

**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**

**NEW CHOICE BASED CREDIT SYSTEM AS PER NEP**

**Syllabus: CHEMISTRY**

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

**(Syllabus to be implemented from w.e.f. July 2023-24)**

# Walchand College of Arts & Science, Solapur

(Autonomous)

## About National Education Policy (NEP) - 2020

With the directions and guidelines issued by **Government of Maharashtra resolution dated 20<sup>th</sup> April 2023 and 16<sup>th</sup> May, 2023** regarding the implementation of NEP at UG and PG level, the Walchand College of Arts & Science (Autonomous), Solapur has taken decision to implement NEP 2020 with Choice Based Credit System (CBCS) at Undergraduate level and Post Graduate level. This has been done to achieve the goals and objectives set in NEP-2020 such as- worldwide recognition, acceptability, horizontal as well as vertical mobility for students completing undergraduate and post-graduate degree.

The CBCS provides an opportunity for the students to select from the prescribed courses comprising core, elective/minor or skill based. 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 NEP:

The structure of the Three/Four-year bachelor's degree programme allows the opportunity to the students to experience the full range of holistic and multidisciplinary education in addition to a focus on the chosen major and minors as per their choices and the feasibility of exploring learning in different institutions. The structure allows students to learn various components like:

**(a) Major (Core) Subject (DSC):** This comprises of Mandatory and Elective Courses that require students to achieve:

- Minimum 50% of total credits corresponding to Three/Four - year UG Degree- Mandatory Courses are offered in all four years;
- 2 credit course on Major Specific IKS shall be included under Major;
- Elective courses of Major will be offered in the third and/or final year;
- Vocational Skill Courses, Internship/ Apprenticeship, Field Projects, Research Projects are related to Major

**(b) Minor Subject (18-20 Credits)**

- The Minor subjects may be from the different disciplines of the same faculty of DSC Major (Core) or they can be from different faculty altogether;
- The credits of Minor subjects shall be completed in the first three years of UG Programme

**(c) Generic/ Open Elective Courses (OE) (10-12 credits)**

- GE/OE are to be offered in I and/or II year;
- Faculty-wise baskets of OE shall be prepared by Autonomous College.

- OE/GE is to be chosen compulsorily from faculty other than that of the Major or as per the directions issued by NEP-Steering Committee

**(d) Vocational and Skill Enhancement Courses (VSEC)**

**i) Vocational Skill Courses (VSC): (8-10 credits):** Includes Hands on Training corresponding to the Major and/or Minor Subjects:

- To be offered in first three years;
- Wherever applicable vocational courses will include skills based on advanced laboratory practicals' of Major

**ii) Skill Enhancement Courses (SEC): (06 credits)**

- To be offered in I and II year;
- To be selected from the basket of Skill Courses approved by Autonomous College

**(e) Ability Enhancement Courses (AEC), Indian Knowledge System (IKS) and Value Education Courses (VEC): (14 Credits)**

**i) AEC: (08 credits)**

- To be offered in I and II year
  - English: 04 Credits
  - Modern Indian Language: 04 credits
  - To be offered from the Basket approved by Autonomous College;
- The focus for both languages should be on linguistic and communication skills.

**ii) IKS: (2 Credits)**

- To be offered in I Year
- Courses on IKS to be selected from the basket of IKS courses approved by Autonomous College

**iii) VEC: 04 Credits**

- To be offered in I year
- Value Education Courses (VEC) such as Understanding India, Environmental Science/Education, and Digital and Technological Solutions.

**(f) Field Projects/ Internship/ Apprenticeship/ Community Engagement and Service corresponding to the Major (Core) Subject, Co-curricular Courses (CC) and Research Project**

- Internship/Apprenticeship corresponding to the Major (Core) Subject: (8 Credits)
- Field Projects/Community Engagement and Service (CEP) corresponding to the Major (Core) Subject (minimum 4-6 credits)  
-To be offered in II and III years of UG Degree Programmes.

- Co-curricular Courses (CC) such as Health and Wellness, Yoga education, sports and fitness, Cultural Activities, NSS/NCC and Fine/ Applied/Visual/ Performing Arts: (8 credits)  
-To be offered in I and/or II year
- Research Projects: (12 credits)  
-To be offered in the final year for 4 year Honours with Research UG Degree

➤ **CREDIT:**

- Credit is a numerical value that indicates students work load (Lectures, Lab work, Seminar, Tutorials, Field work etc.) to complete a course unit. 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.
- **Theory:** ‘15 contact hours’ for theory course constitute ‘one credit’
- **Practical/Tutorial:** ‘30 contact hours’ for practical course constitute ‘one credit’.
- **Workshop based activities/Skill based activities:** Minimum 30 contact hours per credit in a semester is required
- **Internship/On-Job Training:** ‘30 contact hours’ per credit in a semester is required (1 credit/week)
- **Community Engagement and Service-CEP/Field Project:**‘30 contact hours’ per credit in a semester is required

➤ **Credit Framework under Three/Four Years UG Programme with Multiple Entry and Multiple Exit Options:**

The minimum and maximum credit structure for different levels under three or four year UG programme with multiple entry and multiple exit options are as given below:

Levels	Code	Qualification Titles	Credit Requirements		Semester	Year
			Minimum	Maximum		
4.5	100-199	UG Certificate	40	44	2	1
5.0	200-299	UG Diploma	80	88	4	2
5.5	300-399	Three Year Bachelor’s Degree	120	132	6	3
6.0	400-499	Bachelor’s Degree Honours	160	176	8	4
		<b>OR</b>				
		Bachelor’s Degree-Honours with Research				

	500-599	First Year PG & or PG Diploma	40	44	2	1
6.5	600-699	PG Degree	80	88	4	2
8.0	700-799	Ph.D.	16+ Ph.D. Work		---	---

### Multiple Exit Options

Year	Exit Option	Reentry
First Year	Award of UG Certificate in Major with 40-44 credits and an additional 4 credits core NSQF course/Internship OR Continue with Major and Minor	Students opting for exits at any level 'will have the option to reenter' the programme from where they had left off, in the same or in different higher educational institution 'within three years of exits' and complete the degree program within the stipulated maximum period of 07 years from the date admission of first year of UG.
Second Year	Award of UG Diploma in Major and Minor with 80-88 credits and an additional 4 credits core NSQF Course/Internship OR Continue with Major and Minor	
Third Year	Award of UG Degree in Major with 120-132 credits OR Continue with Major and Minor	
Fourth Year Honours	Four Year UG Honours Degree in Major and Minor with 160-176 credits	
Fourth Year Honours with Research	Four Year UG Honours with Research Degree in Major and Minor with 160-176 credits	
<b>Post-Graduation Degree</b>		
Post-Graduation: First Year	PG Diploma (44 Credits) after Three Year UG Degree	Reentry to complete the PG degree after taking exit option will be permissible up to 5 years from the date admission to PG programme

#### ➤ Academic Bank of Credit (ABC):

It is mandatory for all admitted students to get enrolled on ABC Portal and create ABC ID and share ABC-ID with academic institutions where they are enrolled. Credits earned by the students will be reflected in the students ABC account. This will allow students smooth transition during multiple entry and exit.

- Major (Core):        -Mandatory course offered in four years +  
                              -IKS (2 credit, Major specific) +  
                              -Elective Courses (offered in 3<sup>rd</sup>& or final year) +  
                              -VSC, Internship/Apprenticeship, Field Projects, Research Project related to  
                              Major
- Minor:                -Subjects from different disciplines of the same faculty or they can be from  
                              different faculty altogether
- VSC: Vocational Skill Courses **including hands on training** corresponding to the **Major/Minor**  
                              subjects
- VEC:                 -Value Education Courses such as Understanding India, **Environmental**  
                              **Science/Education & Digital and Technological Solutions**
- SEC: Skill Enhancement Courses. To be selected from basket of **skill** courses approved by  
Autonomous College
- IKS: Indian Knowledge System – **Generic / Subject specific (major)**
- OE: Open Elective- to be chosen **compulsorily** from faculty other than that of the major (Discuss  
with SIR).
- AEC: Ability Enhancement Courses- 08 Credits (4 Credits for English + 04 Credits for Modern  
Indian Language)
- CEP: Community Engagement and Services related to **MAJOR**
- OJT: On-Job Training (Internship / Apprenticeship)
- SEC: Skill Enhancement Course
- FP: Field Project
- CES: Community Engagement Service
- CC: Curricular Course
- RM: Research Methodology
- RP: Research Project

<b>M.Sc. (Chemistry)</b>					
<b>Semester-I</b>					
Chemistry (Mandatory)		Paper-I Modern Inorganic Chemistry	4	4	60
Chemistry (Mandatory)		Paper-II Modern Organic Chemistry	4	4	60
Chemistry (Mandatory)		Paper-III Modern Physical Chemistry	2	2	30
Chemistry (Mandatory)		Practical-I Practical - Modern Inorganic Chemistry	2	4 (hours/week/batch)	60
Chemistry (Mandatory)		Practical-II Practical - Modern Organic Chemistry	2	4 (hours/week/batch)	60
Chemistry-Elective-I (Any one)		Elective-I A Modern Analytical Chemistry	2	2	30
		Elective-I B Chemistry in Life Sciences			
		Practical Elective-I Chemistry Elective Practical –I	2	4 (hours/week/batch)	60
Chemistry-RM		RM:	4	4	60
<b>Semester-II</b>					
Chemistry (Mandatory)		Paper-IV Advanced Inorganic Chemistry	4	4	60
Chemistry (Mandatory)		Paper-V Advanced Physical Chemistry	4	4	60
Chemistry (Mandatory)		Paper-VI Advanced Organic Chemistry	2	2	30
Chemistry (Mandatory)		Practical-III Practical - Advanced Inorganic Chemistry	2	4 (hours/week/batch)	60
Chemistry (Mandatory)		Practical-IV Practical - Advanced Physical Chemistry	2	4 (hours/week/batch)	60
Chemistry-Elective-II (Any One)		Elective-II A Advanced Analytical Chemistry	2	2	30
		Elective-II B Medicinal Chemistry			
		Practical Elective-II Chemistry Elective Practical –II	2	4 (hours/week/batch)	60
Chemistry-OJT/FP		OJT/FP: Chemistry Field Project	4	4	60

**M. Sc. Part-I (Semester-I)**  
**Paper-I**  
**Modern Inorganic Chemistry** (4 Credits)

**Unit I: Chemistry of Transition Elements** (15)

General characteristic properties of transition elements, co-ordination chemistry of transition metal ions, ligand field theory, ligand field energy parameters (Racah parameters B and C, Slater Condon Parameters, Slater Condon Shortly Parameters), splitting of d orbitals in low symmetry environment, Jahn-Teller effect, interpretation of electronic spectra including charge transfer spectra, spectrochemical series, nephelauxetic effect and nephelauxetic series. Diaqua-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)  $d\pi - p\pi$  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 & hex nuclear 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

& trinuclear carbonyl complexes [V(CO)<sub>6</sub>, Cr(CO)<sub>6</sub>, Ni(CO)<sub>4</sub>, Fe(CO)<sub>5</sub>, Mn<sub>2</sub>(CO)<sub>10</sub>, Co<sub>2</sub>(CO)<sub>8</sub>, Fe<sub>2</sub>(CO)<sub>9</sub>, Fe<sub>3</sub>(CO)<sub>12</sub>], 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. Schubert 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 Wulff, The Structure and Properties of Materials, Vol. 4, Electronic properties, Willey Estern
16. L.V. Azoroff and J.J. Brophy, Electronic 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. Arnikaar, 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)**  
**Paper-II**  
**Modern Organic Chemistry (4 Credits)**

**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,  $\psi$ -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<sub>2</sub>, SN<sub>1</sub>, mixed SN<sub>1</sub> & SN<sub>2</sub>, and SET mechanisms, Neighboring group participation by  $\pi$  and  $\sigma$ -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<sub>2</sub> and SE<sub>i</sub> The SE<sub>1</sub> mechanisms. Electrophilic substitution accompanied by double bond shifts.

**Unit IV: Stereochemistry** **(15)**

Elements of symmetry, 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 stereochemistry and its application in predicting reactivity of molecules.

**M. Sc.-I (Semester-I)**  
**Paper-III**  
**Modern Physical Chemistry (2 Credits)**

**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  $\Phi$  equation, the  $\Theta$  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.

**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

### Practical - Modern Inorganic Chemistry (2 Credit)

#### 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
6. Determination of calcium from given drug sample.
7. Determination of hardness, alkalinity and salinity of water.
8. Separation and estimation of chloride and bromide on anion exchanger
9. To determine the amount of Cu in brass metal alloy titrimetrically
10. Separation and estimation of Fe and Al on cation exchanger

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 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.

**M.Sc.-I Semester-I**  
**Practical-II**  
**Practical - Modern Organic Chemistry (2 Credit)**

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

**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 Arun Sethi
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

**M. Sc.- I (Semester-I)**  
**Elective-I**  
**Modern Analytical Chemistry (2 Credit)**

**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: 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.

**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

**Course Outcomes:**

- 1) To study the concept of error, its origin, classification, measurement, mathematical derivation, and its minimization.
- 2) To study the various Electroanalytical techniques and its application in various sector of pharma and chemical industries.

## M. Sc.- I (Semester-I)

### Elective-II Chemistry in Life Sciences (2 Credit)

#### 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

#### 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, Addison Wesley Co. (1986).
8. Metabolic Pathways - Greenberg.
9. Biochemistry – G. Zubay, Addison 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.

**M.Sc-I Semester I**  
**Practical Elective-I**  
**Chemistry Elective Practical –I (2 Credit)**

1. To Verify Beer –Lambert’s Law for solution of  $\text{KMnO}_4$  in water and in acid medium Colorimetrically
2. To determine the solubility of calcium Oxalate in presence of KCl (Ionic Strength Effect)
3. To determine the solubility of calcium Oxalate in presence of HCl ( $\text{H}^+$  ion Effect)
4. To determine the  $\text{pK}_a$  value of dibasic acid (malonic) by pH meter.
5. To determine the amount of carbonate & bicarbonate by potentiometrically.
6. Estimate the concentration of  $\text{H}_2\text{SO}_4$ ,  $\text{CH}_3\text{COOH}$  and  $\text{CuSO}_4$  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.

**M.Sc-I Semester I**  
**Research Methodology (4 Credit)**

**Unit I: Basic Concepts of Research ( 15 lectures)**

Research-definition and types of research (Descriptive vs analytical; applied vs fundamental; quantitative vs. qualitative; conceptual vs empirical). Research methods vs methodology. Literature-review and its consolidation; Library research; field research; laboratory research.

**Unit II: Data Collection and Documentation of Observations (15 lectures)**

Maintaining a laboratory record; Tabulation and generation of graphs. Imaging of tissue specimens and application of scale bars. The art of field photography.

**Unit III: Overview of Application to Chemistry related problems (15 lectures)**

Key chemistry research areas, chemoinformatics.

**Unit IV: Ethics and Good Practical's and Art of Scientific Writing (15 lectures)**

Authors, acknowledgements, reproducibility, plagiarism, Numbers, units, abbreviations and nomenclature used in scientific writing. Writing references. Power-point presentation. Poster presentation. Scientific writing and ethics, Introduction to copyright-academic misconduct/plagiarism.

**Practical**

1. Experiments based on chemical calculations.
2. Lab computational experiments.
3. Poster presentation on defined topics.
4. Technical writing on topics assigned.
5. Identification of different type of research in day by day life
6. Curation of relevant scientific literature from Google Scholar
7. Demonstration for checking of plagiarism using recommended software
8. Technical writing on topics assigned.

(More Practical may be added depending on the available facilities)

**Suggested Readings**

1. Dawson, C. (2002). Practical research methods. UBS Publishers, New Delhi.

**M. Sc.-I (Semester-II)**  
**Paper-IV**  
**Advanced Inorganic Chemistry**

**(4 Credit)**

**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, pseudo halides 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 ferredoxins, 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 Wulff, The Structure and Properties of Materials, Vol. 4, Electronic properties, Willey Eastern
10. L.V. Azoroff and J.J. Brophy, Electronic 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 Occurance, 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)**  
**Paper-V**  
**Advanced Physical Chemistry (4 Credit)**

**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 (Green house effect, ozone depletion).

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

Photophysical phenomenon. Jablonski diagram. 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 biomolecular quenching processes, Stern-Volmer equation, formation of photo dimer, (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  $\text{NO}_2$  and  $\text{F}_2$ , 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)**

**Paper-VI**

**Advanced Organic Chemistry**

**(2 Credit)**

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

The arenium ion mechanism, orientation and reactivity, energy profile diagram, ortho/para ratio, IPSO substitution, orientation in other ring system, recapitulation of halogenations, nitration, sulphonation and Friedel-Craft's reactions, Diazonium coupling. The S<sub>N</sub>Ar, S<sub>N</sub>1, S<sub>N</sub>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 stereochemical 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, Wittig reaction, Mechanism of condensation reaction involving enolates : Aldol, Knoevenagel, 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 E<sub>1</sub>, E<sub>2</sub> and E<sub>1c</sub>b mechanism. Orientation of double bond, reactivity: Effect of substrate substance, attacking base, the leaving group and the medium, pyrolytic elimination.

**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 Chemistry: 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**  
**Practical-III**  
**Practical - Advanced Inorganic Chemistry (2 Credit)**

**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
6. Separation and estimation of Ni and Co on anion exchanger
7. Estimation of Pb and Sn in solder alloy
8. Determination of Mo, Fe, by solvent extraction using isopropyl alcohol as solvent.

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 titrimetrically.
3. To perform the Ore analysis and alloy analysis.

## M.Sc.-I Semester-II

### Advanced Physical Chemistry (2 Credit) NON-INSTRUMENTAL

#### Kinetics

1. To investigate the auto-catalytic reaction between potassium permanganate and oxalic acid.
2. Iodination 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. pH metry:

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

#### Conductometry

1. Titration of ZnSO<sub>4</sub> / MgSO<sub>4</sub> against BaCl<sub>2</sub> and Ba(CH<sub>3</sub>COO)<sub>2</sub> and calculation of amount of Sulphate Present .
2. Conductometric estimation of NH<sub>4</sub>Cl with NaOH solution.

#### Potentiometry

1. To determine the basicity and pKa value of organic acids by potentiometric 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.

**M. Sc.-I (Semester-II)**  
**Elective-II A- Advanced Analytical Chemistry (2 Credit)**

**Unit I: Infrared Spectroscopy** **(15)**

Instrumentation and sample handling, Various vibrational transitions, Characteristic vibrational 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 A: Nuclear Magnetic Resonance Spectroscopy** **(10)**

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 II B: Problems based on joint application of IR, NMR 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 study the problem solving techniques and methods combining based on IR, NMR, UV spectroscopy, and Mass Spectrometry.

## M. Sc.-I (Semester-II)

### Elective-II B -Medicinal Chemistry (2 Credit)

#### 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.

#### Reference books:

1. Medicinal Chemistry by Ashutosh Kar, 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 – II, Semester-II

### Practical Elective-II- Chemistry Elective Practical –II (2 Credit)

#### 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

#### 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 KCl (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

**M. Sc. Part – II, Semester-II**

**Chemistry-OJT/FP (4 Credit)**

## Outline of Examination

### THEORY

**1) Internal Evaluation (IE):** Internal evaluation will consist of **40 % marks** per semester per paper. It may be held as **per the following scheme** per semester (**Annexure: I& II**)

Credits	Marks for Attendance	Classroom Test	Home Assignment	Marks for Presentation/Group Discussion/ Participation/Field work/Study visit	Total Marks
02	05	10	05	---	20
04	05	20	05	10	40

**2) End Semester Examination (ESE):** The detailed question paper pattern (**60% marks per paper**) is given as in **Annexure- III; Annexure- IV**

### PRACTICAL

**1) Internal Evaluation (IE):** Internal evaluation will carry **40 % marks** and may consist of:

Credits	Marks for Attendance	Internal Practical Exam	Journal	Total Marks
02	05	10	05	20

**2) End Semester Examination (ESE):** Practical examination **60 % marks** shall be conducted at the end of each semester.

## **Annexure: I**

Walchand College of Arts and Science, Solapur (Autonomous)  
B. SC. Part – I Semester II (w.e.f. June, 2023)

Question Paper for Class Room Test (IE)  
(02 Credit Theory Course)

Marks: 10

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Q.No.1 Multiple choice questions - 04 marks.

Q.No.2 Attempt any two - 6 marks.

- a)
  - b)
  - c)
-

**Annexure: II:**

Walchand College of Arts and Science, Solapur (Autonomous)

B. SC. Part – I Semester II (w.e.f. June, 2023)

Question Paper for Class Room Test (IE)

(04 Credit Theory Course)

Marks: 20

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Q.No.1 Multiple choice questions

- 08 marks.

Q.No.2 Attempt any two

- 12 marks.

- a)
- b)
- c)



## Annexure: IV

Walchand College of Arts and Science (Autonomous), Solapur  
Theory question paper Pattern for **2 credit** course as per NEP 2020 (ESE)  
w. e. f. 2023-24

Examination: \_\_\_\_\_

Class: M.Sc.  
Subject:  
Time: 1.5 hrs

Semester:  
Paper:  
Marks: 30

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### Instructions:

- 1) All questions are compulsory
  - 2) Figures to the right indicate full marks
  - 3) Draw neat labeled drawings wherever necessary
- 

**Q. No.1 Rewrite the following sentences by choosing correct alternative given below** 06

- i) a) b) c) d)
- ii)  
iii)  
iv)  
v)  
vi)

**Q. No.2 Answer the following questions (Any three)** 06

- i)  
ii)  
iii)  
iv)

**Q. No.3 Answer the following questions** 06

- i)  
ii)

**OR**

**Q. No.3 Answer the following questions** 06

- i)  
ii)

**Q. No.4 Answer the following questions** 06

- i)  
ii)

**OR**

**Q. No.4 Answer the following questions** 06

- i)  
ii)

**Q. No.5 Answer the following question** 06

- i)