પરિપત્ર:

ભક્તકવિ નરસિંહ મહેતા યુનિવર્સિટીની સાયન્સ વિદ્યાશાખાનાં અભ્યાસક્રમ ચલાવતી તમામ સંલગ્ન કોલેજોનાં આચાર્યશ્રીઓને સવિનય જણાવવાનું કે સાયન્સ વિદ્યાશાખા હેઠળનો NEP-૨૦૨૦ અંતર્ગત કેમેસ્ટ્રી વિષય સેમેસ્ટર-૬નો અભ્યાસક્રમ આ સાથે સામેલ છે.

માનનીય કુલપતિશ્રીની મંજુરી અનુસાર સદર અભ્યાસક્રમ શૈક્ષણિક વર્ષ જુન,૨૦૨૫ થી અમલવારી કરવાની રહે છે. સાયન્સ વિદ્યાશાખાનાં અભ્યાસક્રમ ચલાવતી તમામ સંલગ્ન કોલેજો ધ્વારા તેની અમલવારી કરવા જણાવવામાં આવે છે.

Bhakta Kavi Narsinh Mehta University Junagadh

ખાસ ફરજ પરના અધિકારી
(એકેડેમિક)

ક્રમાંક/બીકેએનએમયુ/એકેડેમિક/૭૪૨/૨૦૨૫
ભક્તકવિ નરસિંહ મહેતા યુનિવર્સિટી,
સરકારી પોલીટેકનિક કેમ્પસ,
ભક્તકવિ નરસિંહ મહેતા યુનિવર્સિટી રોડ,
ખડીયા, જૂનાગઢ-૩૬૨૨૬૩
તા.૦૩/૧૧/૨૦૨૫

પ્રતિ,

- ભક્તકવિ નરસિંહ મહેતા યુનિવર્સિટી સંલગ્ન સાયન્સ વિદ્યાશાખાનાં અભ્યાસક્રમો ચલાવતી તમામ કોલેજોના આચાર્યશ્રીઓ તરફ....

નકલ સાદર રવાનાઃ-

- માન.કુલપતિશ્રી/ કુલસચિવશ્રીનાં અંગત સચિવશ્રી.
- પરીક્ષા નિયામકશ્રી, ભક્તકવિ નરસિંહ મહેતા યુનિવર્સિટી, જુનાગઢ

નકલ રવાના જાણ તથા યોગ્ય કાર્યવાહી અર્થેઃ

- સીસ્ટમ મેનેજરશ્રી, આઇ.ટી.સેલ વિભાગ (વેબસાઇટ ઉપર પ્રસિદ્ધ થવા અર્થે.)

BHAKTA KAVI NARSINH MEHTA UNIVERSITY

JUNAGADH

BOARD OF STUDIES

FACULTY OF SCIENCE

SYLLABUS FOR CHEMISTRY (HONOURS)

PROGRAMME (SEMESTER- VI)

EFFECTIVE FROM JUNE, 2025

BHAKTA KAVI NARSINH MEHTA UNIVERSITY
Syllabus of B.Sc. (Honors) as per NEP-2020
Faculty of Science
Effective from June 2025
Subject: Chemistry
SEMESTER-VI

SUMMARY OF THE SYLLABUS

Sem No.	Sr. No.	Category of Course	Course Title	Course Level	Credit	Teaching Hrs.	SEE Marks	CCE Marks	Total Marks	Exam Duration
Sem-6	1	Major-14	Higher Chemistry-304	5.5	04	4T	50	50	100	2 T Hours
	2	Major-15	Higher Chemistry-305	5.5	04	4T	50	50	100	2 T Hours
	3	Major-16	Higher Chemistry Practical-306	5.5	04	8P	50	50	100	8 (P) Hours
	4	Minor-6	Minor Chemistry-303	5.5	04	2T+4P	50	50	100	2 T Hours
				Total	**20**					

INDEX

Major Chemistry-14 (CHM304-3C/Higher Chemistry-304)

Course Level	5.5		**Internal Marks**	50
Programme	B. Sc. Chemistry		**External Marks**	50
Semester	VI		**Practical Internal**	-
Category of Course	Major-14		**Practical External**	-
Course Credit	4		**Practical Exam Duration**	-
Teaching Hours	4T		**Total marks**	100
Course Code	**CHM304-3C**		**External Theory Exam Duration**	02:00 Hours
Course Title	**Higher Chemistry-304**			

Course Objectives:

- Crystal Field Theory: Provide insights into the electronic structure, bonding, and magnetic properties of transition metal complexes.
- Introduction to Pericyclic Reactions: Explore the fundamental principles of pericyclic reactions, including molecular orbitals, concerted mechanisms, and their chemical significance.
- Photochemistry: Examine photochemical processes and their applications, including light-induced reactions in chemical systems.
- Magneto chemistry: The course objectives of magneto chemistry are to provide an understanding of how magnetic properties arise from electron spin and orbital motion in materials and how to measure these properties. It further aims to show how these magnetic characteristics can be used to determine the structure, bonding, and electronic configuration of chemical compounds, particularly for transition metal complexes.
- Mass spectrometry: The course objectives for mass spectrometry are to teach students the fundamentals of the technique, including the components of a mass spectrometer and various ionization methods. Upon completion, students should be able to interpret mass spectra to determine the elemental composition and structure of chemical compounds for qualitative and quantitative analysis
- Electrochemistry: Explore electrochemical principles, redox reactions, and applications of electrochemical cells.
- Colorimetery: The course objectives of colorimetry are to teach students the scientific principles of color measurement, enabling them to quantitatively determine the concentration of colored substances in a solution. This includes understanding and applying the Beer-Lambert law, which establishes a linear relationship between a solution's light absorbance and the concentration of the colored compound.
- This course aims to provide a well-rounded understanding of both theoretical concepts and practical applications in chemical sciences.

Course Learning Outcomes: Upon successful completion of this course, students will:

- Crystal Field Theory: Understand the effects of ligand fields on the properties of metal complexes and predict their magnetic behaviour.
- Pericyclic Reactions: Apply molecular orbital theory to understand pericyclic reactions and predict product formation.

- Photochemistry: Analyse photochemical reactions and their relevance in chemical, biological, and industrial processes.
- Magneto chemistry: Course learning outcomes in magneto chemistry involve understanding the fundamental theory of magnetism, such as diamagnetism and paramagnetism, and explaining the origins of magnetic properties from electron spin and orbital motion. Students also learn to apply these principles and magnetic measurement techniques, including magnetic susceptibility, to determine the electronic structure, bonding, and stereochemistry of chemical compounds.
- Mass spectrometry: The course learning outcomes of mass spectrometry include understanding the underlying principles, instrumentation, and diverse ionization techniques. Students will gain the skills to interpret mass spectra for qualitative and quantitative analysis, enabling the identification and structural elucidation of unknown compounds.
- Electrochemistry: Solve problems involving redox reactions, electrode potentials, and electrochemical cells.
- Colorimetery: The course learning outcomes of colorimetry are to understand the principles of how a substance's concentration affects its color and to use instrumentation, such as a colorimeter, to quantitatively determine the concentration of an unknown colored sample. This involves applying the Beer-Lambert Law, which dictates a linear relationship between a solution's absorbance and its concentration, to create and interpret a calibration curve.
- These outcomes ensure students acquire critical thinking skills and practical knowledge applicable in research and industry.

Course Contents:

Sem	Unit No	Syllabi	Teaching Hours
6	1	**Chapter-1: Crystal field theory – I** Introduction, Ligands, Concept of crystal field theory, splitting of d-orbitals in octahedraland, tetrahedral complex with CFSE concept, Weak and strong field ligands, High spin and low spin complexes with pairing energy, Calculation of CFSE, Factors affecting on splitting energy, Magnetic behaviour of transition metal complexes, (Equation for calculation of magneticmoment for d & f block elements)**,** Orbital angular momentum contribution in magnetic momentum of various crystal fields, Application of magnetic momentum to determine the structure of the complexes withlimitation, Example based on CFSE, Pairing energy and Magnetic momentum.	**15**
	2	**Chapter –2: Pericyclic reactions** Definition of Pericyclic Reactions, Construction of π molecular orbitals and FMO approach, Types of pericyclic reactions. **(i)**	**08**

		Electrocyclic: 4π & 6π electron systems, **(ii)** Cycloaddition: [2+2] & [4+2] systems (intermolecular only)**, (iii)** Sigmatropic rearrangements: Classification, Naming of rearrangement [i,j], hydride and alkyl shifts and FMO mechanism of shift, Examples and explanation of thermal and photochemical pericyclic reactions considering FMO approach.	
		Chapter –3: Photochemistry Difference between thermal and photochemical reaction, Stark Einstein photochemical equivalent law, Primary and secondary (Isomeric change, Double decomposition and dissociation) reaction, Chemical actinometer, Quantum yield, Reasons of low and high quantum yield, Mechanism of some photochemical reactions: (1) Reaction between hydrogen and chlorine (2) Reaction between hydrogen and bromine (3) Decomposition of HI (4) Decomposition of HBr (5) Dimerization of Anthracene, Photosensitized reactions, Fluorescence, Phosphorescence and Chemiluminescence, Numerical based on theory.	**07**
	3	**Chapter-4: Magneto chemistry** Introduction of magneto chemistry, Basic terminology: Magnetic field, Magnetic pole-dipole, Intensity of magnetization, Magnetic induction, Magnetic Permeability, Magnetic susceptibility, Magnetic behaviour; Paramagnetism, Diamagnetism, Ferro magnetism, Anti-ferromagnetism and ferri magnetism, Effect of temperature on magnetic behaviour of substances, Equation for magnetic moment of diamagnetic and paramagnetic substances, Methods for determination of magnetic susceptibility (Gouy method), Determination of magnetic susceptibility by using standard substance, Application of magnetic susceptibility.	**10**
		Chapter-5: Mass spectrometry Introduction, Basic principle, Instrumentation, General fragmentation modes, Important features for the mass spectra of alkanes (without problems).	**5**
	4	**Chapter –6: Electrochemistry-II** Definition of Concentration cells, Types of concentration cell: (1) Electrode concentration cells (2) Electrolyte concentration cells , Concentration cells without transference, Concentration cells with transference, Liquid junction potential , Elimination of liquid junction potential, Applications of emf measurements: Solubility of sparingly soluble salts, Valency of metal ion, Dissociation constant of weak acid, Transport number of ion, Ionic product of water, Degree of hydrolysis, Numerical based on theory.	**10**
		Chapter –7: Colourimetry Introduction, Definition of colourimeter, Explanation of terms: Transmittance and Absorbance (Optical Density), Laws of	**5**

		Colorimetry (Grotthus-Draper, Lambert, Beer and Lambert-Beer laws), Nature of Molar absorptivity and Absorbance**,** Deviation of Beer Law, Instrumentation: Radiation source, Filter, Slit, Cell, and Detectors name, Selection of filter, Application in quantitative analysis, Spectrophotometer, Spectrophotometric Titrations: Introduction, Apparatus (Cell), Technique, Dilution Correction**,** Types of Spectrophotometric Titrations, Advantages of Spectrophotometric titrations, Numerical based on theory.	

Major Chemistry-15 (CHM305-3C/Higher Chemistry-305)

Course Level	5.5		**Internal Marks**	50
Programme	B. Sc. Chemistry		**External Marks**	50
Semester	VI		**Practical Internal**	-
Category of Course	Major-15		**Practical External**	-
Course Credit	4		**Practical Exam Duration**	-
Teaching Hours	4T		**Total marks**	100
Course Code	**CHM305-3C**		**External Theory Exam Duration**	02:00 Hours
Course Title	**Higher Chemistry-305**			

Course Objectives:

- Multi-Electron Systems: Introduce the quantum mechanical treatment of multi-electron atoms and molecules, focusing on electronic configurations and energy levels.
- Crystal Field Theory: Provide insights into the electronic structure, bonding, and magnetic properties of transition metal complexes.
- pH Metry: Teach the principles and applications of pH measurement for analysing acid-base equilibria in solutions.
- Potentiometry: Develop skills in measuring electrode potentials to determine the concentration of ions and monitor titrations.
- Conductometry: To teach students how to measure the electrical conductivity of a solution and use this data to analyze ionic species.
- This course aims to blend theoretical knowledge with practical analytical techniques to prepare students for advanced studies and industry applications.

Course Learning Outcomes: Upon successful completion of this course, students will:

- Multi-Electron Systems: Apply quantum concepts to predict the behaviour of multi-electron atoms and molecules.
- Crystal Field Theory: Understand the effects of ligand fields on the properties of metal complexes and predict their magnetic behaviour.
- pH Metry: Accurately measure pH and apply it to analyse acid-base properties in chemical systems.
- Potentiometry: Use potentiometric methods to determine ion concentrations and perform redox titrations.
- Conductometry: Enable students to understand the principles governing the electrical conductivity of ionic solutions and how it changes during chemical reactions. Students learn to apply this technique, particularly in conductometric titrations, to determine the concentration of substances and analyse different types of chemical reactions accurately.
- These outcomes ensure students gain theoretical insights and practical skills applicable to chemical research and industrial problem-solving.

Course Contents:

Sem	Unit No	Syllabi	Teaching Hours
6	1	**Chapter-1 Multi electron systems** Introduction, Quantum numbers, Types of coupling: s-s coupling, *l-l* coupling for p^2, p^3 and d^2 electronic configuration with vector diagram, L-S coupling, j-j coupling, Concept of spectral terms and term symbols, Derivation of spectral term symbol for p^1 to p^6 & d^1 to d^9, Hund's rules for the determination of ground state spectral term, Derive ground state spectral term for p^2 and d^2 electronic configuration, Microstates: Definition and calculation of microstates for p^2 and d^2 electronic configuration, Hole pegion diagram of p^2 and d^1 electronic configuration, Example based on calculation of S, M_S, L, M_L, J and M_J.	**15**
	2	**Chapter-2 Crystal field theory –II** Jahn-Teller effect - Statement and explanation, Strong and weak Jahn-Teller distortion, Explanation of distorted tetrahedron structure due to Jahn-Teller effect with example, Splitting of d-orbitals in square planar complexes with examples, Hole formalism and Hole formalistic pair, Splitting of D and F ground terms (using hole formalism), Orgel Diagram of D and F states, Selection rules for d-d transition, Types of electronic transition in metal complexes, Absorption spectrum of Ti^{+3},Cu^{+2} & Ni^{+2}.	**15**
	3	**Chapter-3: pH metry** Introduction and interpretation of pH metry, Importance of indicator and reference electrode in the measurement of pH, Study of acid-base Titration, Definition, Interpretation of various methods of determining pH value like pH paper method using only hydrogen electrode as indicator electrode and calomel electrode as reference electrode to determine pH value, Weak acid-strong base titration with curve and determination of dissociation constant (Ka) of weak acid, Numericals.	**08**
		Chapter-4: Potentiometry Introduction and interpretation of potentiometry, Importance of indicator and reference electrode in the measurement of EMF, E.M.F. method: Study of acid-base Titration, Redox Titration, Argentometric titration include mixture of Cl^-, Br^-, I^- with graph and properexplanation, Numericals.	**07**

	4	**Chapter-5: Conductomerty** Electric conductance in metals and in electrolyte solution, Terms: Conductance, Specific resistance, Specific conductance, Equivalent conductance, Relationship between specific conductance and equivalent conductance, Effect of dilution on conductance, specific conductance and equivalent conductance, Conductivity cell and platinization of electrodes, Determination of cell constant, Conductivity water, Kohlrausch's law, **Conductometric Titration:** Introduction and dilution correction, Acid base titration: (1) Strong acid - strong base (2) Strong acid - Weak base (3) Weak acid – Strong base (4) Mixture of strong acid + Weak acid - strong base, **Replacement Titration**: (1) Salt of weak acid – strong acid (2) Salt of weak base – strong base, **Precipitation Titration:** (1) $AgNO_3$-NaCl (2) $BaCl_2$-K_2SO_4 (3) $Ba(OH)_2$-$MgSO_4$, Determination of Degree or hydrolysis and Hydrolysis constant, Determination of solubility and solubility product of sparingly soluble salt, Numerical based on theory.	**15**

Major Chemistry-16 (CHM305-3C/Higher Chemistry-306)

Course Level	5.5	**Total Internal Marks**	50
Programme	B. Sc. Chemistry	**Total External Marks**	50
Semester	VI	**Total Practical Internal**	50
Category of Course	Major-16	**Total Practical External**	50
Course Credit	4	**Practical Exam Duration**	8 (P) Hrs
Teaching Hours	8P	**Total marks**	100
Course Code	**CHM306-3C**	**External Theory Exam Duration**	-
Course Title	**Higher Chemistry Practicals-306**		

Course Objectives:

- Inorganic Qualitative Analysis: Develop the ability to systematically identify six unknown inorganic radicals (both cations and anions) through qualitative analysis techniques.
- Physicochemical Exercises: Provide hands-on experience with instrumental and experimental techniques for analysing chemical properties and behaviour:
- pH Metry: Measure and interpret pH to study acid-base equilibrium.
- Potentiometry: Determine ion concentrations using electrode potentials and perform redox titrations.
- Conductometry: The main objective of a Conductometry practical is to determine the equivalence point of a chemical reaction, such as a titration, by monitoring changes in the solution's electrical conductivity. It also helps in understanding the fundamental relationship between ion concentration and a solution's ability to conduct electricity.
- Colorimetery: To teach students how to determine the concentration of a colored substance in a solution by measuring its light absorbance. It demonstrates the Beer-Lambert Law, which shows the linear relationship between a solution's concentration and its light absorbance.
- This course aims to enhance students' analytical skills through laboratory work, emphasizing accuracy, precision, and problem-solving in chemical analysis.

Course Learning Outcomes: Upon completing the course, students will:

- Inorganic Qualitative Analysis: Identify unknown cations and anions through systematic qualitative analysis.
- pH Metry: Measure pH accurately and apply it to study acid-base reactions.
- Potentiometry: Use potentiometric methods to monitor titrations and calculate ion concentrations.
- Conductometry: The Conductometry practical enables students to understand the relationship between ionic concentration and electrical conductivity in a solution and to apply this knowledge to determine the equivalence points of titrations. By operating a conductivity meter and interpreting titration curves, students can accurately analyze solutions, including those that are colored or dilute.
- Colorimetery: Students learn to create a calibration curve using standard solutions,

enabling them to find the concentration of an unknown sample.

- These outcomes ensure students gain practical expertise in chemical analysis, preparing them for advanced research and industry-related applications.

Course Contents:

Sem	Unit No	Syllabi	Teaching Hours
6	1	**Inorganic Qualitative Analysis (six radicals)** To identify six radicals from a mixture containing 3-positive and 3-Negative or 2-positive and 4-negative radicals. ***[15 inorganic mixtures may be analysed]***	**60**
	2	**Physicochemical Exercise** **[15 exercises may be done]** **1. pH metry:** 1. To determine normality and g/lit. of xN HCl by pH metry. 2. To determine normality and dissociation constant of weak acid (xN CH_3COOH) by pH metry. 3. To determine normality and dissociation constant of dibasic acid (xNoxalic acid/malonic acid/maleic acid) using 0.1N NaOH solution. **2. Potentiomentry:** **1.** To determine normality and dissociation constant of benzoic acid used0.1N NaOH. **2.** To determine normality of given acid xN HCl using NaOH solution. **3.** To determine concentration of xN FAS using $K_2Cr_2O_7$. **4.** To determine normality of each halide in the mixture using 0.1N $AgNO_3$ solution. **3. Colourimetry** 1. Find out the amount of Ni+2 in the given solution by colourimetry method. 2. Find out the amount of Fe+3 in the given solution by colourimetry method. **4. Conductometry** 1. To determine normality and gms/lit of xN HCl and also determine specific conductance by conductometry. 2. To determine normality and gms/lit of the mixture of HCl+CH3COOH by conductometry. 3. To determine the normality of weak acid by conductometry 4. To determine the concentration of Ni+2 using 0.1M EDTA solution. 5. To determine the normality of xNAgNO3 using 0.5N NaCl by Conductometry.	**60**

Minor Chemistry-6 (CHE303-3C/Minor Chemistry-303)

Course Level	5.5		**Total Internal Marks**	50
Programme	B. Sc. Chemistry		**Total External Marks**	50
Semester	VI		**Total Practical Internal**	50
Category of Course	Minor-6		**Total Theory External**	50
Course Credit	4 (2T+2P)		**External Practical Exam Duration**	-
Teaching Hours	2T+4P		**Total Marks**	100
Course Code	**CHE303-3C**		**External Theory Exam Duration**	**02:00 Hrs**
Course Title	**Minor Chemistry-6**			

Theory Course content Objectives:

- Principle of Inorganic Qualitative Analysis: To Develop the ability to understand the concepts behind identification and separation of inorganic mixture containing four radicals.
- Gravimetric Exercises: To understand the basic principles of estimating metal ions using Gravimetric exercises. Learn to choose appropriate precipitating agent and method to generate accurate result. Also understand all the steps involved in gravimetric analytical process.
- Fertilizer: Know different types of nutrients, their sources and importance. Types of fertilizers, its classification and source of availability. Methods of synthesis and applications, sustainable usage to ensure long-term agricultural productivity.

Practical Course component Objectives:

- This course also aims to enhance students' analytical skills through laboratory work, emphasizing accuracy, precision, and problem-solving in chemical analysis.

Course Learning Outcomes: Upon completing the course, students will be able to:

- Independently carry out inorganic qualitative analysis of salts and mixtures containing four radicals.
- Independently carry out estimation of amount of metal in a mixture of metal using the most accurate quantitative analytical method like gravimetric analysis.
- Understand chemistry of fertilizers and apply their knowledge in identification, synthesis and end use of it.
- These outcomes ensure students gain practical expertise in chemical analysis, preparing them for advanced research and industry-related applications.

Course Contents:

Sem	Unit No	Syllabi	Teaching Hours
6	1	**Principle of Inorganic Qualitative Analysis**: Introduction, Preparation of Original Solution (OS), Concept of classification of cations (IP and Ksp) and role of Group reagents and common ion effect. Interfering ions and its remedies. Explanation with chemical equations for the following A. Dry test for positive radicals (1) Charcoal test, (2) Cobalt nitrate test & (3) Flame test. B. Dry test for negative radicals (including use of various reagent papers)	**7T**
	2	**Principle of Gravimetric analysis:** Introduction, Von Weimarn ratio, Precipitation methods, Important aspects of gravimetric analysis, conditions for precipitation, Types of Precipitates and characteristics, Co-Precipitation and Post precipitation, Completeness of precipitation, Effect of pH and Temperature on solubility, Remedies of Peptization and occlusion, Purity of ppt, Super saturation, Coagulation. Filtration, Washing, Drying, Incineration, Importane of filter paper, Important Aspects of Gravimetric analysis of Ba+2as $BaSO_4$, Al+2 as Al_2O_3, Ni+2as $Ni(DMG)_2$, Fe+2 as Fe_2O_3	**8T**
	3	**Chapter - 3 Fertilizers-1** Introduction, Types of Plant nutrients (Primary, secondary and micro), Criterion or good fertilizer, Role of various plant nutrients, Classification of fertilizers based on mode of operation and source (Natural and synthetic), Natural organic and inorganic fertilizers, Synthetic fertilizers, Nitrogenous fertilizers: **1) Ammonium nitrate:** (i) Manufacture by Prilling method (ii) Manufacture by Stengel method **2) Ammonium sulphate:** (i) Manufacture from gypsum (Sindri Process) & Action as fertilizer **3) Urea:** (i) Manufacture from Ammonium carbide (ii) Manufacture by Sindri process & Action as fertilizer **3) Calcium cyanamide:** (i) Manufacture & Action as fertilizer	**8T**

	4	**Chapter - 4 Fertilizers-2** **1) Phosphate fertilizer** (i) Manufacture of Normal super phosphate (ii) Manufacture of Triple super phosphate **2) Ammonium Phosphate:** (i) Manufacture of Mono ammonium phosphate (ii) Manufacture of Diammonium phosphate **3) Potassium fertilizer:** Potassium chloride, Potassium sulphate and Potassium nitrate. Mixed or multinutrient fertilizers(NPK), Comparison of advantages and disadvantages of natural and synthetic fertilizers.	**7T**

Minor Chemistry Practical-6

Sem	Unit No	Syllabi	Teaching Hours
6	**1**	**Inorganic Qualitative Analysis (Four radicals)** To identify 2-positive and 2-Negative radicals from the given inorganic mixture containing total four radicals. ***[7 inorganic mixtures may be analyzed]***	**30**
	2	**Gravimetric Analysis:** Minimum six Gravimetric analysis exercises with three containing impurities of Cu or Fe and three pure solutions may be given. 1. Estimation of nickel (II) in a mixture of solution containing $NiSO_4$, $CuSO_4$ and free H_2SO_4 as $Ni(DMG)_2$ complex using Dimethylglyoxime (DMG). 2. Estimation of copper as CuSCN 3. Estimation of Fe^{+2} as Fe_2O_3 in a solution containing a (mixture of $CuSO_4$ and) $FeSO_4$ NH_4SO_4 by precipitating iron as $Fe(OH)_3$. 4. Estimation of Al (III) from the solution mixture containing $CuSO_4$ $AlSO_4$ and H_2SO_4 as Al_2O_3 or by precipitating with oxine and weighing as Al(oxine)3 (aluminium oxinate) 5. Estimation of Ba as $BaSO_4$ in a mixture of solution containing $BaCl_2$, $FeCl_3$ and HCl. 6. Estimation of Mn in a mixture of solution containing $MnCl_2$, $CuCl_2$ and HCl as $Mn_2P_2O_7$. 7. Estimation of Zn in a mixture of solution containing $ZnSO_4$, $CuSO_4$ and H_2SO_4 as $Zn_2P_2O_7$.	**30**

Suggested Reading:

1. Principles of Inorganic chemistry – Puri, Sharma & Kalia
2. Concise Inorganic Chemistry - J. D. Lee
3. Advanced Inorganic Chemistry- Cotton and Wilkinson
4. Basic Inorganic Chemistry - Gurdeep & Chatwal
5. A Text Book of Organic Chemistry (II Edition) by Raj K. Bansal
6. Essentials of Physical Chemistry, B. S. Bahl, G. D. Tli and Arun Bahl, S. Chand & Co. New Delhi
7. Elements of Physical Chemistry, Late B.R. Puri, L. R. Sharma and Madan
8. Pathania, Vishal Publishing Co. Jalandhar
9. Principles of Physical Chemistry, Samule H. Maron and Carl F. Prutton, Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi
10. Physical Chemistry, B. K. Sharma, Goel Publication House. Meerut.
11. Elements of Physical Chemistry, Samuel Glasstone and David Lewis, Macmillan & Co.
12. Industrial Chemistry by B.K. Sharma
13. A Textbook of Quantitative Inorganic Analysis by A. I. Vogel
14. Inorganic inflictive analysis by Vogel and Gehani Parekh
15. Photochemistry and Pericyclic reactios by Jagdamba singh and Jayasingh 6th edition ISBN:9360742724
16. Organic chemistry by Clayden Greeves and warren ISBN:10:9780198728719
17. Spectroscopy of organic compounds by P.S. Kalsi.ISBN-10:9360745162
18. Spectrometric identification of Organic Compounds by *Robert M. Silverstein* et al, Wiley publication

Evaluation scheme for various courses:

Scheme-1 INTERNAL EVALUATION SCHEME (50 Marks) for 4 credit 100 marks (Theory/Practical) course		
NO	**Particulars**	**Marks**
1	**Mid Semester (Theory/Practical) Exam (Mandatory)**	**25**
2	Class Test	05
3	Open book exam/test	05
4	Open note exam/test	05
5	Self-test/ Online test	05
6	Quizzes/Objective test	05
7	Class assignment	05
8	Home assignment	05
9	Research/Dissertation	05
10	Viva/Oral exam	05
11	Group Discussion	05
12	Paper presentation/Seminar	05
13	Co-curricular work	05
14	Field Assignment	05
15	Poster Presentation	05
16	Attendance	05
17	Project Work	05
	Total	**50**

Note: Sr.No.1 is mandatory. Select any five from Sr.No.2 to 17 Each Contains five marks. Student should secure 18 Marks for passing in internal Exam. (Choose particular exam style based on type of course-ie; Theory or practical).

For Major paper 14, 15: 25 marks Mid-term theory exam + 25 CCE + 50 External Theory Exam (SEE) = 100 marks

For Major paper-16(Practical): 25 marks Mid-term (practical exam) + 25 CCE + 50 External Practical Exam (SEE) = 100 marks

For Minor paper-6: 25 marks Mid-term (practical exam) + 25 CCE (Practical) + 50 External (Theory Exam) = 100 marks

Paper Style External Theory Exam (50-marks)

Ques. No.	Particulars	From which Unit	Marks
1	Attempt any two out of three questions	**1**	**10**
2	Attempt any two out of three questions	**2**	**10**
3	Attempt any two out of three questions	**3**	**10**
4	Attempt any two out of three questions	**4**	**10**
5	Attempt any two out of four questions	**One from each unit**	**10**
		Total Marks	**50**

Paper Style External Practical Exam 50-Marks

Exercise	Particulars	Time	Marks
1	Session-1	**4 hrs**	**25**
2	Session-2	**4 hrs**	**25**
	Total	**8 hrs**	**50**