric and potentiometric methods.

Stereochemical aspects - stereoisomerism in inorganic complexes,isomerism arising out of ligand distribution and ligand conformation,chirality.

Macrocyclic ligand types - porphyrins, corrins, Schiff bases, crown ethers, cryptates and catenands. (simple complexes).

UNIT V Reaction Mechanism of transition metal complexes (15Hours)

Energy profile of a reaction-reactivity of metal complexes- inert and labile complexes-kinetic application of valence bond and crystal field theories. Kinetics of octahedral substitutions- acid hydrolysis- factors affecting acid hydrolysis- base hydrolysis- conjugate base mechanism- direct and indirect evidences in favour of conjugate mechanism- anation reactions- reactions without metal ligand bond cleavage. Substitution reactions in square planar complexes- the trans effect- mechanism of the substitution reactions. Redox reactions- electron transfer reactions- mechanism of one electron transfer reactions- outer sphere type reactions- cross reactions and Marcus-Hush theory, inner sphere type reactions.

TEXT BOOKS

1. L. V. Azaroff, "Introduction to Solids",McGraw Hill, NewYork.
2. L.Smart, D. Moore and S. Thomas, "Solid State Chemistry- An Introduction", 2ndEd.
3. D.M.Adams, Inorganic Solids, John Wiley Sons,1974
4. A.R.West, Basic Solid State Chemistry, JohnWiley,1991.
5. F. Basolo and R.G. Pearson, Mechanism of Inorganic Reactions, Wiley Eastern,1967.
6. J.E.Huheey, E.A.Keiter and R.L.Keiter, Inorganic chemistry-Principles of structure and reactivity, 4th edition, Pearson-Education,2002
7. S.F.A. Kettle, Coordination compounds, ELBS,1973.
8. Cotton and Wilkinson : Advanced inorganic Chemistry, Wiley Eastern (P), Ltd.,1968
9. H.J.Emeleus and A.G.Sharp : Modern aspects of Inorganic Chemistry, IV Edn.,1989.

REFERENCE BOOKS

1. Mullor, Inorganic structural chemistry, Wiley, New York,1993.
2. D. Bannerjea, Coordination Chemistry, Tata – McGraw Hill,1993.
3. M.L. Tobe, Inorganic Reaction Mechanism, Nelson,1972.
4. K. Burger, Coordination Chemistry Experimental Methods, Butterworths,1973.
5. B.N. Figgis, Introduction to Ligand Fields, Wiley Eastern Ltd, NewDelhi,1976.
6. G.M.Arora : Solid StateChemistry
7. R.A.Alberty and Silbey : Solid StateChemistry
8. Shriver and Atkins, Inorganic Chemistry, FifthEdition.
9. K.F. Purcell and J.C.Cotz, Inorganic chemistry, , FifthEdition.

M.Sc. CHEMISTRY SEMESTER - III

CORE VIII - PHYSICAL CHEMISTRY III

(75 Hours)

OBJECTIVES

1 To impart knowledge on theoretical elctrochemistry and applications of electrochemical cells

2 To impart knowledge on photochemistry

3 To understand the concepts and principles of quantum chemistry and spectroscopy

UNIT I Electrochemistry – I (15 Hours)

Ions in solutions – Debye – Huckel theory of strong electrolytes – Debye – Huckel – Onsager equation – verification and limitation – Debye – Huckel limiting law and its extension. Electrode – Electrolyte interface - adsorption at electrified interface – electrokinetic phenomena – Tiselius method of separation of proteins – Membrane potential- Lippmann capillary equation – Electrical double layers – Helmholtz Perrin, Gouy-Chapman and Stern models.

UNIT II Electrochemistry – II (15 Hours)

Polarisation and over voltage – Butler Volmer equation- diffusion current-exchange and equilibrium current density-Hydrogen and oxygen evolution reactions. Corrosion and passivation of metals – Pourbaix and Evans diagrams – Prevention of corrosion. Electrochemical energy systems – Primary and secondary batteries – (dry cells, lead acid storage batteries, silver- zinc cell, nickel -cadmium battery) –Fuel cells – Electrodeposition –principles and applications.

UNIT III Photochemistry (15 Hours)

Absorption and emission of radiation-decay of electronically exited states – radiative and non-radiative processes – theory of fluorescence and phosphorescence-prompt and delayed florescence – quenching of fluorescence – static and dynamic quenching – Stern – Volmer equation – Excimers and exciplexes – Kinetics of photochemical reactions – Photosensitized reactions. Photovoltaic and photogalvanic cells – photoelectrochemical cells – solar cells- solar energy coversion.

UNIT IV Quantum Chemistry III (15 Hours)

Theory of chemical bonding – Born – Oppenheimer approximation – LCAO – MO approximation for hydrogen molecule ion and hydrogen molecule – Valence Bond theory of hydrogen molecule – Concept of hybridisation – sp, sp2 and sp3 hybridisation – Huckel Molecular orbital (HMO) theory for conjugated π-systems application to ethylene, butadiene and benzene – Self consistent field approximation –
Hartree and Hartree – Fock self consistant field theory .

UNIT V Spectroscopy (15 Hours)

Rotational spectroscopy – Rigid Rotor – Intensity of spectral lines – Effect of isotopic substitution on the rotation spectra . Vibrational spectroscopy – harmonic oscillator – anharmonic oscillator – Hot bands – selection rules – Overtones and combination frequencies – Fermi Resonance. Raman spectroscopy – Raman effect (quantum theory) - Rotational and Vibrational Raman Spectra – Mutual Exclusion Rule.
Electronic spectroscopy – Electronic spectra of diatomic molecules – vibrational coarse structure – Franck – Condon Principle.

TEXT BOOKS

1. S. Glasstone, Introduction to Electro Chemistry, Affiliated East West Press,New Delhi,1960.
2. D.R. Craw, Principles and applications of Electro chemistry, Chapman andHall, 1991.
3. J. Robbins, Ions in solution – An Introduction to Electro chemistry, Clarendon Press, Oxford(1972).
4. K. K. Rohatgi Mukharjee, Fundamentals of Photochemistry, wiley eastern Ltd,.1978.
5. N.J. Turro,Modern molecular photochemistry, Benjamin / cummings, Menlo park, California (1978)
6. R.K. Prasad, Quantum Chemistry, Wiley Eastern, NewDelhi,1992.
7. M.W. Hanna, Quantum Mechanics in Chemistry, W.A. Benjamin Inc, London1965.
8. C.N. Banwell, Fundamentals of Molecular Spectroscopy, Mc Graw Hill,Newyork, 1966.

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1. J.O.M. Bockris and A.K.N. Reddy, Electrochemistry, Vols, 1 and 2, Plenum, NewYork. 1977.
2. J. C. Calvert and J. N. Pitts, Photochemistry, wiley, London,1966
3. R. P. Wayne, Photochemistry, Butterworths, London,1970.
4. R.P. Cundell and A. Gilbert, Photochemistry, Thomas Nilson, London,1970
5. A. K. Chandra, Introductory quantum chemistry, Tata McGrawHill.
6. D. A. McQuarrie, Quantum Chemistry, University Science Books, Mill Valley, California,1983.
7. P. W. Atkins, Molecular Quantum Mechanics, Oxford University Press, Oxford,1983.
8. Raymond chang, Basic Principle of Spectroscopy, McGrow Hill Ltd., NewYork,1971.
9. G. M. Barrow, Introduction of Molecular Spectroscopy, McGrow Hill Ltd, New York,1963

M.Sc. CHEMISTRY

SEMESTER - III ELECTIVE III

PAPER I - EXPERIMENTAL METHODS IN CHEMISTRY (75 Hours)

OBJECTIVES

1 To study in detail the fundamental aspects of various experimental and instrumental methods in chemistry

2 To understand the principles and instrumentation of destructive and non-destructive techniques

3 To understand the various techniques in Chromatography

UNIT I SURFACE IMAGING (15 Hours)

Basic concepts in surface imaging – Principle, Instrumentation and Applications – secondary electron microscopy(SEM), secondary Auger microscopy(SAM), scanning probe microscopy(SPM), scanning tunneling microscopy(STM), transmission electron microscopy(TEM).

UNIT II CHEMICAL ANALYSIS (15 Hours)

Non-destructive techniques – X-ray absorption, diffraction and fluorescence spectroscopy – theory, instrumentation and applications.

Destructive technique – Atomic absorption spectroscopy – principle, instrumentation –EMR sources – cells – furnaces – detectors – interferences and their corrections – applications of AAS.

UNIT III ELECTROANALYTICAL TECHNIQUES (15 Hours)

Polarography – Theory, apparatus, DME, diffusion, kinetic and catalytic currents, current voltage curves for reversible and irreversible systems, qualitative and quantitative applications to inorganic systems.

Amperometric titrations – Theory, apparatus, types of titration curves, successive titrations and two indicator electrodes , applications – Complexometric titrations – chelating agents, types of EDTA titration – direct and back titrations, replacement titrations – masking and demasking reagents.

UNIT IV SEPARATION METHODS - I (15 Hours)

Normal and Reversed-phase liquid chromatography – Theory and applications – HPLC – principle, instrumentation, apparatus and materials, column efficiency and selectivity, applications – GC chromatography – principle, instrumentation, retention volume, resolution and applications.

UNIT V SEPARATION METHODS – II (15 Hours)

Gel chromatography or Gel Permeation Chromatography – Principle, Materials, Gel preparation, column Packing and Detectors – applications and advantages of gel chromatography.

Ion Exchange Chromatography – Definition, Principle, cation and anion exchangers – regeneration - column used in separations - Ion exchange capacity and techniques - Applications

TEXT BOOKS

1. R.Wiesendanger, Scanning Probe microscopy and spectroscopy, Cambridge university press, 1994
2. Frank A.Settle, Handbook of instrumental techniques for analytical chemistry, Prince Hall , Newjersey,1997
3. Gurdeep R. Chatwal, Sham K. Anand, Instrumental methods of chemical analysis, Himalaya PublishingHouse,2011
4. Willard, Merit, Dean, Settle, Instrumental Methods of Analysis,6th Edition,CBS Publishers and Distributors,1986
5. Mahinder Singh, Analytical Chemistry-InstrumentalTechniques,Dominant Publishers & Distributers, New Delhi, 1st Edition,2003.
6. D.A. Skoog and D.M. west, Fundamental of Analytical Chemistry, Holt Rinehart and Winston Publications, 4th Edition, 1982.
7. H. Kaur, Instrumental Methods of Chemical analysis, Pragati Publishers,2006..
8. B.K. Sharma, Instrumental Methods of Chemical Analysis, Goel Publications, 15th Edition,1996.
9. F.Scholz, Electroanalytical methods, Springer,2nd Ed.,2010.

M.Sc. CHEMISTRY

SEMESTER - III ELECTIVE III

PAPER II - ELECTROANALYTICAL TECHNIQUES (75 Hours)

OBJECTIVES

1. To understand the basic concepts of electroanalytical chemistry
2. To study the principles and instrumentation of various electroanalytical techniques

UNIT I Basic Electrochemical principles (15 Hours)

Mass transfer processes – migration, diffusion and convection– planar and spherical diffusion – Reversible and Irreversible processes.

UNIT II Methods Based on Diffusion (15 Hours)

Principle, instrumentation and applications of the following techniques: Chronoamperometry; Polarography - Ilkovic equation - Square wave polarography; Linear Sweep voltammetry – RandlesSevrik equation; Cyclic voltammetry - Normal pulse, Differential pulse and Squarewave voltammetry.

UNIT III Coulometric and Potentiometric Methods (15 Hours)

Galvanostatic and potentiostatic methods. Principle, instrumentation and applications of the following techniques: Controlled potential coulometry and electrolysis; Chronocoulometry; Potentiometry and Chronopotentiometry.

UNIT IV Stripping voltammetry (15Hours)

Principle, instrumentation and applications of Anodic stripping voltammetry, Cathodic stripping voltammetry and Adsorptive stripping voltammetry.

UNIT V Sine wave methods (Electrochemical Impedance Spectroscopy) (15 Hours)

Principle of Impedance technique - Analysis of Faradaic impedance – Bode Diagrams.

Dynamic electrode techniques, Principle, instrumentation and applications of RDE and RRDE techniques.

TEXT BOOKS

1. D.A.Skoog and D.M.West, Fundamentals of Analytical Chemistry, Holt Rinehart and Winston Publications, IV Edn,1982.

2. Willard, Merit, Dean and Settle, Instrumental Methods of Analysis, CBS Publishers and Distributors, IV Edn.1986

REFERENCE BOOKS

1. B. H. Vassos and G.W. Ewing, Electroanalytical Chemistry, John Wiley and Sons, NY, 1983.

2. A. J. Bard and L.R. Faulkner, Electrochemical methods; Fundamentals and applications, J. Wiley and Sons, NY,1980,

3. J.Wang, Stripping Analysis, VCH Publications,1985.

4. A.M. Bond, Modern Polarographic methods in analytical chemistry, Macel Decker Inc., 1980.

M.Sc. CHEMISTRY SEMESTER – IV
CORE PAPER-IX
INORGANIC CHEMISTRY-III (75 Hours)

OBJECTIVES

1 To understand the bonding in organometallic complexes and metal carbonyls.
2 To learn the synthesis, bonding and reactions of organometallic complexes
3 To understand the importance of catalysis and applications
4 To understand the basics of Supramolecular chemistry and photochemistry and its applications
5 To understand the basics behind the origin and principle of electronic spectra

UNIT I Bonding in Organometallic Complexes and metalcarbonyls (15Hours)

Definition of organometallic compound - 18 electron rule - effective atomic number rule - classification of organometallic compounds - the metal carbon bond types – ionic bond – sigma covalent bond - electron deficient bond - delocalised bond - dative bond -metal carbonyl complexes - synthesis - structure and reactions of metal carbonyls -the nature of M-CO bonding- binding mode of CO and IR spectra of metal carbonyls - metal carbonyl anions - metal carbonyl hydrides - metal carbonyl halides - metal carbonyl clusters – Wade's rule and isolobal relationship.

UNIT II Organometallic and Organometallic Sandwichcomplexes (15 Hours)

Alkene complexes - synthesis of alkene complexes -bonding of alkenes to transition metals - bonding in diene complexes - reactivity of alkene complexes – Alkyne complexes – synthesis, structure and reactions of alkyne complexes.
Arene complexes-synthesis–structure and reactivity of arene complexes-multidecker complexes.
Cyclopentadienyl complexes - metallocenes - synthesis of metallocenes - bonding in metallocenes - reactions of metallocenes - Cp2Fe/Cp2Fe+ couples in biosensors -bent sandwich complexes - bonding in bent sandwich complexes.

UNIT III Catalysis (15 Hours)

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); polymerization (Zeigler- Natta catalyst)- Cyclooligomerization of acetylene using Nickel catalyst (Reppe's catalyst)- polymer bound catalysts - metallocene and stereospecific polymerisation of 1-alkenes.

UNIT IV Supramolecular Chemistry and PhotoChemistry (15 Hours)

Supramolecular chemistry-Introduction, supermolecules, supramolecules, supramolecular interactions (ion-ion, ion-dipole, H-bonding, cation-pi, anion-pi, pi-pi and Vanderwalls interactions), Ionophore and molecular receptors. Structure, reactions and applications of crown ethers, beta-cyclodextrin, clays, zeolite and dentrimers.

Photo chemistry- Photo substitution, Photo redox and isomerisation processes, Photo chemistry of d3 and d6 complexes and Applications of metal complexes in solar energy conversion.

UNIT V Electronic Spectra of Complexes (15Hours)

Spectroscopic Term symbols for dn ions – derivation of term symbols and ground state term symbol, Hund's rule; Selection rules – break down of selection rules, spin-orbit coupling, band intensities, weak and strong field limits- correlation diagram- Energy level diagrams- Orgel and Tanabe - Sugano diagrams; effect of distortion and spin orbit coupling on spectra- Evaluation of Dq and B values for octahedral complexes of Nickel- Charge transfer spectra- Spectral properties of Lanthanides and Actinides.

TEXT BOOKS

1. J.E. Huheey, E.A. Keiter and R.L. Keiter, Inorganic Chemistry – Principles of structure and reactivity, 4th Edition, Pearson – Education,2002.
2. F.A. Cotton and G. Wilkinson, Advanced Inorganic Chemistry, Wiley Eastern, 5th Edition,1988.
3. S.F.A. Kettle, Coordination compounds, ELBS,1973.
4. Basic organometallic chemistry, J. Haiduc and J. J. Zuckerman, Walter de Gruyter, Brelin, 1985.
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6. K.F. Purcell and J.C. Kotz, Inorganic Chemistry, WB. Sanders Co. USA. 1977.
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8. Supramolecular chemistry, Jonathan W. Stead & Jerry L, Atwood, John-Wiley & SonsPublications
9. Supramolecular chemistry- Concepts & Perspectives, J.M. Lehn; Wiley- VCH Publications,1995
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2. Organometallics 2, complexes with transition metal-carbon -bonds, Bockmann, Oxford science publications, Oxford,1996.
3. G.W. King, Spectroscopy and Molecular Structure, Holt Rienehart and Winston,1964
4. Supramolecular chemistry, P,D Beer, P.A. Gale & D.K. Smith, Oxford university Press,1999
5. Accounts of Chemical Research, Volume 28, No.3, 1995-(cyclodextrins)
6. S. Zing& Zimmerman, Dendrimers- Structure, properties & applications. Chemical Review,1999.
7. W. Adamson & P. Fleischauer, Concepts of Inorganic Photo chemistry, Wiley,1975.

M.Sc. CHEMISTRY

SEMESTER - IV

ELECTIVE IV MEDICINAL CHEMISTRY (75Hours)

OBJECTIVES

1 To understand the basic concepts of the drugs.
2 To study the classification, synthesis and mode of action of various types of drugs.

UNIT I Basic Concepts of Drugs (15 Hours)

Drug design- analogues and pro- analogues, factors governing drug design, rational approach, method of variation and tailoring of drugs. Classification of drugs, mechanism of action of drugs, metabolism of drugs, absorption of drugs, factors affecting adsorption of drugs and SAR relationships.

UNIT II Drugs Acting on CNS (15 Hours)

Anaesthetics - Classification, synthesis and mode of action of Halothane, Thiopental sodium, Methohexitone, Procaine hydrochloride and Lignocaine hydrochloride. Analgesics - Classification, mode of action and SAR of Morphine. Synthesis and mode of action of Pethidine and Fentanyl citrate. Sedatives and Hypnotics- Classification, synthesis and mode of action of Barbiturates and Diazepam. Antipsychotics drugs-Classification, synthesis and mode of action of Chlorpromazine hydrochloride and Thioridazine. Anticonvulsants- Classification, synthesis and mode of action of Phenytoin and Ethosuximide.

UNIT III Drugs Affecting the Cardiovascular System (15 Hours)

Antiarrhythmic drugs - Classification, synthesis and mode of action of Quinidine sulphate and Procainamide hydrochloride. Vasodilator- Classification, synthesis and mode of action of Hydralazine hydrochloride and sodium nitroprusside.

Coagulants-Mode of action of Vitamin K and Protamine. Anticoagulants-Mode of action of Thromboplastin and Prothrombin. Antihypertensive agents- Classification, synthesis and mode of action of Methyl dopate hydrochloride and Clonidine. Diuretics- Classification, synthesis and mode of action of Acetazolamide and Chlorthiazide.

UNIT IV Drugs Affecting the Harmonal System and Immune System (15Hours)

Drugs affecting hormonal systems - Hypoglycemic drugs - Causes of diabetes, classification, synthesis and mode of action of Insulin, Tolbutamide and Glipizide. Thyroid drugs- Mode of action of thyroid hormones, Synthesis and uses of Thyroxine and Propyl thiouracil. Drugs affecting the immune systems. Non - steroidal anti inflammatory drugs - Classification, synthesis and mode of action of Flurbiprofen and Indomethacin. Antihistamics (Antiallergic agents).

Histamine, Classification, SAR amongst H1-receptor blockers, prevention of histamine release, synthesis and mode of action of Diphenhydramine hydrochloride and Promethazine hydrochloride. Antiulcers- Histamine H2 Receptor Antagonists, SAR, synthesis and Characteristic features of Cimetidine and Ranitidine.

UNIT V Chemotherapeutic Agents (15 Hours)

Antibiotics- Classification, synthesis and mode of action of Penicillins, Chloramphenicol and Azithromycin. Sulpha drugs- Classification, SAR and mode of action of sulphonamides. Synthesis and uses of Sulfacetamide and sulpha guanidine. Antiviral drugs- Classification, synthesis and mode of action of Acyclovir and Methiazone. Antimyco bacterial drugs- Classification, synthesis and mode of action of Pyrazinamide and Ciprofloxacin hydrochloride. Anthelmintics- Types of warm parasites, classification, synthesis and mode of action of Albendazole and Mebendazole. Antineoplastic drugs- Causes of cancer, classification, synthesis and mode of action of Melphalan andMethotrexate.

TEXT BOOKS

1. Jayashree Ghosh,A Textbook of Pharmaceutical Chemistry, S.Chand& CompanyLtd.
2. AshutarKar,Medicinal Chemistry, 6th Edition,2015.
3. K. Elango, P. Valentina,Textbook of Medicinal Chemistry, 2nd Edition.
4. SurendraNath Pandey, SanjayPandey , Textbook of Medicinal Chemistry.
5. AshutoshKar,Medicinal Chemistry, 6th Edition.
6. D. Sriram, P.Yogeshwari,Medicinal Chemistry, 2nd Edition.
7. Chatwal,Medicinal Chemistry.

REFERENCE BOOKS

1. Willing Foyes, Principles of Medicinal Chemistry, 3rd Edition.
2. WilsonandGisvold,TextbookofOrganicMedicinalandPharmaceuticalChemistry,11th Edition.

M.Sc. CHEMISTRY CORE PRACTICAL - IV
ORGANIC CHEMISTRY PRACTICAL – II

OBJECTIVES

To develop analytical skill in Estimation of organic compounds, Preparation of organic compounds involving two stages, Extraction of natural products and Separation of mixture of organic compounds using Chromatographic technique.

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I. Organic Estimation

1. Phenol
2. Aniline
3. MethylKetone
4. Glucose
5. Iodine value of anoil
6. Saponification value of anoil.

II. Organic Preparation involving Two stages

1. Sym-tribromobenzene from aniline.
2. m- Nitrobenzoic acid from methylbenzoate.
3. para – Nitroaniline from acetanilide.
4. Benzanilide from benzophenone.
5. Aspirin from methyl salicylate
6. Anthraquinone from phthalicanhydride.

III. Extraction of Natural Products:

1. Caffeine from tea leaves.
2. Citric acid from lemon.

IV Chromatographic Separations

1. Column chromatography: separation of a mixture of ortho and para -nitroanilines.
2. Thin layer Chromatography: separation of a mixture of ortho and para –nitroanilines.
3. Paper chromatography – identification of natural alpha aminoacids.

REFERENCE BOOKS

1. B.S. Furniss, A.J. Hannaford, P.W.G. Smith and A.R. Tatchell, Vogel's Practical Organic Chemistry. 5th edn. ELBS.1989.
2. Raj K. Bansal, Laboratory manual of Organic Chemistry, III Edn., New Age International (P) Ltd.1996.
3. Gnanpragasam, Ramamurthy, Organic lab Manual, Viswanathan, S., Printers & Publishers Pvt Ltd, 2009.

M.Sc. CHEMISTRY SEMESTER - IV

CORE PRACTICAL - V INORGANIC CHEMISTRY PRACTICAL – II

OBJECTIVES

To develop analytical skill in Quantitative analysis of complex materials, Analysis of Ores and Alloys and Preparation of complexes

Part I Quantitative analysis of complex materials

Quantitative analysis of the following mixture

1. Iron and magnesium
2. Iron and nickel
3. Copper and nickel
4. Copper and Zinc

B) Analysis of Ores

1. Determination of percentage of calcium and magnesium in dolomite.
2. Determination of percentage of MnO_2 in pyrolusite
3. Determination of percentage of lead in galena.

C) Analysis of Alloys

1. Determination of tin and lead in solder
2. Determination of copper and zinc in brass.
3. Determination of Chromium and nickel in stainless steel.

Part II Preparation of the following

1. Sodium hexanitrocobaltate (III)
2. Sodium Trisoxalatoferrate(III)
3. Prussian blue $Fe_4[Fe(CN)6]_3$
4. Bis (Actylacetanato) Copper(II)
5. Hexamminecobalt (III)chloride
6. Hexamminenickel (II)chloride

REFERENCE BOOKS

1.G.Svehla, Vogel's qualitative Inorganic analysis, VI Edition, Orient Longman, 1987.International (P) Ltd.1996.

2. V.V. Ramanujam, Inorganic Semimicro Qualitative analysis. National Publishing Co., Chennai.1971.
3. J. Basset, R.C. Denney, G.H. Jeffery and J.Mendham Vogel's Text book of quantitative inorganic analysis, IV Edition, ELBS,1985.
4. W.G. Palmer, Experimental Inorganic Chemistry, Van Nostrand Reinhold Co., London,1972.
5. D.N. Grindley, An advanced course in practical Inorganic Chemistry, Butterworths,1964.

M.Sc. CHEMISTRY SEMESTER-IV COREPRACTICAL –VI
Physical chemistry Practical-II

OBJECTIVE

1) To perform experiments in viscosity, surface tension, potentiometry and chemical kinetics.

List of Experiments

1. **Viscosity** Variation of viscosity of liquids with temperature
2. Determination of the partial molar volume of glycine /methanol/ formicacid /sulphuricacid by graphical method and by determining the densities of the solutions of different compositions.
3. Study the surface tension-concentration relationship of solutions (Gibb'sequation)
4. **Electromotive Force**
5. Determination of Standard Potentials (Cu, Ag &Zn)
6. Evaluation of Thermodynamic Quantities from EMF data (DanielCell)
7. Determination of PH values using Quinhydrone electrodes
8. Determination of PKa values using Quinhydrone electrodes
9. Determination of activity coefficient an electrolyte at different molalities by emf measurements.
10. Determination of dissociation constant of acetic acid by titrating it with sodium hydroxide using quinhydrone as an indicator electrode and calomel as a reference electrode.
11. Determination of the composition and instability constant of the complex.
12. Determination of solubility product of sparingly soluble salt by (Concentration cell method and EMF method)

P**otentiometric Titrations**

i) Titration of mixture of acids against strong base

ii) Titration of Ferrous ammonium sulphate against potassium permanganate.

iii) Titration of mixture of halides Vs $AgNO_3$

Chemical Kinetics

1. Determination of rate constant and order of reaction between potassium persulphate and potassium iodide and determine the temperature coefficient and energy of activation of the reaction.
2. Study the primary salt effect on the kinetics of ionic reactions and test the bronsted relationship (iodide ion is oxidsed by persulphateion)
3. **Polarimetry** Study the inversion of cane sugar in presence of acid using polarimeter

***From the list of above experiments a minimum of 15 experiments to be performed.**

REFERENCE BOOKS

1. Findlay's Practical Physical Chemistry, B.P. Levitt, 9thEdition.
2. Experimental Physical Chemistry, G. Palmer, 1stEdition.
3. Practical Physical Chemistry, B. Viswanathan, P.S.Raghavan