

Kadi Sarva Vishwavidhyalaya

M.Sc. Chemistry
Syllabus

Sem-I and Sem-II

w.e.f June 2013

(New Course)

KADI SARVA VISHWAVIDYALAYA-GANDHINAGAR

Teaching & Examination scheme

Effective from Academic Year **June2013** on wards

M.Sc. Chemistry

Semester -I

Course	Subject Title	Credit	Theory (hr/week)	Practical (Hrs/week)	External Marks	Internal Marks	Total Marks
CH101	Inorganic Chemistry-1	4	4	-	70	30	100
CH102	Organic Chemistry-1	4	4	-	70	30	100
CH103	Physical Chemistry-1	4	4	-	70	30	100
CH104	Analytical Chemistry-1	4	4	-	70	30	100
CH105	Practicals	8	-	16	200	-	200
Total	-	24	-	-	-	-	600

KADI SARVA VISHWAVIDYALAYA-GANDHINAGAR

Teaching & Examination scheme

Effective from Academic Year **June2013** on wards

M.Sc. Chemistry

Semester -II

Course	Subject Title	Credit	Theory (hr/week)	Practical (Hrs/week)	External Marks	Internal Marks	Total Marks
CH201	Inorganic Chemistry-2	4	4	-	70	30	100
CH202	Organic Chemistry-2	4	4	-	70	30	100
CH203	Physical Chemistry-2	4	4	-	70	30	100
CH204	Analytical Chemistry-2	4	4	-	70	30	100
CH205	Practicals	8	-	16	200	-	200
Total	-	24	-	-	-	-	600

KADI SARVA VISHWAVIDYALAYA-GANDHINAGAR

Teaching & Examination scheme

Effective from Academic Year **June2013** on wards

M.Sc. Organic Chemistry

Semester -III

Course	Subject Title	Credit	Theory (hr/week)	Practical (Hrs/week)	External Marks	Internal Marks	Total Marks
CH-OC 301	Organic Chemistry-3	4	4	-	70	30	100
CH-OC 302	Organic Chemistry-4	4	4	-	70	30	100
CH-OC 303	Organic Chemistry-5	4	4	-	70	30	100
CH-OC 304	Organic Chemistry-6	4	4	-	70	30	100
CH-OC 305	Practical	8	-	16	200	-	200
Total	-	24	-	-	-	-	600

KADI SARVA VISHWAVIDYALAYA-GANDHINAGAR

Teaching & Examination scheme

Effective from Academic Year **June2013** on wards

M.Sc. Analytical Chemistry

Semester -III

Course	Subject Title	Credit	Theory (hr/week)	Practical (Hrs/week)	External Marks	Internal Marks	Total Marks
CH-AC 301	Analytical Chemistry-3	4	4	-	70	30	100
CH-AC 302	Analytical Chemistry-4	4	4	-	70	30	100
CH-AC 303	Analytical Chemistry-5	4	4	-	70	30	100
CH-AC 304	Analytical Chemistry-6	4	4	-	70	30	100
CH-AC 305	Practical	8	-	16	200	-	200
Total	-	24	-	-	-	-	600

KADI SARVA VISHWAVIDYALAYA-GANDHINAGAR

Teaching & Examination scheme

Effective from Academic Year **June2013** on wards

M.Sc. Organic Chemistry

Semester -IV

Course	Subject Title	Credit	Theory (hr/week)	Practical (Hrs/week)	External Marks	Internal Marks	Total Marks
CH-OC 401	Organic Chemistry-7	4	4	-	70	30	100
CH-OC 402	Organic Chemistry-8	4	4	-	70	30	100
CH-OC 403	Organic Chemistry-9	4	4	-	70	30	100
CH-OC 404	Research Methodology	4	4	-	70	30	100
CH-OC 405	Practical	8	-	16	200	-	200
OR							
CH-OC 405	Dissertation	8	-	16	200	-	200
Total	-	24	-	-	-	-	600

KADI SARVA VISHWAVIDYALAYA-GANDHINAGAR

Teaching & Examination scheme

Effective from Academic Year **June2013** on wards

M.Sc. Analytical Chemistry

Semester -IV

Course	Subject Title	Credit	Theory (hr/week)	Practical (Hrs/week)	External Marks	Internal Marks	Total Marks
CH-AC401	Analytical Chemistry-7	4	4	-	70	30	100
CH-AC402	Analytical Chemistry-8	4	4	-	70	30	100
CH-AC403	Analytical Chemistry-9	4	4	-	70	30	100
CH-AC 404	Research Methodology	4	4	-	70	30	100
CH-AC 405	Practical	8	-	16	200	-	200
OR							
CH-AC 405	Dissertation	8	-	16	200	-	200
Total	-	24	-	-	-	-	600

Semester-I

Paper-I Inorganic Chemistry-1(CH101)

Credit: 04

Rationale of the Paper: To provide the basic knowledge of very important concepts of the inorganic chemistry (group theory, organometallics, and reagents in inorganic chemistry and reaction mechanism of transition metal complexes). To provide overview of the applications of the seconcepts in applied field to the students is also an objective.

Learning outcome:

1. Students will be able to understand the geometry and structure of different molecules.
2. They can understand bonding nature of different compound.
3. How to make reagents and its properties also can understand reaction mechanisms.

Course	Subject Title	Credit	Theory (hr/week)	Practical (Hrs/week)	External Marks	Internal Marks	Total Marks
CH 101	Inorganic Chemistry-1	4	4	-	70	30	100

Unit	Topics of paper CH 101InorganicChemistry-1	Teaching Hours	Marks
	Section A		
1	Group Theory Representation of groups: Preparation of matrices and vectors, Matrix notations for geometrical transformations, Orthogonality theorem and its consequences, Reducible and irreducible representations and their relation, Preparation of character table for C _{2v} , D _{2h} , C _{3v} and D _{3h} point groups. Application of group theory for IR and RAMAN Spectroscopy –Transformation properties of atomic crystals, Hybridization scheme for σ and π - bonding, Spectroscopy	15	15

2	Bioinorganic Chemistry: Essential and trace elements in Biological processes, metal oporphyrins with special references to hemoglobin and myoglobin. Biological role of alkali and alkaline earth metal ones with special reference to Ca ²⁺ . Nitrogen fixation.	15	15
---	---	----	----

Section B			
3	<p>Organo metallic compounds Introduction and Nature of bonding in organo metallic compounds of transition metals: σ-bonded organo metallic compounds: Introduction, Classification and synthesis of σ-bonded organotransition metal compounds, general characteristics, chemical reactions, bonding and structure.</p> <p>π-bonded organometallic compounds: Introduction and Classification of π-bonded organometallic compounds (a) η^2-alkene complexes: Preparative methods, physical properties, chemical properties, bonding of structure.(b) η^3allyl (or enyl) complexes preparation, physical of chemical properties.</p>	15	15
4	<p>Stereochemistry and bonding in main group compound: VSEPR, Valas diagrams (tri and penta - atomic molecules), dpppp bonds, Bent rule and energetic of hybridization, some simple reactions of covalently bonded molecules</p>	15	15
	Objective question from above four units	----	10

Total Hrs of Lectures: 60

Methodology of Teaching

Classroom sessions

Explanation using multimedia projector

Surprisetest

Reference Books

1. Advanced Inorganic Chemistry, Cotton Wilkinson, WSE Wiley.
2. Inorganic Chemistry, J.E.Huhey, Harpes & Row.
3. Principle and Application of Organo transition Metal Chemistry, Collman & Hegsdus, University Science Books.
4. The Organometallic Chemistry of the Transition Metals, R.H.Crabtree, John Wiley.
5. Organometallic Chemistry, R.C.Mehrotra and A. Singh, New Age International.
6. Principle of Bioinorganic Chemistry, S.J.Lippard and J.M. Berg, University Science Books.
7. The Inorganic Chemistry of Biological Processes, M.N. Hughes, John Wiley & Sons.

8. Bioinorganic Chemistry, R.Chatwaland A.K.Bhagi, Himalaya Publishing House.
9. Textbook of Inorganic Chemistry Vol. I & II, A.Singh & R.Singh, Campus International Publication.
10. Vogel's Textbook of Quantitative Inorganic Analysis, ELBS.
11. Chemical Application of Group Theory, F.A.Cotton, WES Wiely.
12. Introduction to Ligand Field, B.N.Figgis, Inc. NewYork.
13. Coordination Compounds, S.F.A.Kettle, ELBS.
14. Introduction to Ligand Field Theory, Bell Hausen, McGraw Hill.
15. Group Theory and Its Application to Chemistry, K.V. Raman.
16. Symmetry and Spectroscopy of Molecules, K.Veera Reddy, New Age International Publishers.
17. Inorganic Reaction Mechanism, J.O. Edwards, Benjamin.
18. Mechanism of Inorganic Reactions, F.Basolo & R.G.Pearson, Wiley New York.
19. Coordination Chemistry, D Benerjia, Tata McGraw Hill.
20. Chemical Applications of group theory, Wiley stern Pvt. Ltd, New Delhi.
21. Shriver and Atkins Inorganic Chemistry, P. Atkins, T. Overton, J. Rourke, M. Weller & F. Armstrong, Oxford University Press (2006).
22. Group Theory and its Chemical Applications, P.K. Bhattacharya, Himalaya Publishing House.
23. Molecular Symmetry and Group Theory, Robert L. Carter.
24. Advanced inorganic chemistry by F.A. Cotton

Paper-II Organic Chemistry-1(CH 102)

Credit: 04

Rationale of the Paper: To provide the basic and advanced knowledge of very useful concepts of organic chemistry i.e. aromaticity, reactive intermediate, rearrangements and organic named reactions. To provide overview of the applications of these concepts in applied field to the students is also an objective.

Learning Outcomes:

1. Students can understand the atomic and molecular basis of organic chemistry.
2. They can know the impact of organic chemistry on the fields of medicine, pharmacy and its impact on the global economy.
3. They can understand the fundamental principles of molecular structure and shape as they relate to organic molecules and their properties.
4. They can identify organic molecules by functional group: alkane, alkene, alkyne, haloalkane, alcohol, thiol, ether, sulfide, amine, aldehyde, ketone, carboxylic acid and carboxylic acid derivatives.
5. How to do organic nomenclature and its symbol list and can learn also the fundamental principles of functional group conversion and organic synthesis.

Course	Subject Title	Credit	Theory (hr/week)	Practical (Hrs/week)	External Marks	Internal Marks	Total Marks
CH 102	Organic Chemistry-1	4	4	-	70	30	100

Unit	Topics of paper CH 102 Organic Chemistry-1	Teaching Hours	Marks
	Section A		
1	<p>Aromaticity Aromaticity and aromatic character, Frost circle diagram for cyclo-butadiene, benzene and others. Concepts of aromaticity resonance and chemical stabilization—aromatic character based on NMR- criteria to check aromaticity character.</p> <p>Crown ether complexes and cryptands, inclusion compounds, cyclodextrins, catenanes and rotaxanes. Huckel rule, energy level of π molecular orbitals, Huckel molecular orbitals (HMO) method, orbital symmetry, M.O. of simple organic systems such as ethene, allyl and butadiene.</p> <p>Aromaticity in benzenoid and non-benzenoid compounds and charged rings, annulenes,</p>	15	15
2	<p>Reactive Intermediate Carbocations (classical and non-classical): stability, structure, generation and fate.</p> <p>Carbanions: stability, structure, generation and fate.</p> <p>Carbenes: stability and structure, the generation and fate</p> <p>Free radicals: stability, structure, generation and fate, NBS</p> <p>Bezynes: stability, structure, generation and fate.</p> <p>Nitrene: stability, structure, generation, reactions.</p>	15	15
	Section B		
3	<p>Molecular rearrangements General mechanistic considerations, nature of migration, migrator aptitude, and memory effects in respect of following.</p> <p>Carbon to Carbon migration of R, H and Ar: Pinacol-Pinacolone rearrangement, Favorskii rearrangement</p> <p>Carbon to Nitrogen migrations: Curtius rearrangement, Schmidt rearrangement</p> <p>Carbon to oxygen migration of and Ar: Baeyer-Villiger rearrangement, Rearrangement of hydro peroxide</p>	15	15
4	<p>Organic Named Reactions Robinson Annulation reaction, Stork-Enamine reaction, Gilman reaction, Umpolung of reactivity, Diels-Alder reaction, Wittig reaction, Hydroboration, Ene reaction, Shapiro reaction, Peterson olefin synthesis, Organolithiation reaction, Thallation reaction, Wilkinson catalyst.</p>	15	15
	Objective question from above four units	----	10

Total Hrs of Lectures: 60

Methodology of Teaching

Classroom sessions

Explanation using multimedia projector

Surprise test

Reference Books

1. F.A.Carey and R.J.Sundberg : Advanced Organic Chemistry Part B, Plenum Press.
2. March Jerry: Advanced Organic Chemistry, 4thEd, Wiley Eastern Ltd. New Delhi (1985).
3. Morrison R T and Boyd RN: Organic Chemistry, Prentice Hall of India Pvt Ltd., 6thEd (2003).
4. R.O.C.Norman and J.M.Coxon: Principles in Organic Synthesis, Blackie Academic & Professional.
5. Carruthers: Some Modern Methods of Organic Synthesis, Cambridge Univ. Press.
6. Mc Marry: Organic chemistry- (Vedition)
7. Finar IL: Organic Chemistry, Vol1 (The Fundamental Principles) 6th Ed Longman (1973).
8. Finar IL : Organic Chemistry, Vol2 (Stereochemistry and chemistry of Natural Products) 6th Ed Longman (1973).
9. V K Ahluwalia, R K Parasar: Organic Reaction Mechanism, 2nd Ed.
10. GR Chatwal: Reaction Mechanism and Reagents in Organic Chemistry.
11. JP Trivedi: Reaction Intermediates in Organic chemistry, University Granth Nirman Board, Ahmedabad.
12. Peter Sykes, Longman: A Guide Book to Mechanism in Organic Chemistry.
13. H.O. House, W.A. Benjamin: Modern Synthetic Reactions.
14. Rodd's Chemistry of Carbon Compounds. Ed. S. Coffey, Elsevier.
15. Organic reactions and their mechanism by P.S.Kalsi

Paper–III Physical Chemistry-1(CH 103)

Credit: 04

Rationale of the Paper: To provide the basic knowledge of very important concepts of the physical chemistry (chemical thermodynamics, surface chemistry, macromolecules, electro chemistry and chemical dynamics). To provide overview of the applications of these concept sin applied field to the students is also an objective.

Learning Out comes:

1. Students can able to state the Third Law and to define heat, work, thermal efficiency and the difference between various forms of energy.
2. They can understand what polymers are made up of, their properties, and basic polymer nomenclature
3. How to identify the different polymerization and polymer analytical techniques

Appreciate how polymers are process ed fors pecificuses and select suitable polymeric material for a daily use product.

Course	Subject Title	Credit	Theory (hr/week)	Practical (Hrs/week)	External Marks	Internal Marks	Total Marks
CH 103	Physical Chemistry-1	4	4	-	70	30	100

Unit	Topics of paper CH 103 Physical Chemistry-1	Teaching Hours	Marks
Section A			
1	Chemical Thermodynamics Nernst heat theorem and its applications to gaseous system, Third law of thermodynamics and its application to evaluate absolute entropies of solids, liquids and gases; Partial molar quantities and their determination, Gibbs-Duhem equation, Gibbs Duhem-Margules equation and its application, Chemical potential and its applications, Activity and activity coefficients, Methods of determination of activity and activity coefficients, Concept of Fugacity and its determination methods. Examples.	15	15
2	Surface Chemistry Physical and Chemical adsorption, Adsorption isotherms, Multi molecular Theory OR B.E.T. Adsorption isotherm, Gibbs Adsorption Equation, Surface active agent OR Surfactants, Micellisation, Critical Micellar Concentration(CMC)	15	15
Section B			
3	Electrochemistry Debye-Huckel Theory (Mathematical Derivation), Thermodynamics of electrified interfaces Lipmann's Equation, Determination of dissociation constant of mono basic acids by conductometry and potentiometry, Gouy-Chapman Theory, Polarization and Overvoltage, Butler-Volmer equation, Principle of polarography, Equation of polarographic wave, Ilkovic equation.	15	15
4	Chemical Dynamics Unimolecular reaction (Lindeman's Theory), Chain reactions and branched chain reactions, Chain reaction between hydrogen and bromine, Transition State Theory, Reaction Kinetics of Thermal and Photochemical Hydrogen-Bromine Reaction, Kinetics of Fast Method reaction (Flow & Flash photolysis), Enzyme catalyzed reactions, mechanism kinetics, Examples. (Arrhenius Equation)	15	15
	Objective question from above four units	----	10

Total Hrs of Lectures: 60

Methodology of Teaching

Class room sessions

Explanation using multimedia projector

Surprise test

Reference Books:

1. Advanced Physical Chemistry-J.N.Gurtu, A.Gurtu.
2. Text book of Physical Chemistry-W.J. Moore.
3. Textbook of Physical Chemistry-Glass tone.
4. Textbook of Physical Chemistry- P. Atkins.
5. Thermodynamics for Chemist-Glass tone.
6. Advanced Physical Chemistry- Surdeep Raj.
7. Surface Chemistry- Admanson.
8. Surface Chemistry- Osipov.
9. Polymer Chemistry– Gowariker.
10. Polymer Chemistry-Billmayer.
11. Polymer Chemistry-Malcolm P. Stevens
12. Polymer Science and Technology-Fried.
13. Principles of Polymer Science– Bahadurand Sastry.
14. Electro chemistry– Bockrisand Reddy
15. Chemical Kinetics– Ladler.
16. Chemical Kinetics– Fro stand Pearson
17. Principle of physical chemistry by Puri, Sharma and Pathania

Paper–IV Analytical Chemistry-1(CH 104)

Credit: 04

Rationale of the Paper: To provide the basic knowledge of very important concepts of the analytical chemistry(Sampling and Calibration Methods, Volumetric Method of Analysis, Gravimetric Analysis).To provide overview of the applications of these concepts in applied field to the student sisal so an objective.

Learning Outcome:

1. Students can learn the basic analytical and technical skills to work effectively in the various fields of chemistry.

To know and understand the issues of safety regulations in the use of chemicals in their laboratory work.

Course	Subject Title	Credit	Theory (hr/week)	Practical (Hrs/week)	External Marks	Internal Marks	Total Marks
CH 104	Analytical Chemistry-1	4	4	-	70	30	100

Unit	Topics of paper CH 104 Analytical Chemistry-1	Teaching Hours	Marks
	Section A		
1	<p>Concepts involved in Analysis and Stastics Scope of analytical chemistry(dyes, drugs, forensic, agriculture, food and nutrition), classification of analytical methods-classical and instrumental, types of instrumental analysis, selecting analysis method, Accuracy, Precision, errors and its causes and way for minimization, absolute error, relative error, Standard deviation, relative standard deviation, mean median, laboratory operations and practices, good laboratory practices (GLP), Consideration with value of significance, Q-value, volumetric glassware-cleaning and calibration of glassware, sample preparation-dissolution and decompositions, selecting and handling reagents, laboratory notebooks, safety in the analytical laboratory, calibration and detection limits, proficiency testing.</p>	15	15
2	<p>Sampling and Calibration Methods Sampling and sample preparation, general steps in chemical analysis, calibration of glass wares. Finding the best straight line-least square regression, correlation coefficient; Calibration curves, standard addition technique and internal standards. Chemical concentrations.</p>	15	15
	SectionB		
3	<p>Volumetric Method of Analysis Primary and Secondary standards, Principles of volumetric analysis, Acid-base titration. Titration in non-aqueous solvents, Complex metric titrations, Precipitation titrations (Mohr's titration, Volhard's titration, adsorption indicators, Fajan's titration), Redox titrations, Theoretical aspects of titration curves and end point evaluation, Choice and suitability of indicator sin each case.</p>	15	15
4	<p>Instrumental analysis pH metry (Principle of instrumentation and mechanism of pH by glass electrode), Potentiometry, Conductometry and types of electrodes and explanation of the nature of titration curves</p>	15	15
	Objective question from above four units	----	10

Total Hrs of Lectures: 60

Methodology of Teaching

Class room sessions

Explanation using multimedia projector

Surprise test

Reference Books:

1. Quantitative Chemical Analysis –by Daniel C. Harris, 5th Edition, W.H. Freeman and Company, New York.
2. Analytical Chemistry –by Gary D. Christian, 6th Edition, John Wiley and Sons Inc. New Jersey.
3. Principles of Instrumental Analysis –by Douglas A. Skoog, 3rd Edition, Holt-Saunders International Edition.
4. Instrumental Methods of Chemical Analysis - by Galen W. Ewing, 4th Edition, International Student Edition.
5. Quantitative chemical analysis by A.I. Vogel (Longman Series).

Semester –I

CH 101 Practicals

Credit: 08

Rationale of the Paper: To enhance practical skills of the students inorganic qualitative analysis, inorganic qualitative analysis, inorganic synthesis, quantitative analysis and instrumental methods of analysis. To provide overview of the applications of these experiments in applied field to the students is also an objective.

Teaching and Evaluation Scheme:

Each practical's listed in the syllabus will be explained and demonstrated in the laboratory. Students are evaluated based on the marks obtained in writing part as well as performance in the laboratory. Viva-voce will be conducted based on practical performed by the students during the examinations.

Course	Subject Title	Credit	Theory (hr/week)	Practical (Hrs/week)	External Marks	Internal Marks	Total Marks
CH 105	Practicals	8	--	16	200	--	200

(1)Inorganic Chemistry(Minimum10)

1. Alloy (any 2)
2. Qualitative Analysis:
Six radicals separation with one less common ion.

References books for Inorganic Chemistry Practical

1. A textbook of quantitative inorganic analysis including elementary instrumental analysis by A.I. Vogel.
2. Inorganic qualitative and quantitative analysis by Shah.

(2)Organic Chemistry.(Minimum10)

1. Organic preparation with IR, TLC and crystallization (Included TLC and IR of starting material and for finish product).
2. Organic Estimation. **(Any 4)**

References books for Organic Chemistry Practical

1. Vogel's Textbook of practical organic chemistry by Furniss Brain S.
2. Elementary practical organic chemistry Part-1 (small scale preparation) by A.I. Vogel.
3. Elementary practical organic chemistry Part-2 (Qualitative organic chemistry) by A.I. Vogel.
4. Elementary practical organic chemistry Part-3 (Quantitative organic chemistry) by A. I. Vogel.
5. Comprehensive practical organic chemistry: preparation and quantitative analysis by V.K. Ahluwalia.
6. Comprehensive practical organic chemistry: qualitative analysis by V.K. Ahluwalia.
7. Practical organic chemistry by Mann and Saunders, 1960, 4th Edition.

(3) Physical Chemistry (Minimum 6)

1. Adsorption (any 2)

- a. Study the variation of surface tension of solution of n-propyl alcohol with concentration.
- b. Study the kinetic of the reaction between Potassium persulphate and Potassium Iodide.
 - Determine rate constant and order of the reaction
 - Study the influence of ionic strength on the rate constant.

2. pH metry:

Determination of dissociation constant of weak like acetic and monochloro acetic acid.

3. Conductometry:

To determine the solubility product and solubility of sparingly soluble salts- PbSO_4 and BaSO_4 .

4. Potentiometry:

- a. Redox Titration Ferrous ammonium sulphate – KMnO_4 , $\text{K}_2\text{Cr}_2\text{O}_7$.

b. To determine potentiometrically the formula of Silver ammonia complex.

5. Distribution method

a. Determination of the formula of the complex formed between cupric ion and ammonia (1M) by distribution method.

b. Distribution of CH_3COOH between H_2O and $\text{CHCl}_3/\text{CCl}_4$

References books for Physical Chemistry Practical

1. Practical in Physical Chemistry-P. S. Sindhu.
2. Practical Physical Chemistry-J. B. Yadav.
3. Experiments in Physical Chemistry- R.C.Das, B.Behra.
4. Experiments in Physical chemistry-P.H. Parsania, F.Karia.

(4) Analytical Chemistry(Minimum6)

1. Water Analysis for TDS.
2. Water Analysis for Ca and Mg.
3. Water Analysis for carbonate and bicarbonate.
4. Water Analysis for Chloride.
5. Water Analysis for Sulphate.
6. Water Analysis for Total hardness.
7. Water Analysis for Nitrate.

References books for Analytical Chemistry Practical

1. British Pharmacopoeia.
2. Indian Pharmacopoeia.
3. U. S. Pharmacopoeia.
4. Qualitative Chemical analysis by A. I. Vogel.
5. Modern analytical chemistry (ISBN 0-07-237547-
6. 7) By David Harvey.
7. Standard Analytical Procedures for water analysis (Hydrology project) Govt. of India and Govt. of Netherlands.

8. Fundamental of Analytical chemistry by Skoog.
9. Instant notes Analytical chemistry by D.Kealey and P.J. Haines.
10. Analytical chemistry for technicians 3rdEdition by john Konkd. (CRC press).
11. AnalyticalChemistry”byGaryD.Christian, 6thEdition, John Wiley and Sons Inc. New Jersey.

Viva –voce based on chemistry practical.

Semester–II

Paper–I Inorganic Chemistry-2(CH 201)

Credit: 04

Rationale of the Paper: To provide the basic knowledge of very important concepts of the inorganic chemistry. To provide overview of the applications of the seconcepts in applied field to the students is also an objective.

Learning outcome:

1. Students will be able to understand the geometry and structure of different molecules.
2. They can understand bonding nature of different compound.
3. How to make reagents and its properties also can understand reaction mechanisms.

Course	Subject Title	Credit	Theory (hr/week)	Practical (Hrs/week)	External Marks	Internal Marks	Total Marks
CH 201	Inorganic Chemistry-2	4	4	--	70	30	100

Unit	Topics of paper CH201 Inorganic Chemistry-2	Teaching Hours	Marks
	Section A		
1	Reaction mechanism of transition metal complexes Energy profile of a reaction, Reactivity of metal complexes, Inert and labile complexes, Kinetic application of VBT and CFT, Kinetics of octahedral substitution, acid hydrolysis, factors affecting acid hydrolysis, base hydrolysis, conjugate base mechanism, direct and indirect evidence in favor of conjugate mechanism, An atomer action, reaction without metal ligand bond cleavage, substitution reaction in square planar complexes, the trans effect, mechanism of the substitution reaction, redox reaction, electron transfer reaction, mechanism of an electron transfer reaction, outer sphere type reaction, cross reactions and Marcus-Hush theory, Inner sphere type reactions.	15	15
2	Mossbauer Spectroscopy Basic applications of Mossbauer spectroscopy, hyperfine structure, quadruple splitting, instrumentation and applications of Mossbauer spectroscopy, problems related to Mossbauer spectra.	15	15
	Section B		
3	ORGANOMETALLIC COMPOUNDS Catalytic Aspects, Biological Applications and Environmental Aspects of Organometallic Compounds -Introduction -Synthetic & Catalytic Aspects of OMC -Synthetic Applications of Main Groups of Organometallic Compounds -Organometallic In Medicines -Organometallic compounds In Agriculture and Horticulture -Organometallic In Industry -Environmental Aspects of Organometallic Compounds	15	15
4	d¹-d⁹ spectra Selection rule for transition, factor affecting an electronic spectrum, or gel diagram with example d ¹ -d ⁹ , d ² -d ⁸ , d ³ -d ⁷ , d ⁴ -d ⁶ , Tanabe-Sugano diagram (d ²), weak field approximation.	15	15
	Objective question from above four units	----	10

Total Hrs of Lectures: 60

Methodology of Teaching

Class room sessions

Explanation using multimedia projector

Surprise test

Reference Books:

1. Fundamentals of molecular spectroscopy by C.N. Barnwell.
2. Physical Chemistry by P.W. Atkins. ELBS 1986.
3. Introduction to molecular spectroscopy by G. M. Barrow.
4. Molecular spectroscopy by I.N. Levis, Wiley interscience.
5. Nuclear Magnetic Resonance by J.D. Roberts, McGraw Hill.
6. Introduction to magnetic resonance by A. Carrington and A.D. McLachlan. Harper and Row.
7. Electron Spin Resonance, Elementary theory and practical applications by J.E. Wets and J.R. Buoulton, Mc Grew Hill.

Paper–II Organic Chemistry-2(CH 202)

Credit: 04

Rationale of the Paper: To provide the basic knowledge of classical branches of the organic chemistry (heterocyclic chemistry and photochemistry) and very widely develops in new branches of the organic chemistry (disconnection approach and green chemistry). To provide

overview of the applications of these concepts in applied field to the students is also an objective.

Learning Outcomes:

1. Students will have acquired an understanding of synthesis and mechanism of Heterocyclic compounds.
2. Knowledge of aromaticity and the chemistry of five and six member heterocycles.
3. They learn about various aspects of Photochemistry

Course	Subject Title	Credit	Theory (hr/week)	Practical (Hrs/week)	External Marks	Internal Marks	Total Marks
CH 202	Organic Chemistry-2	4	4	--	70	30	100

Unit	Topics of paper CH 202 Organic Chemistry-2	Teaching Hours	Marks
	Section A		
1	Retro Synthesis An introduction to synthons and synthetic equivalents. Disconnection approach, functional group inter-conversions, the importance of the order of events in organic synthesis, one group C-X and two group C-X disconnections, chemo selectivity, reversal of polarity, cyclisation reaction, amine synthesis. Principle of protection of alcohol, amine, carbonyl and carboxyl groups.	15	15
2	Photochemistry Basic of Photochemistry: Absorption, excitation, photochemical laws, quantum yield, electronically excited states- life times- measurements of the times. Flash photolysis stopped Flow techniques, Energy dissipation by radioactive and non-radioactive processes, absorption spectra, Franck-Condon principle, and photochemical stages-primary and secondary processes. Photochemical Reactions: Interaction of electromagnetic radiation with matter, types of excitations, fate of excited molecule, quantum, yield, transfer of excitation energy, actinometrical.	15	15
	SectionB		
3	Green chemistry Brief introduction, principles, green catalysts-acid catalyst, basic catalyst, oxidation catalysts, polymer supported catalysts, photo catalyst, green synthesis-phase transfer catalyst, green synthesis of polycarbonates, paracetamol, ibuprofen, citral, urethane, adipic acid and styrene.	15	15
4	Heterocyclic chemistry Nomenclature of Hetero cycles: Replacement and systematic Nomenclature for monocyclic, fused and bridged hetero cycles. Aromatic Hetero cycles and Heterocyclic Synthesis: General chemical behavior of aromatic hetero cycles, Classification of heterocyclic compounds, Principles of heterocyclic synthesis involving cyclization reactions and reactivity and tautomerism of aromatic, heterocyclic compounds and their mechanism containing two heteroatoms.	15	15
	Objective question from above four units	----	10

Total Hrs of Lectures: 60

Methodology of Teaching

Class room sessions

Explanation using multimedia projector

Surprise test

Reference Books

1. Designing Organic Synthesis, S. Warren. Wiley.
2. Organic Synthesis: The Disconnection Approach, S. Warren, Wiley.
3. Organic Synthesis-Concept, Method and Starting Materials, J. Fuhrhop.
4. Some Modern Methods of Organic Synthesis. W. Carruthers, Cambridge Univ. Press.
5. Modern Synthetic Reactions H.O. House, W.A Benjamin.
6. Advanced Organic Chemistry: Reactions, Mechanisms and Structure, J. March. Wiley.
7. Principles, of Organic Chemistry Part B.F .a. Carey and R.J. Sundberg, Plenum Press.
8. Fundamentals of photo chemistry, K.K. Rothagi-Mukheriji, Wiley-Eastern.
9. Essentials of Molecular Photochemistry, a Gilbert and J. Baggott, Blackwell Scientific Publication.
10. Molecular Photochemistry, N.J. Turro, W.A. Benjamin.
11. Introductory Photochemistry, A. Cox and t. Camp, McGraw Hill.
12. Photochemistry, R.P. Kundall and A. Gilbert. Thomson Nelson.
13. Organic Photochemistry, J. Cox on and B.halton, Cambridge University Press.
14. Chemistry of Heterocyclic Compounds by Badger (Academic Press, 1963).
15. Heterocyclic Compounds by R.C. Elder field (Ed.), Vol.1-9 (Wiley, New York, 1960-65).
16. An Introduction to the Chemistry of Heterocyclic Compounds by R.M. Aches on (John Wiley & Sons Ltd. New York, 1967).
17. Heterocyclic Chemistry (2/e) by J.A. Joule and G.F. Smith (Van Nostrand Rein hold (UK) Co.Ltd.1978).
18. The Chemistry of Carbon Compounds by Rodd, E.R.(Ed.),Vol.4A to 4C(Elsevier, Amsterdam,1957-1973).
19. Ring Index by Patterson, Capell and Walker (American Chemical Society, New York, 1960).
20. New Trend sin Green Chemistry by V .K. Ahluwalia, M. Kidwai Second Edition, 2004.

21. Green Chemistry theory and practice, P.T. Anastas and J.C. Warner, New York Oxford university press, 1998.

Paper–III Physical Chemistry-2(CH 203)

Credit: 04

Rationale of the Paper: To provide overview of the applications of these concepts in applied field to the students is also an objective.

Learning Outcome:

1. Students can able to state about the nuclear chemistry and stastical thermo- dynamics.
2. They can understand about the mechanism of polymerization, property of polymer and its application.
3. Also identify different polymerization and polymer analytical technique.

Course	Subject Title	Credit	Theory (hr/week)	Practical (Hrs/week)	External Marks	Internal Marks	Total Marks
CH 203	Physical Chemistry-2	4	4	--	70	30	100

Unit	Topics of paper CH 203 Physical Chemistry-2	Teaching Hours	Marks
Section A			
1	Statistical Thermodynamics Concepts of distribution of molecules, thermodynamic probability, permutations and combinations, Boltzmann's most probable distribution, partition function- translational, vibrational, rotational, electronic nuclear partition functions, calculation of thermodynamics, properties in terms of partition function, Internal energy, Examples.	15	15
2	Nuclear Chemistry Nuclear properties-nuclear radius, coulombic and nuclear potential spin and angular momentum, magnetic moment, nuclear binding energy, nuclear models-shell model, liquid drop model, Fermi gas model, collective model, radioactive decay, nuclear reactions, evaporation, spallation, fragmentation, fission and fusion reactions, accelerators, reaction cross section, use of radioisotopes as tracers.	15	15
Section B			
3	Solid State Chemistry Bonding in solids and electronic structure in solids, bond theory- metals, semiconductors and insulators, defects in crystals, calculation of Schottky and Frenkel defects using statistical method, non-stoichiometry, solid electrolytes, diffusion in solids, electrical conductivity in solids, super conductivity, perovskites.	15	15
4	Macromolecules Kinetics and Mechanism of Polymerisation, Molecular weight of Macromolecules (Number average and weight average Molecular weight), Methods of determining molecular weight of polymers. Properties of polymers and applications. Examples.	15	15
Objective question from above four units		----	10

Total Hrs of Lectures: 60

Methodology of Teaching

Class room sessions

Explanation using multimedia projector

Surprise test

Reference Books

1. Textbook of physical chemistry –W.J. Moore.
2. Textbook of physical chemistry – Glass tone.
3. Textbook of physical chemistry – P. Atkins.

4. Advanced physical chemistry – Sur deep raj.
5. Advanced physical chemistry – J. N. Gurtu, A. Gurtu.
6. Statistical thermodynamics – M.C. Gupta.
7. Polymer Chemistry –Gowarikar.
8. Polymer Chemistry –Billmayer.
9. Principles of polymer science – Bahadur & Sastry.
10. Polymer science & technology – Fried.
11. Polymer Chemistry – Malcom P. Stevens.
12. Nuclear Chemistry – Arniker.
13. Nuclear and radio chemistry – J.W. Kannedy, G. Friedlander.

Paper–IV Analytical Chemistry-2(CH 204)

Credit: 04

Rationale of the Paper: To provide the basic knowledge of the various spectroscopic techniques (UV, IR, MASS and CMR). To provide overview of the applications of these concepts in applied field to the students is also an objective.

Learning Outcome:

1. Students can define and calculate their retention factor, R_f , and describe how TLC and column chromatography can be used for separation and qualitative analysis.
2. How to operate gas–solid and gas–liquid chromatography instruments and explains how analytical data can be obtained.
3. How to use gas chromatography–mass spectrometry to find the concentrations and identities of component in a mixture.
4. Account for the general features of chromatography systems.

Course	Subject Title	Credit	Theory (hr/week)	Practical (Hrs/week)	External Marks	Internal Marks	Total Marks
CH 204	Analytical Chemistry-2	4	4	--	70	30	100

Unit	Topics of paper CH 204 Analytical Chemistry-2	Teaching Hours	Marks
	Section A		
1	Fundamentals of Spectro photometry and UV-Visible Spectroscopy Properties of light, absorption of light, interaction of light with matter and origin of spectra. The spectrophotometer-calibration, sources of light, mono chromators and detectors. Beer's law in chemical analysis, photometric accuracy- Ring bom Plot, deriva- tive pectro photometry.	15	15
2	Fundamental of NMR & CMR Spectroscopy Principal, basic of NMR (Peak hight, Peak signal, Chemical shift,) instrumentation and applications of NMR, Criteria for a compound to be NMR active. Basic components of instrumentation of PMR and CMR. Shielding- deshilding, splitting, TMS. Resolution and multiplicity.	15	15
	SectionB		
3	MASS Spectroscopy Theory, instrumentation and modifications; Unit mass and molecular ions; Important terms-singly and doubly charged ions, meta stable peak, base peak, is otropic mass peaks, relative intensity, etc.; Recognition of M+ion peak; General fragmentation rules: Fragmentation of various classes Of organic molecules, including compounds containing oxygen, sulphur, nitrogen and halogens; α -, β -, allylic and benzylic cleavage.	15	15
4	FT-IR Principal, Types of vibrations in IR, Different important group frequency criteria for compound to be IR active, Instrumentation of FT-IR. Examples of Organic compounds.	15	15
	Objective question from above four units	----	10

Total Hrs of Lectures: 60

Methodology of Teaching

Class room sessions

Explanation using multimedia projector

Surprise test

Reference Books

1. Quantitative Chemical Analysis II by Daniel C. Harris, 5th Edition, W.H. Freeman and Company, New York.
2. Analytical Chemistry II by Gary D. Christian, 6th Edition, John Wiley and Sons Inc. New Jersey.
3. Principles of Instrumental Analysis II by Douglas A. Skoog, 3rd Edition, Holt-Saunders International Edition.
4. Instrumental Methods of Chemical Analysis II by Galen W. Ewing, 4th International Student Edition.
5. Kemp, W. Organic Spectroscopy 3rd Ed., W. H. Freeman & Co. (1991).
6. Silverstein, R. M., Bassler, G. C. & Morrill, T. C. Spectroscopic Identification of Organic Compounds John Wiley & Sons (1981).
7. Carruthers, W. Modern Methods of Organic Synthesis Cambridge University Press (1971).
8. March, J. Advanced Organic Chemistry John Wiley & Sons (1992).
9. Practical NMR Spectroscopy, M.L. Martin, J.J. Delpuch and G.J. Martin, Heyden.23.
10. Spectrometric identification of Organic Compounds, R. M. Silverstein, G. C. Bassler and T. C. Morrill, John Wiley.
11. Introduction to NMR Spectroscopy, R. J. Abraham, J. Fisher and P. Loftus, Wiley.
12. Application of Spectroscopy of Organic Compounds, J. R. Dyer, Prentice Hall.
13. Spectroscopy Methods in Organic Chemistry, D. H. Williams, I. Fleming, Tata McGraw- Hill.
14. Spectroscopy of Organic Compounds, P. S. Kalsi, New Age International Ltd

Semester-II

CH 205 Practical's

Credit:08

Rationale of the Paper: To enhance practical skills of the students in organic synthesis, estimations and separation techniques. To provide overview of the applications of these experiments in applied field to the students is also an objective.

Course	Subject Title	Credit	Theory (hr/week)	Practical (Hrs/week)	External Marks	Internal Marks	Total Marks
CH-205	Practical's	8	--	16	200	--	200

(1) Inorganic Chemistry (Minimum 10)

a. Preparation of selected inorganic compounds and their studies by IR, Electronic spectra, Mossbauer, E.S.R. and magnetic susceptibility measurements. Handling of air and moisture sensitive compounds.

- (1) $\text{VO}(\text{acac})_2$
- (2) $\text{Ti O}(\text{C}_9\text{H}_8\text{NO})_2 \cdot 2\text{H}_2\text{O}$
- (3) $\text{Cis-K}[\text{Cr}(\text{C}_2\text{O}_4)_2(\text{H}_2\text{O})_2]$
- (4) $\text{Na}[\text{Cr}(\text{NH}_3)_2(\text{SCN})_4]$
- (5) $\text{Mn}(\text{acac})_2$
- (6) $\text{K}_3[\text{Fe}(\text{C}_2\text{O}_4)_3]$
- (7) Prussian Blue, Turnbull's Blue
- (8) $[\text{Co}(\text{NH}_3)_6][\text{Co}(\text{NO}_2)_6]$
- (9) $\text{Cis-}[\text{Co}(\text{trien})(\text{NO}_2)_2\text{Cl} \cdot \text{H}_2\text{O}]$
- (10) $\text{Hg}[\text{Co}(\text{SCN})_4]$
- (11) $[\text{Co}(\text{Py})_2\text{Cl}_2]$
- (12) $[\text{Ni}(\text{NH}_3)_6]\text{Cl}_2$
- (13) $\text{Ni}(\text{DMG})_2$
- (14) $[\text{Cu}(\text{NH}_3)_4]\text{SO}_4 \cdot \text{H}_2\text{O}$

b. EDTA binary mixture (any 4)

(2)Organic Practical's(Minimum10)

- a. O
Organic Mixture(Semisolids and Liquids)

References books for Organic Chemistry Practical

1. V
 Vogel's Textbook of practical organic chemistry by
Fumiss Brain S.
2. C
 Comprehensive practical organic chemistry: preparation
and quantitative analysis by V. K. Ahluwalia.
3. C
 Comprehensive practical organic chemistry: qualitative
analysis by V. K. Ahluwalia.
4. P
 Practical organic chemistry by Mann and Saunders,
1960, 4th Edition.

(3)Physical Chemistry (Minimum 10)

1. Distribution

- a. Distribution of I₂ between H₂O and CCl₄.

b.

2. pH metry

- c. To determine the strength of strong and weak base in a given mixture using a
pH meter.

d.

3. Conductometry

- a. To determine the strength of strong and weak acids in a given mixture using a
conduct meter.
- b. Determination of the velocity constant, order of the reaction and energy of
activation for saponification of ethyl acetate by sodium hydroxide conduct
metrically.

4. Polymer Chemistry

- a. Determination of molecular weight of a polymer by Viscosity
Method.

5. Spectrophotometry (Any Two)

- a. To determine the concentration of nitrate (NO_2^{-1}) in the given solution.
- b. To study Beer's law and determine the concentration of an unknown solution of Cu^{+2} by ammonia complex method.

6. Potentiometry

- a. To determine the strength of strong and weak acids in a given mixture using a potentiometer.
- b. To determine the solubility of the given salts, $\text{AgCl}/\text{AgBr}/\text{AgI}$ using a potentiometer.

7. Chemical Kinetics

- a. To determine the temperature coefficient and energy of activation of the reaction between KBrO_3 and KI . At two different temperature.
- b. To study the effect of concentration of reactants on the rate of hydrolysis of an ester.
- c. Determination of the effect of Change of concentration of reactants on the velocity constant of hydrolysis of an ester /Ionic reactions.

(4)Analytical Chemistry(Minimum10)

1. Estimation of lead and Cadmium using solvent extraction method.
2. Determination of Ca by flame-photometric method.
3. Determination of Na by flame-photometric method.
4. Determination of K by flame-photometric method.
5. Determination of Li by flame-photometric method.
6. Estimation of aspirin by UV-visible spectrophotometry (colourimetry).
7. Estimation of paracetamol by UV-visible spectrophotometry (colourimetry).
8. Estimation of Ibuprofen by UV-visible spectrophotometry (colourimetry).
9. Wateranalysispart-2(D.O., C.O.D.).
10. Estimation of binary mixture by EDTA (Ca^{+2} and Mg^{+2}).
11. Estimation of binary mixture by EDTA (Pb^{+2} and Mg^{+2}).
12. Graphical interpretation of IR and NMR spectra.

13. To determine the acid value of an oil sample.

14. To determine ester value of an oil sample

References books for Analytical Chemistry Practical

1. British Pharmacopoeia.
2. Indian Pharmacopoeia.
3. U.S. Pharmacopoeia.
4. Qualitative chemical analysis by A. I. Vogel.
5. Modern analytical chemistry (ISBN 0-07-237547-7) by David Harvey.
6. Standard Analytical Procedures for water analysis (Hydrology project) Govt. of India and Govt. of Netherlands.
7. Fundamental of Analytical chemistry by Skoog.
8. Instant notes Analytical chemistry by D. Kealey and P. J. Hainies.
9. Analytical chemistry for technicians 3rd Edition by John Konkd. (CRC press).
10. Analytical Chemistry” by Gary D. Christian, 6th Edition, John Wiley and Sons Inc. New Jersey.

Viva-voce based on organic and analytical chemistry practicals.