Shikshan Haach Dharma

S. A. P. D. Jain Pathashala's

(Jain Minority Institute)

Walchand College of Arts & Science, Solapur

(Autonomous)

Affiliated to P.A.H. Solapur University, Solapur

Name of the Faculty: Science & Technology

CHOICE BASED CREDIT SYSTEM

SYLLABUS: CHEMISTRY

Name of the Course: M.Sc. I (SEMESTER–I & II)

(Syllabus to be implemented from w.e.f. June 2021-22)

Walchand College of Arts & Science (Autonomous), Solapur

Choice Based Credit System: With the view to ensure worldwide recognition, acceptability, horizontal as well as vertical mobility for students completing undergraduate degree, Walchand College of Arts & Science, Solapur has implemented Choice Based Credit System (CBCS) at Undergraduate level.

The CBCS provides an opportunity for the students to choose courses from the prescribed courses comprising core, elective/minor or skill based courses. The courses can be evaluated following the grading system, which is considered to be better than the conventional marks system. Therefore, it is necessary to introduce uniform grading system in the entire higher education in India. This will benefit the students to move across institutions within India to begin with and across countries. The uniform grading system will also enable potential employers in assessing the performance of the candidates. In order to bring uniformity in evaluation system and computation of the Cumulative Grade Point Average (CGPA) based on student's performance in examinations.

Outline of Choice Based Credit System:

1. ***Core Course:*** A course, which should compulsorily be studied by a candidate as a core requirement is termed as a Core course.

2. ***Elective Course:*** Generally a course which can be chosen from a pool of courses and which may be very specific or specialized or advanced or supportive to the discipline/ subject of study or which provides an extended scope or which enables an exposure to some other discipline/subject/domain or nurtures the candidate's proficiency/skill is called an Elective Course.

Discipline Specific Elective (DSE) Course: Elective courses may be offered by the main discipline/subject of study is referred to as Discipline Specific Elective.

3. **Ability Enhancement Courses (AEC):** The Ability Enhancement (AE) Courses may be of two kinds: **Ability Enhancement Compulsory Courses (AECC)** and **Skill Enhancement Courses (SEC).** "AECC" courses are the courses based upon the content that leads to Knowledge enhancement; (i) Environmental Science and (ii) English/MIL Communication. These are mandatory for all disciplines. SEC courses are value-based and/or skill-based and are aimed at providing hands-on-training, competencies, skills, etc.

Credit: Credit is a numerical value that indicates students work load (Lectures, Lab work, Seminar, Tutorials, Field work etc.) to complete a course unit. In most of the universities **15 contact hours** constitute **one credit**. The contact hours are transformed into credits. Moreover, the grading system of evaluation is introduced for B.Sc. course wherein process of Continuous Internal Evaluation is ensured. **The candidate has to appear for In Semester Examination of 20 marks and End Semester Examination for 80 marks.**

Walchand College of Arts & Science (Autonomous), Solapur

Faculty of Science: Choice Based Credit System (CBCS)
(w.e.f. 2021-22)

Programme Outcomes (POs):

1) Understand the major concepts in various disciplines of chemistry.
2) Inculcate scientific temperament in the students and outside scientific community.
3) Take informed actions, develop critical thinking and execute them for chemical analysis by various techniques.
4) Achieve the skills required to succeed in the T-L process of schools, the chemical industries and professionals schools.
5) Demonstrate, solve and develop an understanding of concepts of chemistry.
6) Gets exposure of a breadth of experimental techniques using modern instrumentation and chemistry software.
7) Understand the importance of Periodic table of the elements and its role in organizing chemical information.
8) Understand the interdisciplinary nature of the chemistry and to integrate the knowledge of Physics, Mathematics and other disciplines to a wide variety of chemical problems.
9) Learn the laboratory skills needed to design, safety and interpret chemical science.
10) Enable to understand and critically interpret the primary chemical literature.
11) Learn professionalism including the ability to work in teams and apply basic ethical principles.

Programme Specific Outcomes (PSOs):

On completion of M.Sc. Chemistry programme, post graduate students will be able to

1) Apply the knowledge of concepts of chemistry to address local and global needs.
2) Apply advanced concepts of organic, analytical, physical and inorganic chemistry to solve complex problems to improve human life
3) Design experiments, analyze, synthesize and interpret data to provide solutions to different industrial problems by working in the pure, inter and multi-disciplinary areas of chemical sciences.
4) Able to independently carry out research / investigation to solve practical problems and write / present a substantial technical report/document.

Preamble: The students of undergraduate programme in Chemistry should be exposed to the fundamental and advanced knowledge used in science. The objective of this academic plan is to make the concepts and methods of chemistry clear and interesting to students. In Physical chemistry section the student will be able to understand the basic concepts of Chemical Kinetics, Thermodynamics and Gas Laws. For Inorganic Chemistry view point molecules are formed from the combination of atoms. The student learns the different approximation for generation molecules, namely the valence bond method and the molecular orbital method. Thus he gets an idea of the quantum mechanical treatment of chemical bonding in diatomic molecules. The concept of hybridization (linear combination of orbitals of the same atom) explains the formation of bands from the atomic orbitals in metals. The course aims to inculcate an atomic/molecular level thinking in the minds of the students. The study of Organic Chemistry continues to move ahead on many fronts. Thousands of organic compounds especially biologically active are added in the literature even on daily basis. For a thorough understanding in Organic Chemistry an undergraduate student is to be exposed to three fundamental aspects: reactions, mechanism and structure. Introduction of topics viz, Stereochemistry, Aromaticity and benzene aim at providing knowledge about fundamental concepts in Organic Chemistry. Practical part of syllabus is framed in such a way that students will be able to apply the knowledge of fundamental principles of chemistry through experimental work.

Objectives of the program:

1) To impart knowledge in fundamental aspects of all branches of chemistry.
2) To acquire deep knowledge in the study of physical, chemical, electrochemical and magnetic properties, structure elucidation using various techniques and applications of various organic and inorganic materials.
3) To acquire basic knowledge in the specialized areas of chemistry.
4) To train the students in various quantitative and qualitative analyses.
5) To update the students with the needs of the industry and society.
6) To develop a generation which feels responsible towards the society and the nation.

Eligibility: B.Sc. (With Chemistry subject at final year at graduation from UGC approved University)

Duration: 2 Years (4 Semesters)

Medium of Instruction: English

Course structure of first year

Semester	Paper Code	Title of the Paper	Semester exam			L	T	P	Credits
I		Hard core	Theory ESE	IE	Total				
	HCT-101	Inorganic Chemistry -I	80	20	100	4	-	-	4
	HCT-102	Organic Chemistry -I	80	20	100	4	-	-	4
	HCT-103	Physical Chemistry -I	80	20	100	4	-	-	4
		Soft Core (Any one)							
	SCT-104	Analytical Chemistry -I	80	20	100	4	-	-	4
	SCT-105	Chemistry in Life Sciences	80	20	100	4	-	-	
		Practicals							
	HCP-106	Inorganic Chemistry	40	10	50	-	-	4	6
	HCP-107	Organic Chemistry	40	10	50	-	-	4	
	HCP-108	Physical Chemistry	40	10	50	-	-	4	
		Soft core (Any one)							
	SCP-109	Analytical Chemistry	40	10	50	-	-	4	2
	SCP-110	Analytical Chemistry	40	10	50	-	-		
	T-I	Tutorial		25	25		2		1
		Total for 1st semester	**480**	**145**	**625**				**25**
II		**Hard core**							
	HCT-201	Inorganic Chemistry -II	80	20	100	4		-	4
	HCT-202	Organic Chemistry -II	80	20	100	4		-	4
		Soft core (Any one)							
	SCT-203	Physical Chemistry -II	80	20	100	4		-	4
	SCT-204	Green Chemistry	80	20	100	4		-	
		Open elective (Any one)							
	OET-205	Analytical Chemistry-II	80	20	100	4		-	4
	OET-206	Medicinal Chemistry -I	80	20	100	4		-	
		Practicals							
	HCP- 207	Inorganic Chemistry	40	10	50	-	-	4	4
	HCP- 208	Organic Chemistry	40	10	50	-	-	4	
		Soft core (Any one)							
	SCP- 209	Physical Chemistry	40	10	50	-	-	4	2
	SCP- 210	Physical Chemistry	40	10	50	-	-		
		Open elective (Any one)							
	OEP- 211	Analytical Chemistry	40	10	50	-	-	4	2
	OEP -212	Medicinal Chemistry	40	10	50	-	-		
	Other								
	T-II	Tutorial		25	25		2		1
		Total for 2nd semester	**480**	**145**	**625**				**25**
			960	**290**	**1250**				**50**

** L = Lecture T = Tutorials P = Practical ** IE=Internal Examination
** ESE= End Semester Examination ** 4 Credits of Theory = 4 Hours of teaching per week
** 2 Credits of Practical = 4 hours per week ** HCT = Hard core theory
** SCT = Soft core theory ** HCP = Hard core practical
** SCP = Soft core practical ** OET = Open elective theory
** OEP = Open elective practical

M. Sc. Part-I (Semester-I)
Inorganic Chemistry– I
Paper No. HCT-101

Unit I: Chemistry of Transition Elements (15)

General characteristic properties of transition elements, co-ordination chemistry of transitionmetal ions, ligand field theory, ligand field energy parameters (Racahparameters B and C, Slater Condon Parameters, Slater Condon Shortly Parameters), splitting of d orbitals in lowsymmetry environment, Janh-Teller effect, interpretation of electronic spectra including chargetransfer spectra, spectrochemical series, nephelauxetic effect and nephelauxetic series. Diapara-ferro and antiferromagnetism, quenching of orbital angular moments, spin orbit coupling.

Unit-II: A) Stereochemistry and Bonding (08)

VSEPR theory, Walsh diagrams (tri and penta-atomic molecules) dπ – pπ bonds, Bent`s rule and energetic of hybridization, some simple reactions of covalently bonded molecules.

Unit-II: B) Inorganic Materials (07)

Insulators and semiconductors, electronic structure of solids, band theory, intrinsic and extrinsic semiconductors, doping of semiconductors and conduction mechanism, semiconductor devices, rectifiers, transistors, photoconductors, photovoltaic cell.

Unit-III: Nuclear Chemistry (15)

Radioactive decay and equilibrium, Nuclear reactions, Q values, cross sections, types of reactions. Chemical effects of nuclear transformations, fission and fusion, fission products and fission yields. Radioactive techniques, tracer techniques, neutron activation analysis, counting techniques such as G.M., ionization and proportional counters, fissile and fertile isotopes, nuclear reactors, application of radio isotopes.

Unit- IV Metal Cluster and Metal Carbonyls (15)

Metal Cluster: Introduction, Classification of metal clusters, Structures of Carbonyl Clusters (LNCC and HNCC), Structural aspects of Halide type Clusters (Di, tri, tetra & hexanuclear clusters)

Metal Carbonyls: Introduction, Classification of carbonyl complexes, Formation of CO molecule, Coulson's modification and explanation of strong field effect of Co ligand, Bonding in metal carbonyl complexes (mono, di & trinuclear carbonyl complexes, synergic relationship between metal and CO ligands), Preparation, properties & structures of mono, di &

trinuclearcarbonyl complexes [$V(CO)_6$, $Cr(CO)_6$, $Ni(CO)_4$, $Fe(CO)_5$, $Mn_2(CO)_{10}$, $Co_2(CO)_8$,$Fe_2(CO)_9$, $Fe_3(CO)_{12}$], EAN rules for metal carbonyls and problems based on EAN, 18electron rule for metal carbonyls and problems based on 18 electron rule.

RECOMMENDED BOOKS

1. A. F. Wells, Structural Inorganic Chemistry – 5th Edition (1984), Oxford Science Publication
2. James H. Huheey, Inorganic Chemistry- Principle, Structure and Reactivity,
3. J. D. Lee, Concise Inorganic Chemistry, ELBS with Chapman and Hall, London
4. A.R. West, Solid State Chemistry and its applications, Plenum-John Wiley and Sons
5. N.B. Hanny, Solid State Physics
6. H.V. Keer, Solid State Chemistry
7. S.O. Pillai, Solid State Physics, New Age International Publication
8. W.D. Callister, Material Science and Engineering: An Introduction, John Wiley and Sons
9. R. Raghwan, First Course in Material Science
10. R.W. Cahan, The coming of Material Science
11. A.R. West, Basic Solid State Chemistry, 2nd Edition, John Wiley and Sons
12. U. Schubest and H. Husing, Synthesis of Inorganic Materials, Wiley VCH (2000)
13. M.C. Day and Selbin, Theoretical Inorganic Chemistry, Reinhold, EWAP
14. A.H. Hanny, Solid State Chemistry, A.H. Publication
15. John Wullf, The Structure and Properties of Materials, Vol. 4, Electronic properties, Willey Estern
16. L.V. Azoroff and J.J. Brophy, Elecronic Processes in Materials, McGraw Hill –I
17. Prakash G. More, Comprehensive Industrial Chemistry, PragatiPrakashan,Meerut
18. F.A. Cotton and R.G. Wilkinson, Advanced Inorganic Chemistry, Wiley Students Edition
19. Williams and L. Jooly, Modern Inorganic Chemistry, McGraw-Hill International Edition
20. ManasChanda, Atomic Structure and Bonding, TMH Publication
21. N.N. Greenwood and A. Earnshaw, Chemistry of Elements, Pergamon
22. Chakrabarty, Solid State Chemistry, New Age International Publication
23. J.J. Lipard, Progress in Inorganic Chemistry, Vol 18 and 38, Wiley
24. E. Konig, Structure and Bonding, Vol 9, 1971, 175
25. H.J. Arnikar, Essentials of Nuclear Chemistry, New Age International Publication
26. Friendlander, Kennedy and Miller, Nuclear and Radiochemistry, Wiley and Sons

Course Outcomes:

1) To know the theory of transition elements and study of physical properties, chemical properties, different parameters and properties of these elements in compound form.
2) To understand the patterns of orientation of orbital as well as its mechanism toward formation of bond in different types of compounds.
3) To understand the concepts of formation of metallic, non metallic, conducting, semiconducting, and insulating substances and its related properties.
4) To study the chemistry of radioactive materials, its reaction, properties and application.
5) To study the concepts and theory regarding Metal Cluster and Metal Carbonyls.

M. Sc.-I (Semester-I)

Organic Chemistry-I

Paper No. HCT-102

Unit I: Nature of Bonding in Organic Molecules (15)

Delocalized chemical bonding conjugation, Resonance, Hyperconjugation, Bonding in fullerenes, Tautomerism, Aromaticity in benzenoid and non–benzenoid compounds, Alternant and non–alternant compounds, Huckel rule, Annulenes, Aromaticity, homo–aromaticity, ψ–aromaticity, PMO approach, Crown ethers complexes and cryptands, Inclusion compounds.

Unit II: Reaction Mechanism: Structure and Reactivity (15)

Types of Mechanisms, Types of reactions, Thermodynamic and Kinetic requirements, Kinetic and Thermodynamic control, Hammonds postulates, Curtin–Hammett principle, Potential energy diagrams, Transition states and intermediates, Methods of determining mechanisms, Isotope effects, Hard and soft acids and bases, Generation, structure, stability and reactivity of carbocations, Carbanions, Free radicals, Carbenes and Nitrenes. Effect of structure on reactivity, Resonance and field effect, Steric effect, Quantitative treatment, The Hammett equation, Linear free energy relationship, Substituents and reaction constants, Taft equation.

Unit III: Aliphatic Nucleophilic & Electrophilic Substitution reactions (15)

The SN^1, SN^2, mixed SN^1 & SN^2, and SET mechanisms, Neighboring group participation by π and 6–bonds, anchimeric assistance. Nucleophilic at an allylic aliphatic trigonal and a vinylic carbon. Reactivity: Effect of substrate structure, attacking nucleophile, leaving group and reaction medium. Ambident nucleophiles, regioselectivity. Bimolecular mechanisms – $SE^{1,}$ SE^2, and SE^i mechanisms. Electrophilic substitution accompanied by double bond shifts.

Unit IV: Stereochemistry (15)

Elements of symmery, Chirality, Enantiomeric and diastereomeric Relationships, R and S, E and Z nomenclature, Molecules with more than one chiral center, Threo and Erythro isomers, Prochiral relationships, groups and faces, stereospecific and stereoselective reactions. Optical activity in the absence of Chiral carbon (Biphenyls, allenes and Spiranes), Chirality due to helical shape, Methods of resolution, optical purity, stereochemistry of the compounds containing Nitrogen, Sulphur and phosphorous, Conformations analysis of cycloalkanes, Mono and disubstituted cyclohexanes, decalins, Effect of conformation on reactivity.

RECOMMENDED BOOKS

1. Advanced Organic Chemistry, IV Edn –J. March
2. Stereochemistry of carbon Compounds: E. L. Eliel
3. Advanced organic chemistry: F. A. Carey and R. J. Sundberg
4. A guide book to mechanism in organic chemistry: Peter Sykes.
5. Mechanism and Structure in organic Chemisry, E.S.Gould
6. Principle of Organic Synthesis: R.O.C. Norman.
7. Modern Methods of Organic Synthesis: W. Carruthers
8. Organic Chemistry: Clayden, Greeves, Warren and Wothers
9. Stereochemistry of Organic Compounds: D. Nasipuri
10. Stereochemistry: P. S. Kalsi
11. Basic Stereochemistry of Organic Molecules: Subrata Sen Gupta

Course Outcomes:

1. To understand the basics of nature of bonding in organic molecules.
2. To study reaction mechanism and its association with structure and reactivity.
3. Understanding of Aliphatic nucleophilic & electrophilic Substitution reactions.
4. Understanding of advanced concepts of steroreochemistry and its application in predicting reactivity of molecules.

M. Sc.-I (Semester-I)
Physical Chemistry-I
Paper No. HCT-103

Unit-I: Wave Mechanics (15)

Origin of quantum theory, black body radiation, atomic spectra, photoelectric effect, matter waves, wave nature of the electron, Heisenberg's uncertainty principle, Schrodinger wave equation, particle in one dimensional box, the particle in three-dimensional box, the hydrogen atom, transformations of coordinates, separation of variables and their significance, the Φ equation, the Θ equation and the Radial equation.

Unit-II: Chemical Thermodynamics (15)

Review of Thermodynamics laws, Derivations of Maxwells Relations, Thermodynamic equation of state, Entropy and Third law of thermodynamics, residual entropy. Concept of fugacity and determination of fugacity, Activity and activity coefficients of solute and solvent, their determination by freezing point depression and vapour pressure measurement, criteria for equilibrium between phases, Derivation of phase rule, application of phase rule to three component system.

Unit-III: Thermodynamics of Solutions (15)

Thermodynamics of ideal solutions, Raoult's and Henrey's law, Deviations, partial molar quantities, Gibbs-Duhem equation, Duhem-Margules equation, Excess and mixing hermodynamic properties of Non- ideal solutions and their determination, solutions of gases in liquids, factors influencing the solubility of a gas

Unit-IV: Statistical Thermodynamics (15)

Weights and configurations, the most probable configuration, thermodynamic probability and entropy: Boltzmann – Planck equation. Ensembles, ensemble average and time average of property. Maxwell-Boltzmann (MB) distribution law and its application to viscosity and diffusion of gases. Physical significance of distribution Law.

RECOMMENDED BOOKS

1. Quantum Chemistry- R. K. Prasad
2. Quantum Chemistry – Donald A. MacQuarrie
3. Physical Chemistry- P.W. Atkins
4. Text book of Physical Chemistry- S.Glasstone
5. Principles of Physical Chemistry – Marron and Prutton
6. Physical Chemistry- G.M.Barrow
7. Thermodynamics for Chemists – S.Glasstone
8. Thermodynamics – Lewis and Randall, revised by Pitzer
9. An introduction to Chemical Thermodynamics- R. R. Mishra and R. P. Rastogi
10. Kinetics and Mechanism – Frost and Pearson
11. Chemical and Kinetics by K. J. Laidler
12. An Introduction to Statistical Thermodynamics – T.L. Hill, Addison-Wesley. 1960.
13. Statistical Mechanics – Donald A. McQuarrie, 2000.
14. Elements of statistical thermodynamics - L. K. Nash, 2nd Ed. Addison Wesley. 1974

Course Outcomes:

1) To understand the principles and laws of thermodynamic reaction, its solution and its applications.
2) To study the speed as rate of progress of reactions including classification, methodology and applications.
3) To solve numerical problems of thermodynamic reaction.
4) To study the colloidal solution and macromolecules including polymers, its type, mechanism, reaction kinetics and derivation of rate of reaction.

M. Sc.- I (Semester-I)
Analytical Chemistry-I
Semester – I
Paper No. SCT-104

Unit-1: Statistical data analysis (15)

Errors, Types of Errors: Determinate, constant, proportional and indeterminate; Significant figures and computation rules, Accuracy and precision, Distribution of random errors, Average deviation and Standard deviation, Variance and Confidence Limit, Least Square method. Methods of Sampling, Sample Size, Techniques of Sampling gases and Solids.

Unit: II A: Atomic absorption spectroscopy (8)

Introduction, principle, difference between AAS and FES. Advantages of AAS over FES, Disadvantages of AAS, Instrumentation, Single and double beam AAS, Detection limits and sensitivity, Interference, Applications

Unit II B: Inductively coupled plasma spectroscopy (7)

Introduction, nebulization, torch, plasma, instrumentation, interferences, Applications

Unit-III: Electroanalytical Techniques (15)

Polarography: - Introduction, Instrumentation, Ilkovic equation and its application in quantitative analysis. Half wave potential. Derivation of wave equation, Determination of half wave potential, qualitative and quantitative applications Potentiometry: - Principles, instrumentation and applications. Amperometry: - Principles, instrumentation, nature of titration curves, applications. Distinguish between Potentiometry and Amperometry.

Unit-IV: Computer for Chemists (15)

Introduction: Software: Overview of the key elements of basic programme structure, Operating with software such as Origin, CHEM DRAW, CHEM SKETCH, word processing, use of MSWORD, PowerPoint and EXCEL in chemistry, Linear regression, X-Y plots, numerical integration and differentiation and use of internet for searching research data.

Reference books:

1. Analytical Chemistry (J.W.)-G. D. Christian.
2. Introduction to Chromatography.1) Bobbit,2) Srivastva.
3. Instrumental Methods of Analysis (CBS)-H. H. Willard, L. L. Merrit, J. A. Dean & F. A. Settle.
4. Instrumental Methods of Analysis: Chatwal and Anand.
5. Instrumental Methods of Inorganic Analysis(ELBS):A. I. Vogel.
6. Chemical Instrumentation: A. Systematic approach-H. A. Strobel.
7. Physical Chemistry-P. W. Atkins.
8. Principles of Instrumental Analysis- D. Skoog and D. West.
9. Treatise on Analytical Chemistry: Vol. I to Vol. II-I .M. Kolthoff.
10. Computer, Fundamentals-P. K. Sinha.
11. Programming in BASIC-E. Balaguruswamy.
12. Computer programming made simple: J. Maynard.
13. The principles of ion selective electrodes and membrane transport.-W.E Mort
14. Computational Chemistry- G. Grant and W. Richards, Oxford University Press.
15. Computer for chemists by S. K. Pundir and A. Ban

Course Outcomes:

1) To study the concept of error, its origin, classification, measurement, mathematical derivation, and its minimization.
2) To understand the concept of Atomic Absorption Spectroscopy and to study its application.
3) To study the principles, instrumentations and workings of Atomic Absorption Spectroscopy and Inductively Coupled Plasma Spectroscopy.
4) To study the various Electroanalytical techniques and its application in various sector of pharma and chemical industries.
5) To discuss the uses of various software as well as hardware related to chemistry.

M. Sc.- I (Semester-I)
Chemistry in Life Sciences
Paper No. SCT-105

Unit I: Introduction to cell biology and Structure of different cell organelles (15)

Prokaryotic (archaea and eubacteria) and eukaryotic cell (animal and plant cells), cells as experimental models. Structure of nuclear envelope, nuclear pore complex. ER structure. Organization of Golgi. Lysosome. Structure and functions of mitochondria, chloroplasts and peroxisomes. Zellweger syndrome.

Unit II: Amino acids and Nucleic acids (15)

Structure and classification, physical, chemical and optical properties of amino acids Nucleotides - structure and properties. Nucleic acid structure – Watson - Crick Model of DNA. Structure of major species of RNA - mRNA, tRNA and rRNA. Nucleic acid chemistry - UV absorption, effect of acid and alkali on DNA. Other functions of nucleotides - source of energy, component of coenzymes, second messengers

Unit: III: Protein Chemistry (15)

Polypeptide backbone, covalent and non-covalent interactions, end-group analysis by chemical and enzymatic methods, Conformation, Configuration, Details of primary, secondary, tertiary and quaternary structures, problems based on determination of primary structure, Ramchandran Plot, structure- function relation of protein (Ex. Haemoglobin) Chemical modification and cross-linking in proteins, dynamic properties and mechanisms of protein folding

Unit IV: Introduction to bioenergetics (15)

Laws of thermodynamics, state functions, equilibrium constant, coupled reactions, energy charge, ATP cycle, phosphorylation potential, phosphoryl group transfers. Chemical basis of high standard energy of hydrolysis of ATP, other phosphorylated compounds and thioesters. Redox reactions, standard redox potentials and Nernst equation. Universal electron carriers.

RECOMMENDED BOOKS

1. Principles of Biochemistry, Lehninger C Rs. Publ. (1982).
2. Biochemistry, L. Stryer, W.H. Freeman, San Francisco.
3. Schaum's Outline Series of Theory and Problems of Biochemistry, Philip W. Kuchel and G.B. Ralston. Int. Ed., McGraw-Hill Book Co.

4. Molecular Biology of the cell – Bruce Alberts – J.D. Watson et al Garland publishing Inc., N.Y. (1983).
5. Cell and Molecular Biology – DeRobertis and Saunders (1980).
6. The cell – C.P. Swanson, Prentice Hall (1989)
7. Cell Biology – C.J. Avers, Addision Wesley Co. (1986).
8. Metabolic Pathways - Greenberg.
9. Biochemistry – G. Zubay, Addision Wesley Publ. (1983).
10. Biochemistry – Stryer (1988) 3rd Edition W.H. Freeman and Co.

Course Outcomes:

1) To understand the basics of cell biology and Structure of different cell organelles.
2) To gain the knowledge of Amino Acids and Nucleic acids as well as their role in human body.
3) To discuss the chemistry of proteins along with their classification and working.
4) To study the new concepts of Biogenetics and terms involved in it.

M. Sc.-I (Semester-II)
Inorganic Chemistry – II
Paper No. HCT – 201

Unit-I: Chemistry of Non- transition Elements (15)

General discussion of the properties of non- transition elements, special features of the individual elements, synthesis, properties and structure of their halides and oxides, polymorphism of carbon, phosphorous, sulphur. Synthesis, structure and properties of boranes, carboranes, borazines, silicates, carbides, silicones, phosphazenes, sulphur nitrogen compounds, oxyacids of nitrogen, phosphorous, sulphur and halogen, interhalogens, pseudohalides and noble gas compounds.

Unit-II: Organometallic Chemistry of Transition Elements (15)

Synthesis, structure and bonding, organometallic reagents in organic synthesis and in homogenous catalytic reactions (hydrogenation, hydroformylation, isomerization,Monsanto acetic acid process, synthesis gas, Wacker Process), Ziegler and Natta catalysis, pi-metal complexes, activation of small molecules by coordination.

Unit-III: A) Metal- Ligand Equillibria in Solution (07)

Stepwise and overall formation constants and their interaction, trends in stepwise constants, factors affecting the stability of metal complexes with reference to the metal ion and ligand, chelate effect and its thermodynamic origin, determination of formation constants by pH-metry and spectrophotometry.

Unit-III: B) Chemistry of Lanthanides and Actinides (08)

Lanthanides: Introduction, spectral and magnetic properties. Classical methods of separation of lanthanides: (i) precipitation (ii) thermal reaction, (iii) fractional crystallization, (iv) complex formation, (v) solvent extraction and (vi) ion exchange. Use of lanthide compounds as shift reagent. Applications of lanthanides.

Actinides: Introduction, spectral and magnetic properties. Methods of separation of actinides. Preparation of trans-uranic elements. Applications of actinides. Further extension of periodic table.

Unit-IV: A) Metallurgy (08)

Occurance, extraction, properties and applications of copper, silver, gold, zinc, tin and lead.

Unit-IV: B) Bioinorganic Chemistry (07)

Role of metal ions in biological processes, molecular mechanism of ion transport across membranes, ionophores, photosynthesis PS I and PS II, nitrogen fixation, oxygen uptake proteins, cytochromes and ferrodoxines, Calcium biochemistry , coenzyme B12 , metals in medicines.

RECOMMENDED BOOKS

1. A. F. Wells, Structural Inorganic Chemistry – 5th Edition (1984), Oxford Science Edition
2. James H. Huheey, Inorganic Chemistry- Principle, Structure and Reactivity, Harper and Row Publisher Inc., New York
3. J. D. Lee, Concise Inorganic Chemistry, ELBS with Chapman and Hall, London
4. M.C. Day and Selbin, Theoretical Inorganic Chemistry, Reinhold, EWAP
5. Jones, Elementary Coordination Chemistry
6. Morttel, Coordination Chemistry
7. T.S. Swain and D.S.T. Black, Organometallic Chemistry
8. Prakash G. More, Comprehensive Industrial Chemistry, PragatiPrakashan, Meerut
9. John Wullf, The Structure and Properties of Materials, Vol. 4, Electronic properties, Willey Eastern
10. L.V. Azoroff and J.J. Brophy, Elecronic Processes in Materials, McGraw Hill –I
11. F.A. Cotton and R.G. Wilkinson, Advanced Inorganic Chemistry, Wiley Student Edition
12. Williams and L. Jooly, Modern Inorganic Chemistry, McGraw Hill International Edition
13. ManasChanda, Atomic Structure and Bonding,TMH Publication
14. P.L. Pausan, Organometallic Chemistry
15. Cullen, Dolphin and James, Biological Aspects of Inorganic Chemistry
16. Williams, An Introduction to Bioinorganic Chemistry
17. M.N. Hughes, Inorganic Chemistry of Biological Processes
18. Ochi, Bioinorganic Chemistry
19. O.A. Phiops, Metals and Metabolism
20. S.J. Lipard and J.M. Berg, Principles of Bioinorganic Chemistry, U niversity Science Books
21. G.L. Eichhron, Inorganic Bichemistry, Vol I and II, Elsevier

Course Outcomes:

1) To study the various aspects like synthesis and properties of non transition elements
2) To study the uses of organometallic compounds as catalyst in synthesis of various commercial based chemicals.
3) To gain the knowledge of lanthanide and actinide series along with its, properties, characterization, and behavior.
4) To study the Occurrence, extraction, properties and applications of copper, silver, gold, zinc, tin and lead.
5) To gain the knowledge of role of biological ions in different processes.

M. Sc. - I (Semester-II)

Organic Chemistry-II

Paper No. HCT - 202

Unit I: Aromatic Electrophilic & Nucleophilic Substitution reactions (15)

The arenium ion mechanism, orientation and reactivity, energy profile diagram, orto/para ratio, IPSO substitution, orientation in other ring system, recapitulation of halogenations, nitration, sulphonation and friedel craft's reactions, Diazonium coupling. The SN^{Ar}, SN^1, SN^2 and benzyne mechanism, Effect of substrate structure, leaving group and attacking nucleophilic on reactivity

Unit IIA: Addition to Carbon–Carbon and Carbon –Hetero multiple bond (10)

Mechanism and streochemical aspects of addition reaction involving electrophile, nucleophile and free radical, Regioselectivity and chemo selectivity, orientation and reactivity, Michael addition, Sharpless asymmetric epoxidation. Mechanism of Metal hydride reduction of saturated and unsaturated carbonyl compound, acid, ester and nitriles, Addition of Grignard reagent, Witting reaction, Mechanism of condensation reaction involving enolates: Aldol, Knovenagel, claisen, Mannich, Benzoin, Perkin, Stobbe reaction, Hydrolysis of ester and amides. Applications of enamine and hydroboration reactions in organic synthesis.

Unit II B: Elimination Reactions (**05)**

The E1, E2 and E1cb mechanism. Orientation of double bond, reactivity: Effect of substrate substance, attacking base, the leaving group and the medium, pyrolytic elimination.

Unit III: Oxidation reactions (15)

Introduction, different oxidative process, hydrocarbons (alkanes and alkenes), aromatic rings, alcohol, diols, aldehyde, ketones, Ketal and carboxylic acids, amine, hydramine and sulphide.

Unit IV: Reduction reactions (15)

Introduction, different reductive process, alkenes, alkynes and aromatic ring carbonyl compounds, aldehydes, ketones, acids and their derivatives, epoxides, nitroso, azo and oxime groups.

RECOMMENDED BOOKS

1. Advanced Organic Chemistry: IV Edn. J. March
2. Stereochemistry of carbon Compounds: E. L. Eliel
3. Advanced organic chemistry: F. A. Carey and R. J. Sundberg
4. A guide book to mechanism in organic chemistry: Peter Sykes.
5. Mechanism and Structure in organic Chemisry: E. S.Gould
6. Principle of Organic Synthesis: R.O.C. Norman.
7. Modern Methods of Organic Synthesis: W. Carruthers
8. Organic Chemistry: Clayden, Greeves, Warren and Wothers
9. Stereochemistry of Organic Compounds: D. Nasipuri
10. Stereochemistry: P. S. Kalsi
11. Basic Stereochemistry of Organic Molecules: Subrata Sen Gupta

Course Outcomes:

1. To understand the basics of Aromatic Electrophilic & Nucleophilic Substitution reactions and apply this knowledge in design of organic synthesis.
2. Apply the basic oxidation and reduction reactions in synthesis of organic molecules
3. Plan to synthesize molecules using popularly named reactions.
4. To understand the basics of elimination reaction.

M.Sc.- I (Semester-II)
Physical Chemistry-II
Paper No. SCT – 203

Unit-I: Photochemistry-I **(15)**

Introduction, Absorption of light and nature of absorption spectra, electronic transitions, Franck–Condon principle, electronic excitation, photo-dissociation and Pre-dissociation, photo-reduction, photo-oxidation, role of photochemistry in environment (Greenhouse effect, ozone depletion).

Unit-II: Photochemistry-II **(15)**

Photophysical phenomenon. Jablonskidigram. Kasha's rule, fluorescence, phosphorescence, delayed fluorescence, differences between phosphorescence and delayed fluorescence. Inter & intra molecular excitation energy transfer (EET) processes. Quenching of fluorescence and kinetics of biomolecluar quenching processes, Stern-Volmer equation, formation of photodimer, (with suitable examples) excimer and exciplex.

Unit-III: Electrochemistry **(15)**

Electrical double layer and its significance (Helmholtz, Gouy-Chapmann and Stern model), evaluation of mean activity coefficients of ions from e.m.f. data, determination of dissociation constant of monobasic acid by e.m.f. method. Debye Huckel theory (without derivation) and limiting law. Storage batteries: acid and alkali storage cells, Electrocatalysis-mechanism, Bioelectrochemistry-mechanism of Nervous system.

Unit-IV: Chemical Kinetics **(15)**

Rate determining step, steady state approximation. Fractional order kinetics, Higher order kinetics and their examples. Reaction mechanism: Thermal decomposition of acetaldehyde, ethane, reaction between hydrogen and halogens, reaction between NO_2 and F_2, Decomposition of Ozone. Ionic reactions: Primary and secondary salt effect, Effect of ionic strength and dielectric constant of medium on the rate of ionic reactions in solution

RECOMMENDED BOOKS

1. Photo chemistry- J.G.Calverts&J.N.Pits
2. Fundamentals of Photochemistry- K.K.Rohatgi, Mukharji
3. Photochemistry of Solutions – C. A. Parker
4. Chemical Kinetics – K.J.Laidler
5. Kinetics and Machanism - R. A. Frost and R. G. Pearson
6. Electrochemistry – S.Glasstone
7. Modern electrochemistry – Bockris& Reddy
8. Physical Chemistry – P. W. Atkins
9. Physical Chemistry – G. M. Barrow
10. Physical Chemistry: A molecular Approach – Donald A. McQuarrie and John D. Simon, Viva Books, New Delhi, 1998.
11. Introduction to Photochemistry-Wells
12. Electrolytic Solutions by R. A. Robinson and R. H. Strokes, 1959
13. Basic chemical Kinetics- G. L. Agarwal, Tata-McGraw Hill

Course Outcomes:

1) To study the different aspects of photochemistry and its different concepts.
2) To gain the knowledge of concept of electrochemistry and different methods of its measurements.
3) To understand the working and mechanism of bio-physical compounds.
4) To study the kinetics of different order of reaction and determination of reaction constants.

M. Sc.-I (Semester-II)
Analytical Chemistry-II
Paper No. OET-205

Unit I: Infrared Spectroscopy (15)

Instrumentation and sample handling, Various vibrational transitions, Characteristic vibrationl frequencies of alkenes, alkynes, aromatic compounds, Carbonyl compounds, hydroxyl compound and amines. Factors affecting IR group frequencies, overtone, combination bands and Fermi resonance. Applications. Fourier-transform infrared spectroscopy (FTIR). Superiority of FTIR over IR.

Unit II: Nuclear Magnetic Resonance Spectroscopy (15)

Elementary Ideas, Chemical Shifts, Factors affecting chemical shifts, Spin–Spin coupling constants (J) Instrumentations, Different types of coupling, Factors affecting coupling constant, Karplus equation, Spin system (AB, AX, ABX, AMX, etc), Rate processes, Spin decoupling, Shift reagents, Nuclear over Hauser effect (NOE).

Unit III A: C13-NMR Spectroscopy (10)

Elementary ideas, instrumental difficulties, FT technique advantages and disadvantages. Proton Noise Decoupling technique advantages and disadvantages, off-resonance technique, factors affecting chemical shifts, analogy with ^{1}H NMR, calculations of chemical shift of hydrocarbons, different types of carbons (alkene, alkyne, allene, carbonyl, nitrile, oxime and aromatic carbons and effect of substituent on chemical shifts of carbons. Chemical shifts of solvents.

Unit III B: 2D- NMR Spectroscopy (05)

Two Dimensional (2D) NMR techniques: COSY, NOESY, DEPT, APT, INEPT & INADQUATE

Unit IVA: Mass Spectrometry (10)

Introduction, Ion production (EI, CI, FD & FAB), Ion analysis, Ion abundance, Factors affecting fragmentation, Fragmentation of different functional groups, Molecular ion peaks, Metastable peaks Nitrogen rule, McLafferty rearrangement, Retro-Diels Alder reaction.

Unit IV B: Problems based on joint application of IR, NMR & Mass spectroscopy (05)

Reference books:

1. Instrumental Methods of Analysis (CBS, Delhi)-Willard, Merritt, Dean & Settle.
2. Spectroscopic identification of Organic Compound (J.W.)R. M. Silverstein and G. C. Bassler.
3. Spectroscopic methods in Organic Chemistry (T. M .Hill)-D .H.Williams and I.Fleming.
4. Absorption Spectroscopy of Organic molecules (Addison-Wesley) V.M.Parikh.
5. Applications of Spectroscopy techniques in Organic Chemistry – (Wiley Eastern)-P.S.Kalsi.
6. Physical methods in Inorganic chemistry (DWAR)-R.Drago
7. Chemical Spectroscopy (Elsevier) Dudd.
8. Instrumental methods of analysis – Chatwal&Anand
9. Introduction to EPR (Hilger)-Assenliein.
10. Fundamentals of Analytical Chemistry by D.A. Skoog& D. M. West (Holt Rinehart & Winston Inc).
11. Introduction to Spectroscopy, D.L. Pavia, G.M. Lampman, G.L. Nelson.
12. Mass Spectroscopy, K.G. Das & James.

Course Outcomes:

1) To study the concepts of Ultraviolet Spectroscopy and problems related to this.
2) To study instrumentation, principle of working, factor affecting the absorption in Infrared Spectroscopy technique.
3) To understand the basic principles and working of Nuclear Magnetic Resonance (NMR) spectroscopy, to study the factors affecting chemical shift and problem solving.
4) To gain the knowledge of Principle, instrumentation, working of Mass Spectrometry and its applications.
5) To study the problem solving techniques and methods combining based on IR, NMR, UV spectroscopy, and Mass Spectrometry.

M. Sc.-I (Semester-II)
Medicinal Chemistry
Paper No. OET-206

Unit –I **(15)**

a) **Drugs**: Essential Drugs, Nomenclature of Drugs, Routes of Drug Administration, Adverse effects of Drugs, IUPAC Naming of Drugs.

b) **Drug Design:** Development of New Drugs, Factors Affecting Development of New Drugs. Sources of lead compounds, Concept of prodrugs and soft drugs, Drug Receptors, Theories of Drug Action.

Unit –II **(15)**

a) **Pharmacokinetics:** Introductions, Drug Absorption, Distribution and Disposition of Drugs, Excretion and Elimination, Pharmacokinetics of Elimination.

b) **Pharmacodynamics:** Introduction, Enzyme Stimulation, Enzyme Inhibition, Membrane Active Drugs, Drugs Metabolism, Biotransformation, Toxicology, Types of Interactions.

Unit-III **(15)**

a) **Cardiovascular Drugs:** Introductions, Classification, Cardiovascular Diseases, Synthesis of Diltiazem, Verapamil, Methyldopa, Atenolol.

b) **Non Steroidal Anti-inflammatory Drugs (NSAIDs):** Introductions, Classification, Synthesis, Mechanism of action of Indomethacin, Ibuprophen, Dichlorophenac, Naproxen, Allorpurinol.

Unit –IV **(15)**

a) Antibiotics: Introductions, Classification, β-Lactum antibiotics, Cephalosporins, Anticancer Antibiotics. Synthesis of Penicillin-G, Penicillin-V, Ampicillin, Amoxycillin, Chloramphenicol, Cephalophalosporin, Tetracyclin and Strectomycin.

b) General anesthetics and local anesthetics: Introduction, Classification, Mode of Action and mechanism of action of general and local anesthetics.

Reference books:

1. Medicinal Chemistry by AshutoshKar, New Age International Publishers.
2. Medicinal Chemistry by Alka L. Gupta.

Course Outcomes:

1) To study the drug Design and synthesis of drug on commercial level.
2) To gain the knowledge regarding pharmacokinetics and pharmacodynamics.
3) To discuss various cardiovascular drugs and Non-Steroidal Anti-inflammatory Drugs.
4) To study the different drugs such as Antibiotics and General Anesthetics.

M. Sc. Part – I
Inorganic Chemistry Practicals
Semester-I

Ore Analysis:

1. Iron Ore
2. Dolomite Ore

Alloy Analysis: (any one)

1. Brass alloy
2. Bronze alloy

Preparation and determination of purity: (any two)

1. Potassium trioxalatochromate(III)
2. Nitritopentacyano ferrate (III) monohydrate
3. Copper acetate
4. Prussian blue
5. Manganese acetate

Note: Any other relevant experiment be added

RECOMMENDED BOOKS

1. Vogel's Text Book of Quantitative Inorganic Analysis.
2. W. G. Palmer, Experimental Inorganic Chemistry, Cambridge at the University Press, 1965.
3. M. A. Malati, Experimental Inorganic/Physical Chemistry, Harwood publishingChichester.
4. A.J.E.Welch, Inorganic Preparations, George Allen & Unwin Ltd.

Course Outcomes:

1) To study the synthesis and determination of purity of inorganic complex salt.
2) To estimate the percentage of different elements in particular ore sample, by thermo gravimetrically and titrametrically.

Semester-II

Ore analysis: (any one)

1. Pyrolusite ore
2. Boxite ore

Alloy analysis: (any two)

1. Type metal alloy
2. Solder alloy
3. Cupro-nickel alloy

Preparation and determination of purity: (any two)

1. Sodium tetrathiocyanatodiamminechromate(III)
2. Potassium hexathiocyanatochromate(III)
3. Hexathioureaplumbus nitrate
4. Hexamine cobalt nitrate
5. Manganous ammonium phosphate

Note: Any other relevant experiments may be added

RECOMMENDED BOOKS

1. Vogel's Text Book of Quantitative Inorganic Analysis.
2. W. G. Palmer, Experimental Inorganic Chemistry, Cambridge at the University Press, 1965.
3. M. A. Malati, Experimental Inorganic/Physical Chemistry, Harwood publishing Chichester.
4. A.J.E.Welch, Inorganic Preparations, George Allen & Unwin Ltd.

Course Outcomes:

1. To study the synthesis and determination of purity of inorganic complex salt.
2. To estimate the percentage of different elements in particular ore sample, by thermo gravimetrically and titrametrically.
3. To perform the Ore analysis and alloy analysis.

ORAGNIC CHEMISTY PRACTICALS

Semester–I

Qualitative analysis:

1. Separation and identification of the two component mixtures using Chemical and physical methods. (Minimum Five Mixtures)

Demonstrative Experiments:

1. Thin layer chromatography (TLC).
2. Vacuum and steam distillation techniques.

RECOMMENDED BOOKS

1. A text book of practical Organic Chemistry- A. I. Vogel.
2. Practical organic Chemistry- Mann and Saunders.
3. A handbook of quantitative and qualitative analysis- H. T. Clarke.
4. Organic Synthesis Collective Volumes by Blat.
5. Systematic Lab Experiments in Organic Chemistry by ArunSethi
6. Advanced practical chemistry by Jagdamba Singh

Course Outcomes:

1. Separate the organic solids using ether and their qualitative analysis and identification of functional groups.
2. Demonstrate purification of organic liquids using Fractional & Vacuum distillations.
3. Verify the purity of organic compounds by employing a thin layer chromatography

Semester–II

Preparations:

1) One stage preparations involving various types of reactions (minimum Two)

1. Coenzyme (Thiamine hydrochloride) catalyzed Benzoin condensation.
2. Sandmeyer reaction: p- Chlorotoulene from p-toluidine.
3. Pechmann condensation for coumarin synthesis.
4. Radical coupling reaction preparation of 1,1-bis-2- naphthol form 2-naphthol.

2) Two stage preparations involving various types of reactions (minimum Four)

1. Aceotophenone- Oxime- Acetanilide

2. Phthalic anhydride- o-Benzoyl benzoic acid- anthraquinone

3. Chlorobenzene-2,4-dintrochlorobenzene-2,4-dinitrophenol

4. Benzoin-benzil-benzilic acid

5. Acetanilide-p-bromoacetanilide using CAN, KBr and Water ethanol solvent system. p-bromoacetanilide-p-bromoaniline

6. Green photochemical reaction benzophenone – benzopinacol- benzopinacolone

3) Estimations: (minimum Two)

1) Estimation of an iodine value of an oil or fat.

2) Determination of percentage of Keto-enol form. (Any other suitable experiments may be added)**.**

3) Study of transestrification reaction – synthesis of biodiesel

RECOMMENDED BOOKS

1. A text book of practical Organic Chemistry- A. I. Vogel.

2. Practical organic Chemistry- Mann and Saunders.

3. A handbook of quantitative and qualitative analysis- H. T. Clarke.

4. Organic Synthesis Collective Volumes by Blat.

5. Systematic Lab Experiments in Organic Chemistry by ArunSethi

6. Advanced practical chemistry by Jagdamba Singh

Course Outcomes:

1. Preparations of biologically and industrially important compounds employing name reactions by one step and two step methods.

2. Quantitative analysis of organic compounds using functional group transformation e.g. estimation of alcohol, amine, ketone and C=C group.

3. Study of transestrification reaction for synthesis of biodiesel.

M.Sc.- I Semester-I
Physical Chemistry Practicals
NON-INSTRUMENTAL

Kinetics:-

1. To investigate the auto-catalytic reaction between potassium permanganate and oxalic acid.
2. Iodonation of acetone
3. Determination of energy of activation of acid catalyzed hydrolysis of an ester.

Viscosity :-

1. Determine the molecular weight of PVA by viscosity measurements.

Adsorption

1. Acetic acid on activated animal charcoal

Phase Equilibria :-

1. Three component system: Acetic acid, chloroform, water
2. To determine the CST of phenol-water system in presence of 1% NaCl

Surface Tension: -

1. To determine the surface tension of a liquid by stalagmometer (drop number method)

INSTRUMENTAL

Refractometry

1. To determine the structure of given Organic Liquids

2. **pHmetry:**

1. Determination of pKa of dibasic acid (Oxalic acid)
2. Determination of hydrolysis constant of aniline hydrochloride

Conductometry

1. Titration of $ZnSO_4$ / $MgSO_4$ against $BaCl_2$ and $Ba(CH_3COO)_2$ and calculation of amount of Sulphate Present .
2. Conductometric estimation of NH_4Cl with NaOH solution.

Potentiometry

1. To determine the basicity and pKa value of organic acids by potentimetric method. (Orthophosphoric acid)
2. Determine the solubility and solubility product of sparingly soluble salts.

RECOMMENDED BOOKS

1. Findlay's Practical Physical Chemistry by J.A. Kitchnar

2. Text-book of Quantitative Inorganic Analysis including elementary

Instrumental Analysis- A.I.Vogel, Revised by J.Bassott, R.C.Banney

3. Experimental Physical Chemistry – F.Daniels&J.Williams

4. Experimental Physical Chemistry – R.C.Das&B.Behra

5. Systematic experimental Physical Chemistry by- Rajbhoj and Chondhekar.

6. Experimental physical Chemistry- V.D. Athawale and P. Mathur

7. Advanced practical physical Chemistry- J. B. Yadav

8. Advanced physical Chemistry Experiments- Gurtu and Gurtu

Course Outcomes:

1) To study the kinetics of the hydrolysis of reaction
2) To gain the knowledge of adsorption of acid on activated charcoal.
3) To Study the term viscosity experimentally.

Semester-II
NON-INSTRUMENTAL

Kinetics

1. Determination of order of reaction by differential method
2. Comparison of acid strength by hydrolysis of ester

Viscosity

1. To determine the radius of molecule by viscosity measurements. (glycerol / sucrose)

Adsorption

1. Oxalic acid on activated animal charcoal

Phase Equilibria :-

1. Three component system: Benzene, ethyl alcohol and water
2. To determine the CST of phenol-water system in presence of 0.5% naphthalene (or 1% succinic acid)

Surface Tension:

1. To determine the atomic parachor of C, H and Cl by surface tension measurements.

INSTRUMENTAL

Refractometry

1. To determine the electron polarization and electron polarizability of a liquid.

2. **pHmetry:**

1. Determination of pKa of acid (Succinic acid)
2. Determination of hydrolysis constant of aniline hydrochloride

Conductometry

1. Solubility and solubility product of spranigly soluble salts.
2. Titration of a mixture of HCl, CH_3COOH and $CuSO_4$ against alkali.

Potentiometer

1. Estimate the amount of halides present in the given mixture by titrating with $AgNO_3$ solution.
2. Titration of mixture of acids with base.

Polarimetry

1. To determine the percentage of two optically active substances (d-sucrose and d-tartaric acid) in a given solution.

Each candidate has to perform minimum 12 experiments (at least one from each technique) in

each semester. Any other relevant experiments may be added.

RECOMMENDED BOOKS

1. Findlay's Practical Physical Chemistry by J.A. Kitchnar
2. Text-book of Quantitative Inorganic Analysis including elementary
Instrumental Analysis- A.I.Vogel, Revised by J.Bassott, R.C.Banney
3. Experimental Physical Chemistry – F.Daniels&J.Williams
4. Experimental Physical Chemistry – R.C.Das&B.Behra
5. Systematic experimental Physical Chemistry by- Rajbhoj and Chondhekar.
6. Experimental physical Chemistry- V.D. Athawale and P. Mathur
7. Advanced practical physical Chemistry- J. B. Yadav
8. Advanced physical Chemistry Experiments- Gurtu and Gurtu

Course Outcomes:

1) To study the Instrumental experiments such as Refractometry, pH Metry, Conductometry etc.
2) To gain the knowledge of Potentiometer.
3) To understand the experiment of polarimetry to determine the optical activity of different compounds.

Analytical Chemistry Practicals
Semester I

A) Inorganic Analytical Chemistry

1. Determination of calcium from given drug sample.
2. Determination of hardness, alkalinity and salinity of water.
3. Separation and estimation of chloride and bromide on anion exchanger
4 To determine the amount of Cu in brass metal alloy titrimetrically
5 Separation and estimation of Fe and Al on cation exchanger

B) Organic Analytical Chemistry

1. Analysis of Pharmaceutical tablets.
2. To verify the Beer-Lambert's Law and determine the concentration of given dye solution colorimetrically.
3. To determine the acid value of given oil.
4. Separation of mixture of o-and p-nitroanilines on an alumina column..
5. Determination of uric acid / createmins in urine.
6. Analysis of pharmaceutical tablet lbrufen
7. Estimate amount of endosulphon.

C) Analytical Physical Chemistry

1. To Verify Beer –Lambert's Law for solution of $KMnO_4$ in water and in acid medium Colorimetrically
2. To determine the solubility of calcium Oxalate in presence of KCI (Ionic Strength Effect)
3. To determine the solubility of calcium Oxalate in presence of HCI (H^+ ion Effect)
4. To determine the pKa value of dibasic acid (malonic) by pH metery.
5. To determine the amount of carbonate & bicarbonate by potentiometrically.
6. Estimate the concentration of H_2SO_4, CH_3COOH and $CuSO_4$ by conductometric titration with NaOH solution.

RECOMMENDED BOOKS

1. A text book of quantitative inorganic analysis, A.I. Vogel
2. Standard methods of chemical analysis, F. J. Welcher
3. Experimental Inorganic Chemistry, W. G. Palmer
4. Manual on water and waste-water analysis, NEERI, Nagpur; D.S. Ramteke and C.A. Moghe
5 .Inorganic synthesis, King
6. Synthetic inorganic chemistry, W. L. Jolly
7. EDTA titrations, F. Laschka
8. Experimental physical Chemistry- V.D. Athawale and P. Mathur
9. Advanced practical physical Chemistry- J. B. Yadav
10. Advanced physical Chemistry Experiments- Gurtu and Gurtu
11. Practical organic Chemistry by F. G. Mann, B. C. Saunders
12. Quantitative organic analysis, A.I. Vogel

Course Outcomes:

1) To learn estimation of hardness, alkalinity and salinity of water as well as chloride and bromide on anion exchanger
2) To analyze the pharmaceutical tablet in laboratory
3) To study the reactions by means of laboratory equipment.

Semester II

A) Inorganic Analytical Chemistry

1. Determination of sodium from the fertilizer sample using cation exchange chromatography.
2. Determination of Zn and Cd from the given solution by using anion exchanger resin
3. Separation and estimation of Ni and Co on anion exchanger
4. Estimation of Pb and Sn in solder alloy
5. Determination of Mo, Fe, by solvent extraction using isopropyl alcohol as solvent.

B) Organic Analytical Chemistry

1. To estimate the amount of D-glucose colorimetrically
2. To separate a mixture of 2,4-dinitrophenyl hydrazones by adsorption chromatographic technique.
3. Analysis of pharmaceutical tablet Analgin.
4. Caffeine in Tea Powder.
5. Determination of percentage purity of given olefinic compound by bromination method.
6. Colorimetric estimation of drugs.

C) Analytical Physical Chemistry

1. To Verify Beer –Lambert's Law for $K_2Cr_2O_7$ in water and in acid medium colorimetrically
2 .To determine the solubility of lead iodide in different concentrations of KCI (Ionic Strength Effect)
3. To determine the solubility of lead iodide in different concentrations of KNO_3 (Ionic Strength Effect)
4. To determine the amount of carbonate & bicarbonate by pHmetry
5. To determine the concentration of vinegar conductometrically.
6. To estimate the amount of D-glucose in given solution polarimetrically.

Minimum three experiments from each section may be conducted during each semester.
However, the total number of experiments conducted should be commensurate with the facilities and time available.
Any other relevant experiments may be added.

RECOMMENDED BOOKS

1. A text book of quantitative inorganic analysis, A.I. Vogel
2. Standard methods of chemical analysis, F. J. Welcher
3. Experimental Inorganic Chemistry, W. G. Palmer
4. Manual on water and waste-water analysis, NEERI, Nagpur; D.S. Ramteke and C.A. Moghe
5 .Inorganic synthesis, King
6. Synthetic inorganic chemistry, W. L. Jolly
7. EDTA titrations, F. Laschka
8. Experimental physical Chemistry- V.D. Athawale and P. Mathur
9. Advanced practical physical Chemistry- J. B. Yadav
10. Advanced physical Chemistry Experiments- Gurtu and Gurtu
11. Practical organic Chemistry by F. G. Mann, B. C. Saunders
12. Quantitative organic analysis, A.I. Vogel

Course Outcomes:

1) To study and perform cation exchange chromatography
2) To understand the experiment of colorimetry
3) To perform pH metry, conductometry and polarimetry

Walchand College of Arts & Science, Solapur
(Autonomous)

Scheme of Marking for End Semester Theory Examination

Day and date: Maximum Marks: 80
Time: 2 Hrs

Instructions: a) All questions are compulsory
b) Figures to the right indicates full marks
c) Draw neat & well labeled diagram wherever necessary

Q. 1) A) Multiple choice questions. **(10)**

i) .....

(a)..... (b) ..... (c) ..... (d) .....

ii)
iii)
iv)
v)
vi)
vii)
viii)
ix)
x)

Q. 1) B) Fill in the blank/Definition/One sentence answer/ One word answer/ Give the name/Predict the product etc. **(06)**

i)
ii)
iii)
iv)
v)
vi)

Q. 2) Solve any Eight of the following. **(16)**

a)
b)
c)
d)
e)
f)
g)
h)

i)

j)

Q. 3 A) Attempt any Two of the following. **(10)**

a)

b)

c)

Q. 3 B) Short note/Solve **(06)**

Q. 4 A) Attempt any Two of the following. **(08)**

a)

b)

c)

Q. 4 B) Describe/Explain/Solve **(08)**

Q. 5) Attempt any Two of the following. **(16)**

a)

b)

c)

Scheme of Marking for End Semester Practical Examination

Practical paper has 200 marks for external practical examination. Duration of practical examination is Four days. There will be three practicals, one from each sections physical, inorganic and organic chemistry. Out of 200 marks for end semester practical examination, the mark distribution is as follows.

Q. 1 Physical Chemistry experiment: 40 Marks +10 Marks (Internal Exam)

Q. 2 Inorganic Chemistry experiment: 40 Marks +10 Marks (Internal Exam)

Q. 3 Organic Chemistry experiment: 40 Marks +10 Marks (Internal Exam)

Q. 4 Analytical Chemistry experiment: 40 Marks +10 Marks (Internal Exam)

---------- Total: 200 marks

Scheme of marking for Theory Internal Evaluation

Total Marks = 10

Q 1) **A) Multiple choice questions.** **(10)**

i) .....

(a)..... (b) ..... (c) ..... (d) .....

1.
2.
3.
4.
5.
6.
7.
8.
9.
10.

OR

Q 1) Write notes on followings (Any Five)

i)
ii)
iii)
iv)
v)
vi)

OR

Q 1) Write in Brief on followings (Any two)

i)
ii)
iii)

Scheme of marking for Practical Internal Evaluation

Q 1) **A) Multiple choice questions.** **(10)**

i) .....

(a)..... (b) ..... (c) ..... (d) .....

1.
2.
3.
4.
5.
6.
7.
8.
9.
10.

OR

Q 1) Perform the given experiment and write the result. (Any One) **(10)**

1)

2)

(Dr. S. D. Mitragotri)
Chairperson
BoS in Chemistry