KAKARAPARTI BHAVANARAYANA COLLEGE (Autonomous)
PG Department of Chemistry (Analytical Chemistry)

Class:	Semester:	Title of The Paper:	Paper Code:	W.E.F
I M.Sc	I	GENERAL CHEMISTRY	R22ACH101	2022-23

Syllabus

Total No of Hours for Teaching - Learning	Instructional Hours for Week		Duration of Semester End Examination in Hours	Max Marks		Credits
60 Hours	Theory	Practical	3 Hours	CIA	SEE	4
	4	0		30	70	

Course Learning Objective(S):

This course aims to impart to the student, knowledge of:

1. Errors, statistical treatment of analytical data and use of various computational tools on interpreting experimental data
2. Principles, terminologies, types and applications of chromatography.
3. Various concepts of volumetric analysis

Course Learning Outcome(S):

On completion of the course, students should be able to:

1. Organize, analyze and interpret data using the tools learned in an ethically responsible approach and present it systematically.
2. Describe and adopt suitable separation techniques.
3. Write balanced chemical equations, plot titration curves and calculate concentrations of analyte from neutralization, redox, complexometric, precipitation and gravimetric titrations.

Unit-I:

Treatment of analytical data: Accuracy and precision- Classification of errors- Determinate and Indeterminate errors- Minimization of errors- Absolute and Relative errors, propagation of errors- Distribution of Indeterminate errors- Gaussian distribution- Measures of central tendency-Measures of precision- Standard deviation- Standard error of mean- student's t- test- Confidence interval of mean- Testing for significance- Comparison of two means- F-test- Criteria of rejection of an observation-Significant figures and computation rules, control charts.

Unit-II:

Titrimetric Analysis: Titrimetric Analysis: Classification of reactions in titrimetric analysis-Primary and secondary standards- **Neutralization Titrations**-Theory of neutralization indicators - Mixed indicators- **Precipitation titrations**-Indicators for precipitation titrations-Volhard's method-Mohr's method- Theory of adsorption indicators-Fajjan's method- **Oxidation reduction titrations**-Change of electrode potentials during titration of Fe (II) with Ce (IV)-Detection of end point in redox titrations-**Complexometric titrations**-calcium magnesium estimations by EDTA.

Unit-III: Methods of purification: 1. Distillation: Basic principles, Distillation types- continuous distillation, batch distillation, fractional distillation, vacuum distillation and steam distillation. Industrial applications; **2. Drying Techniques**: Drying of Hydrocarbons, ethers and alcohols, Tetra hydro furan, DMF and DMSO**; 3. Solvent extraction:** Basic principles, Different types of extraction. Selection of solvents. Avoiding emulsion formation. Basic concepts on Soxhlet extraction. Industrial applications**; 4. Recrystallization**: Basic principles, choice of solvent, seeding, filtration and centrifugation and drying.

Unit-IV:

Principles of Chromatography: Introduction to chromatography, Different types of Chromatography: **Adsorption chromatography:** adsorbents, solvents, solutes, apparatus; **Column Chromatography:** stationary phase, Mobile phase, packing of column, advantages and disadvantages. **Paper chromatography:** Basic Principles. Ascending and descending types. Selection of mobile phase, Development of chromatograms, Visualization methods. Applications of paper chromatography in the identification of sugars and amino acids. One- and two-dimensional paper chromatography; **Thin Layer chromatography:** Basic Principles. Common stationary phases, Methods of preparing TLC plates, Development of TLC plates, Visualization methods, Rf value. Application of TLC in monitoring organic reactions. Identification and quantitative analysis.

Unit-V:

Gas Chromatography And High – Performance Liquid Chromatography: Gas chromatography: Basic Principles. Different types of GC techniques. Selection of columns and carrier gases. Instrumentation. detectors; RT values. Applications in the separation, identification and quantitative analysis of organic compounds; **High Performance liquid chromatography (HPLC):** Basic Principles. Normal and reversed Phases. Selection of column and mobile phase. Instrumentation. detectors; RT values. Applications in the separation, identification and quantitative estimation of organic compounds. Concepts on HPLC method development.

Textbooks/Reference books:

1. Vogel's text book of quantitative analysis. Addition Wesley Longmann Inc.
2. Quantitative analysis R.A Day and A.L. Underwood. Prentice Hall Pvt. Ltd.
3. Principles of Instrumental Analysis by D.A.Skoog, F.J.Holler and T.A.Nieman, Harcourt College Pub.
4. Separation Techniques by M.N.Sastri, Himalaya Publishing House (HPH), Mumbai.
5. Chromatography, E.Helftnan, Van Nostrand, Reinhold, NewYork.
6. Chromatography, E.Lederer and M.Lederer, Elsevier, Amsterdam.
7. Thin layer chromatography, E.Stahl, Academic Press, NewYork.
8. Introduction to Organic Laboratory Techniques-D.L.Pavia, G.M.Lampman, G.S.Kriz and R. G.Engel, Saunders College Pub (NY).
9. Instrumental methods of Chemical Analysis by H. Kaur, Pragati Prakasan, Meerut.
10. Protein Purification-Principles and practice, III Edn-R.K.Scopes, Narosa Publishing House, Delhi.
11. D.D.Perrin; Purification of Laboratory Chemicals.

Model Question Paper

Class: I MSc Analytical Chemistry **Semester: I**
Paper: General chemistry **Code: R22ACH101**
Time: 3Hrs **Max. Marks: 70 M**

UNIT-I

1. Define an error? Explain the classification of errors with suitable examples? (14M)

OR

2. a) Explain t-Test and F-Test? (8M)
   b) Write a note on Gaussian distribution curve ? (6M)

UNIT-II

3. a) Explain the Classification of reactions in titrimetry? (8M)
   b) Write a note on Neutralization indicators. (6M)

OR

4. Explain the change of electrode potentials during titration of Fe (II) with Ce (IV). (14M)

UNIT-III

5. a) Discuss the basic principle and working of Steam distillation? (8M)
   b) Write a note on drying agents Benzene and Ethanol. (6M)

OR

6. a) Explain Soxhlet extraction? (6M)
   b) Write a note on continuous distillation? (8M)

UNIT-IV

7. a) Explain the Types of Paper chromatography. (8M)
   b) Write a note on advantages and disadvantages of column chromatography? (6M)

OR

8. Explain the principle and applications of TLC. (14M)

UNIT-V

9. Explain the basic principle and instrumentation of HPLC? (14M)

OR

10. Explain the detectors used in the GC? (14M)

KAKARAPARTI BHAVANARAYANA COLLEGE (Autonomous)
PG Department of Chemistry (Analytical Chemistry)

Class:	Semester:	Title of The Paper:	Paper Code:	W.E.F
I M.Sc	I	ORGANIC CHEMISTRY	R22ACH102	2022-23

Syllabus

Total No of Hours for Teaching - Learning	Instructional Hours for Week		Duration of Semester End Examination in Hours	Max Marks		Credits
60 Hours	Theory	Practical	3 Hours	CIA	SEE	4
	4	0		30	70	

Course Learning Objective(S):

This course aims to impart to the student, knowledge of:

1. Basic concepts of bonding, structures, resonance, aromaticity, hyperconjugation and tautomerism in organic molecules.
2. Generation, structure, stability and reactivity of reactive intermediates.
3. Stereochemistry of organic compounds, isomerism, and different projection formulae with nomenclature.
4. The fundamentals of substitution, addition and elimination reactions.
5. Widely used name reactions and rearrangements for the synthesis of industrially and pharmaceutically important compounds.

C**ourse Learning Outcome(S):**

On completion of the course, the student should be able to:

1. Apply the concepts of bonding, resonance, aromaticity, hyperconjugation and tautomerism to higher organic compounds.
2. Predict the products, identify reaction intermediates and propose suitable mechanism for organic reactions.
3. Identify stereogenic centres, recognize enantiomers, diastereomers, meso compounds, draw stereochemical structures, and provide R/S designations of stereocenters.
4. Apply the concepts of substitution, addition and elimination reactions to some synthetic organic reactions.
5. Design reactions with the help of name reactions and rearrangements and use of suitable reagents.

Unit-I:

Nature of bonding, Aromaticity and Reactive intermediates: Nature of bonding: Aromaticity:

Aromaticity in benzenoid and non-benzenoid compounds, Benzene, Cyclobutadiene, Tropyllium cation, 1,3,5,7- Cyclooctatetraene, aromaticity of Hetero-aromatic Systems, anti-aromaticity and homo-aromaticity, pseudo aromaticity.

Reactive intermediates : Generation, reactivity and stability of Carbocations, Carbanions, Free radicals and Carbenes.

Unit-II: Substitution Reactions:

The S_N2 , S_N1, mixed S_N1 and S_N 2 reactions, S_Ni, and their mechanisms, Neighboring Group Participation, Anchimeric assistance. Aromatic Nucleophilic substitution reactions: SN2Ar,

(Addition-Elimination) SN1 Ar and Benzyne mechanisms, (Elimination-Addition), Von-Richter and Sommelet-Hauser rearrangements.

Unit-III:

Addition Reactions and Elimination Reactions:

Addition to carbon carbon double bonds – Stereochemical aspects and mechanism of Hydro halogenation and halogenation (HX, X_2) - Hydrogenation of double bonds and Hydroboration.

Types of elimination reactions, mechanisms, Stereochemistry and Orientation, Hofmann and Saytzeff rules, dehydration, dehydrogenation, dehalogenation, decarboxylative eliminations and pyrolytic eliminations.

Unit IV:

Named reactions:

Definition, mechanism, and synthetic applications of Aldol condensation, Benzoin condensation, Cannizzaro condensation, Dieckmann condensation, Perkin condensation, Stobbe condensation, Oppenaur oxidation reaction, Clemmensen reduction reaction, wolf kishner reduction, Meerwein–Ponndorf–Verley reduction reaction, Birch reduction reaction.

Unit-V:

Stereo Chemistry:

Chirality, Definition and classification of Stereoisomers, Enantiomer, Diastereomer, Homomer, Epimer, Anomer, Configuration and Conformation, Configurational nomenclature: D,L and R,S nomenclature. Molecular representation of organic molecules: Fischer, Newman and Sawhorse projections and their inter- conversions. Geometrical Isomerism. Cis-trans, E, Z- and Syn and anti nomenclature.

Textbooks/Reference books:

1. Advanced organic chemistry-Reaction mechanism and structure, Jerry March, John Wiley.
2. Advanced organic chemistry, F.A. Carey and R.J. Sundberg, Springer, New York.
3. A guide book to Mechanism inorganic chemistry, Peter Sykes, Longman.
4. Organic chemistry, I.L.Finar, Vol. I, Fifth ed.ELBS.
5. Organic chemistry, Hendrickson, Cram and Hammond (McGraw–Hill).
6. Modern organic Reactions, H.O.House, Benjamin.
7. Structure and mechanism in organic chemistry, C.K. Ingold, Cornell University Press.
8. Principles of organic synthesis, R.O.C. Norman and J.M.Coxon, Blakie Academic & Professional.
9. Reaction Mechanism in Organic Chemistry, S.M.Mukherji and S.P.Singh, Macmillan.
10. Basic Principles of Organic Chemistry by J.B.Roberts and M.Caserio.
11. Organic chemistry by Morrison and Boyd.

Model Question Paper

Class: I MSc Analytical Chemistry **Semester: I**
Paper: Organic Chemistry **Code: R22ACH202**
Time: 3Hrs **Max. Marks: 70 M**

UNIT-I

1. a) Expalin the aromaticity of non benzenoid compounds. (8M)
   b) Write a note on homo aromaticity. (6M)

OR

2. a) Describe stability and reactivity of carbocations. (8M)
   b) Write the generation and reactivity of carbenes. (6M)

UNIT-II

3. a) Explain S_N1 and S_N2 reactions with mechanisms. (8M)
   b) Write a note on Sommelet Hauser rearrangement. (6M)

OR

4. a) Explain benzyne mechanism? (8M)
   b) Explain neighbouring group participation? (6M)

UNIT-III

5. a) Discuss the stereo chemical aspects of halogenation of alkenes. (8M)
   b) Write a note on homogeneous catalytic hydrogenation of alkenes. (6M)

OR

6. a) Explain the mechanism of E_1 and E_2 eliminations. (8M) . b) Write a note on Pyrolytic Elimination. (6M)

UNIT-IV

7. a) Discuss the reaction and mechsnism of Benzoin condensation. (7M)
   b) Write the mechanism and applications of Dieckmann condensation. (7M)

OR

8. a) Discuss the reaction and mechsnism of Stobbe condensation. (8M)
   b) Write a note on Birch reduction. (6M)

UNIT-V

9. a) Write a note on enantiomers and diastereomers. (8M)
   b) Explain DL Nomenclature with suitable examples. (6M)

OR

10. What are geometrical isomers and explain the methods used for the determination of configuration of geometrical isomers. (14M)

KAKARAPARTI BHAVANARAYANA COLLEGE (Autonomous)
PG Department of Chemistry (Analytical Chemistry)

Class:	Semester:	Title of The Paper:	Paper Code:	W.E.F
I M.Sc	I	INORGANIC CHEMISTRY-I	R22ACH103	2022-23

Syllabus

Total No of Hours for Teaching - Learning	Instructional Hours for Week		Duration of Semester End Examination in Hours	Max Marks		Credits
	Theory	Practical		CIA	SEE	
60 Hours	4	0	3 Hours	30	70	4

Course Learning Objective(S):

This course aims to impart to the student, knowledge of:

1. Advanced principles of bonding in inorganic compounds.
2. The chemistry of coordination compound with Pi acceptor ligands
3. The chemistry of non-metal containing compounds such as Boron-nitrogen, sulphur-nitrogen compounds and phosphorus-nitrogen compounds.
4. The various principles and applications of hard-soft acid base (HSAB), theories of acids and bases and concept of super acids..

Course Learning Outcome(S):

On completion of the course, students should be able to:

1. Appreciate the different theories of chemical bonding and be able to apply these theories to solve structures.
2. learn about the theories, bonding and structure of coordination compounds.
3. Study the structure of non metallic compounds.
4. The various principles and applications of hard-soft acid base (HSAB) and theories of acids and bases.

Unit-I:

Coordination Chemistry:

Nomenclature of ligands, Nature and types of ligands, metal complexes, coordination speheres, Werners theory, structural and stereo isomerism in complexes with coordination number 4 and 6, and spectrochemical series.

Unit II:

Structure and Bonding: Bent'srule, Non-valence cohesive forces, VSEPR theory and limitations, Molecular Orbital theory, Bond order, Symmetry of Molecular orbitals, Molecular orbitals in triatomic (BeH_2) molecules and ions (NO_2^-) and energy level diagrams. Walsh diagrams for linear (BeH_2) and bent (H_2O) molecules.

Unit III:

Metal–ligand bonding: Crystal Field Theory of bonding in transition metal complexes- Splitting of d-orbitals in octahedral, tetrahedral, square planar and Trigonal bipyramidal and Square pyramidal fields, Tetragonal distortions - Jahn-Teller effect. Applications and limitations of CFT. Molecular Orbital Theory of bonding for Octahedral, tetrahedral and square planar complexes. π-bonding and MOT - Effect of π - donor and π –acceptor ligands on Δ_o.

Unit IV:

Metal – ligand Equilibria insolutions:

Step wise and over all formation constants. Trends in stepwise constants (statistical effect and statistical ratio). Determination of formation constants by Spectrophotometric method (Job'smethod) and pH metric method (Bjerrum's). Stability correlations - Irwing -William's series, Hard and soft acids and bases (HSAB) Principle, Acid-base strengths.

Unit V:

Chemistry of non- transition elements:

Clathrate compounds, Spectral and Magnetic properties of Lanthanides and Actinides. Analytical applications of Lanthanides and Actinides. Synthesis, properties and structure of B-N, S-N,P-Ncyclic compounds.

Metal π- complexes: preparation, structure and bonding in Dinitrogen and Dioxygen complexes.

Textbooks/Reference books:

1. Inorganic Chemistry Huheey, Harper andRow.
2. Physical methods in inorganic chemistry, R.S.Drago. Affliated East-West Pvt. Ltd.
3. Concise inorganic chemistry, J.D.Lee, ELBS.
4. Modern Inorganic Chemistry, W.L.Jolly, Mc Graw Hill.
5. Inorganic Chemistry, K.F.Purcell and J.C.Kotz Holt Saunders international.
6. Concepts and methods of inorganic chemistry, B.E.Douglas and D.H.M.C.Daniel, oxford Press.
7. Inorganic Chemistry, Atkins, ELBS.
8. Advanced Inorganic Chemistry, Cotton and Wilkinson, Wiley Eastern.
9. Text book of Coordination chemistry, K.Soma SekharaRao and K.N.K.Vani, Kalyani Publishers.
10. Inorganic Chemistry by AK Das
11. Selected topics in inorganic chemistry by Madan, Mallik and Tuli

Model Question Paper

Class: I MSc Analytical Chemistry **Semester: I**

Paper: Inorganic Chemistry-I **Code: R22ACH103**

Time: 3Hrs **Max. Marks: 70 M**

UNIT-I

1. a) What are the fundamental postulates of Werner's Coordination theory. (8M)
b) Write a note on Spectrochemical series. (6M)

OR

2. Discuss the geometrical isomerism exhibited by the complexes with coordination number 4 and 6. (14M)

UNIT -II

3. a) Write an account on Bent's rule, energetics of hybridisation? (8M)
b) Explain molecular orbital diagram for NO_2^- ion. (6M)

OR

4. a) What are Walsh diagram ? Predict the shape of H_2O molecule using relevant Walsh diagrams? (8M)
b) Explain non valence cohesive forces. (6M)

a) Explain the noble gas compounds with special reference to the clatharates. (6M)
b) Write a note on dioxygen complexes. (8M)

OR

4, c) Describe the spectral and magnetic properties of Lanthanides and Actinides. (8M)
d) Explain the properties and structure of S-N complexes. (6M)

UNIT-III

5. a) Explain Jahn Teller effect with suitable example. (8M)
b) Write the splitting of d-orbitals in trigonal bipyramidal and square pyramidal complexes. (6M)

OR

6. a) Explain molecular orbital theory of bonding in octahedral complexes ? (8M)
b) Explain ∏ bonding in molecular orbital theory? (6M)

UNIT-IV

7. a) Determine the formation constant by spectrophotometric method ? (8M)
b) Explain step wise and overall formation constants? (6M)

OR

8. a) Explain Hard and Soft Acid base theory. (8M)
b) Explain Irving William series. (6M)

UNIT-V

9. a) Describe noble gas compounds with special reference to clathrates. (8M)
b) Write a note on dioxygen complexes. (6M)

OR

10. a) Elaborate the spectral and magnetic properties of lanthanides and actinides. (8M)
b) Describe the structure, synthesis and properties of S-N cyclic compounds. (6M)

Class:	Semester:	Title of The Paper:	Paper Code:	W.E.F
I M.Sc	I	PHYSICAL CHEMISTRY-I	R22ACH104	2022-23

Syllabus

Total No of Hours for Teaching - Learning	Instructional Hours for Week		Duration of Semester End Examination in Hours	Max Marks		Credits
	Theory	Practical		CIA	SEE	
60 Hours	4	0	3 Hours	30	70	4

Learning Objective(S):

This course aims to impart to the student, knowledge of:

1. The principles and applications of quantum mechanics in detail with further introduction of different types of operators later on used in the solution of conjugated systems.
2. Concepts in classical laws of thermodynamics and their application.
3. Surface and colloid chemistry from a physical-chemical perspective.
4. Basics of thermodynamic and kinetic studies of the electrochemical process
5. To understand the advanced concepts involved in kinetics.

Course Learning Outcome(S):

On completion of the course, students should be able to:

1. The basic principles of quantum mechanics. Introduction to new operators such as Hermitian and Hamiltonian and their use in the solution of Hydrogen and Hydrogen like atoms.
2. Account for the physical interpretation of distribution functions and discuss and show how these can be used in calculations of basic thermodynamic properties.
3. Define and explain surface and interfacial phenomenon.
4. Correlate electrochemistry with thermodynamics that will enable to get best output from industrial perspective.
5. Understand the concept of activation energy and its calculation from kinetic data.

Unit-I: Quantum Mechanics:

Schrodinger equation, importance of wave function, Operators, Eigen values and Eigen functions, derivation of wave equation using operator concept. Discussion of solutions of Schrodinger's equation to some model systems viz. particle in one dimensional box applications.

Unit II

Thermodynamics:

Classical thermodynamics - Brief review of first and second laws of thermodynamics - Entropy change in reversible and irreversible processes - Entropy of mixing of ideal gases - Free energy functions - Gibbs-Helmholtz equation - Free energy changes in chemical reactions, Van't Hoff reaction isotherm, Van't Hoff equation – Classiuss - Clapeyron equation - partial molar quantities - Chemical potential - Gibbs- Duhem equation - Fugacity - Determination of fugacity.

Unit-III:

Chemical kinetics:

Theories of reaction rates – Collision theory – limitations – Transition state theory – Lindemann theory of unimolecular reaction - Effect of ionic strength - Primary and secondary salt effects – Chain reactions - Rate laws of photochemical reaction of H_2–Cl_2, and thermal decomposition of acetaldehyde

Unit-IV:

Surface phenomena and phase equilibria:

Pressure difference -across curved surface (young - Laplace equation) - Vapour pressure of small droplets (Kelvin equation) -Gibbs-Adsorption equation - BET equation - Estimation of surface area - **Surface active agents** - classification of surface-active agents - Micellization – critical Micelle concentration (CMC) - factors affecting the CMC of surfactants, Micro emulsions - Reverse micelles.

Unit-V:

Electrochemistry-1:

Electrochemical cells - Measurement of EMF - Nernst equation – Equilibrium constant from EMF Data - pH and EMF data -Determination of solubility product from EMF measurements. Concentration cells with and without transference – Liquid junction potential and its determination - Activity and activity coefficients - Debye Huckel limiting law and its verification. Effect of dilution on equivalent conductance of electrolytes - Anomalous behavior of strong electrolytes. Debye Huckel-Onsagar equation - verification and limitations.

Textbooks/Reference books:

1. Introductory quantum Mechanics, A.K. Chandra.
2. Quantum Chemistry, R.K. Prasad Physical Chemistry P.W.Atkins, ELBS.
3. Chemical Kinetics - K.J. Laidler, Mc Graw Hill Pub.
4. Text Book of Physical Chemistry. Samuel Glasstone, Mcmillan Pub.
5. Physical Chemistry, G.W. Castellan. Narosa Publishing House
6. Thermodynamic for Chemists. Samuel Glasstone.
7. Electrochemistry, Samuel Glasstone, Affiliated East West
8. Physical Chemistry, W.J.Moore, Prentice Hall
9. Atomic structure and chemical bond. Manas chanda. Tata Mc Graw Hill Company Limited.

Model Question Paper

Class: I MSc Analytical Chemistry **Semester: I**

Paper: Physical Chemistry-I **Code: R22ACH104**

Time: 3Hrs **Max. Marks: 70 M**

UNIT-I

1. Derive Schrödinger wave equation. (14M)

OR

2. Derive wave equation using operator concept. (14M)

UNIT-II

3. Derive Van't Hoff's equation? (14M)

OR

4. a) Define chemical potential and derive the Gibs Duhem Equation? (7M)
   b) Describe fugacity and determination of fugacity (7M)

UNIT-III

5. a) Explain Lindemann theory of Unimolecular reaction rate? (8M)
   b) Derive rate law for the thermal decomposition of Acetaldehyde? (6M)

OR

6. Discuss primary salt effect. (14M)

UNIT-IV

7. Derive BET equation. (14M)

OR

8. a) Explain the classification of surface active agents? (8M)
   b) Define Critical Micelle Concentration and explain the factors effecting CMC. (6M)

UNIT-V

9. What is concentration cells and calculate the potential of concentration cells with transference. (14M)

OR

10. Write a note on Debye Huckle Onsagar Equation, its verification and its limitations? (14M)

KAKARAPARTI BHAVANARAYANA COLLEGE (Autonomous)
PG Department of Chemistry (Analytical Chemistry)

Class:	Semester:	Title of The Paper:	Paper Code:	W.E.F
I M.Sc	I	PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS	R22ACH105	2022-23

Syllabus

Total No of Hours	Instructional Hours	Duration of	Max Marks	Credits

for Teaching - Learning	for Week		Semester End Examination in Hours			
60 Hours	Theory	Practical	3 Hours	CIA	SEE	4
	4	0		30	70	

Course Objectives:

The Course will introduce the students to

1. Learn to achieve the highest goal happily.
2. Become a person with stable mind, pleasing personality and determination.
3. Learn to build positive attitude, self-motivation, enhancing self-esteem and emotional intelligence
4. Learn to develop coping mechanism to mange stress through Yoga and meditation techniques
5. Awaken wisdom among them.

Learning Outcomes:

At the end of this course the students should be able to:

1. Develop their personality and achieve their highest goals of life.
2. Lead the nation and mankind to peace and prosperity
3. Practice emotional self regulation.
4. Develop a positive approach to work and duties
5. Develop a versatile personality

UNIT- I:

Introduction to Personality Development:

The concept of personality - Dimensions of Personality – Theories of Personality development (Freud & Erickson) – The concept of Success and Failure – Factors responsible for Success –Hurdles in achieving Success and Overcoming Hurdles — Causes of failure – Conducting SWOT (Strengths, Weaknesses, Opportunities and Threats) analysis.

UNIT- II:

Attitude, Motivation and Self-esteem:

Conceptual overview of Attitude – Types of Attitudes – Attitude Formation – Advantages/ Disadvantages of Positive/Negative Attitude - Ways to Develop Positive Attitude **Concept of motivation:** Definition and Nature of Motivation/Motive – Internal and external motives – Theories of Motivation – Importance of self-motivation- Factors leading to de- motivation.

Self-esteem - Definition and Nature of self-esteem – Do's and Don'ts to develop positive self- esteem – Low self esteem - Personality having low self esteem - Positive and negative self esteem.

UNIT -III:

Other Aspects of Personality Development

Body language - Problem-solving - Conflict Management and Negation skills - Decision-making skills - Leadership and qualities of a successful leader – Character building -Team-work – Time management - Work ethics – Good manners and etiquette – Emotional Ability/Intelligence – Dimensions of Emotional Intelligence – Building Emotional Intelligence.

UNIT- IV:

Neetisatakam-Holistic Development of Personality

Verses- 19,20,21,22 (wisdom) – Verses- 29,31,32 (pride and heroism) – Verses- 26,28,63,65 (virtue)

Personality of Role Model – Shrimad Bhagwadgeeta

Chapter2-Verses 17, Chapter 3-Verses 36,37,42 – Chapter 4-Verses 18, 38,39 Chapter18 – Verses 37,38,63

UNIT -V:

Yoga & Stress Management

Meaning and definition of Yoga - Historical Perspective of Yoga - Principles of Astanga Yoga by

Patanjali – Meaning and Definition of Stress - Types of Stress - Eustress and Distress –Stress Management – Pranayama- Pranayama: Anulom and Vilom Pranayama - Nadishudhi Pranayama– Kapalabhati-Pranayama - Bhramari Pranayama - Nadanusandhana Pranayama – Meditation techniques: Om Meditation - Cyclic meditation : Instant Relaxation technique (QRT), Quick Relaxation Technique (QRT), Deep Relaxation Technique (DRT) (Theory & Practical).

Text and Reference Books:

1. Hurlock, E.B. Personality Development, 28th Reprint. New Delhi: Tata McGraw Hill, 2006.
2. Gopinath, Rashtriya Sanskrit Sansthanam P, Bhartriharis Three Satakam, Niti-sringar- vairagya, New Delhi, 2010
3. Swami Swarupananda, Srimad Bhagavad Gita, Advaita Ashram, Publication Department, Kolkata, 2016.
4. Lucas, Stephen. Art of Public Speaking. New Delhi. Tata - Mc-Graw Hill. 2001
5. Mile, D.J Power of positive thinking. Delhi. Rohan Book Company, (2004).
6. Pravesh Kumar. All about Self- Motivation. New Delhi. Goodwill Publishing House. 2005.
7. Smith, B . Body Language. Delhi: Rohan Book Company. 2004
8. Yogic Asanas for Group Training - Part-I: Janardhan Swami Yogabhyasi Mandal, Nagpur.
9. Rajayoga or Conquering the Internal Nature by Swami Vivekananda, Advaita Ashrama (Publication Department), Kolkata.
10. Nagendra H.R nad Nagaratna R, Yoga Perspective in Stress Management, Bangalore, Swami Vivekananda Yoga Prakashan.

Online Resources:

1. https://onlinecourses.nptel.ac.in/noc16_ge04/preview
2. https://freevideolectures.com/course/3539/indian-philosophy/11

PG Department of Chemistry (Analytical Chemistry)

Semester-I

Paper Code & Title: R22ACH 106
ORGANIC CHEMISTRY LAB-I

No. of hours per week: 04 **Total credits: 04**
Total marks: 100 **(Internal: 30 M & External: 70M)**

Course Objectives:

- To develop an insight into the preparation of organic compounds in various reactions
- To understand the process of preparation of organic through various reactions
- To acquire skills in the preparation of organic compounds, their separation, purification and identification

Learning Outcomes: At the end of the course, the learners should be able

- To Prepare various organic compounds using various reactions
- Develop skill in handling apparatus, measure the quantities and carryout the reaction, separate the products, purify them and analyze the products formed
- Applies the skill in preparing novel organic moieties

Synthesis of Organic compounds

1. β-Napthyl methyl ether from β-Naphthol
2. m-dinitrobenzene from Nitrobenzene
3. Aromatic acid from ester
4. Benzanilide from aniline
5. p-nitroaniline from Acetanilide
6. p-Bromo acetanilide from aniline
7. Benzanilide from Benzophenone
8. Preparation of Phthalimide from Phthalic anhydride – High Temperature.
9. Preparation of p-nitro acetanilide – Low temperature.
10. Preparation of Iodoform–Room temperature.
11. Preparation of Aspirin (Acetylation)
12. Preparation of Sodium wire-to make Sodium Wire for solvent drying.
13. Preparation of Sodium Granules and preparation of Sodiumt-butoxide.
14. Preparation of Grignard Reagent and its usage one reaction.
15. Preparation of Wittig reagent.

Textbooks/Reference books:

1. A Textbook of Practical Organic Chemistry by A. I. Vogel, ELBS and Longman group.
2. Practical Organic Chemistry by Mann and Saunders, ELBS and Longman group.
3. A.I.Vogel, "Elementary Practical Organic Chemistry", Longman
4. F.G.Mann and B.C.Saunders, "Practical Organic Chemistry", Longman
5. Reaction and Synthesis in Organic Laboratory, B.S. Furniss, A.J. Hannaford, Tatchell, University Science Book smills valley.
6. Purification of Laboratory chemicals, manual, W.L.F.Armarego EDD Perrin
7. Reaction and Synthesis in Organic Chemistry Laboratory, Lutz-Friedjan- Tietze, Theophil Eicher, University Science Book.
8. Laboratory manual of organic chemistry, B.B. Dey, M.V.Sitaraman and T.R. Govindachari, Allied publisher limited.

PG Department of Chemistry (Analytical Chemistry)

Paper Code & Title: R22 ACH 107

INORGANIC CHEMISTRY LAB

No. of hours per week: 04 **Total credits: 04**

Total marks: 100 **(Internal: 30 M & External: 70M)**

Course Objectives:

- To develop an insight into the preparation of inorganic complexes
- To understand the process of preparation of inorganic complexes
- To acquire skills in the preparation of inorganic complexes

Learning Outcomes:

At the end of the course, the learners should be able

- To Prepare various inorganic complexes

- Develop skill in handling apparatus, measure the quantities and carryout the reaction and analyze the inorganic mixtures.
- Applies the skill in preparing new metal complexes and analysis of inorganic mixtures
- Understand the regulations in handling and disposal of chemicals.

1. Synthesis of Inorganic Metal Complexes: Synthesis of 3d transition metal complexes of tetrahedral, square planar and octahedral geometries.

(i) Preparation of Tetra ammine Copper(II) sulphate monohydrate

(ii) Potassium tris-oxalatoferrate (III) trihydrate

(iii) Tris-thiourea copper(I) sulphate

(iv) Preparation of Cis and trans potassium diaquodioxalato chromium(III). (v) Preparation of Hexaammine cobalt(III)chloride.

(vi) Determination of $Zn^{2+}$with potassium Ferrocyanide.

(vii) Determination of Mg^{2+} using EDTA. (viii) Determination of Ni^{2+}using EDTA.

(ix) Determination of hardness of water using EDTA.

(x) Gravimetric determination of nickel using dimethyl glyoxime.

(xi) Gravimetric determination of Copper using ammonium thiocyanate.

(xii) Gravimetric determination of Zn using diammonium hydrogen phosphate.

2. Systematic Semi micro Qualitative Analysis of Inorganic six radical mixtures: In systematic Semi micro qualitative inorganic analysis, inorganic mixture contains three cations and three anions. The analysis involves identification and conformation of cations and anions containing one less familiar cation (Tungsten, Molybdenum Zirconium, Thorium, Titanium, Uranium, Cerium, Vanadium, Lithium, Berkelium Etc... and one interfering anion.

Anions: CO_3^{2-}, S^{2-}, SO_3^{2-}, Cl^-, Br^-, I^-, NO_3^-, SO_4^{2-}, CH_3COO^-, $C2O^{4-}$, $C_4H_4O_6^{2-}$, PO_4^{3-}, $Cr)_4^{2-}$, AsO_4^{3-}, F^-, BO_3^-,

Cations : Ammonium (NH_4^+),

1st group: Hg, Ag, Pb, Tl, W ;

2nd group: Hg, Pb, Bi, Cu, Cd, As, Sb, Sn, Mo;

3rd group: Fe, Al, Cr, Ce, Th, Ti, Zr, V, U, Be

4th group: Zn, Mn, Co, Ni

5th group: Ca, Ba, Sr,

6th group: Mg, K, Li

Note: A minimum of 4 inorganic mixtures must be analysed in this Semester

REFERENCE BOOKS:

1. Practical Inorganic Chemistry, G. Marr and B. W. Rockett.

2. Practical Inorganic Chemistry by G.Pass H.Sutchiffe,2nd edn John Wiley & Sons.

3. Experimental Inorganic/Physical Chemistry, M. A. Malati, Horwood Publishing, Chichester, UK (1999).

4. Vogels Text Book of Quantitative analysis, revised.J.Bassett, R.C.Denny, G.H.Jeffery and J.Mendhan, ELBS.

5. Synthesis and Characterization of Inorganic Compounds, W.L.Jolly.Prentice Hall.

KAKARAPARTI BHAVANARAYANA COLLEGE (Autonomous)
PG Department of Chemistry (Analytical Chemistry)

Class:	Semester:	Title of The Paper:	Paper Code:	W.E.F
I M.Sc	II	ORGANIC SPECTROSCOPY	R22ACH201	2022-23

Syllabus

Total No of Hours for Teaching - Learning	Instructional Hours for Week		Duration of Semester End Examination in Hours	Max Marks		Credits
60 Hours	Theory	Practical	3 Hours	CIA	SEE	4
	4	0		30	70	

Learning Objective(S):

This course aims to impart to the student, knowledge of:

1. Spectroscopic techniques including the basic principles for recording of NMR, IR, UV, and MS spectra.
2. Applications of UV-Vis spectroscopy.
3. Identification and characteristics of functional groups using IR spectroscopy.
4. Principles of nuclear magnetic resonance spectroscopy of ^{1}H,
5. Fragmentation pattern, effect of isotopes in Mass spectroscopy.

Course Learning Outcome(S):

On completion of the course, the student should be able to:

1. Combine information from experimental NMR, IR, UV, and MS spectra and elucidate the structure of unknown organic compounds.
2. Suggest molecular structure from analysis of the spectral data.
3. Predict the NMR, IR, UV-Vis and MS spectra from a given molecular structure.

Unit-I:

UV-Visiblespectroscopy:

Lambert'slaw, Beer-Lambert'slaw, Instrumentation, Energy transitions–Simple chromophores-Auxochrome, Absorption shifts (Bathochromic, Hypsochromic, Hyper chromic and Hypochromic shifts), UV absorption of Alkenes, Polyenes unsaturated cyclic systems. UV absorption of carbonyl compounds: α, β- unsaturated carbonyl systems, UV absorption of aromatic systems, solvent effects, geometrical isomerism, acid and base effects. Calculation of λ_{max} values using Woodward-Fieser rules with examples.

Unit-II:

Infrared spectroscopy:

Mechanics of measurement-Fundamental modes of vibrations- stretching and bending vibrations-Factors effecting Vibrational frequency- Hydrogen bonding. Finger print region and its importance, typical group frequencies for functional groups like –CH, -OH, - NH, - CC, -CO and aromatic systems. Application in structural determinations.

Unit-III:

^{1}H-NMR Spectroscopy-I:

Introduction: Basic principle of NMR, Nuclear spin, nuclear resonance, saturation, Relaxation, Instrumentation. Shielding and deshielding of magnetic nuclei, chemical shift and its measurements, factors influencing chemical shift, spin-spin interactions, factors influencing–coupling constant J and factors effecting J value.

Unit-IV:

^{1}H-NMR Spectroscopy-II:

Improving the PMR spectrum: Chemical and Magnetic Equvalence. Chemical exchange, First and Non-First Order Spectra and analysis of AB, AMX and ABX systems.

Simplification of complex spectra: Nuclear Magnetic double resonance, Lanthanide shift reagents, Deuterium Exchange, spectra at higher fields, solvent effects,

Fourier transforms technique, Nuclear Overhauser Effect (NOE). Hindered Rotations and Rate processes.

Unit-V:

Mass spectrometry:

Introduction & Instrumentation, Ion production- E1, C1,ES, MALDI and FAB, determination of Molecular weight and formulae, behavior of organic compounds in mass spectrometer- factors affecting fragmentation, Mass spectral fragmentation of organic compounds, Common functional groups, molecular ion peak, meta stable peak, isotopic peak, Mc Lafferty rearrangement, Nitrogen rule. Structural determination of organic compounds using mass spectra.

Textbooks/Referencebooks:

1. Introduction to Spectroscopy – D.L.Pavia, G.M.Lampman, G.S.Kriz, 3rd Ed. (Harcourtcollege publishers).

2. Spectrometric identification of organic compounds R.M.Silverstein, F.X.Webster, 6th Ed.John Wiley and Sons.

3. Spectroscopic methods inorganic chemistry- D.H.Williams and I. Flemming Mc.GrawHill.

4. Absorption spectroscopy of organic molecules –V. M.Parikh.

5. Nuclear Magnetic Resonance–Basic Principles-Atta-Ur-Rehman, Springer-Verlag (1986).

6. One- and Two-dimensional NMR Spectroscopy–Atta-Ur-Rehman, Elsevier (1989).

7. Organic structure Analysis-Phillip Crews, Rodriguez, Jaspars, Oxford University Press(1998).

8. Organic structural Spectroscopy-Joseph B.Lambert, Shurvell, Lightner, Cooks, Prentice-Hall (1998).

9. Organic structures from spectra–Field L.D.,Kalman J.R. and Sternhell S.4th Ed.John Wiley and sons Ltd.

10. Elementary organic spectroscopy Y R Sharma

11. Organic spectroscopy William Kemp.

Model Question Paper

Class: I MSc Analytical Chemistry **Semester: II**

Paper: Organic Spectroscopy **Code: R22ACH201**

Time: 3Hrs **Max. Marks: 70 M**

UNIT-I

1. a) Write Wood-Ward Fieser rules for carbonyl compounds? (8M)
   b) Explain types of electronic transitions. (6M)

OR

2. a) Types of absorption shifts? (8M)
   b) Write a note on auxochromes and chromophores? (6M)

UNIT-II

3. a) Write a note on fundamental modes of vibration? (8M)
   b) Write about solvent effect on IR spectroscopy? (6M)

OR

4. How would you distinguish the following sets of compounds using IR spectra. (14M)

a) primary, secondary and tertiary amines
b) cis and trans cinnamic acid

UNIT-III

5. Define chemical shift and explain factors effecting chemical shift? (14M)

OR

6. Define coupling constant and explain factors effecting coupling constants? (14M)

UNIT-IV

7. a) Write a note on nuclear magnetic double resonance. (8M)
b) Explain the complex PMR spectra of ABX and AMX systems. (6M)

OR

8. a) Write a note on Chemical shift reagents. (8M)
b) Explain Nuclear overhauser Effect (NOE). (6M)

UNIT-V

9. a) Write briefly about the ionization techniques EI and CI in mass spectroscopy? (8M)
b) Explain the mass fragmentation pattern in Aromatic compounds. (6M)

OR

10. a) Explain MC Lafferty rearrangement with an example. (8M)
b) Explain the mass fragmentation pattern in Aldehydes. (6M)

KAKARAPARTI BHAVANARAYANA COLLEGE (Autonomous)
PG Department of Chemistry (Analytical Chemistry)

Class:	Semester:	Title of The Paper:	Paper Code:	W.E.F
I M.Sc	II	PHYSICAL CHEMISTRY-II	R22ACH202	2022-23

Syllabus

Total No of Hours for Teaching - Learning	Instructional Hours for Week		Duration of Semester End Examination in Hours	Max Marks		Credits
60 Hours	Theory	Practical	3 Hours	CIA	SEE	4
	4	0		30	70	

Learning Objective(S):

This course aims to impart to the student, knowledge of:

1. Basic concepts of group theory and its applications.

2. Fundamental aspects of classifying molecules based on various symmetry elements, point groups and constructing character table.
3. Principles and instrumentation of different molecular spectroscopic methods.
4. Qualitatively predict which signals are to be observed in the rotational, vibrational or electronic spectrum of various materials ranging from single atoms (atomic spectroscopy) to molecules (IR, Raman, UV- Vis Spectroscopy).
5. Statistical mechanics are used to develop the statistics for Bose-Einstein, Fermi-Dirac and photon gases.
6. How probability theory can be used to derive relations between the microscopic and macroscopic properties of matter.
7. The kinetics and thermodynamics of electrochemical recations

Course Learning Outcome(S):

On completion of the course, the student should be able to:

1. Recognize symmetry elements, identify point groups of molecules, construct and explain character table for simple molecules.
2. Categorize molecules based on their symmetry properties and predict their molecular properties.
3. Combine, evaluate and interpret information from the various spectroscopic techniques in determination of molecular structures.
4. Account for the physical interpretation of partition functions and be able to calculate thermodynamic properties of model systems with using Boltzmann -, Fermi-Dirac and Bose-Einstein statistics.
5. Account for the physical interpretation of distribution functions and discuss and show how these can be used in calculations of basic thermodynamic properties.
6. Explain fundamental aspects of electrochemical reaction in terms of thermodynamics, And kinetics.

Unit-I:

Third law of Thermodynamics and Statistical thermodynamics:

Nernst Heat theorem - Third law of thermodynamics - Determination of absolute entropy of solids - Thermodynamic probability and most probable distribution, Entropy and probability - Boltzmann- Plank equation. Ensembles, Maxwell-Boltzmann distribution, Fermi-Dirac statistics, Bose Einstein statistics. Partition function - Translational, rotational and electronic partition function - Entropy of Monoatomic gases (Sackur-Tetrode equation).

Unit-II:

Chemical kinetics and Photochemistry:

Branching Chain Reactions - Hydrogen- oxygen reaction - Fast reactions - Study of kinetics by flow methods - Relaxation methods - Flash photolysis. Acid base catalysis –protolytic and prototropic mechanism. Enzyme catalysis - Michelis-Menten kinetics. **Photochemistry:** Quantum yield and its determination, Actinometry, Reactions with low and high quantum yields, Kinetics of collisional quenching - Stern- Volmer equation.

Unit-III:

Symmetry and Group theory in chemistry:

Symmetry elements, symmetry operation, definition of group, sub group, relation between order of a finite group and its sub group. GMT tables. Abelian and non-abelian groups. Point group. Classification of molecules into point groups. Schonfiles symbols, Find out Point group of a molecule (yes or no Method). Representation of groups by Matrices-C_2 and C_{2V} point groups . Character of a representation. The great Orthogonality theorem (without proof) and its importance. Anatomy of Character tables.

Unit -IV:

Microwave Spectroscopy and Rotational Vibrational Spectroscopy:

Classification molecules, rigid rotator model, effect of isotopic substitution on the transition frequencies, Intensities non-rigid rotator-Microwave spectra of polyatomic molecules. **Rotational Vibrational Spectroscopy**: Harmonic oscillator, vibrational energies of diatomic molecules, zero-point energy, anharmonicity Morse potential energy diagram. Vibration – rotation spectroscopy. PQR branches, Born–Openheiner approximation, selection rules, overtones, hot bands.

Unit-V:

Electro Chemistry-II:

Reference electrode - Standard hydrogen electrode. Calomel electrode -Indicator electrodes: Membrane electrodes – Glass electrode, potentiometric titrations, advantages of potentiometric titrations, Decomposition potential - Over potential - Tafel plots - Derivation of Butler- Volmer equation for one electron transfer.

Text books/Reference books:

1. Physical chemistry, G.K.Vemulapalli (Prentice Hall of India).
2. Physical chemistry, P.W.Atkins. ELBS**.**
3. Chemical kinetics-K.J.Laidler, Mc Graw Hill Pub.
4. Text book of Physical Chemistry, Samuel Glasstone, Macmillan pub.
5. Statistical Thermodynamics - M.C.Gupta.
6. Polymer Sceince, Gowriker, Viswanadham, Sreedhar.
7. Quantitative Analysis, A.I.Vogel, Addison Wesley Longmann Inc.
8. Physical Chemistry by G.W.Castellan, Narosa Publishing House, Prentice Hall.
9. Physical Chemistry by W.J.Moore, Prentice Hall.
10. Polymer Chemistry by Billmayer.
11. Fundamentals of Physical Chemistry by KK.Rohatgi - Mukherjee. Wiley Eastern Ltd publications.
12. Statistical Thermodynamics by M.Dole.
13. Introductory Group Theory for Chemists by George Davidson.
14. Group theory for chemistry by A.K.Bhattacharya.
15. Fundamentals of Molecular spectroscopy by C.N.Banwell.
16. Molecular spectroscopy by B.K.Sharma.

17. Vibrational Spectroscopy by D.N.Sathyanarayana New Age Int.Pub.

Model Question Paper

Class: I MSc Analytical Chemistry **Semester: II**
Paper: Physical Chemistry-II **Code: R22ACH202**
Time: 3Hrs **Max. Marks: 70 M**

UNIT-I

1. a) Derive Maxwell Boltzmann distribution? (8M)
b) Explain 3rd law of thermodynamics in determining the absolute entropy of solids. (6M)

OR

2. a) Explain Fermi-dirac statistics. (8M)
b) Derive Sackur Tetrode equation. (6M)

UNIT-II

3. a) Write the kinetics of Hydrogen and oxygen reaction. (8M)
b) Explain Michelis-Menten kinetics? (6M)

OR

4. a) Derive Stern Volmer equation. (8M)
b) Write a note on flash photolysis. (6M)

UNIT-III

5. a) Define group and sub group and write the relation between order of a finite group and its sub group. (8M)
b) Write the group multiplication table for C2V point group. (6M)

OR

6. Explain Great Orthogonality theorem and its importance. (14M)

UNIT-IV

7. a) Describe the rotational spectra of a diatomic molecule as rigid rotor. (8M)
b) Write a note on classification of molecules. (6M)

OR

8. a) Explain the vibrational spectra of harmonic oscillator. (8M)
b) Write a note on overtone and hot bands. (6M)

UNIT-V

9. a) Explain various types of potentiometric titrations. (8M)
b) Write a note on standard hydrogen electrode. (6M)

OR

10. a) Derive Butler Volmer equation for one electron tranfer. (8M)
b) Write note on Tafel plots. . (6M)

KAKARAPARTI BHAVANARAYANA COLLEGE (Autonomous)
PG Department of Chemistry (Analytical Chemistry)

Class:	Semester:	Title of The Paper:	Paper Code:	W.E.F
I M.Sc	II	INORGANIC CHEMISTRY-II	R22ACH203	2022-23

Syllabus

Total No of Hours for Teaching - Learning	Instructional Hours for Week		Duration of Semester End Examination in Hours	Max Marks		Credits
	Theory	Practical		CIA	SEE	
60 Hours	4	0	3 Hours	30	70	4

Learning Objective(S):

1. Advanced theories of bonding in complexes along with their stereochemistry.
2. Mechanisms of inorganic redox reactions involving coordination compounds.
3. Electronic spectroscopy and magnetic properties of coordination compounds.
4. The structure and applications of isopoly and heteropoly anions of vanadium, molybdenum and tungsten and metal carbonyl clusters.

Course Learning Outcome(S):

1. Relate the structure of complexes to their properties.
2. Use electronic spectroscopy as an analytical tool in the structural elucidation of complexes.
3. Interpret the magnetic properties of transition metal complexes based on magnetic measurements.
4. Correctly write the structures of heteropoly, isopoly anions and metal carbonyl clusters and relate the structure to chemical reactivity.

Unit-I: Non-metal cages and metal clusters: Structure and bonding in higher boranes with (special reference to B12 icosahedra). Carboranes, metalloboranes. Isoelectronic and Isolobal relationships, electron counting rules: Wade's and Lauher's rules. M-M multiple bonding; preparation, structure and bonding in dinuclear $[Re_2Cl_8]^{2-}$ ion, trinuclear $[Re_3Cl_9]$, tetra nuclear $W_4(OR)_{16}$, hexa nuclear $[Mo_6Cl_8]^{4+}$ and $[Nb_6Cl_{12}]^{2-}$.

Unit-II: Organometallic chemistry of transition metals: Classification, hapticity, synthesis, structure and bonding of Olefinic complexes, Acetylene complexes, ferrocene, dibenzene chromium of transition metals. Reactions of organometallic compounds - oxidative addition reductive elimination, insertion and elimination. Applications of organometallic compounds, Catalytic hydrogenation, Hydroformylation.

Unit-III: Reaction mechanism of transition metal complexes: Kinetics of octahedral substitution, acid hydrolysis, base hydrolysis-conjugate base (CB) mechanism. Direct and indirect evidences in favour of CB mechanism. Anation reactions. Reactions without metal-ligand bond cleavage. Factors affecting the substitution reactions in octahedral complexes. Mechanism of redox reactions, outer sphere mechanism, cross reactions and Marcus –Hush equation, inner sphere mechanism.

Unit-IV: Term symbols and Electronic spectra: Term symbols: Term symbols and their derivation Microstates, Hunds rules to predict ground terms and ground states. List of ground energy and higher energy terms from d^1 to d^9 configurations; **Electronic spectra of transition metal complexes** Spectroscopic terms. Selection rules, Slator–Condon parameters, Racah parameters, Term separation energies for d^n configurations of Orgel diagrams. Tanabe-Sugano diagrams for d^1 to d^9 configurations. Calculations of Dq, B and β parameters. Charge transfer spectra.

Unit-V: Bio-inorganic chemistry and Magnetic properties of complexes: Storage and transport of dioxygen by Hemoglobin and Myoglobin, Vitamin B_{12} and its importance.
Magnetic properties of transition metal complexes Types of magnetism, factors affecting Para

magnetism, anomalous magnetic moments - Orbital and spin contribution, spin-orbit coupling and magnetic moments.

Text books/ Reference books:

1. Inorganic Chemistry by Huheey. Harper and Row.
2. Concise inorganic chemistry by J. D. Lee, ELBS.
3. Inorganic chemistry, K.F. Purcell and J.C. Kotz, Holt Saunders international
4. Organometallic chemistry by R.C. Mehrotra and A. Singh. New Age International.
5. Advanced Inorganic Chemistry by Cotton and Wilkinson, Wiley Eastern
6. Inorganic reaction mechanism by Basolo and Pearson, Wiley Eastern
7. Bioinorganic Chemistry by K. Hussan Reddy
8. Biological Aspects of inorganic chemistry by A. W.Addiso, W. R. Cullen, D.Dorphin and G. J. James. Weliey Interscience.
9. Photochemistry of coordination compounds by V. Balzaniand V.Carassiti. Academic Press.
10. Text book of Coordination chemistry by K. Soma Sekhara Rao and K.N.K. Vani, Kalyani Publishers.

Model Question Paper

Class: I MSc Analytical Chemistry **Semester: II**
Paper: Inorganic Chemistry-II **Code: R20ACH203**

Time: 3Hrs **Max. Marks: 70 M**

UNIT-I

1. a) Discuss the preparation, structure, bonding and magnetic property of $Re_2Cl_8^{-2}$ion. (8M)
   b) Describe the structure and bonding in higher boranes ? (6M)

OR

2. a) Explain structure and bonding in carboranes. (8M)
   b) What are Wades and Lauher rule ? How are they helpful in counting electrons in metal clusters. (6M)

UNIT-II

3. a) Write a note on catalytic hydrogenation and hydroformylation ? (8M)
   b) Discuss the significance of oxidative addition and reductive elimination in the catalytic applications of organometallic compounds? (6M)

OR

4. a) Discuss the structure and bonding in ferrocene and explain its bonding using M.O. theory? (8M)
   b) Define heptacity and write the classification of organometallic compounds. (6M)

UNIT-III

5. a) Explain acid hydrolysis and base hydrolysis. (8M)
   b) Explain the reactions without metal ligand bond cleavage. (6M)

OR

6. a) Write then mechanism of inner sphere reactions. (6M)
   b) Explain Complimentary and non- complementary reactions. (8M)

UNIT-IV

7. a) Explain Charge transfer spectra (8M)
   b) Explain Slator Condon parameters ? (6M)

OR

8. a) Draw T.S. diagram for d^5 configuration ? (8M)
   b) Write the calculations of Dq, B and beta parameters. (6M)

UNIT-V

9. a) What is paramagnetism and what are the factors affecting paramagnetism. (8M)
   b) Write a note on myoglobin? (6M)

OR

10. a) Write the structure and function of vitamin B_{12}? (8M)
    b) Explain anomalous magnetic moments. (6M)

KAKARAPARTI BHAVANARAYANA COLLEGE (Autonomous)
PG Department of Chemistry (Analytical Chemistry)

Class:	Semester:	Title of The Paper:	Paper Code:	W.E.F
I M.Sc	II	RESEARCH METHODOLOGY& IPR	R22ACH204	2022-23

Syllabus

Total No of Hours for Teaching - Learning	Instructional Hours for Week		Duration of Semester End Examination in Hours	Max Marks		Credits
	Theory	Practical		CIA	SEE	
60 Hours	4	0	3 Hours	30	70	4

Course Objectives:

1. To understand some basic concepts of research and its methodologies.
2. To develop an understanding of the basic framework of research process.
3. To develop an understanding of various research designs and techniques.
4. To identify various sources of information for literature review and data collection.
5. Ability to write a research Proposal, report and thesis.
6. To demonstrate knowledge and understanding of IPR Filing and Rights.

Course Learning Outcomes:

At the end of this course the students should be able to:

1. Understand some basic concepts of research and its methodologies
2. Identify appropriate research topics
3. Select and define appropriate research problem and parameters
4. Demonstrate the ability to choose methods appropriate to research aims and objectives
5. Have adequate knowledge on measurement & scaling techniques.
6. Have basic awareness of data analysis-and hypothesis testing procedures
7. Prepare a project proposal (to undertake a project)
8. Write a research report and thesis
9. File Patents, Trademarks and Copy Rights

UNIT- I:

Foundations of Research & Research Design:

Meaning of Research – Definitions of Research – Motivation in Research – General Characteristics of Research – Criteria of Good Research – Types of Research – Research Process – Research Methods vs. Methodology – Defining and Formulating the Research Problem – Review of Literature – Approaches to Critical Literature Review – Importance of Literature Review in Identifying Research Gaps and Defining a Problem – Development of Working Hypothesis.

UNIT- II:

Research Design, Sampling Concepts, and Data Collection Methods

Meaning, Significance and Characteristics of Good Research Design–Types of

Research Design: Exploratory, Conclusive Research and Experimental – Sampling Theory: Types of Sampling and Errors in Sampling – Data Collection: Types of Data – Data Collection Methods and Techniques for Primary and Secondary Data.

UNIT-III:

Measurement & Scaling Techniques, Hypothesis Formulation and Testing, Overview of Data Analysis and Report Writing

Basic measurement scales –Reliability & Validity – Definition and Types of Hypothesis– Hypothesis Formulation and Testing Procedure – Overview of Data Analysis: Methods, Process and Types–Report Writing: Significance of Report Writing, Different Steps in Writing Report, Layout of the Research Report, Types of Reports, Oral Presentation, Mechanics of Writing a Research Report Precautions for Writing Research Reports – How to Write a Research Proposal– Research Ethics, Conflict of Interest and Plagiarism.

UNIT- IV:

Intellectual Property Rights (IPR)

Definition and Nature and Features of Intellectual Property Rights (IPR) –Types of Intellectual Property Rights – Procedure for Grants of Patents –Rights of a Patent – Scope of a Patent Rights-Licensing and Transfer of Technology–Why protection of intellectual property is important? Enforcement of IPR – Infringement of IPR.

UNIT -V:

Indian and International Scenario and New Developments in IPR

IPR Developments in India for the past Five Years – Development of IPR Laws in India – International Cooperation on IPR – New Developments in IPR – Administration of Patent System –International Patent protection – Case Studies in Indian and Global Contexts.

Text and Reference Books:

1. Garg, B.L., Karadia, R., Agarwal, F. and Agarwal, U.K., 2002, An introduction to Research Methodology, RBSA Publishers.
2. Cohen, L. Lawrence, M., & Morrison, K. (2005), Research Methods in Education (5th edition). Oxford: Oxford University Press.
3. Kothari, C.R., 1990, Research Methodology: Methods and Techniques, New Age International.
4. Dornyei, Z. (2007). Research Methods in Applied Linguistics. Oxford: Oxford University Press.
5. Anthony, M., Graziano, A.M. and Raulin, M.L., 2009, Research Methods: A Process of Inquiry, Allyn and Bacon.
6. Fink, A., 2009, Conducting Research Literature Reviews: From the Internet to Paper. Sage Publications.
7. Day, R.A., 1992, How to Write and Publish a Scientific Paper, Cambridge University Press.
8. Wadehra, B.L. 2000, Law relating to patents, trade marks, copyright designs and geographical indications. Universal Law Publishing.
9. Coley, S.M. and Scheinberg, C. A., 1990, Proposal Writing, Sage Publications.
10. Carlos, C.M., 2000. Intellectual property rights, the WTO and developing countries: the

TRIPS agreement and policy options, Zed Books, New York.
11. Leedy, P.D. and Ormrod, J.E., 2004, Practical Research: Planning and Design, Prentice Hall.
12. Satarkar, S.V., 2000. Intellectual property rights and Copy right. EssEss Publications.

Important Websites:

- ➢www.ipindia.nic.in - Intellectual Property Office, India
- ➢www.patentoffice.nic.in – Patent office, India
- ➢http://copyright.gov.in/ - Copyright Office, India
- ➢ipr.icegate.gov.in – Automated Recordation & Targeting for IPR Protection
- ➢http://www.icegate.gov.in- E- Commerce portal of Central Board of Excise and Customs
- ➢www.ipab.tn.nic.in - Intellectual Property Appellate Board, India
- ➢www.mit.gov.in – Department of Information Technology, India
- ➢http://www.mit.gov.in/content/office-semiconductorintegrated-circuits-layout-designregistry
- ➢Semiconductor Integrated Circuits Layout-Design Registry (SICLDR)
- ➢www.plantauthority.gov.in – Plant Varieties and Farmers' Rights Authority, India

Model Question Paper

Class: I MSc Analytical Chemistry **Semester: II**
Paper: Research Methodology and IPR **Code: R22ACH204**

Time: 3Hrs **Max. Marks: 70 M**

Unit – I

1. Write a note on a) Types of research b)Research method Vs Methodology. 14M

OR

2. Explain the importance of Literature review in identifying research gaps and defining a problem. 14M

Unit – II

3. Explain the meaning, Significance and Characteristics of Good Research. 14M

OR

4. Write a note on types of sampling and Errors in sampling. 14M

Unit – III

5. a) Define and Explain the types of Hypothesis. 7M
   b) Explain formulation and testing of hypothesis. 7M

OR

6. Write a note on i. Ethics in Research ii. Conflict of Interest iii. Plagiarism 14M

Unit – IV

7. Write a note on i. Types of Intellectual Property Rights ii. Procedure for grants of Patents. 14M

OR

8. Explain, why protection of intellectual property is important? 14M

Unit – V

9. Write a note on i. IPR developments in India for the past five years. 7M
   ii. Development of IPR laws in India. 7M

OR

10. Write a note i. International Patent Protection. 7M
    ii. Case studies in Indian and Global contexts. 7M

KAKARAPARTI BHAVANARAYANA COLLEGE (Autonomous)
PG Department of Chemistry (Analytical Chemistry)

Class:	Semester:	Title of The Paper:	Paper Code:	W.E.F
I M.Sc	II	HETEROCYCLIC CHEMISTRY	R22ACH205	2022-23

Syllabus

Total No of Hours for Teaching - Learning	Instructional Hours for Week	Duration of Semester End Examination in	Max Marks	Credits

			Hours			
60 Hours	Theory	Practical	3 Hours	CIA	SEE	4
	4	0		30	70	

Course Objectives:

This course aims to impart to the student, knowledge of:

1. The structure, nomenclature, reactivity, synthesis and reactions of heterocyclic compounds.
2. Heterocyclic structures in biologically active compounds.
3. Synthesis and design of biologically active compounds derived from heterocyclic compounds.

Course Learning Outcomes:

On completion of the course, the student should be able to:

1. Classify heterocyclic compounds based on the characteristics of the heteroatom and explain their reactivity and properties.
2. Correlate how the structure of bio-molecules determines their chemical properties and reactivity.
3. Design new methods for synthesis of bio-molecules using principles and reagents learned.

UNIT-I: Definition, Classification, and Nomenclature (Hantzsch Widman System) of heterocycles. **Three membered Heterocyclic Compounds:** Synthesis, reactivity, and importance of the following ring systems: Aziridines, Oxiranes and Thiiranes.

UNIT-II: Four membered Heterocyclic Compounds: Synthesis, reactivity, and importance of the following ring systems: Azitidines, oxetanes, Thietanes.

UNIT-III:

Five membered Heterocyclic Compounds with two hetero atoms:

Synthesis, reactivity and importance of the following heterocycles: Pyrazole, Imidazole, Oxazole, Isoxazole, Thiazole, isothiazole.

UNIT-IV:

Six-membered Heterocyclic Compounds with two hetero atoms:

Synthesis, reactivity and importance of the following heterocycles: Pyridazines, pyrimidine, Pyrazine, Oxazine, Thiazine.

UNIT-V:

Fused heterocycles :

Synthesis and reactivity of Indole, quinolione, isoqinoline, benimidazole, quinoxalines, isoxazoles.

Reference books:

1. Some Modern Methods of Organic Synthesis W.Caruthers, Cambridge University Press, Cambridge.
2. Organic Synthesis viz Boranes, Herbet C.Brown Gray, W.Kramer Alan B.Levy and M.Mark

Midlan d John Willy & Sons, NewYork.

3. Hetero chemistry, T.L.Gilchrist, Longman science and tech.

4. An introduction to the Chemistry of Heterocyclic Compounds, R.M.Acheson, Inter science Publishers, NewYork

5. Principle of Organic Chemistry, Roc Norman, J.M.Coxon, Nelson Throms

6. Advanced Organic Chemistry, F.A Carey and R.J.Sundberg. Plenum.

7. Hetero cyclic chemistry by Jai Jack Lie, Springer publications.

Model Question Paper

Class: I MSc Analytical Chemistry **Semester: II**
Paper: Heterocyclic Chemistry **Code: R22ACH205**

Time: 3Hrs **Max. Marks: 70 M**

Answer all the questions

Unit – I

1. Write the reactivity, Synthesis and importance of Aziridine. 14 M

OR

2. Write the reactivity, Synthesis and importance of Oxirane. 14 M

Unit – II

3. Write the reactivity, Synthesis and importance of Oxetane. 14 M

OR

4. Write the reactivity, Synthesis and importance of Thietane. 14 M

Unit – III

5. Write the reactivity, Synthesis and importance of Pyrazole. 14 M

OR

6. Write the reactivity, Synthesis and importance of Oxazole. 14 M

Unit – IV

7. Write the reactivity, Synthesis and importance of Pyrimidine. 14 M

OR

8. Write the reactivity, Synthesis and importance of Oxazine. 14 M

Unit – V

9. Write the reactivity, Synthesis and importance of Indole. 14 M

OR

10. Write the reactivity, Synthesis and importance of Isoquinoline. 14 M

KAKARAPARTI BHAVANARAYANA COLLEGE (Autonomous)
PG Department of Chemistry (Analytical Chemistry)

Class:	Semester:	Title of The Paper:	Paper Code:	W.E.F
I M.Sc	II	CHEMISTRY OF BIO-ORGANIC COMPOUNDS	R22ACH206	2022-23

Syllabus

Total No of Hours for Teaching - Learning	Instructional Hours for Week		Duration of Semester End Examination in Hours	Max Marks		Credits
60 Hours	Theory	Practical	3 Hours	CIA	SEE	4

	4	**0**		**30**	**70**	

Course Objectives:

This course aims to impart to the student, knowledge of:

1. Synthesis and design of biologically active compounds derived from heterocyclic compounds.
2. Biologically important molecules and their monomers.
3. Various aspects of the principles of organic chemistry in the structure, classification, nature of bonding and functions of bio-molecules.
4. Structural elucidation of bio-molecules and steps involved in their chemical synthesis and reactions.

Course Learning Outcomes:

On completion of the course, the student should be able to:

1. Correlate how the structure of bio-molecules determines their chemical properties and reactivity.
2. Design new methods for synthesis of bio-molecules using principles and reagents learned.

UNIT-I:

Carbohydrates:

Introduction, Classification, Occurrence of Hexoses and Ketoses, Nomenclature, Mutarotation, anomeric effects and Stereochemistry and ring structures of Carbohydrates. Chemistry of Glucose, Fructose, and Sucrose.

UNIT-II:

Amino Acids and Proteins: Classification of Amino acid and their general properties.

General methods of synthesis of alpha-amino acids. Isoelectric point, Determination of C- Terminal and N-terminal Amino acid. Definition and Classification of Peptides and Proteins.

UNIT-III:

Vitamins:

Classification, Occurrence, Structural elucidation, synthesis and biogenesis of Vitamin-A_1, B_1, C, D and B_{12} and its importance.

UNIT-IV:

Nucleic acids:

Basic concepts of the Structure of RNA, DNA, and their hydrolysis products. Base pairs and whatson and crick model, Nucleotides, Nucleosides, reactions of nucleic acid bases, mutations, and Hetero cyclic bases.

UNIT-V:

Bio polymers:

Introduction, Classification of bio-polymers, properties of biopolymers, Difference between bio polymers and synthetic polymers, production and processing of biopolymers. Applications of bio-polymers.

ReferenceBooks:

1. Natural products: Chemistry and Biological significance, J.Mann, R.S.Davidson, J.B.Hobbs, D.V.Banthropde and J.B.Harborne.
2. Organic Chemistry, vol-2, I.L.Finar.
3. Stereoselective synthesis: a practical Approach, M.Nogrudi.
4. Rodd's Chemistry of carbon compounds, Ed.S.Coffey.
5. Chemistry, Biological and Pharmacological Properties of Medicinal Plants from the Americans By Ed.Kurt. Hostettmann, M.P.Gupta and A.Marston.
6. Introduction to Flavonoids by B.A.Bohm.
7. Necotrends in natural products Chemistry by Ata-ur-Rahman and M.I.Choudhary.
8. Chemistry of natural products byS.V.Bhat, B.A.Naga Sampagi and M.Siva Kumar.
9. Biopoymers: Biomedical and Environmental applications by Susheelkalia Scrivener, Willey publication.

Model Question Paper

Class: I MSc Analytical Chemistry **Semester: II**
Paper: Chemistry of Bio-Organic Compounds **Code: R22ACH206**

Time: 3Hrs **Max. Marks: 70 M**

Answer all the questions

Unit – I

1. i. Classification of carbohydrates ii) Mutarotation, iii) Anomeric effects 14 M

OR

2. Stereo chemistry and ring structure of Glucose 14 M

Unit – II

3. Explain the general methods of synthesis of alpha-amino acids. 14 M

OR

4. What are peptides and write the Classification of Peptides 14 M

Unit – III

5. a) Write a note on classification of Vitamins. 4 M
   b) Explain the structural elucidation and synthesis of vitamin C 10 M

OR

6. Write the structural elucidation and of Vitamin B12 14 M

Unit – IV

7. Write the basic concepts of the Structure of RNA and DNA 14 M

OR

8. What are nucleic acid bases and write the reactions of nucleic acid bases 14 M

Unit – V

9. What are simple lipids (fats) and explain the hydrolysis, addition and autooxidation reactions of fats. 14 M

OR

10. Explain the structure and functioning of cholesterol. 14 M

KARAPARTI BHAVANARAYANA COLLEGE (Autonomous)
PG Department of Chemistry (Analytical Chemistry)

Class:	Semester:	Title of The Paper:	Paper Code:	W.E.F
I M.Sc	II	POLYER CHEMISTRY	R22ACH207	2022-23

Syllabus

Total No of Hours for Teaching - Learning	Instructional Hours for Week		Duration of Semester End Examination in Hours	Max Marks		Credits
	Theory	Practical		CIA	SEE	
60 Hours	4	0	3 Hours	30	70	4

Course Objectives:

This course aims to impart to the student, knowledge of:

1. The basic concept of macromolecules,
2. polymerization processes and polymer stereochemistry
3. Theory of polymer soultions and speciality polymers

Course Learning Outcomes:

On completion of the course, the student should be able to :

1. Classification of polymers and its nomenclature.
2. Polymerization methods and Polymerization kinetics
3. Uses of polymers for commercial purposes

UNIT – I:

Polymers introduction:

Introduction, Classification of Polymerization reactions - condensation polymerization, addition polymerization, step polymerization, chain polymerization, Free radical polymerization, cationic polymerization, anionic polymerization, Polymerization Techniques, Graft and Block Copolymers.

UNIT–II:

Polymer Synthesis:

Polymer Synthesis, Isolation and Purification of polymers, Determination of Molecular weight of polymers- Light Scattering Method, Osmometry and viscometry, Processing Techniques.

UNIT–III:

Polymer reactivity:

Polymer Reactions– Introduction, Hydrolysis, Acidolysis, Aminolysis, Hydrogenation, Addition and Substitution Reactions, Cyclisation reactions, Cross-linking Reactions.

UNIT – IV:

Degradation of polymers:

Polymer Degradation – Definition, Types of Degradation, Thermal Degradation, Mechanical Degradation, Degradation by Ultrasonic Waves, Photo degradation, Degradation by High-Energy Radiation, Oxidative Degradation, Hydrolytic Degradation.

UNIT–V:

Preparation and Properties of polymers:

Polyethylene, Polystyrene, PolyEsters, PolyAcrylonitrile, Polyurethanes and Polyvinyl Chloride. Resins–Phenol Formaldehyde Resin, Silicon Polymers and poly urethanes.

Reference books:

1. Text book of Polymer Science by Frod,W.Billmayer,
2. An Introduction to Polymer Chemistry by Moore.
3. Polymer Chemistry-An Introduction by M.P.Stevens.

4. Polymer Science –VR Gowariker, NV Viswanathan, Jayadev Sreedhar.

Model Question Paper

Class: I MSc Analytical Chemistry **Semester: II**
Paper: Polymer Chemistry **Code: R22ACH207**

Time: 3Hrs **Max. Marks: 70 M**

Answer all the questions

Unit – I

1. Write a note on Chain polymerization and condensation polymerisation. 14 M

OR

2. Describe various polymerization techniques. 14 M

Unit – II

3. Write a note on Isolation and purification of polymers. 14 M

OR

4. Describe light scattering method and osmometry for the determination of molecular weight of polymers. 14 M

Unit – III

5. Explain the addition and substitution reactions of polymers. 14 M

OR

6. Explain the cyclisation reactions and cross-linkage reactions of polymers. 14 M

Unit – IV

7. Write a note on Thermal and mechanical degradation of polymers. 14 M

OR

8. Write a note on Oxidative and hydrolytic degradation of polymers. 14 M

Unit – V

9. Write the preparation and properties of Polyethylene, and Polystyrene 14 M

OR

10. Describe the preparation and properties of Phenol formaldehyde resin and Poly urethane. 14 M

M.Sc Analytical Chemistry
II SEMESTER
TITLE: Organic Chemistry LAB-2
PAPER CODE: R22ACH 208

Total marks:100 **(Internal:30M & External:70M)**

Course Objectives:

1. To develop an insight into the identification of organic compounds by systematic analysis.
2. To understand the process of identification of organic compounds by systematic analysis.
3. To acquire skills in the identification of organic compounds by systematic analysis.

Learning Outcomes:

1. At the end of the course, the learners should be able to: Identify an organic compound by systematic analysis
2. Develop skill in identification of organic compounds by systematic analysis
3. Apply the skill in the identification of new organic compounds by systematic analysis

COURSE CONTENT:

1. Preparation of organic compounds: Two stage preparations by reactions involving nitration, halogenation, oxidation, reduction, alkylation, acylation, condensation and rearrange ment. (A student is expected to prepare at least 5 different organic compounds by making use of the reactions given above).

2. Identification of the unknown organic compounds

Systematic identification of organic compounds – preliminary tests, detection of extra elements, solubility, common functional group tests (determination of functional group/s in a single compound, if present), preparation of two rational derivatives

The given organic compound must be identified by comparing the melting point /Boiling point of the compound and melting points of its derivatives with the literature

List of suggested compounds

Glucose, fructose, benzaldehyde, p-anisaldehyde, p-chloro benzaldehyde, acetophenone, phenol, cresols, naphthols, esters, p-chloro benzoic acid, aniline, p-tolune, p-anisidine, p-chloroaniline, diphenyl amine, N,N-dimethylaniline, benzamide, naphthalene and anthracene.

TEXT BOOKS

1. A Textbook of Practical Organic Chemistry by A. I. Vogel, ELBS and Longman group.
2. Practical Organic Chemistry by Mann and Saunders, ELBS and Longman group.
3. A.I.Vogel,"Elementary Practical Organic Chemistry", Longman
4. Reaction and Synthesis In Organic Laboratory, B.S.Furniss, A.J.Hannaford, Tatchell, University Science BOoks Mills valley.
5. Purification of Laboratory chemicals, manual, W.L.F.Armarego EDD Perrin.
6. Reaction and Synthesis in Organic Chemistry Laboratory, Lutz-Friedjan- Tietze, Theophil Eicher, University Science Book.

M.Sc., CHEMISTRY (ANALYTICAL CHEMISTRY)

II SEMESTER

PaperCode & Title:R22ACH209 : PHYSICAL CHEMISTRY LAB

Total marks: 100 (Internal: 30M & External:70M)

Course Objectives:

- To teach laboratory ethics, safety and cleanliness,
- Preparation and standardization of solutions, develop hands-on experience/practical knowledge in performing Physical chemistry experiments,
- develop skills on handling instruments like conductometry and perform different types of acid- base titrations,
- train plot accurate graphs of the desired scale for the calculations of Langmuir and Freundlich isotherms,
- train to Prepare the solution of the desired concentration and the desired volume in Cuprammonium cation.
- Over all Objective Of This paper is to give a practical knowledge for the students on Physical chemistry experiments.

Course Outcomes:

- At the end of the course, the learners should be able to: develop/practical skills to solve problems in chemistry,
- extend the principle of Conductometric titration to other kind of reactions,
- learn to use the concept of phase diagram for different systems,
- apply adsorption isotherms for other reactions.
-

1. Conductometry
   a) Conductometric titration of strong acid (HCl) vs strong base (NaOH)
   b) Conductometric titration of weak acid (CH_3COOH) vs strong base (NaOH)
   c) Conductometric titration of mixture of acids (HCl + CH_3COOH) vs strong base (NaOH)
2. Determination of Critical solution temperature of phenol-Water system
3. Potentiometric titration of Iron (II) using potassium dichromate
4. Determination of kinetics of Ester hydrolysis
5. Determination of Equilibrium constant of Potassium Iodide-Iodine system
6. Determination of effect of electrolyte (NaCl) on the miscibility temperature of Phenol- Water system
7. pH-metric determination of strong acid with strong base. Relative strengths of acids by studying the hydrolysis of ethyl acetate /methyl acetate.
8. Determination of equilibrium constant of $KI_3 \rightleftharpoons KI + I_2$ by partition coefficient.
9. Determination of unknown concentration of potassium iodide by partition coefficient method.
10. Distribution coefficient of Benzoic acid between Benzene and water.
11. Verification of Beers Law using potassium permanganate/Potassium dichromate

Text books/Reference books:

1. Experimental Physical chemistry by V.D.Athawale, Parul Mathur, New Age International publishers.
2. Physical chemistry experiments by V.P.Kudesia, Pragati Prakasan publishers.
   Advanced practical Physical chemistry by J.B.Yadav, Krishna's educational publishers

KAKARAPARTI BHAVANARAYANA COLLEGE (Autonomous)

PG Department of Chemistry (Analytical Chemistry)

Class	Semester	Title of The Paper	Paper Code	W.E.F
II M.Sc	III	SEPARATION METHODS	R20 ACH 301	2020-21

Syllabus

Total No of Hours for Teaching - Learning	Instructional Hours per Week		Duration of Semester End Examination in Hours	Max Marks		Credits
60 Hours	Theory	Practical	3 Hours	CIA	SEE	4
	4	0		30	70	

Course Learning Objective(S): The main objective of this paper is to give a basic and updated knowledge for the students on various types of Chromatography, sampling of solids ,liquids and gases and solvent extraction.

Course Learning Outcome(S): After studying this paper, students will acquire the knowledge of on various chromatographic methods, sampling of sampling of solids, liquids and gases and solvent extraction.

UNIT-I

Unit-1:

Importance of Analytical Chemistry to Industrial Research:

Importance of Qualitative and Quantitative analysis in research and development, industries and other branches of science. Development and validation of an analytical method, units, concentrations, calculations, standards, chemical reactions, expressions of concentrations, importance of separation methods with examples.

Chromatography: retardation factor, retention time and volume, column capacity, temperature effects. Efficiency of chromatographic column, zone spreading, High Equivalent Theoretical Plate (HETP), Van Demeter equation, resolution, choice of column, length and flow velocity, qualitative and quantitative analysis.

UNIT-II

Ion Exchange and Ion Chromatography

Ion Exchange chromatography: Principle, synthetic ion-exchange resins, properties of anion and cation exchange resins, ion-exchange mechanism, ion-exchange equilibria, selectivtity, ion exchange capacity, applications.

Ion chromatography: Principle, instrumentation, detectors, applications in the analysis of water and air pollutants.

UNIT-III

Gel Exclusion, Capillary electrophoresis, Ion exclusion and Affinity chromatography

Gel Exclusion chromatography: Principles, properties of xerogels, detectors, resolution of gel type, applications to organic compounds.

Capillary Electrophoresis: Principle, Instrumentation, applications.

Inorganic molecular sieves: Principle**,** structure of zeolites, crystals, applications.

Ion exclusion: principles and applications,

Affinity chromatography: principles and applications.

UNIT –IV

Sampling of Solids, Liquids and Gases

Basis of sampling, Sampling procedure, homogeneous and heterogeneous samples, sampling statistics, sample size, sampling unit. Sampling of solids: Cone and Quartering method, Long pile and alternative shovel method, precautions in preservation of solid samples.

Sampling of different types of liquids: different sampling techniques, sampling of drinking water, industrial effluents, precautions in preservation of collected liquid samples. Sampling of gases: Different types of gas samplers, precautions in preservation of gas samples.

UNIT-V

Solvent Extraction:

Principles and processes of solvent extraction, Distribution Law and Partition coefficient, nature of partition forces, different types of solvent extraction systems – Batch extraction, Continuous extraction, Counter current extraction, solvent extraction systems, applications in metallurgy, general applications in analysis and pre-concentration, special extraction systems like crown ethers, super fluid and surfactant extractions-examples.

Reference books:

1. Techniques and practice of Chromatography, R.P.W Scott, Marci Dekker Inc., New York.
2. Separation methods, M.N Sastri, Himalaya Publishing Company, Mumbai

3. Chromatography, E. Helftnan, Van Nostrand, Reinhold, New York.
4. Chromatography, E. Lederer and M. Lederer, Elsevier, Amsterdam.
5. Chemical separation methods, John A Dean, Von Nostrand Reinhold, New York.
6. Ion chromatography, James, G. Tartor.

KAKARAPARTI BHAVANARAYANA COLLEGE (Autonomous)

PG Department of Chemistry (Analytical Chemistry)

Class	Semester	Title of The Paper	Paper Code	W.E.F
II M.Sc	III	SPECTROSCOPIC METHODS	R20 ACH 302	2020-21

Syllabus

Total No of Hours for Teaching - Learning	Instructional Hours per Week		Duration of Semester End Examination in Hours	Max Marks		Credits
60 Hours	Theory	Practical	3 Hours	CIA	SEE	4
	4	0		30	70	

No. of hours per week: 04 **Total credits: 04**

Total marks: 100 (Internal: 30 M & External: 70M)

Course Learning Objective(S): The main objective of this paper is to give a basic and updated knowledge for the students on mass spectrometry, GC-MS and LC-MS, advanced magnetic Resonance spectroscopy, ^{13}C-NMR and combined spectral problems.

Course Learning Objective(S):

The main objective of this paper is to give a basic and updated knowledge for the students on ^{13}C NMR Spectroscopy, Structural Elucidation of Organic compounds Using UV, IR, 1H-NMR,13C-NMR, 2D NMR spectroscopy, Electron Spin Resonance Spectroscopy and Optical Rotatory Dispersion (ORD) and CD spectroscopy.

Course Learning Outcome(S):

After studying this paper, students will acquire the knowledge of 13C NMR Spectroscopy, Structural Elucidation of Organic compounds Using UV, IR, 1H-NMR,13C-NMR, 2D NMR

spectroscopy, Electron Spin Resonance Spectroscopy and Optical Rotatory Dispersion (ORD) and CD spectroscopy.

Unit-I

^{13}C NMR Spectroscopy: Similarities and Differences between PMR and CMR, general considerations, chemical shift (aliphatic, olefinic, alkyne, aromatic, hetero aromatic and carbonyl carbon), coupling constants, typical examples of CMR spectroscopy-simple systems.

Unit-II

Structural Elucidation of Organic compounds: Structural Elucidation of Organic compounds Using UV, IR, ^{1}H-NMR,^{13}C-NMR and mass spectrometry.

Unit-III

2D NMR Spectroscopy: Definitions and importance of COSY, DEPT, HOMCOR, HETCOR, INADEQUATE, INDOR, INEPT, NOESY, HOM2DJ, HET2DJ, DQFCOSY – COSY of menthol DEPT of ethanol – the study of simple organic compounds.

Unit-IV

Optical Rotatory Dispersion (ORD) and CD spectroscopy: Phenomena of Optical Rotation, Circular birefringence, Circular dichroism and Cotton effect. Plane curves and Anomalous curves. Empirical and semi empirical rules – The axial halo ketone rule, the Octant rule and Helicity rule. Application of the rules to the study of absolute configuration and confirmations of organic molecules.

Unit-V

Electron Spin Resonance Spectroscopy: Introduction, Basic Principle and Instrumentation; Relaxation process and line widths; definition and examples of Zero field splitting, Fine splitting, Hyper fine splitting, Super Hyper fine splitting and Kramer‟s degeneracy; Factors affecting the “g‟ value. Isotropic and anisotropic hyperfine coupling constants, Hamiltonian and spin densities.

Text books/ Reference books:

1. Introduction to Spectroscopy – D. L. Pavia, G.M. Lampman, G. S. Kriz, 3rd Ed. (Harcourt college publishers).

2. Spectrometric identification of organic compounds R. M. Silverstein, F. X. Webster, 6thEd. John Wiley and Sons.

3. Spectroscopic methods in organic chemistry - D. H. Williams and I. Flemming McGraw Hill.

4. Absorption spectroscopy of organic molecules – V. M. Parikh

5. Nuclear Magnetic Resonance – Basic Principles- Atta-Ur-Rehman, Springer- Verlag (1986).

6. One- and Two-dimensional NMR Spectroscopy – Atta-Ur-Rehman, Elsevier (1989).

7. Organic structure Analysis- Phillip Crews, Rodriguez, Jaspars, Oxford University Press (1998).

8. Organic structural Spectroscopy- Joseph B.Lambert, Shurvell, Lightner, Cooks, Prentice Hall (1998).

9. Organic structures from spectra –Field L.D., Kalman J.R. and Sternhell S. 4th Ed.John Wiley and sons Ltd.

Question Paper

Class: II M.Sc Analytical Chemistry **Semester: III**

Paper: SPECTROSCOPIC METHODS **Code: R20 ACH 301**

Time: 3Hrs **Max. Marks: 70 M**

UNIT-I

1. a) Write a note on off resonance decoupling? (8M)

b) Write the the differences and similarities of 13C and proton NMR. (6M)

(OR)

2. Write the factors effecting ^{13}C NMR? (14M)

UNIT-II

3. Molecular formula: C6H10O2

H NMR : δ (PPM) = 6.97 (dq, J = 6.8 and 15.2 Hz, 1H), 5.83 (d, J = 15.2 Hz, 1H), 4.17 (q, J = 7.2 Hz, 2H), 1.87 (d, J = 6.8 Hz, 3H), 1.27 (t, J = 7.2 Hz, 3H). 13C NMR δ (ppm) = 170.0 144.6 123.0 60.3 18.1 14.5

Discuss the component structure of the given molecule by utilizing the above NMR data.

(OR)

4. In the MS, the molecular ion occurs at m/z = 150, The IR shows 1680 cm-1 and 1250-1000 cm-1 . 13 C-NMR shows 196 ppm, 163 ppm, 131 ppm, 130 ppm, 114 ppm 55 ppm and 26 ppm. H-NMR

δ/ppm	multiplicity	integration

8.0	doublet	2
7.0	doublet	2
3.9	singlet	3
2.6	singlet	3

UNIT-III

5. Give importance of HOMCOR, HET2DJ. (14M)

(OR)

6. Explain definitions and importance of COSY, INDOR, HETCOR. (14M)

UNIT-IV

7. a) Explain applications of Octant rule. (8M)

b) Explain theory of ORD in detail and ORD curves. (6M)

(OR)

8. a) Explain octant, haloketo rule. (8M)

b) Explain positive and negative cotton effects. (6M)

UNIT-V

9. a) Write Zero – Field splitting in ESR, kramer's Degeneracy? (8M)

b) Explain Hyper fine splitting and factors effecting g value? (6M)

(OR)

10. a) Explain isotropic and anisotropic coupling constants? (8M)

b) Write the applications of ESR to organic radical? (6M)

Class	Semester	Title of The Paper	Paper Code	W.E.F
II M.Sc	III	APPLIED ANALYSIS	R20 ACH 303	2020-21

Syllabus

Total No of Hours for Teaching - Learning	Instructional Hours per Week		Duration of Semester End Examination in Hours	Max Marks		Credits
	Theory	Practical		CIA	SEE	
60 Hours	4	0	3 Hours	30	70	4

Course Learning Objective(S): The main objective of this paper is to give a basic and updated knowledge on analysis of ores like Managenese and Aluminium analysis of raw materials, analysis of soil, fertilizers, fuels and finished products.

Course Learning Outcome(S): After studying this paper, students will acquire the knowledge analysis of ores like Managenese and Aluminium, analysis of raw materials, analysis of soil, fertilizers, fuels and finished products.

UNIT-I

Analysis of Ores

Analysis of ores: Iron ore-Analysis of the constituents - Moisture,loss on ignition, total Iron, ferrous Iron, Ferric Iron, alumina, silica, Titania, Lime, Magnesia, Sulphur, phosphrous, manganese, alkalies, combined water.

Manganese Ore: Analysis of the constituents - total manganese, MnO_2, SiO_2, BaO, Fe_2O_3, Al_2O_3, CaO, P and S. Chromite ore- Analysis of the constituents - Chromiurn, SiO_2, FeO, Al_2O_3CaO, & MgO.

Aluminiumore (Bauxite): Analysis of the constituents - Silica, Alumina, Fe_2O_3,Titania, MnO, P_2O_5, CaO, MgO, vanadium, zirconium, and alkalies.

UNIT-II

Analysis of raw materials

Analysis of non-ferrous alloys:

1.Brass - Analysis of the constituents-Cu, Zn, Sn, Pb and Fe.

2.Bronze - Analysis of the constituents - Cu, Sn, Zn, Pb and Fe.

3.Solder - Analysis of the constituents - Sn, Pb and Sb.

Analysis of ferro alloys:

i) Ferro vanadium - Analysis of the constituents - V, C, P, S. Si, Al.

ii) Ferro manganese - Analysis of the constituents - Mn, S, C. P. Si

iii) Ferro chromium - Analysis of the constituents - Cr, C, Si.

UNIT-III

Analysis of Soil, Fertilizer and Fuels

Analysis of soils: sampling, determination of moisture, total N, P, Si, lime, humusnitrogen, alkali salts.

Analysis of fertilizers: ammonical fertilizers, Phosphate fertilizers, Nitrate fertilizers.

Analysis of fuels: solid fuels-coal, proximate analysis, ultimate analysis.

UNIT-IV

Analysis of finished products

Chemical Analysis of cement: silica, NH_4OH group, ferric oxide, alumina, lime, magnesia, Sulphide , Sulphur , K_2O,Na_2O, free CaO in Cement and Clinker,SO_3 and loss on ignition.

Analysis of oils: Saponification number, iodine number, and acid number.

Analysis of soaps: Moisture, volatile matter, total alkali, total fatty matter, free caustic alkali or free fatty acids, sodium silicate , chloride.

UNIT-V

Analysis of paints and Non aqueous titrimetry

Analysis of paints-vehicle and pigment, $BaSO_4$, total lead and lead chromate.

Non aqueous titrimetry: Classification of solvents and titrations for non aqueous titrimetry- Types of reactions - Indicators.(i) Determination of acids (ii) Determination of bases (iii) Karl-Fisher reagent for the determination of moisture content in drugs and other samples.

Reference books:

1. Vogel's Text book of Quantitative Inorganic analysis - J. Basset, R.C Denney, G.H. Jefferey and J. Madhan.
2. Quantitative analysis R.A Day and A.L. Underwood. Prentice Hall Pvt. Ltd.
3. Chemical analysis - H.A Laitinan, Mc Graw Hill Book Co.
4. Standard methods of Chemical Analysis, Welcher.
5. Technical Methods of Analysis, Griffin, Mc Graw Hill.
6. Commercial Methods of Analysis, Foster Dee Sneel and Frank M. Griffin, Book Co.

KAKARAPARTI BHAVANARAYANA COLLEGE (Autonomous)

PG Department of Chemistry (Analytical Chemistry)

Class	Semester	Title of The Paper	Paper Code	W.E.F
II M.Sc	III	INSTRUMENTAL METHODS OF ANALYSIS	R20 ACH 304	2020-21

Syllabus

Total No of Hours for Teaching - Learning	Instructional Hours per Week		Duration of Semester End Examination in Hours	Max Marks		Credits
60 Hours	Theory	Practical	3 Hours	CIA	SEE	4
	4	0		30	70	

Course Learning Objective(S):

The main objective of this paper is to give a basic and updated knowledge for the students on spectro-analytical methods of analysis like flame photometry, AAS,ICP-AES, ICP-MS, thermogravimetry and electroanalytical methods like plorography, anode striping voltametry, electrogravimetry, coulometry, amperometry, biamperometry and cyclic voltametry methods.

Course Learning Outcome(S): After studying this paper, students will acquire the knowledge on spectro-analytical methods of analysis like flame photometry, AAS,ICP-AES, ICP-MS, thermogravimetry and electroanalytical methods like plorography, anode striping voltametry, electrogravimetry, coulometry, amperometry, biamperometry and cyclic voltametry methods.

UNIT-I

Spectro-analytical methods of analysis

Flame photometry: Theory, instrumentation, combustion flames, detectors, and analysis of Na, K, Ca, Mg.

Atomic Absorption Spectrometer: theory, instrumentation, flame and non-flame techniques, resonance line sources, hollow cathode lamp, chemical and spectral interferences, applications with special reference to analysis of trace metals in oils, alloys and toxic metals in drinking water and effluents.

Inductively coupled plasma spectrometer(ICP-AES, ICP-MS): principles, instrumentation, plasma, AES detectors, quadrupole mass spectrometers, difference between the two detectors, applications.

UNIT-II

Thermal methods of Analysis

Thermo gravimetry: Theory, instrumentation, applications with special reference to$CuSO_4.5H_2O$, $CaC_2O_4.2H_2O$, $CaCO_3$, $(COOH)_2.2H_2O$

Differential thermal analysis: Principle, instrumentation, difference between TG and DTA - applications with special reference to the clays and minerals, coals (fuels).

Differential scanning calorimetry: Principle, instrumentation, applications to inorganic materials like chlorates and per chlorates, ammonium nitrate, organic compounds and drugs.

UNIT-III

Electro analytical Methods-1

Polarographic analysis: Principle and Instrumentation, Dropping mercury electrode (DME), advantages and disadvantages of DME, qualitative and quantitative analysis of inorganic ions-Cu, Bi, Pb, Cd, Zn, AC polarography, pulse polarography.

Anode stripping voltametry: Principle, instrumentation, Hanging mercury drop electrode, application in the analysis of Pb and Cd in environmental samples, principle of cathode stripping voltametry.

UNIT-IV

Electro analytical methods -2

Electro gravimetric analysis: Principle, important terms in electrogravimetry, decomposition voltage or decomposition potential, over voltage and their importance, instrumentation, electrolysis at constant current, determination of Cu^{2+} by constant current electrolysis, electrolysis at controlled potentials, determination of Cu, Pb, Sn in brass and bronze by controlled potential electrolysis.

Coulometric analysis: Principles of coulometric analysis with constant current and controlled potential, coulometric analysis with controlled potential, applications of coulometric methods for the analysis of cations - As (III), Fe(II) and I^- and S^{2-} by using I_2 liberations and Ce^{4+} liberation in solutions.

UNIT-V

Electro analytical methods -3

Amperometry: Introduction, principle, conditions for performing amperometric titrations, advantages, titrations with rotating platinum electrode, applications.

Biamperometry: Principle, biamperometric titrations and its curves, applications.

Cyclic voltametry: Basic principles, applications.

Reference books:

1. Instrumental methods of analysis - H.H Willard, Meritt Jr. and J.A Dean.
2. Principles of instrumental analysis - Skoog and West.
3. Vogel's Textbook of Quantitative Inorganic analysis - J. Basset, R.C. Denney, G.H. Jefferey and J.Madhan.
4. Instrumental methods of analysis - B.K Sarma, Goel Publishing House, Meerut.
5. Instrumental methods of Analysis - Chatwal and Anand.
6. Instrumental methods of Analysis - Ewing W. Wendtland.

7. Thermal Analysis, John Wiley Sons, New York.

M.Sc., CHEMISTRY (ANALYTICAL CHEMISTRY)

III SEMESTER

PAPER CODE & TITLE: R20 ACH 305:

CLASSICAL METHODS OF ANALYSIS PRACTICAL

No. of hours per week: 06 **Total credits: 03**

Total marks: 100 (Internal: 30 M & External: 70M)

Course Learning Objective(S): The main objective of this paper is to give a basic and updated knowledge for the students on classical methods of analysis practical.

Course Learning Outcome(S): After studying this paper, students will acquire the knowledge of on classical methods of analysis practical.

1. Analysis of water for total hardness ($Ca^{+2}$and Mg^{+2}).
2. Analysis of Water for Alkalinity (carbonates and bicarbonates).
3. Analysis of dissolved oxygen(DO) in drinking water and sewage water.
4. Analysis of chemical oxygen demand (COD) in drinking water and sewage water.
5. Analysis of iron ore (with special reference to percentages of Fe(II) and Fe(III) present in the sample).
6. Determination of Iron by photochemical reduction.
7. Analysis of Pyrulosite.
8. Analysis of fertilizer for ammonia, nitrate and phosphate.
9. Analysis of Zn in zinc ore by using EDTA.
10. Analysis of nickel by EDTA.
11. Analysis of lime stone.
12. Determination of lead and tin in a mixture by using EDTA.
13. Analysis of oil for the determination of saponification value, acid value and iodine value.
14. Analysis of synthetic mixture of iron and zinc.
15. Analysis of solder.

Reference books:

1. Vogels Text Book of Quantitative analysis, revised. J. Bassett, R.C. Denny, G.H. Jeffery and J. Mendhan, ELBS.

2. Practical Inorganic Chemistry by. K. Somasekhara Rao and K.N.K. Vani. Kalyani publishers.

M.Sc., CHEMISTRY (ANALYTICAL CHEMISTRY)

III SEMESTER

PAPER CODE & TITLE: R20 ACH 306: INSTRUMENTAL AND SPECTRAL METHODS OF ANALYSIS PRACTICAL

No. of hours per week: 06 **Total credits: 03**

Total marks: 100 (Internal: 30 M & External: 70M)

Course Learning Objective(S): The main objective of this paper is to give a basic and updated knowledge for the students on instrumental methods of analysis practical.

Course Learning Outcome(S): After studying this paper, students will acquire the knowledge of on instrumental methods of analysis practical.

1. pH-metric determination of strong acid + Weak acid with strong base.
2. pH-metric determination of strong base + weak base with strong acid.
3. Determination of alkalinity in industrial samples using pH metric method.
4. Assay of commercial acids by pH metric titration.
5. Potentiometric determination of mixture of Mn(VII)+V(V) with Fe(II).
6. Potentiometric determination of mixture of Ce(IV)+V(V) with Fe(II).
7. Spectrophotometric determination of Fe(III) with KSCN.
8. Spectrophotometric determination of nitrite with NEDA.
9. Spectrophotometric determination of phosphate with ammonium molybdate.
10. Determination of Na, K, and Li by flame photometry.
11. Characterization of organic compounds using IR, UV-Vis, ^{1}H-NMR, ^{13}C-NMR and Mass spectral methods. (At least 10 molecules).

Reference books:

1. Vogels Text Book of Quantitative analysis, revised. J. Bassett, R.C. Denny, G.H. Jeffery and J. Mendhan, ELBS.
2. Practical Inorganic Chemistry by. K. Somasekhara Rao and K.N.K. Vani. Kalyani publishers.

KAKARAPARTI BHAVANARAYANA COLLEGE (Autonomous)

PG Department of Chemistry (Analytical Chemistry)

Class:	Semester:	Title of The Paper:	Paper Code:	W.E.F
II M.Sc	III	WATER ANALYSIS (OPEN ELECTIVE-II)	R20 OEACH 307.1	2020-21

Syllabus

Total No of Hours for Teaching - Learning	Instructional Hours Per Week		Duration of Semester End Examination in Hours	Max Marks		Credits
60 Hours	Theory	Practical	3 Hours	CIA	SEE	4
	4	0		30	70	

Course Learning Objective(S):

The main objective of this paper is to give a basic and updated knowledge for the students on water analysis.

Course Learning Outcome(S): After studying this paper, students will acquire the knowledge of water analysis.

Unit-I

Water quality parameters and their determination: Physical, chemical and biological standards significance of these contaminants over the quality and their determinations - Electrical conductivity - turbidity - pH, total solids, TDS - alkalinity - hardness - chlorides - DO - BOD-COD - TOC - nitrate –sulphate-fluoride - iron - arsenic - mercury/Algal analysis plankton analysis - biomass and chlorophyll estimation – microbial examination -standard plate count - MPN of coliforms - estimation of MPN – bioassay - requirements of bioassay.

Unit-II

Ground water and surface water pollution and control measures: Surface water and ground water pollution - Harmful effects-pollution of major rivers – protecting ground water from pollution - ground water pollution due to Fluoride, Iron, Chromium and Arsenic sources, ill effects and

treatment methods. Water pollution control- stabilization of the ecosystem – waste treatment reclamation - various approaches to prevent and control water pollution.

Unit-III

Water treatment methods: Treatment for community supply - screening, sedimentation, coagulation, filtration - removal of microorganisms - chlorination, adding bleaching powder, UV irradiation and ozonation. Demineralization of water for industrial purposes - boiler problems - scale and sludge formation - prevention of scale formation, internal and external treatment - lime soda - zeolite process.

Unit-IV

Sewage and industrial effluent treatment: Sewage - characteristics – purpose of sewage treatment - methods of sewage treatment - primary - secondary and tertiary – Role of algae in sewage treatment. Types of industrial wastes - treatment of effluents with organic and inorganic impurities - treatment of waste waters from specific industries - pulp and paper - chemical industry - food processing-water hyacinth in the treatment of industrial effluents.

Unit-V

Water Management: Water resources management - rain water harvesting methods - percolation ponds - check darns - roof top collection methods – water management in industries - recycling and reuse of waste water - metal recovery from metal bearing waste water - recovery of zinc and nickel.

Reference books:

1. Chemical and Biological Methods for Water Pollution Studies, R.K. Trivedy and P.K. Goel, Environmental Publications, 1986.

2. Engineering Chemistry, P.C. Jain and Monica Jain, Dhanpat Rai & Sons, 1993.

3. Environmental Chemistry, B.K. Sharma, Goel Publishing House, 2001.

4. Water Quality and Defluorination Techniques, Rajiv Gandhi National Drinking Water Mission Publication, 1994.

Model Question Paper

Class: II M.Sc Analytical Chemistry **Code: R20 OEACH 307.1**

Paper: WATER ANALYSIS (OPEN ELECTIVE-II) **Semester: III**

Time: 3Hrs **Max. Marks: 70 M**

UNIT-I

1. Explain the terms DO, BOD and COD in detail. (14M)

OR

2. Write a note on MPN of coliforms - estimation of MPN. (14M)

UNIT-II

3. Explain harmful effects of water pollution. (14M)

OR

4. Write a note on ground water pollution due Chromium and Arsenic sources. (14M)

UNIT-III

5. Explain water treatment methods for community supply. (14M)

OR

6. Write a note on lime soda and zeolite process. (14M)

UNIT-IV

7. Explain different - methods of sewage treatment. (14M)

OR

8. Write different types of industrial wastes. (14M)

UNIT-V

9. Write different rain water harvesting methods. (14M)

OR

10. Describe metal recovery from metal bearing waste water. . (14M)

KAKARAPARTI BHAVANARAYANA COLLEGE (Autonomous)

PG Department of Chemistry (Analytical Chemistry)

Class:	Semester	Title of The Paper	Paper Code	W.E.F
II M.Sc	III	TECHNIQUES FOR MODERN INDUSTRIAL APPLICATIONS (OPEN ELECTIVE-II)	R20 OEACH 307.2	2020-21

Syllabus

Total No of Hours for Teaching - Learning	Instructional Hours Per Week		Duration of Semester End Examination in Hours	Max Marks		Credits
60 Hours	Theory	Practical	3 Hours	CIA	SEE	4
	4	0		30	70	

Course Learning Objective(S):

The main objective of this paper is to give a basic and updated knowledge for the students on Recrystallization, Distillation, Solvent extraction, Adsorption and Partition Chromatography, Gas Chromatography and High-Performance Liquid Chromatography and Ion-Exchange Chromatography and Electrophoresis.

Course Learning Outcome(S):

After studying this paper, students will acquire the knowledge of Recrystallization, Distillation, Solvent extraction, Adsorption and Partition Chromatography, Gas Chromatography and High-Performance Liquid Chromatography and Ion-Exchange Chromatography and Electrophoresis.

Unit-I

Classical Methods of purification: Recrystallization: Basic principles, choice of solvent, seeding, filtration and centrifugation and drying. Industrial applications. Concepts of fractional crystallization. Distillation: Basic principles. Distillation types- continuous distillation, batch distillation, fractional distillation, vacuum distillation and steam distillation. Industrial applications. Solvent extraction: Basic principles, Different types of extraction. Selection of solvents. Avoiding emulsion formation. Basic concepts on Soxhlet extraction. Industrial applications.

Unit-II

Adsorption and Partition Chromatography: Introduction to chromatography. Different types of Chromatography. Adsorption chromatography-adsorbents, solvents, solutes, apparatus. Column Chromatography-stationary phase, Mobile phase, packing of column, advantages and disadvantages. Thin Layer chromatography: Basic Principles. Common stationary phases, Methods of preparing TLC plates, Selection of mobile phase, Development of TLC plates, Visualization methods, Rf value. Application of TLC in monitoring organic reactions. identification and quantitative analysis. Paper chromatography: Basic Principles. Ascending and descending types. Selection of mobile phase, Development of chromatograms, Visualization methods. Application of paper chromatography in the identification of sugars and amino acids. One- and two-dimensional paper chromatography.

Unit-III

Gas Chromatography and High-Performance Liquid Chromatography: Gas chromatography: Basic Principles. Different types of GC techniques. Selection of columns and carrier gases. Instrumentation. detectors; RT values. Applications in the separation, identification and quantitative analysis of organic compounds. High Performance liquid chromatography (HPLC): Basic Principles. Normal and reversed Phases. Selection of column and mobile phase. Instrumentation. detectors; RT values. Applications in the separation, identification and quantitative estimation of organic compounds. Concepts on HPLC method development.

Unit-IV

Ion-Exchange Chromatography and Electrophoresis: Ion exchange chromatography: Basic Principles. Preparation of cross-linked polystyrene resins. Different types of cation and anoin exchange resins. Application in the purification of carboxylic acids and amines. Electrophoresis: Basic Principles. Capillary electrophoresis. Instrumentation, applications, zone- electrophoresis, gel-electrophoresis.

Unit-V

GC-MS – Introduction: Instrumentation – GC – MS interface – Mass spectrometer (MS) Instrument operation, processing GC – MS data – ion chromatogram Library searching – Quantitative measurement – sample preparation Selected ion monitoring – Application of GC-MS for Trace constituents. Drugs analysis, Environmental analysis and others.

Reference books:

1. Principles of Instrumental Analysis by D. A. Skoog, F. J. Holler and T. A. Nieman, Harcourt College Pub.

2. Separation Techniques by M. N. Sastri, Himalaya Publishing House (HPH), Mumbai.

3. Introduction to Organic Laboratory Techniques-D. L. Pavia, G. M. Lampman, G. S. Kriz and R. G. Engel, Saunders College Pub (NY).

4. Instrumental Methods of Chemical Analysis by H. Kaur, Pragati Prakashan, Meerut.

5. Protein Purification-Principles and practice, III Edn- R. K. Scopes, Narosa Publishing House, Delhi.

Model Question Paper

Class: II M.Sc Analytical Chemistry **Code: R20 OEACH 307.2**

Paper: TECHNIQUES FOR MODERN INDUSTRIAL APPLICATIONS

(OPEN ELECTIVE-II)

Semester: III

Time: 3Hrs **Max. Marks: 70 M**

UNIT-I

1. Write the basic principle involved in recrystallization process. (14M)

OR

2. Explain the basic concepts on Soxhlet extraction. (14M)

UNIT-II

3. Explain the advantages and disadvantages of column chromatography. (14M)

OR

4. Explain the basic Principles involved in Ascending and descending Paper chromatography: (14M)

UNIT-III

5. Explain the applications of HPLC. (14M)

OR

6. write the basic Principles and Different types of GC techniques. (14M)

UNIT-IV

7. Different types of cation and anoin exchange resins used in ion exchange chromatography. (14M)

OR

8. Write the basic principle and applications of Capillary electrophoresis. (14M)

UNIT-V

9. Write the instrumentation of GC-MS . (14M)

OR

10. Write the applications of GC-MS. . (14M)

KAKARAPARTI BHAVANARAYANA COLLEGE (Autonomous)

PG Department of Chemistry (Analytical Chemistry)

Class:	Semester	Title of The Paper	Paper Code	W.E.F
II M.Sc	III	POLYMER CHEMISTRY (OPEN ELECTIVE-II)	R20 OEACH 307.3	2020-21

Syllabus

Total No of Hours for Teaching - Learning	Instructional Hours Per Week		Duration of Semester End Examination in Hours	Max Marks		Credits
60 Hours	Theory	Practical	3 Hours	CIA	SEE	4
	4	0		30	70	

Course Learning Objective(S):

The main objective of this paper is to give a basic and updated knowledge for the students on Polymer chemistry.

Course Learning Outcome(S):

After studying this paper, students will acquire the knowledge of Polymer chemistry.

UNIT – I

Introduction, Classification of polymers, Polymerization, chain polymerization, step polymerization, Copolymerization, Free radical chain polymerization, cationic polymerization, anionic polymerization, Polymerization Techniques, Graft and Block Copolymers.

UNIT – II

Polymer Synthesis, Isolation and Purification of polymers, Polymer Fractionation, Molecular weight determination, Molecular weight determination curve, Processing Techniques.

UNIT – III

Polymer Reactions – Introduction, Hydrolysis, Acidolysis, Aminolysis, Hydrogenation, Addition and Substitution Reactions, Cyclisation reactions, Cross-linking Reactions.

UNIT – IV

Polymer Degradation – Definition, Types of Degradation, Thermal Degradation, Mechanical Degradation, Degradation by Ultrasonic Waves, Photo degradation, Degradation by High-Energy Radiation, Oxidative Degradation, Hydrolytic Degradation.

UNIT – V

Plastics, Fibres, Elastomers - Polyethylene, Polystyrene, Poly Esters, Poly Acrylonitrile, Polyurethanes, Polyvinyl Chloride, Polyisoprenes. Resins – Phenol Formaldehyde Resin, Urea Formaldehyde and Melamine –Formaldehyde Resins, Epoxy Polymers, Silicon Polymers.

Reference books:

1. Textbook of Polymer Science by Frod, W. Billmayer,

2. An Introduction to Polymer Chemistry by Moore.

3. Polymer Chemistry - An Introduction by M.P. Stevens.

4. Polymer Science – V R Gowariker, N V Viswanathan, Jayadev Sreedhar.

Model Question Paper

Class: II M.Sc Analytical Chemistry **Code: R20 OEACH 307.3**

Paper: POLYMER CHEMISTRY (OPEN ELECTIVE-II)

Semester: III

Time: 3Hrs **Max. Marks: 70 M**

UNIT-I

1. Write a note on Classification of polymers. (14M)

OR

2. Explain different types of Polymerization Techniques. (14M)

UNIT-II

3. Explain Isolation and Purification of polymers. (14M)

OR

4. Explain Molecular weight determination of polymers. (14M)

UNIT-III

5. Explain the following polymer reactions. (14M)

i) Hydrolysis ii) Acidolysis iii) Aminolysis.

OR

6. Write a note on Cyclisation reactions and Cross-linking Reactions of polymers.(14M)

UNIT-IV

7. Write a note on the following polymer Degradations. (14M)

i) Thermal Degradation ii) Mechanical Degradation

OR

8. Explain Oxidative Degradation and Hydrolytic Degradation. (14M)

UNIT-V

9. Write a note on Polystyrene and Poly Esters. (14M)

OR

10. Write a note on phenol formaldehyde resins and silicon polymers. . (14M)

KAKARAPARTI BHAVANARAYANA COLLEGE (Autonomous)

PG Department of Chemistry (Analytical Chemistry)

Semester-IV

PAPER CODE & TITLE: R20 ACH 401: MOOCS

No. of hours per week: 04 **Total credits: 04**

Total marks: 100 (Internal: 30 M & External: 70M)

Course Learning Objective(S):

The main objective of this paper is to give knowledge for the students on MOOCS COURSES.

Course Learning Outcome(S):

After studying this paper, students will acquire the knowledge of MOOCS COURSES.

KAKARAPARTI BHAVANARAYANA COLLEGE (Autonomous)

PG Department of Chemistry (Analytical Chemistry)

Class	Semester	Title of The Paper	Paper Code	W.E.F

II M.Sc	IV	CHEMICAL AND SPECTRAL METHODS OF ANALYSIS (ELECTIVE-I)	R20ACH402.1	2020-21

Syllabus

Total No of Hours for Teaching - Learning	Instructional Hours per Week		Duration of Semester End Examination in Hours	Max Marks		Credits
	Theory	Practical		CIA	SEE	
60 Hours	4	0	3 Hours	30	70	4

Course Learning Objective(S): The main objective of this paper is to give a basic and updated knowledge for the students on nephelometry, turbidimetry, spectrofluorimetry, X-ray spectroscopy, radiochemical and kinetic methods of analysis,electronmicroscopy and Mossbauer spectroscopy.

Course Learning Outcome(S): After studying this paper, students will acquire the knowledge on nephelometry, turbidimetry, spectrofluorimetry, X-ray spectroscopy, radiochemical and kinetic methods of analysis, electron microscopy and Mossbauer spectroscopy.

UNIT-I

Nephelometry & Turbidimetry

Theory – Instrumentation – effect of concentration, particle size and wavelength on scattering, Difference between Nephelometry & Turbidimetric titrations – compassion of Colorimetry with Tubidimetry, comparision of Fluorimetry with Nephelometry -Applications.

UNIT-II

Spectrofluorimetry and X-ray Spectroscopy

Spectrofluorimetry*:* Theory of fluorescence, phosphorescence,quenching, relation between intensity of fluorescence and concentration, instrumentation, Application with reference to Thiamin (B_1) and Riboflavin (B_2) in drug samples.

X-ray Spectroscopy: Chemical analysis by X-ray spectrometers, energy dispersive and wavelength dispersive techniques, evaluation methods, instrumentation, matrix effects applications.

UNIT-III

Radio chemical and kinetic methods of analysis

Detection and Measurement of radioactivity, introduction to radioactive tracers, applications of tracer technique, isotope dilution analysis - applications, activation analysis – application, advantages and disadvantages, radio carbon dating technique.

Kinetic methods of analysis: introduction, slow reactions, catalyzed reactions, methods of determination of catalyst concentration.

UNIT-IV

Electron microscopy

Principle, theory and classification of Electron microscopic methods, scanning electron microscopy(SEM),working of SEM instrument, applications.

Scanning tunnelling microscopy (STM), basic principle and applications.

Transmission electron microscopy, (TEM) basic principle and applications

Atomic force microscope (AFM) basic principle and applications

UNIT-V

Mossbauer Spectroscopy

Principle, theory of Mossbauer spectroscopy, Instrumentation, interpretation of spectra, applications with reference to analytical sciences, chemical sciences, physical and biological sciences.

Reference books:

1. Kinetic Methods of Analysis by K.B. Yarstimiskii.
2. Technical Methods of Analysis, Griffin, Mc. Graw Hill.
3. Principles of instrumental analysis – Skoog and West, Saunders College publishing.
4. Instrumental methods of Analysis – Galen W. Ewing, (Mc. Graw Hill).
5. Basic concepts of Analytical Chemistry S M Khopkar, New age International publishers.

KAKARAPARTI BHAVANARAYANA COLLEGE (Autonomous)

PG Department of Chemistry (Analytical Chemistry)

Class:	Semester	Title of The Paper	Paper Code	W.E.F
II M.Sc	IV	GREEN CHEMISTRY (ELECTIVE-I)	R20 ACH 402.2	2020-21

Syllabus

Total No of Hours for Teaching - Learning	Instructional Hours Per Week		Duration of Semester End Examination in Hours	Max Marks		Credits
	Theory	Practical		CIA	SEE	
60 Hours	4	0	3 Hours	30	70	4

Course Learning Objective(S):

The main objective of this paper is to give a basic and updated knowledge for the students on Green chemistry.

Course Learning Outcome(S):

After studying this paper, students will acquire the knowledge of significance of Green Chemistry, Principles of Green chemistry, Microwave assisted reactions, Solvent Free Reactions and Ionic liquids.

Unit-I

Fundamentals and significance of Green Chemistry: Discussion of the current state of chemistry and the environment and the definition of green chemistry. Assessment of the impact of chemistry in the environment and definition of risk hazard. An introduction to the tools of green chemistry and its fundamental principles.

Unit-II

Principles of Green Chemistry: Prevention of waste / by-products, Hazardous products- Designing of safer chemicals- Selection of appropriate solvents and starting materials- Use of protecting groups and catalysis- Designing of biodegradable products.

Unit-III

Microwave assisted reactions: Introduction to Microwave organic synthesis, Applications: solvents (water and organic solvents), solvent free reactions (solid state reactions), Phase transfer catalysis-Principle, Types, advantages and applications, Crown ethers.

Unit-IV

Solvent Free Reactions: Solvent free techniques- Reactions on solid mineral supports, Phase Transfer Catalysis- C-alkylation, N-alkylation, S-alkylation, Darzen‟s reaction, Wittig reaction. Ultrasound assisted green synthesis- Oxidation, Reduction, Hydroboration, Bouveault reaction, Strecker reaction.

Unit-V

Ionic liquids: Definition- Types of Ionic Liquids-Synthesis of Ionic Liquids, Selection of ionic liquids- physical properties- Application in organic synthesis- alkylation, allylation, oxidation, reduction, polymerization, hydrogenation, hydroformylation, alkoxy carbonylation, carbon-carbon bond forming reactions, alkene metathesis.

Text books/ Reference books:

1. New Trends in Green Chemistry by V.K. Ahluwalia, M. Kidwai.

2. Green Chemistry: Environment Friendly Alternatives by Rashmi Sanghi, M M Srivastava

3. Green Solvents for Organic Synthesis by V.K. Ahluwalia, Rajender S. Varma

4. Green Analytical Chemistry by Mihkel Koel and Mihkel Kaljurand.

Model Question Paper

Class: II M.Sc Analytical Chemistry **Code: R20 ACH 402.2**

Paper: GREEN CHEMISTRY (ELECTIVE-I)

Semester: IV

Time: 3Hrs **Max. Marks: 70 M**

UNIT-I

1. Write a note on twelve principles of green chemistry. (14M)

OR

2. What is meant by risk hazard and write the impact of chemistry in the environment . (14M)

UNIT-II

3. Explain Prevention of waste / by-products and Designing of safer chemicals with suitable examples. (14M)

OR

4. Write a note on use of protecting groups and catalysis in green chemistry. (14M)

UNIT-III

5. Explain solvent free reactions with suitable examples. (14M)

OR

6. Write the Principle, and applications of Crown ethers. (14M)

UNIT-IV

7. Write a note on the following. (14M)

i) C-alkylation ii) N-alkylation iii) S-alkylation

OR

8. Explain Ultrasound assisted green synthesis with examples. (14M)

UNIT-V

9. Write different types of Ionic Liquids and Synthesis of Ionic Liquids. (14M)

OR

10. Write the application of ionic liquids in alkylation, allylation, oxidation and reduction, processes. . (14M)

KAKARAPARTI BHAVANARAYANA COLLEGE (Autonomous)

PG Department of Chemistry (Analytical Chemistry)

Class	Semester	Title of The Paper	Paper Code	W.E.F
II M.Sc	IV	TRADITIONAL AND ENVIRONMENTAL METHODS OF ANALYSIS (ELECTIVE-II)	R20ACH403.1	2020-21

Syllabus

Total No of Hours for Teaching - Learning	Instructional Hours per Week		Duration of Semester End Examination in Hours	Max Marks		Credits
60 Hours	Theory	Practical	3 Hours	CIA	SEE	4
	4	0		30	70	

Course Learning Objective(S): The main objective of this paper is to give a basic and updated knowledge for the students on decomposition techniques, organic functional group analysis, drug analysis, analysis of water and air.

Course Learning Outcome(S): After studying this paper, students will acquire the knowledge of on decomposition techniques, organic functional group analysis, drug analysis, analysis of water and air.

UNIT-I

Decomposition techniques in analysis

Principle of decomposition and Dissolution. Difference between dissolution and decomposition. Decomposition of samples with acids - HCl, HF, HNO_3, H_2SO_4 and $HClO_4$.

Decomposition of samples by fusion, Alkali Fusion- Na_2CO_3, NaOH, Acidic Fusion- Sodium Hydro Sulphate, Sodium Pyrosulphate, Oxidation Fusion-Na_2O_2, Sodium Chlorate, Reductive Fusion Na_2CO_3 +Na_4BO_4. Sintering, difference between sintering and fusion. Decomposition of samples by sintering with sodium peroxide, sodium carbonate.

UNIT-II

Organic functional group analysis: Classification of functional groups with suitable examples. Determination of:

1) Functional groups imparting acidic nature – thiol, enediol, phenolic hydroxyl.
2) Functional groups imparting basic nature – Aliphatic and Aromatic primary, secondary and tertiary amines – hydrazine derivatives.
3) Functional groups which impart neither acidic nor basic nature – Aldehydes, Ketones, Nitro, Methoxy and Olifinic.

UNIT-III

Analysis of some selected drugs: Basic considerations of drugs, Classification, Determination of the following Drugs:

1) Actyl salicylic acid (Antipyretic – Analgesic)

2) Sulphadiazine (sulpha drugs)
3) Phenobarbitone (Barbituric acid derivatives)
4) Chloramphenicol, Benzyl penicillin and Tetracycline (Antibiotics)
5) Isoniazid (Antimicrobacterial agents)
6) Methlydopa (Antihypertensive agents)
7) Metronidazole (Antiamoebic agents).

UNIT-IV

Analysis of Water

Types of water pollutants and their effects, Analytical methods for the determination of the following ions in water, anions like CO_3^{2-}, HCO_3^-, F^-, Cl^-, SO_4^{2-}, PO_4^{3-}, NO_3^-, NO_2^-, CN^-, and S^{2-}.

Determination of Cations in water: Fe^{2+}, Fe^{3+}, Ca^{2+}, Mg^{2+}, Cr^{3+}, As^{5+}, Pb^{2+}, Hg^{2+},Cu^{2+}, Zn^{2+},Cd^{2+}, Co^{2+}. Determination of Dissolved oxygen (D.O), Biochemical Oxygen Demand (BOD) and Chemical Oxygen Demand (COD), standards for drinking water.

UNIT-V

Analysis of Air

Composition of pure air, classification of air pollutants, chemical analysis for the following.

Primary pollutants: Carbon compounds - Carbon monoxide(CO) and Carbon dioxide(CO_2). Sulphur compounds- sulphur dioxide (SO_2), Sulphur trioxide (SO_3) Nitrogen compounds - nitric oxide (NO) and nitrogen dioxide (NO_2).

Hydrocarbons - Aliphatic hydrocarbons and polycyclic aromatic hydrocarbons, Inorganic and Organic particulates. Secondary pollutants - ozone (O_3), peroxy acetyl nitrate (PAN), peroxy benzyl nitrate (PBN). Standards for ambient air quality.

Reference books:

1. Quantitative Chemical Analysis - I.M Kolthoff, F.B Sandal, F.J. Meehan, S. Bruckenstein, Macmillan Company, London.
2. Decomposition Techniques in Inorganic Analysis - J.Dolezal, P.Ponondra, Z.Sulcek.
3. Chemical Separation and measurements - D.G. Peterseti, John M.Haves Sanders Co.

4. Analytical Chemistry,An Introduction, D.ASkoog, D.M Westand F.J Holler, SandersCollege Publishing, New York.
5. Environmental Chemistry, Anil Kumar De Wiley Eastern Ltd.
6. EnvironmentaI Analysis, S.M Khopkar (IIT Bombay).
7. Environmental Air Analysis, Trivedi and Kudesia, Akashdeep Pub.
8. Organic functional groups - S.Siggia.

KAKARAPARTI BHAVANARAYANA COLLEGE (Autonomous)

PG Department of Chemistry (Organic Chemistry)

Class:	Semester	Title of The Paper	Paper Code	W.E.F
II M.Sc	IV	NANO CHEMISTRY (ELECTIVE-II)	R20 ACH 403.2	2020-21

Syllabus

Total No of Hours for Teaching - Learning	Instructional Hours Per Week		Duration of Semester End Examination in Hours	Max Marks		Credits
60 Hours	Theory	Practical	3 Hours	CIA	SEE	4

Course Learning Objective(S):

The main objective of this paper is to give a basic and updated knowledge for the students on NANO CHEMISTRY.

Course Learning Outcome(S):

After studying this paper, students will acquire the knowledge of synthesis, characterisation, and applications of nanomaterials,

Unit-I

Introduction to Nano chemistry: Definition of terms-nanoscale, nanomaterials, nanoscience, nanotechnology-scale of materials natural and manmade-nanoscience practiced during ancient and modern periods- contributors to the field of Nano chemistry.

Unit-II

Synthesis of Nanomaterials: Top down and bottom-up approaches-synthesis of carbon nanotubes, quantum dots, gold and silver nanoparticles.

Unit-III

Characterization of Nanomaterials: Electron microscopy techniques-scanning electron microscopy, transmission electron microscopy and atomic force microscopy.

Unit-IV

Application of Nanomaterials: Solar cells-smart materials-molecular electronics biosensors-drug delivery and therapy- detection of cancerous cells.

Unit-V

Nano chemistry in Nature: The science behind the nanotechnology in lotus effect-self-cleaning property of lotus-gecko foot climbing ability of geckos-water strider anti wetting property of water striders-spider silk mechanical properties of the spider silk.

Reference books:

1. Nano: The Essentials: Understanding Nanoscience and Nanotechnology, T. Pradeep, McGraw-Hill Professional Publishing, 2008.

2. Introduction to Nanoscience, J. Dutta, H.F. Tibbals and G.L. Hornyak, CRC press, Boca Raton, 2008.

Model Question Paper

Class: II M.Sc Organic Chemistry **Code: R20 ACH 403.2**

Paper: NANO CHEMISTRY (ELECTIVE-II)

Semester: IV

Time: 3Hrs **Max. Marks: 70 M**

UNIT-I

1. Define the following terms. (14M)

i) Nanoscale ii) nanomaterials iii) nanoscience iv) nanotechnology

OR

2. Write a note nanoscience practiced during ancient and modern periods. (14M)

UNIT-II

3. Explain Top down and bottom-up approaches for the synthesis of nanotubes. (14M)

OR

4. Write various methods for the synthesis of Gold nanoparticles. (14M)

UNIT-III

5. Write the principle and applications of scanning electron microscopy. (14M)

OR

6. Write the principle and applications of atomic force microscopy. (14M)

UNIT-IV

7. Write the applications of nanomaterials in solar cells and smart materials. (14M)

OR

8. Explain the applications of detection of cancerous cells. (14M)

UNIT-V

9. Write a note on lotus effect-self-cleaning property of lotus. (14M)

OR

10. Write a note on spider silk mechanical properties of the spider silk. (14M)

KAKARAPARTI BHAVANARAYANA COLLEGE (Autonomous)

PG Department of Chemistry (Analytical Chemistry)

Class	Semester	Title of The Paper	Paper Code	W.E.F
II M.Sc	IV	QUALITY CONTROL AND STANDARD METHODS OF ANALYSIS	R20ACH404	2020-21

Syllabus

Total No of Hours for Teaching - Learning	Instructional Hours per Week		Duration of Semester End Examination in Hours	Max Marks		Credits
60 Hours	Theory	Practical	3 Hours	CIA	SEE	4
	4	0		30	70	

Course Learning Objective(S): The main objective of this paper is to give a basic and updated knowledge for the students on Quality control in Analytical Chemistry, GLP, precipitation gravimetry, selected oxidant and reductant systems used in analysis.

Course Learning Outcome(S): After studying this paper, students will acquire the knowledge of Quality control in Analytical Chemistry, GLP, precipitation gravimetry, selected oxidant and reductant systems used in analysis.

UNIT-I

Quality control in Analytical Chemistry

Quality assurance and management systems: elements of quality assurance, quality assurance in design, development, meaning of quality and customer requirement of quality. Quality management system, ISO 9000 and ISO 14000 series- statistical process control, process control tools.

Good laboratory practices (GLP): Need for GLP, GLP organization and management, Brief outline of ICH guidelines on drug substances and products.

UNIT-II

Quality assurance and management systems: Elements of quality, quality control, quality assurance, Triple role concept, quality process model. Customer requirement of quality, quality assurance in design, development, Statistical process control, statistical quality control and acceptance sampling.

UNIT-III

Characteristics of an analysis: Classification of errors, accuracy-absolute and comparative method, propagation of errors, precision, significant figures, mean and standard deviation, the confidence limit, Test of significance-Q-test, T-test and F-test, control charts, Quality of an analytical procedure.

UNIT-IV

Precipitation methods

Nucleation and Crystal growth, homogeneous and heterogeneous nucleation, solubility and particle size, completeness of precipitation, effect of excess precipitant, pH, complex formation, temperature, purity of precipitates. Theory of co-precipitation**,** mixed crystal formation by occlusion and entrapment, re-precipitation with examples, theory of post-precipitation, examples of post-precipitation.

UNIT-V

PFHS and Gravimetric determination

Precipitation from Homogeneous Solution (PFHS), theory of PFHS, methods of PFHS - increase in pH, decrease in pH, cation release, anion release, reagent synthesis, change in oxidation state, photochemical reactions, precipitation from mixed solvents. Applications of PFHS methods.

Gravimetric determinations: nature of species, preparation of solutions, Inorganic precipitants-chloride and sulphate. Organic precipitants: Dimethyl glyoxime (DMG), oxine, benzidine, salicylaldoxime, benzoin oxime.

References books:

1. Quality Assurance and Good Laboratory Practices, Prof. Y. Anjaneyulu, In Now Publication, New York.
2. Quality Assurance in Analytical Chemistry - G.Kateman and F.W Pipers, John Wiley and Sons, New York.
3. Technical methods of analysis - Griffin, MC Graw Hill Book Co.
4. Chemical analysis - H.A Laitinan, Me Graw Hill Book Co.
5. Newer redox titrants - Berka, Zyka and Vulterin, Pergamon Press.
6. Volumetric Analysis, Vol III- 1.M Kolthoff and R. Belcher, Interscience Public, New York.
7. Vogel's Text Book of Inorganic Quantitative Analysis - J. Bassett et al, ELBS.
8. Analytical Chemistry, An Introduction, D.A. Skoog, D.M West and F.J Holler, Sanders College Publishing, New York.
9. An Introduction ISO 9000, ISO 1400 Series, Environmental Management. K.V.S.G. Murali Krishna.

Model Question Paper

Class: II M.Sc Organic Chemistry **Code: R20 ACH 404**

Paper: QUALITY CONTROL AND STANDARD METHODS OF ANALYSIS (ELECTIVE-II)

Semester: IV

Time: 3Hrs **Max. Marks: 70 M**

UNIT-I

1. Write a note on elements of quality assurance. (14M)

OR

2. Write brief outline of ICH guidelines on drug substances and products. (14M)

UNIT-II

3. Describe the following

a) Triple role concept b) quality process model. (14M)

OR

4.Write a note on Statistical process control, statistical quality control. (14M)

UNIT-III

5. Write a note on classification of errors. . (14M)

OR

6.Write a note on Q-test, T-test and F-test. (14M)

UNIT-IV

7. Write a note on Nucleation and Crystal growth. (14M)

OR

8. Explain the theory of Co-precipitation and post precipitation. (14M)

UNIT-V

9. Write a note on theory and methods of PFHS. (14M)

OR

10. Write a note on gravimetric determination using DMG. . (14M)

M.Sc., CHEMISTRY (ANALYTICAL CHEMISTRY)

IV SEMESTER

PAPER CODE & TITLE: R20 ACH 405

STANDARD METHODS OF ANALYSIS PRACTICAL

No. of hours per week: 06 **Total credits: 03**

Total marks: 100 (Internal: 30 M & External: 70M)

Course Learning Objective(S): The main objective of this paper is to give a practical knowledge for the students on separation techniques.

1. Column chromatography – separation of the given mixture of o-and p-nitro aniline.
2. Paper chromatography - separate the given mixture of sugars and amino acids.
3. Thin-layer chromatography - separate the given mixture of phenols and 2,4 DNP derivatives of carbonyls compounds.
4. Analysis of samples by HPLC.
5. Water analysis of five different samples (at least five parameters).

Course Learning Outcome(S): After studying this paper, students will acquire the knowledge of separation techniques.

Text books/ Reference books:

1. A.I. Vogel, "A Text Book of Practical Organic Chemistry", Longman
2. A.I. Vogel, "Elementary Practical Organic Chemistry", Longman
3. F.G.Mann and B.C. Saunders, "Practical Organic Chemistry", Longman
4. Reaction and Synthesis in Organic Laboratory, B.S. Furniss, A.J. Hannaford, Tatchell, University Science Books mills valley
5. Purification of Laboratory chemicals, manual, W.L.F. Armarego EDD Perrin
6. Reaction and Synthesis in Organic Chemistry Laboratory, Lutz-Friedjan-Tietze, TheophilEicher, University Science Book.

M.Sc., CHEMISTRY (ANALYTICAL CHEMISTRY)

IV SEMESTER

PAPER CODE & TITLE: R20 ACH 406:

IN HOUSE MINOR RESEARCH PROJECT

No. of hours per week: 08 **Total credits: 04**

Total marks: 100 (Internal: 30 M & External: 70M)

Course Learning Objective(S): The main objective of this paper is to give a practical knowledge for the students on separation techniques.

Course Learning Outcome(S): After studying this paper, students will acquire the knowledge of project.

- Isolation and characterization of Natural Products.
- Synthesis and characterization of Hetero Cyclic Compounds.
- Spectroscopic study of Organic compounds.
- Industrial visit and submit research findings of their Industrial visit / IIT's, CSIRLab's, NIT's Central Universities etc.,