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KAKARAPARTI BHAVANARAYANA PG COLLEGE

(Affiliated to Krishna University)

Kothapet, Vijayawada-1

SYLLABUS

PG Department of Chemistry

(Analytical Chemistry)

Regulation 2020

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	R20ACH101	2020-21

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):

The main objective of this paper is to give a knowledge for students on Titrimetric Analysis, Treatment of analytical data, Adsorption, Partition, Gas Chromatography and High-Performance Liquid Chromatography.

Course Learning Outcome(S):

After studying this paper, students will acquire the knowledge of Titrimetric Analysis, Treatment of analytical data, Adsorption, Partition, Gas Chromatography and High-Performance Liquid Chromatography.

Unit-I: 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**-EDTA Titrations.

Unit-II: 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-

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 Hexane, Benzene, Toluene, Xylene, Tetrahydrofuran, DMF, DMSO, Ethanol, Diethyl ether and Dioxane**.**

3. Solvent extraction: Basic principles, Different types of extraction. Selection of solvents. Basic concepts on Soxhlet extraction. Industrial applications**.**

Unit-IV: Adsorption and Partition Chromatography: Introduction to chromatography, Different types of Chromatography: **Adsorption chromatograph:** 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. Application 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.

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.

Text books/ 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, New York.
6. Chromatography, E. Lederer and M. Lederer, Elsevier, Amsterdam.
7. Thin layer chromatography, E. Stahl, Academic Press, New York.
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.

Model Question Paper

Class: I MSc Analytical Chemistry **Semester: I**
Paper: General chemistry **Code: R20ACH101**
Time: 3Hrs **Max. Marks: 70 M**

UNIT-I

1. a) Expalin the Classification reactions in titrimetry? (8M)
   b) Write a note on Neutralization indicators. (6M)

OR

2. a) Write a note on Mohr's method and Volhard's method? (8M)
   b) Explain EDTA titrations? (6M)

UNIT-II

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

OR

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

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. a) Explain the applications of TLC. (14M)

UNIT-V

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

OR

10. a) 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-I	R20ACH102	2020-21

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):
The main objective of this paper is to give a basic and updated knowledge for students on Nature of bonding, Aromaticity and organic reaction mechanism.

Course Learning Outcome (S): After studying this paper, students will acquire the knowledge of Nature of bonding, Aromaticity and organic reaction mechanism.

Unit-I: Aromaticity: Aromaticity in benzenoid compounds - Benzene, Naphthalene and Anthracene, aromaticity in non-benzenoid compounds Cyclo propenyl cation, Cyclobutadienyl di cation ,Cyclppentadienyl anion, Tropyllium cation, 1,3,5,7- Cyclooctatetraenyl dianion, aromaticity of Hetero-aromatic Systems : Pyridine, Pyrrol and Thiophene. Annulenes: [10], [12], [14], [16] and [18] annulenes, azulenes, anti- aromaticity and homo-aromaticity.

Unit-II: Reactive intermediates:
Generation, Structure, Stability, Detection and Reactivity of Carbocations, Carbanions, Free radicals, Carbenes, Nitrenes and Arynes.

Unit-III: Addition Reactions:
Mechanistic, regio and stereo chemical aspects of addition to carbon carbon double bonds – Hydro halogenation and halogenation (HX, X_2) - Hydrogenation of double bonds, triple bonds and aromatic rings, Hydroboration.

Unit-IV: Elimination Reactions:
Types of elimination reactions, mechanisms, Stereochemistry and Orientation, Hofmann and Saytzeff rules, Syn elimination versus anti-elimination, competition between elimination and substitution, dehydration, dehydrogenation, dehalogenation, decarboxylative eliminations and pyrolytic eliminations**.**

Unit-V: Substitution Reactions: Aliphatic Nucleophilic Substitution Reactions: The S_N2, S_N1, mixed S_N1 and S_N2 and S_Ni reactions and their mechanisms - Neighboring Group Participation by sigma and pi bonds, Anchimeric assistance. **Aromatic Nucleophilic substitution Reactions:** S_N2 (Ar) (Addition–Elimination), SN1 (Ar) and benzyne mechanisms (Elimination - Addition). Von Richter, Sommelet-Hauser rearrangements.

Text books / 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 in organic 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.

Model Question Paper

Class: I MSc Analytical Chemistry **Semester: I**
Paper: Organic Chemistry-I **Code: R20ACH102**
Time: 3Hrs **Max. Marks: 70 M**

UNIT-I

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

OR

2. a) Write a note on anti aromaticity and homo aromaticity? (8M)
   b) Explain the aromaticity of annulenes? (6M)

UNIT-II

3. a) Explain generation, structure ,stability, detection and reactivity of carbo cations ? (8M)
   b) Write the generation and reactivity of carbenes? (6M)

OR

4. a) Explain generation and reactivity of Arynes? (6M)
   b) Write the generation and reactivity of carbanions ? (8M)

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 hydroboration reaction with mechanism? (6M)
   b) Write a note on orientation in hydro halogenation of alkenes? (8M)

UNIT-IV

7. a) Explain the mechanism of E_1 and E_2 eliminations. (8M)
   b) Write a note on syn elimination versus anti elimination? (6M)

OR

8. a) Explain Hofmann elimination with suitable examples. (6M)
   b) Write a note on Pyrolytic Elimination? (8M)

UNIT-V

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

OR

10. a) Explain benzyne mechanism? (8M)
    b) Explain neighbouring group participation? (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	I	INORGANIC CHEMISTRY-I	R20ACH103	2020-21

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):

The main objective of this paper is to give a basic and updated knowledge for students on Introduction to Exact Quantum Mechanical Results, Chemistry of non- transition elements, Structure & Bonding, Metal–ligand bonding, and Metal – ligand Equilibria in solutions.

Course Learning Outcome(S):

After studying this paper, students will acquire the knowledge of Introduction to Exact Quantum Mechanical Results, Chemistry of non- transition elements, Structure & Bonding, Metal–ligand bonding, and Metal – ligand Equilibria in solutions.

Unit-I: Introduction to Exact Quantum Mechanical Results: 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, three-dimensional box, Rigid rotator system and the Hydrogen atom. Variation theorem and application of variation method to the Hydrogen atom.

Unit-II: 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-N cyclic compounds.
Metal π- complexes: preparation, structure and bonding in Dinitrogen and Dioxygen complexes.

Unit-III: Structure and Bonding: Bent's rule, Non-valence cohesive forces, Molecular Orbital theory, 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-IV: 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. 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 Δo.

Unit-V: Metal – ligand Equilibria in solutions: Step wise and over all formation constants. Trends in stepwise constants (statistical effect and statistical ratio). Determination of formation constants by Spectrophotometric method (Job's method) and pH metric method (Bjerrum's). Stability correlations - Irwing -William's series. Hard and soft acids and bases (HSAB).

Text books/ Reference books:

1. Inorganic Chemistry Huheey, Harper and Row.
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, McGrawHill.
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. Introductory quantum Mechanics, A. K. Chandra.
8. Quantum Chemistry, R. K. Prasad.
9. Inorganic Chemistry, Atkins, ELBS.
10. Advanced Inorganic Chemistry, Cotton and Wilkinson, Wiley Eastern.
11. Text book of Coordination chemistry, K. SomaSekhara Rao and K.N.K. Vani, Kalyani Publishers.

Model Question Paper

Class: I MSc Analytical Chemistry **Semester: I**
Paper: Inorganic Chemistry-I **Code: R20ACH103**

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

OR

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

UNIT-IV

7. 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

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

UNIT-V

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

OR

10. a) Explain Hard and Soft Acid base theory. (8M)
   b) Explain Irving William series. (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	I	PHYSICAL CHEMISTRY-I	R20ACH104	2020-21

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):
The main objective of this paper is to give a basic and updated knowledge for students on Thermodynamics, Surface phenomena and phase equilibria, Electrochemistry, Chemical kinetics and Microwave Spectroscopy and Rotational Vibrational Spectroscopy.

Course Learning Outcome(S): After studying this paper, students will acquire the knowledge of Thermodynamics, Surface phenomena and phase equilibria, Electrochemistry, Chemical kinetics and Microwave Spectroscopy and Rotational Vibrational Spectroscopy.

Unit-I: Thermodynamics–I: 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-II: 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-III: 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.

Unit-IV: 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 – consecutive reactions – parallel reactions – opposing reactions (unimolecular steps only, no derivation) . Chain reactions - Rate laws of photochemical reaction of $H_2 – Cl_2$ and thermal decomposition of acetaldehyde.

Unit-V: Microwave Spectroscopy and Rotational Vibrational Spectroscopy:
Microwave 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.

Text books / Reference books:

1. Physical Chemistry P.W. Atkins, ELBS.
2. Chemical Kinetics - K.J. Laidler, McGraw Hill Pub.
3. Text Book of Physical Chemistry. Samuel Glasstone, Mcmillan Pub.
4. Physical Chemistry, G.W. Castellan. Narosa Publishing House
5. Thermodynamic for Chemists. Samuel Glasstone.
6. Electrochemistry, Samuel Glasstone, Affiliated East West
7. Physical Chemistry, W.J. Moore, Prentice Hall
8. Atomic structure and chemical bond. Manaschanda. Tata McGraw Hill Company Limited.
9. Fundamentals of Molecular spectroscopy: by C.N. Banwell
10. Molecular spectroscopy by B.K. Sharma
11. Vibrational Spectroscopy by D.N. Satyanarayana New Age Int. Pub.
12. Spectroscopy by Aruldas.

Model Question Paper

Class: I MSc Analytical Chemistry **Semester: I**
Paper: Physical Chemistry-I **Code: R20ACH104**
Time: 3Hrs **Max. Marks: 70 M**

UNIT-I

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

OR

2. a) Derive the Gibs Duhem Equation? (8M)
   b) Discuss First and Second law thermodynamics. (6M)

UNIT-II

3. Derive BET equation. (14M)

OR

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

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UNIT-III

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

OR

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

UNIT-IV

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

OR

8. Explain primary and secondary salt effects. (14M)

UNIT-V

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

OR

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

PG Department of Chemistry (Analytical Chemistry)

Semester-I

Paper Code & Title: R20ACH 105

ORGANIC CHEMISTRY PRACTICAL-I

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

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

List of experiments:

1. Separation of Binary mixtures of Carboxylic acid + Neutral organic compounds (Solvent extraction method).
2. Separation of Binary mixtures of Basic nature + Neutral organic compounds (Solvent extraction method).
3. Separation of Binary mixtures of Phenolic compounds + Neutral organic compounds (Solvent extraction method).
4. Preparation of Phthalimide from Phthalic anhydride – High Temperature.
5. Preparation of p-nitro acetanilide – Low temperature.
6. Preparation of Iodoform – Room temperature.
7. Column chromatography - separate the given mixture of o-and p-nitro aniline.
8. Paper chromatography - separate the given mixture of sugars or amino acids.
9. Thin layer chromatography - separate the given mixture of phenols or 2,4-DNP derivatives of carbonyls compounds.
10. Preparation of Sodium wire - to make Sodium Wire for solvent drying.
11. Preparation of Sodium Granules.
12. Preparation of Sodium t-butoxide.
13. Preparation of Grignard Reagent and its usage one reaction.
14. Preparation of Wittig reagent.
15. Preparation of Butyl Lithium.

Course Objective(S):

The main objective of this paper is to give a basic and updated knowledge for students on synthesis of organic compounds. Separation of binary mixture of organic compounds and chromatography techniques.

Course Learning Outcome(S):

After studying this paper, students will acquire the practical knowledge on organic chemistry practical.

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, Theophil Eicher, University Science Book.

PG Department of Chemistry (Analytical Chemistry)

Paper Code & Title: R20 ACH 106

INORGANIC CHEMISTRY PRACTICAL

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

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

List of experiments:

1. Preparation of Potassium trisoxalato ferrate (III).
2. Preparation of Tris thiourea copper (1) sulphate.
3. Preparation of Cis and trans potassium diaquodioxalato chromium (III).
4. Preparation of Hexa ammine cobalt (III) chloride.
5. Determination of Zn^{2+} with potassium Ferro cyanide.
6. Determination of Mg^{2+} using EDTA.
7. Determination of Ni^{2+}using EDTA.
8. Determination of hardness of water using EDTA.
9. Gravimetric determination of nickel using dimethyl glyoxime.
10. Gravimetric determination of Copper using ammonium thio cyanate.
11. Gravimetric determination of Zn using diammonium hydrogen phosphate.
12. Semi micro qualitative analysis of six radical mixtures

(One interfering anion and one less familiar cation for each mixture)
(minimum three mixtures).

Anions: S^{2-} , SO^{2-} ,Cl^-, Br^-, I^-, NO_3^- , SO_4^{2-}, CH_3COO^-,$C_2O_4^{-2}$, $C_4H_4O_6^{-2}$, PO_4^{3-}, CrO_4^{2-}, BO_3^{3-}.

Cations: Ammonium (NH_4^+)

1st group: Hg^+, Ag^+, Pb^{+2}, Tl^+, W^{+6}.

2nd group: Hg^{+2}, Pb^{+2}, Bi^{+3}, Cu^{+2}, Cd^{+2}, Sn^{+2}, Sn^{+4} , Mo^{+6}.

3rd group: Fe^{+2}, Fe^{+3}, Al^{+3}, Cr^{+3}, Ce^{+4}, Th^{+4}, Ti^{+4}, Zr^{+4}, VO^{+2}, UO_2^{+2}, Be^{+2}.

4th group: Zn^{+2}, Mn^{+2}, Co^{+2}, Ni^{+2}.

5th group: Ca^{+2}, Ba^{+2}, Sr^{+2}.

6th group: Mg^{+2}, K^+, Li^+.

Course Learning Objective(S):

The main objective of this paper is to give a practical knowledge for students on Inorganic experiments.

Course Learning Outcome(S):

After studying this paper, students will acquire the practical knowledge of Inorganic experiments.

Text books/ Reference books:

1. Vogels Text Book of Quantitative analysis, revised. J. Bassett, R.C. Denny, G.H. Jeffery and J. Mendhan, ELBS.
2. Synthesis and Characterization of Inorganic Compounds, W.L. Jolly. Prentice Hall.
3. Practical Inorganic Chemistry by G. Pass and H. Sutcliffe Chapman and Hall.
4. 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
I M.Sc	II	ORGANIC SPECTROSCOPY	R20ACH201	2020-21

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):

The main objective of this paper is to give a basic and updated knowledge for the students on UV-Visible spectroscopy, Infrared spectroscopy, ^{1}HNMR Spectroscopy and Mass spectrometry.

Course Learning Outcome(S):

After studying this paper, students will acquire the knowledge of UV-Visible spectroscopy, Infrared spectroscopy,^{1}H-NMR Spectroscopy, ^{13}C- NMR Spectroscopy, and Mass spectrometry.

Unit-I: UV Visible Spectroscopy: Beer-Lambert's law-Energy transitions-Simple chromophores, Auxochrome, Absorption shifts (Bathochromic, Hypsochromic, Hyper chromic and Hypo chromic shifts) UV absorption of Alkenes - UV absorption of carbonyl compounds: α, β-unsaturated carbonyl systems-UV absorption of aromatic systems-solvent effects- geometrical isomerism-acid and base effects-typical examples-calculation of λmax values using Woodward-Fieser rules.

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 –CH, -OH, - NH, - CC, - CO and aromatic systems- Examples-simple problems.

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 values.

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, solvent effects, Nuclear Overhauser Effect (NOE).

Unit-V: Mass spectrometry: Introduction, Ion production-E1, CI, determination of Molecular weight and formulae - Factors affecting fragmentation. Mass spectral fragmentation of organic compounds, Common functional groups, molecular ion peak, meta stable peak, Mc Lafferty rearrangement, Nitrogen rule. Examples of mass spectral fragmentation of organic compounds.

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, 6^{th} Ed. John Wiley and Sons.
3. Spectroscopic methods in organic chemistry - D. H. Williams and I. Flemming Mc.Graw 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.

Model Question Paper

Class: I MSc Analytical Chemistry **Semester: II**
Paper: Organic Spectroscopy **Code: R20ACH201**
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

   a) Expalin 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	ORGANIC CHEMISTRY-II	R20ACH202	2020-21

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):

The main objective of this paper is to give a basic and updated knowledge for the students on Named reactions, Stereo Chemistry, Green chemistry & Phase transfer catalysis and Chemistry of Nanomaterials.

Course Learning Outcome(S):

After studying this paper, students will acquire the knowledge of Named reactions, Stereo Chemistry, Green chemistry & Phase transfer catalysis and Chemistry of Nanomaterials.

Unit-I: Named reactions: Definition, mechanism and synthetic applications of Dieckmann condensation, Stobbe condensation, Mannich reaction, Vilsmeier- Haack reaction, Shapiro reaction, McMurray reaction, Oppenaur oxidation reaction, Clemmensen reduction reaction, Wolff-Kishner reduction reaction, Meerwein– Ponndorf–Veriey reduction reaction, Birch reduction reaction, and Simmon-Smith reaction.

Unit-II: Stereo Chemistry-I: Concept and Recognition of Molecular Symmetry and 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. Geometrical Isomerism. Cis-trans, E, Z- and Syn and anti-nomenclature, Methods of determining configuration of Geometrical isomers using physical, spectral and chemical methods, Stability.

Unit-III: Stereo Chemistry-II: Definition of Conformation and factors influencing on stability of Conformations- Conformational analysis and energy profile diagram of acyclic molecules-ethane, n-butane. Conformational analysis of cyclic molecules - cyclobutane, cyclopentane, cyclohexane - mono and di substituted cyclohaxanes and carbon hetero atom bonds having C–O & C–N.

Unit-IV: Green chemistry : Introduction to Green chemistry, Principles and concepts of Green chemistry, Green Catalysis, Biocatalysis, Green Reagents, examples of green reactions-synthesis of Ibuprofen, Clean Fischer-Indole synthesis comparison of the above with conventional methods. Introduction to Microwave organic synthesis- introduction, advantages and disadvantages, solvents (water and organic solvents), solvent free reactions.

Unit-V: Chemistry of Nanomaterials: Introduction, carbon nanotubes: structure of single and multi-walled carbon nanotubes, synthesis-solid and gaseous carbon source-based production techniques, synthesis with controlled orientation. Growth mechanism of carbon nano tubes-catalyst free growth, catalyst activated growth, properties-general, adsorption, electronic, optical and Mechanical. Applications.

Text books:

1. Advanced organic chemistry –Reaction, mechanism and structure, Jerry March, John Wiley.
2. A guide book to Mechanism in organic chemistry, Peter Sykes, Longman.
3. Organic chemistry, I.L. Finar, Vol. I & II, Fifth ed. ELBS, 1975.
4. Stereo Chemistry of carbon compounds – E.L. Eliel.
5. Nano, The Essentials: T. Pradeep, The Mc. Graw Hill & Co.
6. Principles of organic synthesis, R.O.C. Norman and J.M. Coxon, Blakie Academic & Professional.
7. Reaction Mechanism in organic chemistry, S.M. Mukherji and S.P. Singh, Macmillan.
8. Green chemistry Theory and Practice by Paul T. Anastas and John C. Warner, Oxford University press.
9. Methods and reagents for Green chemistry, PietroTundo, Alvise Perosa, Fulvio Zecchini, John Willey& sons Inc.

Model Question Paper

Class: I MSc Analyitcal Chemistry **Semester: II**
Paper: Organic Chemistry-II **Code: R20ACH202**
Time: 3Hrs **Max. Marks: 70 M**

UNIT-I

1. a) Wrtie the mechanism of Vilsmeier- Haack reaction and McMurray reactions.(8M)
   b) Write the mechanism and applications of Dieckmann condensation. (6M)

OR

2. Explain the following reactions with mechanism. (14M)
   a) Oppenaur Oxidation b) Birch reduction c) Heck reaction

UNIT-II

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

OR

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

UNIT-III

5. a) Explain the factors influencing on the stability of conformation. (8M)
   b) Explain the conformational analysis of n-butane. (6M)

OR

6. Explain the conformational analysis of mono and di substituted cyclohexanes. (14M)

UNIT-IV

7. a) Write 12 principles of green chemistry. (8M)
   b) Write a note on green reagents. (6M)

OR

8. a) Compare green synthesis of ibuprofen with conventional method. (8M)
   b) Write a note on Microwave assisted organic synthesis. (6M)

UNIT-V

9. a) Write a note on structure of single and Multi walled carbon nanotubes. (8M)
   b) Write a brief note on catalyst activated growth with suitable examples. (6M)

OR

10. a) Discuss the properties of carbon nanotubes? (8M)
    b) Discuss the synthesis with controlled orientation? (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	R20ACH203	2020-21

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):

The main objective of this paper is to give a basic and updated knowledge for the students on Non-metal cages and metal clusters, Organometallic chemistry of transition metals, Reaction mechanism of transition metal complexes, Term symbols and Electronic spectra and Bio-inorganic chemistry and Magnetic properties of complexes.

Course Learning Outcome(S):

After studying this paper, students will acquire the knowledge of

Non-metal cages and metal clusters, Organ metallic chemistry of transition metals, Reaction mechanism of transition metal complexes, Term symbols and Electronic spectra and Bio-inorganic chemistry and Magnetic properties of complexes.

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	PHYSICAL CHEMISTRY-II	R20ACH204	2020-21

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):

The main objective of this paper is to give a basic and updated knowledge for the students on Third law of Thermodynamics and Statistical thermodynamics, Polymer chemistry and Raman Spectroscopy, Electro Chemistry, Chemical kinetics and Photo chemistry, Symmetry and Group theory in chemistry.

Course Learning Outcome(S):

After studying this paper, students will acquire the knowledge of Third law of Thermodynamics and Statistical thermodynamics, Polymer chemistry and Raman Spectroscopy, Electro Chemistry, Chemical kinetics and Photo chemistry, Symmetry and Group theory in chemistry.

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: Polymer chemistry and Raman Spectroscopy: Classification of polymers - Zeigler - Natta Polymerization - kinetics of free radical polymerization - Glass transition temperature - Factors influencing the glass transition temperature. Number average and Weight average molecular weights- Classical and quantum theories of Raman effects, pure rotational, vibrational and Vibrational- rotational Raman spectra, selection rules, mutual exclusion principle.

Unit-III: 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.

Unit-IV: Chemical kinetics and Photo chemistry: 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-V: 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.

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, McGraw 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 K K. 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.
18. Spectroscopy by Aruldas.

Model Question Paper

Class: I MSc Analytical Chemistry **Semester: II**
Paper: Physical Chemistry-II **Code: R20ACH204**

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 a note on Zeigler Natta Polymerisation. (8M)
b) Write a note on number average and weight average molecular weights. (6M)

OR

4. a) Explain the classical theory of Raman effect. (8M)
b) Write a note on Mutual Exclusion principle. (6M)

UNIT-III

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

OR

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

UNIT-IV

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

OR

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

UNIT-V

9. 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 C_{2V} point group. (6M)

OR

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

PG Department of Chemistry (Analytical Chemistry)

Semester-II

Paper Code & Title: R20 ACH 205 : ORGANIC CHEMISTRY PRACTICAL-II

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 practical knowledge for the students on Organic chemistry practical.

List of experiments:

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

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

3. Systematic qualitative analysis of organic compounds with different functional groups (5 different compounds)

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

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. Practical Organic Chemistry, F.G.Mann and B.C.Saunders, 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.

PG Department of Chemistry (Analytical Chemistry)
Semester-II
Paper Code & Title: R20ACH 206
PHYSICAL CHEMISTRY PRACTICAL

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

List of experiments:

1. Relative strengths of acids by studying the hydrolysis of ethyl acetate / methyl acetate.
2. Determination of equilibrium constant of $KI_3 \longrightarrow KI + I_2$ by partition coefficient.
3. Determination of unknown concentration of potassium iodide by partition coefficient method.
4. Distribution coefficient of Benzoic acid between Benzene and water.
5. Determination of critical solution temperature of phenol-water system.
6. Study of the effect of electrolyte on the miscibility of phenol-water system.
7. Determination of Coordination number of cuprammoniumcation.
8. Potentiometric determination of Fe(II) with Cr (VI).
9. Potentiometric determination of Fe(II) with Ce (IV).
10. pH-metric determination of strong acid with strong base.
11. Conductometric titration of strong acid with strong base.
12. Conductometric titration of strong acid + Weak acid with strong base.
13. Dissociation constant of weak acid (CH_3COOH) by conductometric method.
14. Determination of cell constant.
15. Verification of Beers Law using potassium permanganate/Potassium dichromate.

Course Learning Outcome(S): After studying this paper, students will acquire the knowledge of Inorganic and Physical chemistry experiments.

Course Learning Objective(S): The main objective of this paper is to give a practical knowledge for the students on Inorganic and Physical chemistry experiments.

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.
3. 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
I M.Sc	II	CHEMISTRY IN DAILY LIFE (OPEN ELECTIVE-I)	R20ACH207	2020-21

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):
The main objective of this paper is to give a basic and updated knowledge for the students on Chemistry Laboratory safety symbols – Meaning, Environmental Chemistry, Bioinorganic Chemistry, Biological functions of Hormones and Medicinal Chemistry.

Course Learning Outcome(S): After studying this paper, students will acquire the knowledge of Chemistry Laboratory safety symbols – Meaning, Environmental Chemistry, Bioinorganic Chemistry, Biological functions of Hormones and Medicinal Chemistry

Unit-I: Chemistry Laboratory safety symbols – Meaning: Corrosive, carcinogenic, Harmful, toxic, dangerous to environment, Explosive, flammable, Narcotic, Oxidizing, Lachrymatory, Radioactive, irritant, gases under pressure, general laboratory safety precautions.

Unit-II: Environmental Chemistry: Ambient air quality standards, Acid rain, Smog, Greenhouse effect, Bhopal gas tragedy, Vishakhapatnam polymer industry tragedy, Renewable and Non- renewable energy resources, Methods to convert temporary hard water into soft water, DO, COD, BOD, Toxicity of lead, mercury, arsenic and Cadmium.

Unit-III: Bioinorganic Chemistry: Essential elements, biological significance of Na, K, Mg, Ca, Fe, Co, Ni, Cu, Zn and Cl. Metalloporphyrin –functions of hemoglobin, Myoglobin and Chlorophyll.

Unit-IV: Biological functions of Hormones: Introduction, mechanism of action of Adrenaline, melatonin, noradrenaline, dopamine, prostacyclin, adreno carticotropic hormone, antidiuretic hormone, Insulin.

Unit-V: Medicinal Chemistry: Disease -medicinal molecule-mode of action on the following diseases Malaria-Artesunate, Dengue-Acetaminophen, Asthma-Albuterol, Diabetes(type-II) (iiddm) – metformin, Diabetes(type-I)(iddm) – Insulin, Arthritis-methotrexate, Glaucoma- brimonidine, Chickenpox-acyclovir, Anxiety – citalopram, Thyroid- Levithyroxine(lt4), Insomnia- estazolam, peptic ulcer, GERD(acid reflux) – Omeprazole, pantoprazole.

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Text books/ Reference books:

1. Laboratory safety for Chemistry Students by Robert H. Hill and David Finster
2. A Text book of Environmental chemistry by W. Moore and F.A. Moore
3. Environmental Chemistry by Samir K. Banerji
4. Organic Chemistry by G. Mare Loudan, Purdue University
5. Unified Chemistry by O.P. Agarwal, Paper-III, JPNP Publications.
6. Hormones and Endocrine system – Kleine, Rossemanith.
7. Principles of Biochemistry-Leninger.
8. Essentials of Medical pharmacology- K. D. Tripathi.

PG Department of Chemistry (Analytical Chemistry)
Model Question Paper

Semester: II

Paper: Chemistry in Daily Life **Code: R20ACH207**

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

UNIT-I

1. Define the following terms
   a) Corrosive, b) carcinogenic c) toxic d) Narcotic e) Lachrymatory (14M)

OR

2. Write the general laboratory safety precautions. (14M)

UNIT-II

3. a) Write a note on Acid Rains. (7M)
   b) Write a note on Green house effect. (7M)

OR

4. a) Explain the methods to convert temporary hard water into soft water. (7M)
   b) Write the toxicity of lead and mercury. (7M)

UNIT-III

5. Write the biological significance of Na, K and Fe. (14M)

OR

6. Write the functions of hemoglobin and Chlorophyll (14M)

UNIT-IV

7. Write the mechanism of action of Adrenaline, melatonin. (14M)

OR

8. Write the mechanism of action of Dopamine and Insulin. (14M)

UNIT-V

9. Explain the mode of action of Acetaminophen on Dengue and Albuterol on Asthma. (14M)

OR

10. Explain the mode of action of citalopram on Anxiety and Levithyroxine(lt4) on thyroid. (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	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
	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

- various types of Chromatographic techniques
- sampling of solids, liquids and gases
- solvent extraction techniques.

Course Learning Outcome(S): After studying this paper, students will acquire knowledge on

- various chromatographic methods,
- sampling of solids, liquids and gases
- Principle and applications of 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.

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,

sample size, sampling unit. Sampling of solids, Reduction of gross sample, Cone and Quartering method, Long pile and alternative shovel method.

Sampling of different types of liquids: different sampling techniques.

Sampling of gases: Different types of gas samplers.

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.

M.Sc Chemistry (Analytical Chemistry)
Paper-I
SEPARATION METHODS
Paper Code: R20ACH301
Model paper

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

Answer all questions.

UNIT-1

1) a) write a note on importance of qualitative and quantitative analysis in research and development. **14 M**

(or)

b) Describe the terms retardation factor, Efficiency of column, High Equivalent Theoretical Plate (HETP).

.

UNIT-II

2) a) Write the principle and theory of ion exchange chromatography. **14 M**

(or)

b) Summarize the applications of ion chromatography in the analysis of water and air pollutants.

UNIT-III

3) a) Write the principle, instrumentation and applications of gel exclusion chromatography. **14 M**

(or)

b) Write the principle, instrumentation and applications of Capillary electrophoresis.

UNIT-IV

4) a) Write a note on sampling of solids and liquids. **14 M**

(or)

b) Write a note on Cone and Quartering method, Long pile and alternative shovel methods.

UNIT-V

5) a) Write a note on continuous and batch extraction. **14 M**

(or)

b) Write a note on applications of solvent extraction in metallurgy.

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
	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 structural Elucidation of Organic compounds Using UV, IR, ^{1}H-NMR,^{13}C-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

Photoelectron spectroscopy: x-ray and Auger photoelectron spectroscopy, electron energy loss spectroscopy, ESCA.

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.

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 302**

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. Describe 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. Describe the applications of GC-MS in drugs analysis, environmental analysis. (14M)

(OR)

7. Write the theory and instrumentation of LCMS. (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) Summarize the applications of ESR to organic radical? (6M)

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	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, different raw materials, soil, fertilizers, fuels and finished products.

Course Learning Outcome(S): After studying this paper, students will be able to

- analyse of samples of ore, raw materials, soil, fertilizers, fuels and finished products.

UNIT-I

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 - Chromium, SiO_2, FeO, AI_2O_3, CaO, & MgO.

Aluminium ore (Bauxite): Analysis of the constituents - Silica, Alumina, Fe_2O_3, Titania.

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.

Analysis of ferro alloys:

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, Fertilizers and Fuels

Analysis of soils: sampling, determination of moisture, total N, P, Si, lime, humus nitrogen, 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, K_2O, Na_2O, free CaO in Cement.

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.

M.Sc Chemistry (Analytical Chemistry)
Paper-III
APPLIED ANALYSIS
Paper Code: R20ACH303
Model paper

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

Answer all questions.

UNIT-1

1) a) Write a note on determination of total iron, ferrous and ferric iron present in iron ore. **14 M**

(or)

b) Write a note on the analysis of allumina, silica and titania in bauxite ore.

UNIT-II

2) a) Write the analysis of Cu and Zn in brass. **14 M**

(or)

b) Write the analysis of lead and iron in ferromanganous ore.

UNIT-III

3) a) Describe briefly about the sampling of soil. **14 M**

(or)

b) Write a note on proximate and ultimate analysis.

UNIT-IV

4) a) Write a note on saponification value of oils and and total alkali matter present in soaps . **14 M**

(or)

b) Write a note on analysis of alumina, lime and silica present in cement.

UNIT-V

5) a) Write the analysis of total lead and lead chromate present in paints. **14 M**

(or)

b) Explain the determination of moisture content in drugs and other samples by using Karl-Fisher reagent.

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
	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

- Spectro-analytical methods of analysis like flame photometry, AAS, ICP-AES, ICP-MS, thermogravimetry
- Electroanalytical methods like polorography, anode striping voltametry, electrogravimetry, coulometry and amperometry 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.
- Electroanalytical methods like plorography, anode striping voltametry, electrogravimetry, coulometry and amperometry.

UNIT-I

Spectro-analytical methods

Flame photometry: Theory, instrumentation, combustion flames, detectors, and applications of flame photometry.

Atomic Absorption Spectrometer: Theory, instrumentation, flame and non-flame techniques, hollow cathode lamp, chemical and spectral interferences, applications of AAS.

UNIT-II

Thermal methods

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, and applications of DTA, difference between TG and DTA.

Differential scanning calorimetry: Principle, instrumentation, and its applications.

UNIT-III

Electro analytical Methods-1

Polarography and Amperometry: Principle of polarography – instrumentation - dropping mercury electrode (DME) - Factors effecting limiting current- residual current, migration current, diffusion current, half-wave potential - Ikovic equation - advantages and disadvantages of DME - Evaluation methods in polarography – Advantages of polarography - Amperometric titrations – applications, advantages and disadvantages of Amperometric titrations.

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.

UNIT-V

Electro analytical methods -3

Coulometric analysis: Principles – working – instrumentation of coulometry - analysis with constant current coulometry - Controlled potential coulometry - applications of coulometric methods for the analysis of cations – Neutralisation Reactions – Precipitation and complexometric titrations – Redox titrations.

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)
Paper-IV
INSTRUMENTAL METHODS OF ANALYSIS
Paper Code: R20ACH304
Model paper

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

Answer all questions.

UNIT-1

1) a) Write a note on Theory and instrumentation of flame photometry. **14 M**

(or)

b) Describe the applications of flame photometry and AAS.

UNIT-II

2) a) Explain theory and instrumentation of thermal gravimetry. **14 M**

(or)

b) Explain theory and instrumentation of DTA.

UNIT-III

3) a) Write a note on half wave potential and Ilkovic equation. **14 M**

(or)

b) Write a note on amperometric titrations.

UNIT-IV

4) a) Write a note on decomposition potential and over voltage. **14 M**

(or)

b) Write the theory and instrumentation of electrogravimetric analysis.

UNIT-V

5) a) Write a note on coulometric analysis. **14 M**

(or)

b) Illustrate the applications of coulometric titrations.

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 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.
16. A case study on analysis of any one raw material or finished product.

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 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
	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 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
	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 Recrystallization, Distillation, Solvent extraction, Adsorption and Partition Chromatography, Gas Chromatography, High-Performance Liquid Chromatography, 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. 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	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
	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 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. Describe the Classification of polymers. (14M)

OR

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

UNIT-II

3. Write briefly on 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. Describe briefly about 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.

- The student is expected to enroll and complete any one chemistry related course which is not included in the course structure (4 credits equivalent) from MOOCS platforms like NPTEL and SWAYAM .
- The student is expected to submit the above course pass certificate. Otherwise, the department of chemistry will conduct the evaluation (as per the prescribed format in the academic regulations) to issue the pass certificate.
- The selection of the course by the student happens under the supervision of mentor.

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, electron microscopy 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 – comparison of Colorimetry with Tubidimetry, comparision of Fluorimetry with Nephelometry -Applications.

UNIT-II

Spectrofluorimetry:

Theory of fluorescence, phosphorescence, factors affecting the fluorescence and phosphorescence, quenching, relation between intensity of fluorescence and concentration, instrumentation, application with reference to thiamine (B1) and riboflavin(B2) in drug samples.

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

GC-MS and LC-MS techniques

GC-MS: Introduction, Instrumentation - GC - MS interface - Mass spectrometer (MS), ion chromatogram, application of GC-MS for trace constituents, drugs analysis, environmental analysis and others.

LC-MS: Introduction, Instrumentation, liquid chromatography-Mass spectrometer, ion chromatograms, Application of LC-MS for drug analysis, environmental samples and others.

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.

Model Question Paper

Class: II M.Sc Analytical Chemistry **Code: R20 ACH 402.1**

Paper: CHEMICAL AND SPECTRAL METHODS OF ANALYSIS (ELECTIVE-I)

Semester: IV

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

UNIT-I

1. Write a note on theory and instrumentation of Nephelometry. (14M)

OR

2. Write a note on turbidimetric titrations. (14M)

UNIT-II

3. Derive the relation between intensity of fluorescence and concentration. (14M)

OR

4. Explain the applications of spectrofluorimetry with reference to vitamin B_1 and Vitamin B_2. (14M)

UNIT-III

5. Write a note on isotopic dilution analysis and carbon dating. (14M)

OR

6. Write a note on slow reactions and catalysed reactions. (14M)

UNIT-IV

7. Write the theory and instrumentation of SEM. (14M)

OR

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

UNIT-V

9. Describe the theory and instrumentation of GC-MS. (14M)

OR

10. Summarise the application of LC-MS for drug and environmental samples. (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	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 significance of Green Chemistry, Principles of Green chemistry, Microwave assisted reactions, Solvent Free Reactions and Ionic liquids.

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

Principles of Green Chemistry: Introduction, Principles of green chemistry, Organic synthesis in Benign green solvents-Claisen Rearrangement, Wittig Horner reaction, Heck reaction, Aldol Condensation, Pinacol Coupling, Benzoin condensation, Wurtz reaction.

Unit-II

Green synthesis: Introduction, Green Synthesis of adipic acid, Ibuprofen, methyl methacrylate, Sebacic acid, Quinoxalines, 3-phenylcatechol and prednisolone.

Unit-III

Microwave assisted reactions: Introduction, microwave assisted reactions in water, microwave assisted reactions in organic solvents, **Phase Transfer Catalysis**- C-alkylation, N-alkylation, S-alkylation.

Unit-IV

Solid state reactions: Introduction, solid state reactions using solid support, Ultrasound assisted organic synthesis- Types of Sonochemical reactions, homogeneous, heterogeneous liquid-liquid,

and heterogeneous solid-liquid reactions.

Unit-V

Ionic liquids: Introduction- Types of Ionic Liquids, Properties, Synthesis of Ionic Liquids, Selection of ionic liquids- - Application in organic synthesis- alkylation, allylation, oxidation, hydrogenation, carbon-carbon bond forming reactions-Friedel Craft's reaction, Suzuki coupling reaction, Stille coupling reaction, Negishi cross coupling reaction.

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 briefly twelve principles of green chemistry. (14M)

OR

2. Describe the following reactions in green solvents.
i) Aldol Condensation ii) Pinacol Coupling (14M)

UNIT-II

3. Elaborate the following Green Synthesis
i) Ibuprofen ii) methyl methacrylate (14M)

OR

4. Write briefly about the green synthesis of 3-phenylcatechol and prednisolone. (14M)

UNIT-III

5. Explain microwave assisted reactions in organic solvents. (14M)

OR

6. What are phase transfer catalysts and describe about C-alkylation and N-alkylation using phase transfer catalyst. (14M)

UNIT-IV

7. Write briefly about solid state reactions using solid support. (14M)

OR

8. Write different types of Sonochemical reactions and describe briefly about homogeneous sonochemical reactions. (14M)

UNIT-V

9. Write a note on types of Ionic Liquids and Synthesis of Ionic Liquids. (14M)

OR

10. Illustrate the application of ionic liquids in the following carbon-carbon bond forming reactions.

i) Suzuki coupling reaction ii) Stille coupling reaction (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
	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 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 - HCI, 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 Olefinic.

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.

Model Question Paper

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

Paper: TRADITIONAL AND ENVIRONMENTAL METHODS OF ANALYSIS (ELECTIVE-II)

Semester: IV

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

UNIT-I

1. Write the principle of decomposition and dissolution techniques. (14M)

OR

2. Write a note on decomposition of samples by sintering with sodium peroxide, sodium carbonate. (14M)

UNIT-II

3. Describe the method for the quantitative determination of phenolic hydroxyl group. (14M)

OR

4. Explain the method for the quantitative determination of aldehydes and ketones.(14M)

UNIT-III

5. Describe the analysis of asprin. (14M)

OR

6. Summarise the analysis of Chloramphenicol. (14M)

UNIT-IV

7. Explain the analytical methods for the determination of fluoride and phosphate. (14M)

OR

8. Explain the determination of COD and BOD. (14M)

UNIT-V

9. Describe the analysis of CO and SO_2. . (14M)

OR

10. Explain the analysis of PAN and PBN. . (14M)

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 OCH 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 man made-nanoscience practiced during ancient and modern periods- contributors to the field of Nano chemistry.

Unit-II

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.

Unit-III

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

Unit-IV

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

Unit-V

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

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 Analytical 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
	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 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

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-III

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.

UNIT-IV

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-V

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.

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 Analytical chemistry **Code: R20 ACH 404**
Paper: QUALITY CONTROL AND STANDARD METHODS OF ANALYSIS
Semester: IV
Time: 3Hrs **Max. Marks: 70 M**

UNIT-I

1. Write a note on ISO 9000, ISO 14000 and its requirements. (14M)

OR

2. Write briefly about outline of ICH guidelines on drug substances and products (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)

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, CSIR Lab's, NIT's Central Universities etc.,