From
Prof. G. Madhavi,
Professor & Chairman-BOS (PG), KCDC,
SVU College of Sciences,
Sri Venkateswara University,
Tirupati.

To
The Principal,
Krishna Chaitanya Degree College (A),
Nellore -524003.

Sir,

Sub. : KCDC, Nellore-BOS Chemistry Submission of revised syllabus for M.Sc.(Organic Chemistry) Major (P.G)-Reg.

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Under the subject Cited the B.O.S of Chemistry (P.G) had met on 12-11-2025 at 11:00 AM in Online to revise the syllabus for M.Sc. (Organic Chemistry) Major for the Academic Year 2025-2026. I am here with submitting the syllabus for M.Sc. (Organic Chemistry) Major after the discussion of the BOS by online, confirming the Rules and Regulations laid down by the A.P.S.C.H.E. & VSU. The Revised Syllabus along with Model Papers and signatures of B.O.S members, are Enclosed.

Thanking you,

Prof. G. Madhavi
(Chairman – BoS)

Members:

1 **Prof. N.C.Gangi Reddy,**
Professor,
Dept. of Chemistry,
Yogi Vemana University, Kadapa.

2. **Dr.S.Adinarayana Reddy,**
Associate Professor,
Dept. of Materials Science and Nano-Technology,
Yogi Vemana University, Kadapa.

3. **Dr. D Ramasekhar Reddy,**
Assistant Professor,
Dept. of Chemistry,
Krishna University, Machilipatnam.

4. **Sri.M.Praveen Kumar Reddy,**
DC Manager,
Deloitte Consulting India Pvt. Ltd.,
Hyderabad.

5. **Sri.K.Satish Kumar Reddy,**
Senior Research Scientist,
GaloreTx Pvt. Ltd., Bangalore.

6. **Smt.V.Vijaya,**
Dept. of Chemistry,
Krishna Chaitanya Degree College, Nellore

7. **Smt.M.Madhavi**,
Dept. of Chemistry,
Krishna Chaitanya Degree College, Nellore.

8. **Smt.U.Nirmala,**
Dept. of Chemistry,
Krishna Chaitanya Degree College, Nellore

KRISHNA CHAITANYA DEGREE COLLEGE::NELLORE.

(Autonomous)

(Affiliated to V.S.University)

M.Sc (Organic Chemistry)

(With effect from the batch of Students admitted from the academic year 2025-26)

MASTER OF SCIENCE

Semester I (Course Structure)

S. No	Course	Code	Title of the Course	H/W	C	SEE	IA	Total Marks
1	CC	101	Core course–1: Inorganic Chemistry-I	4	4	70	30	100
2		102	Core Course–2(A): Organic Chemistry-I Core Course–2(B): Analytical Chemistry-I	4	3	50	25	75
3		103	Core Course–3(A): Physical Chemistry-I Core Course–3(B): Pharmaceutical Quality Control And Quality Assurance	4	3	50	25	75
4	*P	104	Practical I (related to CC 1 & 3)	6	2	35	15	50
5	SOC	105	Skill Oriented Course–1(A): Chemotherapy and Drug Analysis Skill Oriented Course–1(B): Inorganic Materials in Industry	4	3	50	25	75
6	SOC	106	Skill Oriented Course–2(A): Industrial Chemistry Skill Oriented Course–2(B): Applied Methods of Chemical Analysis	4	3	50	25	75
7	*P	107	Practical II (related to SOC 1 & 2)	6	2	35	15	50
8	OOTC	108	Moocs/Open Online Trans Disciplinary Course-I/Open Online Elective	0	2	0	0	0
9	Audit	109	Indian Knowledge Systems - 1	4	0	0	0	0
			Total	36	22	340	160	500

CC (Core Course) – 1st Core Course is mandatory and 2nd & 3rd Core Courses Student can choose one from each code

***SOC (Skill Oriented Courses) – Student can choose one from each code**

***Practical –1 relating to 2nd & 3rd Core Courses and Practical – II relating to 1st & 2nd Skill Oriented Courses (SOC)**

Audit Course – Zero Credits but mandatory with only a Pass

NOTE: Every student should submit the certificate related to MOOCS / Open online elective on or before the final year result without fail.

Semester II (Course Structure)								
S. No	Course	Code	Title of the Course	H/W	C	SEE	IA	Total Marks
1	CC	201	Core course–4: Inorganic Chemistry-II	4	4	70	30	100
2	CC	202	Core Course–5(A): Organic Chemistry-II	4	3	50	25	75
			Core Course–5(B): Industrial Methods of Chemical Analysis					
3	CC	203	Core Course–6(A): Physical Chemistry-II	4	3	50	25	75
			Core Course–6(B): Main Group Chemistry & Spectroscopic Characterizations of Inorganic Compounds					
4	P	204	Practical III (related to CC 4 & 6)	6	2	35	15	50
5	SOC	205	Skill Oriented Course–3(A): Instrumental Methods	4	3	50	25	75
			Skill Oriented Course–3(B): Materials Chemistry					
6	SOC	206	Skill Oriented Course–4(A): Heterocyclic Chemistry	4	3	50	25	75
			Skill Oriented Course–4(B): Bio-organic Chemistry					
7	P	207	Practical IV (related to SOC 3 & 4)	6	2	35	15	50
8	OOTC	208	Moocs/Open Online Trans Disciplinary Course-I/Open Online Elective	0	2	-	-	-
9	Audit	209	Indian Knowledge Systems – 2	4	0	0	0	0
			Total	36	22	340	160	500

- **CC (Core Courses): 4th Core Course is mandatory and 5th & 6th Core Courses student can choose one from each code.**
- **SOC (Skill Oriented Courses): Student can choose one from each code.**
- **Practical III relates to 5th & 6th Core Courses and Practical IV relates to 3rd & 4th Skill Oriented Courses (SOC).**
- **OOTC: Students can choose any relevant course of their choice from online government agencies like SWAYAM, NPTEL, etc.**
- **Audit Course: Zero Credits but mandatory with only a Pass.**

NOTE: Every student should submit the certificate related to MOOCS / Open online elective on or before the final year result without fail.

(M.Sc. CHEMISTRY (Organic Chemistry)

(Effective from Academic year 2025-2026)

FIRST SEMESTER

CC101-CORE COURSE 1: INORGANIC CHEMISTRY-I

Theory **Credits: 4** **4Hrs/Week**

COURSE OBJECTIVES:

- Comprehend the key features of Co-ordination Compounds, crystal field theory different properties and bonding by spectroscopic techniques.
- Study the polymorphic forms of non-transition elements and their synthesis and properties.
- Understand the basics of reaction mechanism and the mechanistic concepts of Dissociative (Id) and Associative interchange mechanism (Ia), Taube's classification, Trans effect and Electron transfer reactions.
- Familiarize with the methods of synthesis of metal carbonyls and metal nitrosyls, synergistic, effect EAN and 18-electron rule.

COURSE OUT COMES:

- To understand the key features of co-ordination compounds, crystal field theory, magnetic properties and bonding in transition metal complexes.
- To learn about the polymorphic forms of Carbon, sulphur and Phosphorus, synthesis and properties of sulphur- nitrogen compounds, boranes, Carbides, silicates and to know wades rules.
- To explain the reactivity of complexes in terms of valence bond and crystal field theories, Taube's classification, Trans effect and Electron transfer reactions.
- To gain knowledge on synthesis and structures of different metal carbonyls, synergistic effect and 18-electron rule.

UNIT-I: COORDINATION COMPOUNDS & METAL-LIGAND BONDING THEORIES ***15 Hrs***

Introduction to Crystal field Theory, CFSE and its calculation, Paring energy, Splitting of 'd' orbitals in Trigonal bi pyramidal, square planar, square pyramid and pentagonal bipyramidal geometries, Jahn – Teller effect, Application of CFT, OSSE, site Selection in Spinels, Short comings of CFT, Nephelauxetic effect. MOT of co-ordinate bonds – M.O. Diagrams for octahedral, tetrahedral and square planar complexes. Experimental evidences for π- bonding.

UNIT-II: CHEMISTRY OF NON-TRANSITION ELEMENTS ***15 Hrs***

General characteristics of the non-transition elements special features of individual elements; Synthesis properties and structure of their Halides and Oxides, Synthesis, properties and structure of boranes, Carboranes, borazines, Silicates, Carbides, Sulphur-nitrogen compounds, Electron counting in boranes, Wade's rules (Polyhedral skeletal electron pair theory), Isopoly and hetero poly acids.

UNIT-III: REACTION MECHANISMS IN METAL COMPLEXES. ***15 Hrs***

Reactivity of metal complexes. Inert and Labile complexes. Concept of Labile and Inert complexes in terms of Valence bond and Crystal Field theories. Taube's classification of complexes as labile and inert complexes. Dissociative (D) and Dissociative interchange Mechanism (Id) & Associative (A) and Associative interchange Mechanism (Ia). Substitution reactions in octahedral complexes - Acid Hydrolysis - factors affecting Acid Hydrolysis - Base Hydrolysis-conjugate Base Mechanisms -

Substitution Reactions in Square Planar complexes- Trans effect - Mechanisms of Trans effect: polarization and π-bonding theories. Electron Transfer Reaction-Inner Sphere and outer Sphere Mechanisms- Marcus theory.

UNIT-IV: TRANSITION METAL CARBONYL AND METAL NITROSYL COMPLEXES ***15 Hrs***

Nature of π bonding, Classification of π ligands, π donor ligands and π-acceptor ligands. Metal Carbonyls: Synthesis of metal carbonyls, Structures of metal carbonyls of the types M(CO)n (M= Cr, Fe, Ni; n=4-6), M2(CO)n (M=Co, Fe, Mn; n=8-10), M3(CO)12 (M=Fe, Ru and Os), M4(CO)12 (M=Co, Rh, Ir). IR Spectra of metal carbonyls (i) Detection of bridging and terminal CO ligand, (ii) Synergistic effect, EAN and 18-electron rule.

Metal Nitrosyls: Synthesis of metal Nitrosyls, bonding, Electron donation by nitric oxide, Models for NO bonding (i) Covalent model and (ii) Ionic models, Structures of metal nitrosyls 1.)[IrCl(PPh_3) CO NO]$^{+}$2) [RuCl(PPh_3)($NO)_2$]$^{+}$3) [(Cp)CrCl($NO)_2$]4) [$(Cp)_2$CrCl$(NO)_4$]Applications of metal nitrosyls.

Books suggested:

1. F.A. Cotton and G. Wilkinson, Advanced In-organic chemistry VI Edition, 1999. John Wiley & Sons, Inc., New York.
2. James E. Huhey, Inorganic chemistry- Principles of structure and reactivity, VI Edition 1993. Harper Collins College Publishers, New York.
3. J.D. Lee: Concise Inorganic Chemistry (Blackwell)
4. Gary Wolfsburg: Inorganic Chemistry (5th Ed. Viva Books)
5. W.L. Jolly: Modern Inorganic Chemistry (McGraw-Hill)
6. B.N Figgis: Introduction to Ligand Fields (John-Willey)
7. S.F.A. Kettle: Coordination compounds.
8. Coordination Chemistry. Bassalo& Johnson.

(M.Sc. CHEMISTRY (Organic Chemistry)

(Effective from Academic year 2025-2026)

FIRST SEMESTER

CC102-CORE COURSE 2(A): ORGANIC CHEMISTRY-I

Theory **Credits: 3** **4Hrs/Week**

COURSE OBJECTIVES:

- Understand thermodynamic and kinetic requirements, kinetic and thermodynamic control, potential energy diagrams, transition states and intermediates, methods of determining mechanisms, isotopic effects in reactive intermediates.
- Familiarize with different types of substitution reactions, able to predict products, including stereochemistry in aliphatic and aromatic nucleophilic substitution reactions, effect of neighboring group participation.
- Able to recognize, classify, explain and apply fundamental organic reactions such as E1, E2 and E1cB and electrophilic addition to carbon-carbon double bond by syn and anti addition.
- Classify molecule based on stereo chemical aspects study on optical and geometrical isomerism by the application of Cahn-Ingold-Prelog rules and conformational analysis.

COURSE OUT COMES:

- To know the concept of isotopic effects, potential energy diagrams and different intermediates, transition states in different intermediates.
- To ascertain the stereochemistry of the products with the effect of neighbouring group participation and to familiarize the various types of aromatic substitution reactions.
- To familiarize the mechanisms of E1, E2, and E1cB reactions, stereoselectivity and Pyrolytic eliminations and Electrophilic addition reactions.
- To detect stereochemical structures of the molecules, stereoselective and stereocontrolled reactions and conformations of dimethyl substituted cyclohexanes.

UNIT-I: REACTIVE INTERMEDIATES **15 Hrs**

Introduction, generation, structure, stability and reactivity of carbocations, carbanions, free radicals, carbenes, nitrenes and arynes. Thermodynamic and kinetic requirements, kinetic and thermodynamic control, potential energy diagrams, transition states and intermediates, methods of determining mechanisms, isotope effects.

UNIT-II: SUBSTITUTION REACTIONS **15 Hrs**

Aliphatic Nucleophilic Substitution: Introduction to SN1, SN2, mixed SN1 and SN2, SET mechanisms. The neighbouring group participation (NGP) anchimeric assistance, NGP by σ and π-bonds, phenonium ions, norbornyl and norbornenyl systems, Classical and nonclassical carbocations, NGP by heteroatoms (O, N, S).

Aromatic Nucleophilic Substitution: Addition-Elimination reaction (SNAr), benzyne mechanism. The Von Richter, Sommelet-Hauser and Smiles rearrangements.

UNIT-III: ADDITION AND ELIMINATION REACTIONS **15 Hrs**

Addition Reactions:

Electrophilic addition to carbon-carbon double bond: Stereoselective addition to carbon-carbon double bond; anti addition - Bromination and Epoxidation followed by ring opening. Syn addition of OsO_4 and $KMnO_4$.

Addition to Carbon-Hetero Multiple Bonds: Steric course of addition reactions C=O and C=N, Cram's rule, Aldol condensation, Cannizzaro, Perkin, Knoevenagel, Claisen-Schmidt, Claisen, Dieckman, Benzoin and Stobbe condensations.
Elimination reactions: E2, E1, E1CB mechanisms. Orientation and Stereochemistry in E2 eliminations, Hofmann and Saytzeffrules,Pyrolytic eliminations.

UNIT-IV: STEREOCHEMISTRY AND CONFORMATIONAL ANALYSIS **15 Hrs**
Stereoisomerism - Introduction to Stereochemistry
Molecular Symmetry & Chirality: Symmetry operations and symmetry elements (Cn & Sn).
Optical isomerism: Molecular Symmetry and Chirality, Cahn-Ingold-Prelog rules (R, S-nomenclature), stereoisomerism resulting from more than one chiral centrecompounds.
Axial Chirality: Stereochemistry of allenes, spiranes.
Atropisomerism - biphenyl derivatives.
Planar chirality Ansa compounds and trans Cycloalkenes - Helicity.
Geometrical isomerism: E, Z - nomenclature - Physical and Chemical methods of determining the configuration of geometrical isomers.
Conformational Analysis: Conformations of dimethyl substituted cyclohexanes.

Books Suggested:
1. Advanced Organic Chemistry-Reactions, Mechanism and Structure, Jerry March, John Wiley.
2. Advanced Organic Chemistry, F.A. Carey and R.J. Sundberg, Plenum.
3. Structure and Mechanism in Organic Chemistry C.K. Inglod, Cornell University Press.
4. Organic Chemistry, R.T Morrison and R.N. Boyd, Prentice - Hall.
5. Principles of Organic Synthesis, R.O.C Norman and J. M. Coxon, Blackie Academic.
6. Stereochemistry, P.S. Kalsi, Wiley Eastern.
7. Stereochemistry of Organic compounds: principles and applications, D.Nasipuri, New age international publishers.
8. Textbook of Organic Chemistry, M.C. Murry.
9. Organic Chemistry, Vol I, I.L. Finar, ELBS Eds.

(M.Sc. CHEMISTRY (Organic Chemistry)

(Effective from Academic year 2025-2026)

FIRST SEMESTER

CC102-CORE COURSE 2(B): ANALYTICAL CHEMISTRY-I

Theory **Credits: 3** **4Hrs/Week**

COURSE OBJECTIVES:

- To learn about physical methods of drug analysis and Quality management system.
- To learn about Gravimetric analysis, use of organic reagents in inorganic precipitation analysis
- To study about use of complexometric titrations and precipitation titrations.
- To learn about Redox titrations such as oxidising, Reducing systems and diazotization titrations.

COURSE OUT COMES:

- To know the analyzing about Drugs such as identification, M.P, water content, Hardness measurements and Quality management
- To know the analyzing about different precipitations.
- To know the analyze about titration curves, Qualitative applications, Titration of mixtures, sensitivity, masking & De-masking agents. Qualitative applications of Precipitation titration
- To know the oxidizing systems, Reducing systems, Types of diazotization titrations.

UNIT-I: PHYSICAL METHODS OF DRUG ANALYSIS & QUALITY MANAGEMENT SYSTEM 15 Hrs

Physical methods of Drug Analysis : Identification, Melting point, Solubility, Polymorphism, Water content or moisture content, Residue on ignition, Heavy metals for drug products, Disintegration test, Hardness test, Hardness Measurements.

Quality Management System: The laboratory product, Laboratory process, Laboratory Customer, Satisfaction, Improvement, Documentation Requirements, Management Responsibility-Quality Policy, Responsibility, Authority and Communication, Resource Management, Product Realization, Measurement, Analysis and Improvement, Tools and Mechanism, Laboratory Environment.

UNIT-II: GRAVIMETRY **15 Hrs**

Gravimetric Analysis: Methods of precipitation, Theory of relative supersaturation and precipitate formation, Purity of the precipitate- Co-precipitation, Post precipitation, occlusion, surface adsorption. Precipitation from homogeneous solution (PFHS) - effect of pH, Ion release method, change in oxidation state etc. Examples-homogeneous precipitation methods of Al, Fe, Bi, Cu, Ba, homogeneous precipitation of Mg with oxine (8-hydroxy quinoline), Ni with DMG, Cu precipitation with benzoin oxime. Change of oxidation state, Ce^{3}+. Precipitation of Pb as chromate by oxidation of Cr+3.

Organic reagents in Inorganic Analysis: Theoretical principles involved in the use of organic reagents in inorganic precipitation analysis. (i) DMG (ii) Cuferon (iii) 8-hydroxy quinoline.

UNIT-III: TITRIMETRIC ANALYSIS **15 Hrs**

Complexometric Titrations: Introduction, Stability of complexes, factors influencing the

stability of complexes, stability constants of EDTA complexes. Titration curves, Types of EDTA curves, Representative methods, Qualitative applications. Titration of mixtures, Sensitivity, Masking and Demasking agents.
Precipitation Titrations: Titration curves, feasibility of precipitation titration, factors affecting shape-titrant and analyte concentration, volhard, Mohr and Fazan's titration methods, Selection and Evaluation of External and Adsorption Indicators of end points. Quantitative application of precipitation titrations.

UNIT-IV: REDOX AND DIAZOTIZATION TITRATIONS **15 Hrs**

Redox Titrations: Analytical chemistry of some selected redox systems. Formal and Standard potentials in various media, stability of solutions, species responsible for oxidizing and reducing properties, standardization, requirement for the selection of oxidants and reductants.
Oxidizing Systems: Ce(IV) and iodate.
Reducing Systems: Cr(II), V(II), Ti(III). Selection of Suitable Indicators for Oxidant and Reductant systems. Estimation of Drugs and Pesticides by volumetric method. Applications of Redox titrations by using CAS.
Diazotization Titrations: Principles, Preparation and standardization of 0.1 M $NaNO_2$ solution, Procedure for diazotization titrations, Types of diazotization titrations-Direct, Reverse, Special methods, Applications of diazotization titrations-Direct titrations Conversion to amino group by chemical reactions by reduction and by Hydrolysis.

Books suggested

1. Analytical Chemistry by Gary D. Christian, 6th Edition.
2. Analytical Chemistry and Principles by T.H. Kennedy, 2nd Edition.
3. Fundamentals of Analytical chemistry by David Harvey, Mc Graw Hill – 2003.
4. Vogel's text book of Quantitative analysis, III Edition, Longman publications.
5. Principles and methods of chemical Analysis by Walton 3rd Edition.
6. Text book of Pharmaceutical Analysis by Dr. S. Ravi Sankar, Rx Publications.

(M.Sc. CHEMISTRY (Organic Chemistry)

NEP - 2020 under CBCS (Effective from Academic year 2024-2025)

FIRST SEMESTER

CC103-CORE COURSE 3(A): PHYSICAL CHEMISTRY-I

Theory **Credits: 3** **4Hrs/Week**

COURSE OBJECTIVES:

- Acquire knowledge in Quantum chemistry. Applications of Schrodinger wave equation.
- Study on chemical Dynamics and theories in unimolecular chain and fast reactions and determination of rate of reactions. Different types of catalysis.
- Familiarize with concepts of Thermodynamics. Gibbs-Duhem equation and Sackur-Tetrade equation.
- Know about thermodynamic and kinetic concepts of Electrochemistry and conductance, conductivity of electrolytes.

COURSE OUT COMES:

- To know the concepts such as Operator algebra, Eigen Values and Eigen functions. Degeneracy, Schrodinger wave equation. Homogeneous and heterogeneous catalysis.
- To learn about homogeneous and heterogeneous catalysis , acid-base catalysis, Enzyme catalysis.
- To know about Thermodynamic concepts and entropy changes in reversible and irreversible process. Gibbs-Duhem equation, calculations.
- To study the thermodynamic and kinetic derivation of Nernst equation and the derivation. Debye-Huckle equation and its verification.

UNIT-I: QUANTUM CHEMISTRY – I **15Hrs**

Photoelectric effect-black-body radiation- Plank's equation- wave particle duality and uncertainty principle- Hydrogen emission spectrum- Bohr's model of the atom. Operators Algebra operator, Addition- subtraction-multiplication operators. Commutator operator- Commutative property of operator linear operator- operators∇ and ∇^2- derivation of Schrodinger wave equation - Eigen values and Eigen functions-Hermitian property of operators-properties of Hermitian operator- derivation of operator for momentum and energy - well behaved functions-Normalized function- orthogonality condition-degeneracy.

UNIT-II: CHEMICAL DYNAMICS –I **15Hrs**

Homogeneous and Heterogeneous Catalysis. Homogeneous catalysis; catalysis by transition metal ions and their complexes; industrially important processes; supported transition metal complexes as catalysts; bimolecular reactions; electronic theories of chemisorption and heterogeneous catalysis.

Acid Base Catalysis. Specific acid catalysis and general acid catalysis (hydrolysis of ester and vinyl ether); specific base catalysis and general base catalysis (the alcohol reaction and hydrolysis of acetic anhydride); protolytic and prototropic mechanism.

Introduction to Enzyme Catalysis. Michaeles - Menton Kinetics - Effect of pH and effect of temperature on the rates of enzyme reactions.

UNIT-III: THERMODYNAMICS -I **15 Hrs**

Brief review of Thermodynamic concepts: Entropy change and phase change - Entropy of

mixing - Entropy and disorder. Free energy and Gibbs - Helmholtz equation. Chemical Potential and Gibbs - Duhem equation.

Statistical thermodynamics: Partial molar properties: their significance and determination of partial molar properties, fugacity and its determination. Concept of distribution, thermodynamic probability and most probable Distribution, Ensemble averaging, postulates of ensemble averaging, canonical, grand canonical and micro- canonical ensembles, partition functions, translational, rotational, vibrational and electronic partition functions, Entropy of monatomic gases (Sackur-Tetrade equation).

UNIT-IV: ELECTROCHEMISTRY –I **15Hrs**

Thermodynamic and Kinetic concept of Electrochemistry

Thermodynamic and Kinetic Derivation of Nernst Equation, Chemical and Concentration Cells with and without Transference, Liquid Junction Potential, Derivation of the Expression for Liquid Junction Potentials-its determination and elimination, Applications of EMF Measurements: (i) Solubility product, (ii) pH Determination, (iii) Potentiometric Titrations.

Classification of electro chemical cells, selection and characterization of electro chemical cells.

Books suggested

1. Physical Chemistry, P. W. Atkins (ELBS).
2. Introduction to quantum Chemistry, A. K. Chandra (Tata McGraw Hill).
3. Quantum Chemistry, Ira N. Levine (Prentice Hall).
4. Atomic Structure and chemical bond, Manas Chandra.
5. Chemical Kinetics, K.J.Laidler (McGraw Hill).
6. Kinetics and Mechanism of Chemical Transformations, J. Rajaraman and J. Kuriacose (Mcmilan)
7. Thermodynamics for Chemists, S. Glasstone.
8. Chemical Thermodynamics, I. M. Klotz.
9. Statistical Thermodynamics, M. Dole.
10. Modern Electrochemistry, vol. I & II, J. O. M. Bockris and A. K. N. Reddy (Plenum).
11. An Introduction to Electrochemistry (3rd ed.), S. Glasstone (Afffilated East-West).

(M.Sc. CHEMISTRY (Organic Chemistry)
NEP - 2020 under CBCS (Effective from Academic year 2024-2025)
FIRST SEMESTER
CC103-CORE COURSE 3(B): PHARMACEUTICAL QUALITY CONTROL AND QUALITY ASSURANCE

Theory **Credits: 3** **4Hrs/Week**

COURSE OBJECTIVES:

- To acquire knowledge about WHO Specifications. To handle Manufacturing documents. Reprocessing
- Training for personal Hygiene Environmental Control.
- Cleaning methods. and Quality control
- To know about basic concept of Quality Assurance Principles and Quality management concepts.

COURSE OUT COMES:

- Standard operating procedure. ISO-9000; ISO-14000 USFDA guidelines. Master formula & batch formula. Distribution of records
- Construction, Maintainance and Sanitations. Sterile areas, control of contamination
- Equipment cleaning methods. In process quality control on various dosage forms.
- Needs, requirements and expectations. Quality Management System ISO 9001-2000 QMS case Study in chemical industry.

UNIT-I: QUALITY AUDIT, DOCUMENTATION AND HANDLING **15 Hrs**

Quality audit. Standard operating procedure (SOP): international conference harmonization (ICH); ISO-9000; ISO-14000, WHO specifications, USFDA guidelines and ICMR.
Documentation and Handling: Manufacturing documents, Master Formula, batch formula, Record, Distribution of records, Handling of returned goods, Recovered materials and Reprocessing.

UNIT-II: ORGANIZATION AND PERSONNEL RESPONSIBILITIES **15 Hrs**

Training, Hygiene, Premises: Location, Design, Plant layout, Construction, Maintenance and Sanitations. Environmental control, Sterile areas, control of contamination.

UNIT-III: REGULATORY ASPECTS AND QUALITY CONTROL **15Hrs**

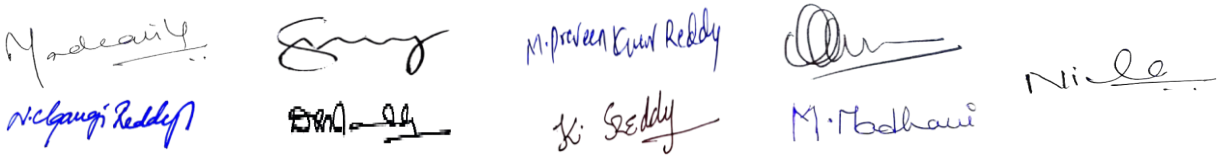
Regulatory aspects. Validation of Personnel, Equipment and cleaning methods, regulatory aspects of pharmaceutics.
Quality Control. In-process quality Control on various dosage forms, Sterile and non- sterile operations.

UNIT-IV: BASIC CONCEPTS OF QUALITY ASSURANCE **15 Hrs**

Basic concepts, principles or prescription, Needs, requirements and expectations, characteristics of quality, Achieving, sustaining and improving quality, Quality dimensions and costs of quality. Elements of quality Assurance, Quality Management System, Quality management concepts and principles: ISO 9001:2000, QMS Case studies on ISO 9001: 2000 in chemical industries.

Books Suggested

1. R. Pannerselvam, Production and Operations Management, Prentice Hall India Learning Pvt. Ltd. 3rd Ed., 2012.
2. M. Savsar, Quality Assurance and Management, InTech-Croatia, 2012.
3. D.C. Montgomery, Statistical Quality Control, John Wiley & Sons, 5th Ed., 2005.
4. M. K. Starr, Production and Operations Management, Biztantra, Delhi, 2004.
5. D.H. Shah, QA Manual, Business Horizons, 2000.
6. D.H. Besterfield, C. Besterfield-Michna, G.H. Besterfield, M. Besterfield-Sacre, Total Quality Management, Pearson Education, Inc., 3rd Ed., 2003.
7. P. Konieczka, J. Namiesnik, Quality Assurance and Quality Control in the Analytical Chemical Laboratory: A Practical Approach, 1st Ed., CRC press 2009.
8. D. Hoyle, ISO 9000 Quality Systems Handbook, 5th Ed., Butterworth Heinemann-Elsevier, New York, 2006.



(M.Sc. CHEMISTRY (Organic Chemistry)

(Effective from Academic year 2025-2026)

FIRST SEMESTER

P-104: Practical I (related to CC101 and CC103)

Practical	**Credits: 2**	**6Hrs/Week**

COURSE OBJECTIVES:

- Basic Laboratory techniques & titration and analysis
- Calibration of volumetric apparatus and statistical analysis of the data.

COURSE OUT COMES:

- To demonstrate Mastery of Basic semi micro-Qualitative analysis of simple salts and put up analytical data by the observation
- To familiarize with techniques of Titration & Calculation of Errors
- To Study the distribution of Benzoic acid in Benzene - water system
- To Study the determination of chemical kinetics of acid hydrolysis of an ester.

CC101-CORE COURSE-1 PRACTICAL: (INORGANIC CHEMISTRY-I)

Semi micro qualitative analysis

Qualitative analysis of a mixture containing four cations including two less common cations(Viz – W,Mo,Se,Te,Ce,V,Zr,Li)

CC103-CORE COURSE – 3(A) PRACTICAL: PHYSICAL CHEMISTRY -1

1. Determination of Eutectic composition and temperature of binary system.
2. Determination of Distribution Coefficient of benzoic acid between water and benzene.
3. Determination of rate constant of acid hydrolysis of an ester and investigate the effect of catalyst concentration, rate constant concentration and temperature.

(M.Sc. CHEMISTRY (Organic Chemistry)

(Effective from Academic year 2025-2026)

FIRST SEMESTER

SOC105-SKILL ORIENTED COURSE 1(A): CHEMOTHEROPY AND DRUG ANALYSIS

Theory **Credits: 3** **4Hrs/Week**

COURSE OBJECTIVES:

- To Gain knowledge on chemotherapy and analysis of Drugs.
- Analysis of Drugs chemically and Biologically

COURSE OUT COMES:

- To know about the classification & Synthesis of drugs
- To familiarize with the Qualitative and Quantitative analysis of Drugs
- To know about routes of Administration of Drugs
- To understand prodrug design & Common Drugs

UNIT-I: CHEMOTHERAPY **15 Hrs**

Definition, History, and Evolution of Chemotherapy; Discovery, Classification, Nomenclature, Mode of action and synthesis of the following classes of compounds with special references to specific drugs mentioned under each class

Sulfa drugs- Sulfanilamide and Sulfamethoxazole.

Antibiotics- Lactum group of antibiotics - Penicillin, Ampicillin and Amoxycillin. Cephalosporin-C.**Anticancer drugs** - 5-Flurouracil

Antifungals–Griseofulvin**Antimalarials** – Chloroquin

UNIT-II: CHEMICAL AND BIOCHEMICAL ANALYSIS OF DRUGS **15 Hrs**

Qualitative and Quantitative Analysis of drugs: Uses of IR, UV, GLC and HPLC methods. Drug Assay by Biochemical Analysis - ELISA (Cortisol, alcohol, opiates). Radio Immuno Assay (RIA) - Enalapril, Insulin, Use of isotopes in the Bioanalysis of drugs and in drug design programmes.

UNIT-III: PRINCIPLES OF PHARMACOKINETICS, PHARMACODYNAMICS AND MECHANISM OF DRUG ACTIONS **15 Hrs**

Method of Administration, Absorption, distribution, metabolism and excretion of drugs (ADME); nature of drug - receptor interactions; theories of drug action: occupancy theory, rate theory, Induced-fit theory, drug synergism and antagonism.

UNIT-IV: PRODRUG DESIGN AND COMMON DRUGS **15 Hrs**

Principles of prodrug design. Structure, uses, mechanism of action of following drugs.

i) sulfamethoxazole,
ii) mechlorethamine,
iii) omeprazole,
iv) captopril,
v) paracetamol and
vi) levodopa

Book Suggested

1. Medicinal Chemistry and Pharmaceutical Chemistry - Harikishan Singh and Kapur
2. Medicinal Chemistry and Biochemistry - R.L.Nath
3. Introduction to Medicinal Chemistry - Patrick
4. The Organic Chemistry of Drug Synthesis Vols. 1-6 - Ledneicer
5. Top drugs top syntheti routes - John Saunders
6. Medicinal Chemistry - Ashutoshkar
7. Synthetic Organic Chemistry and Drugs - Gurideep R Chetwal
8. Bergers Medicinal Chemistry Vols. 1-5 – Manfred E. Wolf
9. Prinicples of Medicinal chemistry - William Foye

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FIRST SEMESTER

SOC105-SKILL ORIENTED COURSE 1(B): INORGANIC MATERIALS IN INDUSTRY

Theory **Credits: 3** **4Hrs/Week**

COURSE OBJECTIVES:

- To know about the difference between ores and Minerals. Manufacture of ceramics and applications.
- Acquiring knowledge about different types inorganic pigments and their industrial applications.
- About Metal oxide photocatalysis and its application
- About different types of inorganic fertilizers.

COURSE OUT COMES:

- Methods and procedures for the analysis of Limestone, Ilmenite and Beryl. Properties of ceramics. Applications of colors to porcelain.
- General properties of inorganic pigments. preparation and properties of white, coloured, Black and Special pigments.
- Applications of photo catalysis. Purification of water and air. X-ray photo election spectroscopy.
- Types of inorganic fertilizers. Analysis of ammonical, phosphate, nitrate fertilizers.

UNIT-I: MINERALS, ORES AND CERAMICS **15 Hrs**

Minerals and Ores: Definition, types, differences between minerals and ores, methods and procedures for the analysis of Limestone, Ilmenite, Chalcopylites and Beryl.

Ceramics: General Properties of Ceramics- Basic Raw materials-Manufacture of Ceramics-Glaring in Ceramics. Applications of colors to the pottery-Porcelain-Raw Materials-Manufacture of Porcelain.

UNIT-II: INORGANIC PIGMENTS **15 Hrs**

Definition, types and classification of inorganic pigments, general properties of inorganic pigments. Preparation, properties and industrial applications of White pigements: TiO_2, ZnO; Colored pigments: Iron oxide, chromium trioxide; Black pigments: Carbon black, Iron oxide black pigments; Special pigments: Anticorrosive pigments, Luminiscent pigments.

UNIT-III: METAL OXIDE PHOTOCATALYSTS **15 Hrs**

Metal oxide photocatalysts design and synthesis, appplication of photocatalysis, Self-cleaning, purification of water and air, photoreduction of CO_2 and fuel production. Characterization of metal oxide photocatalysts by X-ray diffraction, transmission electron microscopy, X-ray photoelectron spectroscopy.

UNIT-IV: INORGANIC FERTILIZERS **15 Hrs**

Definition, types of inorganic fertilizers, analysis of ammonical fertilizers, phosphate fertilizers, nitrate fertilizers, estimation of micro nutrients in fertilizers.

Books suggested:

1. H.W.Willard, LL.Merritt and J.A.Dean: Instrumental Methods of Analysis
2. Instrumental Methods of Analysis H.Kaur
3. Industrial Chemistry by B.K.Sharma, Goel Publishing House, Meerut, 11th Edition, 2000.
4. Environmental Chemistry by S.C.Bhatia, CBS Publisheres, New Delhi, 1st Edition, 2002.
5. Environmental Chemistry by A.K.DE, New Age International (P) Limited, 6th Edition, 2007.
6. A Textbook of Environmental Chemistry and Pollution Control by S.S. DARA, S.Chand& Company Ltd.,5th revised edition, 2002.
7. Advanced Inorganic Chemistry by Cotton and Wilkinson, 5th Edition.

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FIRST SEMESTER

SOC106-SKILL ORIENTED COURSE 2(A): INDUSTRIAL CHEMISTRY

Theory **Credits: 3** **4Hrs/Week**

COURSE OBJECTIVES:

- To Gain knowledge on Nuclear chemistry and Nano Chemistry
- Analyse of Industrial applications of polymers

COURSE OUT COMES:

- To know about Nuclear reactions & Radio-Pharmaceuticals.
- To understand the Nano chemistry Polymer
- To know about Industrial applications & Polymers
- To understand Surface chemistry & Theorems.

UNIT - I: NUCLEAR CHEMISTRY: **15 Hrs**

Basic concepts of nuclear chemistry; radioactive decay and equilibrium; nuclear reactions; Q value; cross sections; types of nuclear reactions; radioactive techniques: counting techniques such as G. M. ionization and proportional counter, isotopic dilution, neutron activation analysis, radiometric titration; radiopharmaceuticals: radioimmunoassay, immunoradiometric assay, classification of radiopharmaceuticals, labeled compounds preparation, PET studies.

UNIT – II: NANOCHEMISTRY: **15 Hrs**

Terminology in Nano materials, Nanoscale, Quantum dots, Nano synthesis (sol-gel method and chemical vapor deposition method), Nano applications, Supramolecules, optical, electrical, transport and magnetic properties of nano materials, applications of nano materials (Biology, energy storage and fuel cells).

UNIT-III: INDUSTRIAL APPLICATIONS OF POLYMERS **15 Hrs**

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

UNIT-IV: SURFACE CHEMISTRY **15 Hrs**

Structural and theoretical treatment of liquid interfaces; thermodynamics of binary system; Gibbs equation and verification of Gibbs equation by microtome method and tracer method; spreading of one liquid on anther; states of monomolecular films; the surface area of solids;
Gibbs adsorption isotherm; the Longmuir adsorption isotherm; BET adsorption isotherm; estimation of surface area (BET equation, theoretical concept).

Books suggested:

1. P.T.K. Kissinger, W.R.Heinemann. Laboratory Techniques in Electro analytical Chemistry, Marsal Debber, Inc.
2. Willard, Merit. Instrumental methods of analysis, WelowarthPubliching Co.,
3. Silbey, Alberty, Bawendi. Physical chemistry. Jhon-Wiley & sons. 4th edition-2006.
4. Introduction to polarography and allied Technique by Dr.K. Zutshi
5. Text Book of Polymer Science, F. W. Billmeyer, Jr. (Wiley Inter Science)
6. Polymer Sciences by V. R. Gowariker, N. V. Viswanathan and Jayadev Sreedhar.
7. Essentials of Nuclear Chemistry, 4th Ed., 1995, H. J. Harnikar (Weily Eastern)
8. Hand book nano structured materials and nano technology by HS Nalwa- 2000
9. Engineering Chemistry by Jain & Jain.

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FIRST SEMESTER

SOC106-SKILL ORIENTED COURSE 2(B): APPLIED METHODS OF CHEMICAL ANALYSIS

Theory **Credits: 3** **4Hrs/Week**

COURSE OBJECTIVES:

- To Gain knowledge on paint pigments and Portland Cement
- learn the FOOD and Dairy Products & Forensic analysis.

COURSE OUT COMES:

- To Know the paint products & Pigments
- To gain knowledge on Dairy products & Forensic analysis
- To understand clinical chemistry & Tests
- To Familiarize With Drugs and Antibiotics

UNIT-I: ANALYSIS OF PAINT PIGMENTS AND PORTLAND CEMENT **15 Hrs**

Analysis of paint pigments: Preliminary inspection of the sample, non-volatile matter, water contents in the paint, used paint products. General separation of pigment binder and thinner of solvent types and latex type of paint products. Analysis of lamp black and carbon black. General procedure for analysis of white tinted pigments.

Analysis of Portland Cement: Loss on ignition, insoluble residue; Chief constituents of Portland cement-total silica, sesquioxide, lime, magnesia, ferric oxide, sulphuric anhydride etc. Air and dust pollution from cement plant, atmospheric dispersion of pollutants in cement industry.

UNIT-II: ANALYSIS OF FOOD AND DAIRY PRODUCTS & FORENSIC ANALYSIS **15 Hrs**

Food Analysis: Moisture, ash, crude fibres, fat, protein, carbohydrate, calcium, potassium, sodium and phosphate, common Food adulterants of main food stuffs, microscopic examination of adulterants in some common food stuffs, contamination of food stuffs. Pesticides Analysis in food products - BHC residues in foodstuffs, determination of DDT residues in food grains, determination of methyl parathion residues in food grains and vegetables, estimation of malathion residues in food grains.

Analysis of Dairy products: Composition of the milk, determination of some physical chemical properties of milk, determination viscosity, pH by chemical methods, determination of fat, alcohol test, estimation of calcium, magnesium, potassium, sodium, minerals separation and identification. Analysis of fat and butter.

Forensic analysis: General discussion of poisons, organo phosphates and snake venom, estimation of poisonous materials such as lead, Hg and Barbiturates in biological materials.

UNIT-III: CLINICAL CHEMISTRY **15 Hrs**

Clinical Chemistry: Analysis of Blood-Composition of blood, Collection and Preservation of samples, Clinical analysis-serum electrolytes, blood glucose and blood urea nitrogen (BUN), uric acid, albumin and globulin. Immunoassay, blood gas analysis, trace elements in the body.

UNIT-IV: ANALYSIS OF DRUGS AND ANTIBIOTICS **15 Hrs**

Drug Analysis: Introduction, sources of drugs, classification and nomenclature of drugs, drug screening test and investigating the drugs-complexometric titrations, acid base titrations,

polarimetry, determination of thiamine and riboflavin by fluorimetry, determination of the concentration of alcohol in pharmaceutical preparations and alcoholic bevarages.
Antibiotics and Sulpha Drugs: Classification of antibiotics, structures, properties and assay of some antibiotics-Chloramphenicol, Penicillin, Streptomycin and Cibazole.

Books Suggested

1. Standard methods of Chemical analysis by Welcher.
2. Text book of quantitative analysis by A. I. Vogel, 3rd Edition.
3. Food Chemistry by Lillian Hoagland Meyer, CBS Publishers.
4. Introduction to the chemical analysis of foods by Suzanne Nielson, CBS Publishers.
5. Fundamental of Analytical Chemistry by Gary D. Christian.
6. Standard Methods of Chemical analysis by Scott and Ferman.
7. Food Science experiments and Applications by Mohini Sethi, Eram S. Rao, CBS Publications.
8. Comprehensive experimental Chemistry by V. K. Ahluwalia and Sudha Ragav, New Age International, New Delhi.
9. Fundamental of Dairy Chemistry by Webb Johnson and Alford, CBS Publication second Edition.
10. Analytical Chemistry by Gary D. Christian, Fifth Edition, John Wiley & Sons, INC.
11. The chemical Analysis of Foods by Henry Edward Cox, Second Edition, J. & A. Churchill Ltd.

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FIRST SEMESTER

P 107: Practical II (related to SOC105 & SOC106)

Practical **Credits: 2** **6Hrs/Week**

COURSE OBJECTIVES:

- Basic Laboratory techniques of Titration & analysis
- Preparation of Aspirin, paraceptamol & Nerolin.
- Determination of CST of Phenol-water system

COURSE OUT COMES:

- To understand preparation of Aspirin, paraceptamol & Nerolin
- Determination of CST of Phenol-water system
- Determination Isotherm for Adsorption of acetic acid by charcoal
- Determination of Surface-Tension.

SOC105-SKILL ORIENTED COURSE 1(B) PRACTICALS: CHEMOTHERAPY & DRUG ANALYSIS

1. Preparation of Aspirin.
2. Preparation of Paraceptamol.
3. Preparation of Nerolin.

SOC106-SKILL ORIENTED COURSE 2(A) PRACTICAL: INDUSTRIAL CHEMISTRY

1. Determination of Critical Solution Temperature of phenol-water system.
2. Determination of Isotherm for Adsorption of Acetic acid by Charcoal.
3. Determination of surface tension.

Audit Course : 109 : The Indian Knowledge System – I **4hrs/week**

Learning Objectives :

Gain an understanding of Indian Knowledge System.

- Develop an ability to apply the IKS to societal challenges faced today in areas such as holistic health, governance, public administration and sustainable living.

Understand the importance of yoga to maintain both physical and mental health.

Learning Outcomes :–

1. Classify the key concepts of IKS and discuss the multi-faceted nature of knowledge contained in the Traditional Systems of India.
2. Identify the importance of Yoga way of living in maintaining a sound physical, emotional and mental health.
3. Recognize the relevance of Unique Traditional Practices and Knowledge.

Unit-I: Introduction to Indian Knowledge System (IKS), Definition, Concept and Scope of IKS.

Unit-II: Indian Philosophical systems: Its distinctive features in Puranas, Itihasa and Subhashitas.

Unit-III: Yoga Way of Life: Relevance to Health and Wellness; Managing Health: Importance of Ahara, Vihara and Vichara. Vaidya (traditional health care system), Tantra-Mantra, Amchi Medicine System

Unit-IV: Unique Traditional Practices and Applied Traditional Knowledge: Rituals, Spirituals, Taboos and Belief System, Sacred Groves, water and Soil Conservation and management Practices.

References:

1. Chakradeo, Ujwala, Temples of Bharat, Aayu Publications, New Delhi, 2024.
2. D.N. Bose, S.N. Sen and B. V. Subbarayappa, A Concise History of Science in India, Indian National Science Academy, New Delhi, 2009.
3. Datta B. and A. N. Singh, History of Hindu Mathematics: Parts I and II, Asia Publishing House, Bombay, 1962.
4. Kapoor, K. (2021), Indian Knowledge System: Nature, Philosophy, Character in Indian Knowledge System, vol. 1, Pub. Indian Institute of Advanced Studies, Shimla
5. Kulkarni, RaghunathPurushottam, Char Shulbsutra, RashtriyaVedVidyaSansthan, 2000.
6. Mahadevan, B., Bhat, V.R., Pavana, N. (2022), Philosophical Systems, in Introduction to Indian Knowledge System, Pub. PHI Learning, New Delhi.
7. Mahadevan, B., Bhat, V.R., Pavana, N. (2022), Knowledge: Framework and Classification, in Introduction to Indian Knowledge System, Pub. PHI Learning, New Delhi.
8. Mahadevan, B., VinayakRajatBhat, and R.N. NagendraPavana, Introduction to Indian Knowledge System: Concepts and Applications, PHI Learning Private Limited, New Delhi, 2022.
9. Mahadevan, B., Bhat, V.R., Pavana, N. (2022), Astronomy, in Introduction to Indian Knowledge System, Pub. PHI Learning, New Delhi.
10. Mukharji, AnishaShekhar.JantarMantar,MaharajaJaysingh's Observatory in Delhi, Atlantic Publication, Delhi. 2010. 11. M. Hiriyanna, M., Outlines of Indian Philosophy, MotilalBanarsidass, New Delhi, 1994.
11. Pandey, Om Prakash, SanskriticVicharkiAviramBhartiyaYatra, Uttar Pradesh Hindi Sansthan, Lucknow, 2019

12. Pandey, Om Prakash, Vedic VangamaykaParisheelan, Uttar Pradesh Hindi Sansthan, Lucknow, 2020. 14. Pandey, K.K., KriyaSarira Comprehensive Human Physiology, Chaukhambha Sanskrit series, Varanasi, 2018.
13. Pandey, K.K., PrakrutikAaharDwaraNisargopachar Nature Care Through Natural Foods, ChaukhambhaOrientalia, Varanasi, 2008.
14. Pandey, K.K, BharatiyaKundaliGanit, Chaukhambha Sanskrit series, Varanasi, 2018.
15. Pandey, K.K. KriyaSarira Comprehensive Human Physiology, Chaukhambha Sanskrit series, Varanasi, 2018.
16. Pandey, K.K., GoliyaRekhaganitam, Chaukhambha Sanskrit series, Varanasi, 2018.
17. Shukla Vidyadhar&TripathiRavidatt, AayurvedkaItihasevamParichay, Chaukhambha Sanskrit Sansthaan, New Delhi, 2017

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SECOND SEMESTER

CC 201- CORE COURSE 4: INORGANIC CHEMISTRY-II

Theory **Credits: 4** **4Hrs/Week**

COURSE OBJECTIVES:

- Understand stoichiometric reactions in catalysis and dynamic equilibria in η3 –allyl , dienyl complexes.
- Understand magnetic properties of transition metal complexes and various reactions on ligands with respect to synthesis.
- Gain knowledge on electronic spectra of complex molecules of octahedral and tetrahedral geometry.
- Understand magnetic properties viz., diamagnet and para magnetism and other related properties of complex molecules.

COURSE OUT COMES:

- To know about stoichiometric reactions in catalysis and flexional organo metallic compounds and properties, nature
- To familiarize with the general methods of complex preparations and properties, nature of bonding and structural features of metal complexes.
- To know about Russel-Saunders coupling and differentiate between orgel diagrams and Tanabe-Sugano diagrams.
- To understand about the laws of Hunds, Curies & Weiss, magnetism and magnetic susceptibility determination by Gouy's method.

UNIT-I: ORGANOMETALLIC CHEMISTRY **15 Hrs**

Organometallic Reagents in Synthesis

Stoichiometric reactions in catalysis, Homogeneous catalytic hydrogenation, Hydroformylation (oxo reaction), Isomerisation, Zeigler-Natta polymerization of olefins, Oxopalladation reactions, Activation of small molecules by coordination.

Fluxional Organometallic Compounds

Fluxionality and dynamic equilibria in compounds such as, n3-allyl and dienyl complexes.

UNIT-II: TRANSITION METAL *л* – COMPLEXES **15 Hrs**

Transition metal – complexes with unsaturated organic molecules - alkenes, alkynes, diene, dienyl and Cyclopentadienyl complexes and arene complexes-general methods of preparation, properties, nature of bonding and structural features - Important reactions relating to Nucleophilic and Electrophilic attack on ligands and to organic synthesis.

UNIT-III: ELECTRONIC SPECTRA OF METAL COMPLEXES **15 Hrs**

Free Ion Terms and Energy Levels: Configurations, Terms, States and Microstates. Calculation of Microstates for p^2 and d2 configuration, L-S (Russell-Saunders) Coupling Schemes, J-J Coupling scheme, derivation of terms for p^2 and d2 configuration. Hole Formulation, Energy ordering of terms (Hund's Rules), Splitting of energy levels and spectroscopic states in Octahedral field, Selection rules - Break - down of selection rules, Orgel diagrams, Definition and utility-Orgel Diagrams for d' to d configurations in Octahedral and tetrahedral fields. Interpretation of electronic spectra of high spin octahedral and tetra hedral complexes of Ti(III), V(III), Cr(III), Mn(III), Mn(II), Fe(II), Fe(III), Co(III), Co(II), Ni(II) and Cu(II) complexes, Tanabe – Sugano diagrams, Differences between Orgeldiagrams

and Tanabe – Sugano diagrams, Tanabe - Sugano diagrams of d2 to d and d configurations. Charge transfer spectra- LMCT and MLCT.

UNIT-IV: MAGNETIC PROPERTIES OF TRANSITION METAL COMPLEXES 15 Hrs

Diamagnetism and paramagnetism-orbital and spin contributions, spin-orbit coupling, Hund's third rule and Energies of J levels - Curie law and Curie - Weiss law- Ferromagnetism and antiferromagnetism - Temperature independent magnetism Magnetic susceptibility and its determination by Gouy's and Faraday methods. Calculation of magnetic moment from magnetic susceptibility, spin-only formula, Orbital contribution to magnetic moment (Oh and Td Complexes) - Paramagnetism and crystalline fields – Ti (III), V (III), VO2+, Cr (III), Mn (II), Fe (III), Co(II), Ni (II) and Cu (II).

Books suggested

1. The Organometallic Chemistry of the Transition Metals, R. H. Crabtree, 3rd and 4th Ed. (Wiley Interscience).
2. Organometallic Chemistry: A Unified Approach, R. C. Mehrotra and A. Singh, 2nd Ed. (New Age International).
3. Principles of Organometallic Chemistry, P. Powell, 2nd Ed. (ELBS)
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4. Concise Coordination Chemistry, R.Gopalan, and V.Ramalingam, Vikas publishing house, second Edition, 2007
5. Inorganic Chemistry, A.G.Sharpe, Pearson Education, 3rd Edition, 1999
6. Advanced Inorganic Chemistry, F.A.Cotton and G.Wilkinson, John Wiley Inter science publishers, 5th edition, 1989.
7. Organometallic Chemistry, Ayodhya Singh, Ratheesh singh, Campus books international, 1st Edition, 2006
8. Inorganic Chemistry: Principles of Structure and Reactivity, J. E. Huheey, E. A. Keiter & R. L. Keiter. 4thedition, Harper Collins publications, New York, 1993.

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SECOND SEMESTER

CC 202- CORE COURSE 5(A): ORGANIC CHEMISTRY-II

Theory **Credits: 3** **4Hrs/Week**

COURSE OBJECTIVES:

- Gain the knowledge about different reagents in organic synthesis
- familiarize with molecular rearrangements with mechanisms
- Able to recognise Oxidation & Reductions and also asymmetric Synthesis.

COURSE OUT COMES:

- To understand the different reagents in Organic Synthesis
- To know about different molecular rearrangements and their mechanisms
- To understand Oxidation and reductions in organic Chemistry.
- To understand asymmetric synthesis and Reagent controlled methods.

UNIT-I: REAGENTS IN ORGANIC SYNTHESIS **15 Hrs**

Use of the following reagents in organic synthesis: Anhydrous $AlCl_3$, Boran trifluoride, N-Bromosuccinimide, Diazomethane, Dicyclohexylcarbodiimide, ZieglarNatta catalysts, DDQ, Dithianes, Merrifield resin.

UNIT-II: MOLECULAR REARRANGEMENTS **15 Hrs**

Rearrangements to electron deficient Carbon atom:
Pinacol-Pinacolone, Wagner-Meerwein, Dienone-Phenol and DemjanovRearrngements
Rearrangements to electron deficient Nitrogen atom:
Hofmann, Curtius, Schimidt and Beckmann Rearrangements.
Rearrangements to electron deficient Oxygen atom: Baeyer-Villiger and Dakins Rearrangements
Rearrangements to electron rich Carbon atom: Favorski and Neber Rearrangements
Aromatic and Sigmatropic Rearrangements: Fries and Claisen Rearrangements

UNIT III: OXIDATIONS AND REDUCTIONS **15 Hrs**

Oxidations: (a) Alcohols to carbonyls-Chromium (vi) oxidants-Dimethyl sulfoxide oxidation, periodate oxidation, Oppenauer oxidation, oxidation with manganese dioxide, silver carbonate **(b)** Alkenes to epoxides-peroxide induced epoxidations. **(c)** Alkenes to diols-oxidation with potassium permanaganate, osmium tetraoxide, Prevost reaction **(d)** Ketones to esters-BayerVilliger oxidation.
Reductions : Reduction with lithium aluminium hydride, sodium borohydride, alkoxides, bismethoxy ethoxy aluminium hydride, -catalytichydrogenation-dissolving metal reductions.

UNIT IV: ASYMMETRIC SYNTHESIS **15 Hrs**

Topocity - Prochirality - Substrate selectivity - Diastereoselectivity and enantioselectivitySubstrate controlled methods-use of chiral substrates - examples
Auxiliary controlled methods - Use of chiral auxiliaries-Chiral enolates-alkylation of chiral imines - Stereoselective Diels-Alder reaction
Reagent controlled methods - Use of chiral reagents-Asymmetric oxidation-Sharpless epoxidation-Asymmetric reduction - Use of lithium aluminium hydride and borate reagents.

Books Suggested:

1. Advanced Organic Chemistry-Reactions, Mechanism and Structure, Jerry March, John Wiley.
2. Advanced Organic Chemistry, F.A. Carey and R.J Sundberg, Plenum.
3. A Guide Book to Mechanism in Organic Chemistry, Peter Sykes, Longman.
4. Structure and Mechanism in Organic Chemistry, C.K.Inglod, Cornell University Press.
5. Organic Chemistry, R.T Morrison and R.N. Boyd, Prentice - Hall.
6. Name reactions and reagents in organic synthesis, B.P. Muway and M.G Ellord, John Wiley.
7. Modern Organic Reactions, H.O. House, Benjamin.
8. Principles of Organic Synthesis, R.O.C Norman and J.M Coxon, Blackie Academic & Professional.
9. Reaction Mechanism in Organic Chemistry, P.S. Kalsi, New Age International.
10. Principles of organometallic chemistry, P. Powell, ELBS.
11. Organo transition metal chemistry-Applications to organic synthesis, S.G. Davis, Pergmon.
12. Stereochemistry to Organic Compounds, E.L. Eliel and others, John Wiley.
13. Stereochemistry to Organic Compounds, D. Nasipuri, New Age International.
14. Stereochemistry, P.S.Kalsi, Wiley Eastern.

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SECOND SEMESTER

CC 202- CORE COURSE 5(B): INDUSTRIAL METHODS OF CHEMICAL ANALYSIS

Theory **Credits: 3** **4Hrs/Week**

COURSE OBJECTIVES:

- Learn Gas analysis & Thermal Conductivity
- Knowledge on Sewage and Hazardous waste disposal
- Analyse Fertilizers, pesticides and Industrial Products

COURSE OUT COMES:

- To understand the gas samplings and Analysers
- To learn the Sewage and Hazardous waste disposal & Biological tests.
- To study the determination of Fertilizers and Pesticides
- To know the analysis of Industrial Products and Rocket Propellants.

UNIT-I: GAS ANALYSIS **15 Hrs**

Gas sampling-tubes, pumps, containers, gas-volumetirc methods of analysis for solid and liquidslunge nitro meter, absorbing reagents of gas, types of gas analyzers. Analysis of gaseous mixtures (CO_2, O_2, CO and hydrocarbons) by Orsat and Elliot apparatus; Thermal conductivity methods.

UNIT-II: SEWAGE AND HAZARDOUS WASTE DISPOSAL **15 Hrs**

Sewage and Sewage Disposal: Introduction, Important definitions, Sewage and its composition, Bacteriology of sewage and sewage treatment, properties of sewage, purpose of sewage treatment, methods of sewage treatment, primary or mechanical treatment, secondary or biological treatment, cycle of decomposition, analysis of sewage-physical tests, chemical tests, biological tests; sewage disposal, methods of sewage disposal.

Hazardous waste and Disposal: Introduction, effect on health, Nature and sources of hazardous substances and wastes, classification of hazardous substances and wastes, chemical classes of hazardous substances, physical and chemical methods of waste treatment, preparation of wastes for disposal and ultimate disposal of waste, biodegradation, enzymes in waste degradation.

UNIT-III: ANALYSIS OF FERTILIZERS AND PESTICIDES **15 Hrs**

Introduction, determination of moisture, determination of ammonia, nitrogen and albunoid nitrogen, determination of total phosphates as phosphorous pentoxide and estimation of micro nutrients in fertilizers. Analysis of organo chlorine pesticides by gas chromatography, analysis of organo phosphorous. Determination of DDT residue in vegetable and food grains. Analysis of cation and anions present in different fertilizer.

UNIT-IV: ANALYSIS OF INDUSTRIAL PRODUCTS **15 Hrs**

Analysis of steel: (Carbon, Silicon, Sulphur and phosphorus), Analysis of non-ferrous alloys, brass, Bronze, solder. Analysis of Ferro manganese, ferro-silicon, Ferro-vanadium and silicomanganese.

Analysis of Fats and Oils: Natural fats, edible and industrial oils, unsaturated oils, acid value, saponification value, Iodine value, refractive index values.

Analysis of Explosives and Propellants: Explosives, classifications of explosives, primary explosives, low explosives, high explosives, nitrocellulose or smokeless powder, ammonium nitrate, 2,4,6-

Trinitrotoluene(TNT), Pentaerythritol tetranitrate (PETN), Cylonite or RDX or cyclotrimethylenetrinitroamine, Picric acid, Tetryl or nitroaryl nitroamine, Dynamites, Lead azide, Nitroglycerine, black powder or gun powder, Cordite, Lead azide, Tetracene, Diazodinitro phenol.
Rocket Propellants: Introduction, Characteristics, classification-solid, liquid propellants.

Suggested Books

1. Vogel's Text book of Quantitative analysis 3rd Edition.
2. Environmental Chemistry by Stanley E. Manahan, 6th Edition.
3. Environmenal Chemistry by A. K. De.
4. Solid chemical Analysis by M. L. Jackson, Printice-Hall, London.
5. Environmental Chemical Analysis by B. K. Sharma, H. Kaur, Goel Publications.
6. Standard chemical analysis by Velchear.
7. Water and water analysis by M. V. Subba Rao, Published by Environmental research academy International.
8. Engineering Chemistry by Jain & Jain.
9. Environmental Chemistry by Moore & Moore.

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SECOND SEMESTER

CC 203- CORE COURSE 6(A): PHYSICAL CHEMISTRY-II

Theory **Credits: 3** **4Hrs/Week**

COURSE OBJECTIVES:

- Learn postulates of Quantum mechanics and Schrodinger wave equation
- Knowledge about Thermodynamics and Surface Chemistry
- Get knowledge on Symmetry and group theory.

COURSE OUT COMES:

- To know about Postulates of Quantum mechanics and different Oscillators
- To learn phase equillibria, clapeyron equation and applications
- To acquire knowledge on DC - Polarography, AC- Polarography and Controlled potential electrolysis
- To identify relation between order of a finite group and its sub-group, Conjugacy, Symmetry Point group and orthoganality theorem etc.

UNIT-I: QUANTUM CHEMISTRY – II **15 Hrs**

Postulates of quantum mechanics: postulate-I (physical interpretation of wave function) – postulate-II (observables and operators) postulate-III (measurability of observables) – postulate-IV (average values of observables) postulates-V (Time dependent and independent Schrodinger equation). Solution of Schrodinger wave equation to particle in one-dimensional box – three dimensional box, quantization of energy. Harmonic oscillator – zero point energy. Application of Schrodinger wave equation to hydrogen atom – variation Theorem, Linear variation principle, perturbation Theory (first Order and non-degenerate).

UNIT-II: THERMODYNAMICS-II **15 Hrs**

Phase Equilibria: Equilibrium between two phases of one component; the Clapeyron equation; the Clausius Clapeyron equation, applications; integrated form of Clapeyron equation.
Phase rule: Thermodynamic derivation of phase rule, Solid-liquid equilibria - Thermal analysis, simple eutectic, congruent fusion, incongruent fusion and systems consisting of both.

UNIT-III: ELECTROCHEMISTRY -II **15 Hrs**

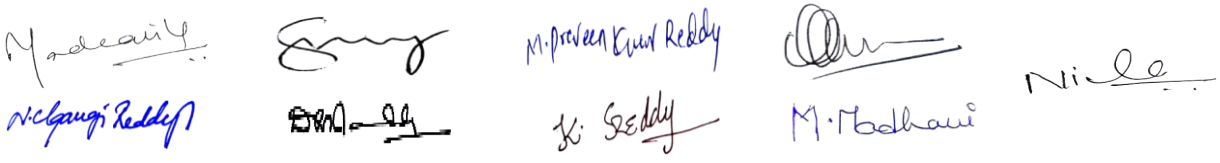
Theory, classification, principle, Instrumentation of Polarography, DME, HMDE diffusion current, Ilkovic equation, DC-Polarography, AC-Polarography, Controlled Potential Electrolysis, Millicoulometry, Equation for half-wave potentials, for reversible system when oxidant alone, reductant alone and both are present. Amperometric titrations - Anodic stripping voltammetry, chronoamperometry, chronopotentiometry, Cyclic Voltammetry, Differential Pulse Polarography, linear sweep voltammetry, square wave voltammetry.

UNIT-IV: SYMMETRY & GROUP THEORY **15 Hrs**

Definitions of a group, sub-group; relation between orders of a finite group and its sub-group; conjugacy relation and classes, Symmetry elements and symmetry operation; - symmetry point group; Schonflies symbols; representation of groups by matrices; character of a representation; the great orthogonality theorem (without proof). Character tables of H_2O and NH_3.

Books Suggested:

1. Physical Chemistry, P. W. Atkins, (ELBS).
2. Introduction to quantum Chemistry, A. K. Chandra (Tata McGraw Hill).
3. Quantum Chemistry, Ira N. Levine, (prenticxe Hall).
4. Coulson's Valence, R. Mcweeny, (ELBS).
5. Modern Electrochemistry, vol.I& II, J. O. M. Bockris and A. K. N. Reddy (Plenum).
6. D.A. Skoog and D.M. West: Principles of Instrumental Analysis (Holt, Rinehart and Wilson).
7. An Introduction to Electrochemistry (3rd ed.), S. Glasstone (Affiliated East-West).
8. Micelles, theoretical and applied aspects, V. Moroi (Plenum).
9. A text Book of Physical Chemistry (2nd Ed.), S. Glasstone (Macmilan).
10. Principles of Physical Chemistry, Maron and Prutton.
11. Theoretical Electrochemistry, L. I. Antropov.
12. Thermodynamics for Chemists, S. Glasstone.
13. Chemical Thermodynamics, I. M. Klotz.
14. Statistical Thermodynamics, M. Dole.
15. Introduction to Group Theory by Prof. G. Veera Reddy
16. Applications of group theory to spectroscopy by Dr. P. K. Mohanty.



(M.Sc. CHEMISTRY (Organic Chemistry)

(Effective from Academic year 2025-2026)

SECOND SEMESTER

CC 203- CORE COURSE 6(B): MAIN GROUP CHEMISTRY AND SPECTROSCOPIC CHARACTERIZATIONS OF INORGANIC COMPOUNDS

Theory **Credits: 3** **4Hrs/Week**

COURSE OBJECTIVES:

- Acquiring knowledge about structure and bonding in boranes, Carboranes, Silanes, S-N-heterocycles. Chemistry of halogens and group 18 elements.
- Predicting number of active modes of vibrations of IR and Raman spectroscopy.
- Applications of $_1H^1$,C^{13} NMR in Inorganic and organo metallic chemistry EPR of inorganic compounds selected applications of coupling constants.
- Basic principles and techniques of Mass spectrometry.

COURSE OUT COMES:

- Synthesis of polyhedral boranes; isolobal analogy, wades rule, organyls of Al, Ga, In and Tl, Symmetry and point group analysis.
- Infrared and Raman spectroscopy of simple inorganic molecules. Analysis of metal complexes with various functional groups.
- Fluxionality and dynamics, NMR special analysis of B, Al, Si, F and P containing compounds g-Values.
- Basic principles of Mass spectrometry supramolecules, isotope abundance.

UNIT-I: STRUCTURE AND BONDING OF MAIN GROUP ELEMENTS **15 Hrs**

Structure and bonding in polyhedral boranes and carboranes, styx notation; Wade's rule; electron count in polyhedral boranes; synthesis of polyhedral boranes; isolobal analogy; boron halides; phosphine-boranes; borazine. Organyls of Al, Ga, In and Tl. Silanes, silicon halides, silicates, silanols; germanium, tin and lead organyls; phosphorous halides, acids and oxyacids, phosphazenes; sulphur halides, oxo acids of sulphur; structural features and reactivity of reactivity of S-N heterocycles; chemistry of halogens and group 18 elements. Structural elucidation using the following spectroscopic techniques: Symmetry and Point group analysis of simple inorganic compounds. Electronic spectroscopy: electronic transitions in inorganic and organometallic compounds.

UNIT-II: IR AND RAMAN SPECTROSCOPY OF SIMPLE INORGANI COMPOUNDS **15 Hrs**

Infrared and Raman spectroscopy of simple inorganic molecules; predicting number of active modes of vibrations, analysis of representative spectra of metal complexes with various functional groups.

UNIT-III: ^{1}H AND ^{13}C NMR OF ORGANOMETALLICS **15 Hrs**

Applications of H and 13C NMR in inorganic and organometallic chemistry, fluxionality and dynamics; deriving activation and thermodynamic parameters; NMR spectral analyses of B, Al, Si, F and P containing compounds. Elementary aspects of Electron paramagnetic resonance (EPR) spectroscopy of inorganic compounds - g-values, hyperfine and super hyperfine coupling constants; selected applications in inorganic chemistry.

UNIT-IV: MASS SPECTROMETRY OF INORGANIC AND ORGANOMETALLICS **15 Hrs**

Mass spectrometry, basic principles, ionization techniques, isotope abundance, molecular ion; illustrative examples from supramolecules, inorganic/coordination and organometallic compounds.

Books suggested:

1. M. Weller, T. Overton, J. Rourke and F. Armstrong, Inorganic Chemistry, 6th Edition, Oxford University Press, 2014. (South Asia Edition 2015)
2. J. E. Huheey, E. A. Keiter, R.L. Keiter and O. K. Mehdi, Inorganic Chemistry, Principles of Structure and Reactivity, 4th Edition, Pearson, 2006.
3. F. A. Cotton, G. Wilkinson, C. A. Murillo and M. Bochmann, Advanced Inorganic Chemistry, 6th Edition, Wiley, 2007.
4. A. Abragam and B. Bleaney, Electron Paramagnetic Resonance of Transition Ions, Oxford University Press, 1970. (Reprint Edition 2013)
5. R. S. Drago, Physical Methods for Chemists, 2nd Edition, Saunders, 1992.
6. C. N. Banwell and E. M. McCash, Fundamentals of Molecular Spectroscopy, 4th Edition, McGraw-Hill, 1994.
7. H. Gunther, NMR Spectroscopy, Basic Principles, Concepts and Applications in Chemistry, 3rd Edition, Wiley VCH, 2013.
8. F. A. Cotton, Chemical Applications of Group Theory, Wiley, 3rd Edition, 1990

(M.Sc. CHEMISTRY (Organic Chemistry)

NEP -2020 under CBCS (Effective from Academic year 2024-2025)

SECOND SEMESTER

P 204: Practicals III (related to CC 201 and CC 203)

Practical **Credits: 2** **6Hrs/Week**

COURSE OBJECTIVES:

- Preparation of Co-ordinated Metal Complexes
- Familiarize with Conductometric and Potentiometric Titration.

COURSE OUT COMES:

- To acquire knowledge in the preparation of metal complexes
- To Study the determination of Cell Constant
- To get knowledge on the applications of Conductometric Titration.
- To get knowledge on the applications of Potentiometric Titration.

CC 201- CORE COURSE 4 PRACTICALS: (INORGANIC CHEMISTRY-II)

PREPARATION OF METAL COURSE

- Hexa ammine Nickel(II) chloride[Ni(NH3)6]Cl2.
- Tetra ammine Copper(II) sulphate. Monohydrate [Cu(NH3)4]SO4.H20.
- Penta ammine Chloro Cobalt(III) Chloride $[Co(NH3)_5Cl]Cl_2$

CC 203- CORE COURSE 6(A) PRACTICALS: PHYSICAL CHEMISTRY-II

Conductometry

1. Determination of cell constant
2. Titration of a strong acid with a strong base
3. Titration of a weak acid with a strong base

Potentiometry:

4. Titration of a strong acid with a strong base
5. Titration of a weak acid with a strong base

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(Effective from Academic year 2025-2026)

SECOND SEMESTER

SOC 205- SKILL ORIENTED COURSE 3(A): INSTRUMENTAL METHODS

Theory **Credits: 3** **4Hrs/Week**

COURSE OBJECTIVES:

- Acquiring knowledge about different types of Chromatographic techniques.
- About instrumentation of Gas liquid chromatography, column efficiency, Van-Deemte equation.
- Principles, chemical reactions of flames, experimental techniques and applications.
- Principle and instrumentation Flame AAS. Comparison between Flame AAS and furnace AAS

COURSE OUT COMES:

- To know the Classification of chromatographic methods-column Chromatography Separation of O- or P-nitro anilines. Classification, Principle of Thin layer chromatography.
- To understand Retention time and retention volume, column efficiency, time analysis and resolution.
- To know Flame photometer and experimental techniques disadvantages, Applications of Flame emission spectroscopy
- To understand Sources of radiation (HCL and EDL), Spectral and ground corrections, principle and technique for Graphite Furnace AAS.

UNIT-I: CHROMATOGRAPHY-I **15 Hrs**

Introduction - Classification of Chromatographic methods – Column chromatography- Adsorption phenomenon: Nature of adsorbents-Solvent systems-Differential migration- Separation of mixture of o- or p-nitro anilines

Thin layer chromatography: Classification, principle, experimental technique, sample application,development of plate, retardation factor.

UNIT-II: CHROMATOGRAPHY-II **15 Hrs**

Gas liquid chromatography: Gas liquid chromatography - instrumentation (columns and detectors). Chromatographic behaviour of solutes, column
efficiency and resolution, column processes and band broadening, time of analysis and resolution, Van-Deemter equation.

UNIT-III: FLAME EMISSION SPECTROSCOPY **15 Hrs**

Flame Emission Spectroscopy: Principles, chemical reactions in flames, Interferences, evaluation methods, flame photometer and experimental technique, procedure for determinations, limitations and disadvantages. Applications of Flame Emission Spectroscopy.

UNIT-IV: ATOMIC ABSORPTION SPECTROSCOPY **15Hrs**

Atomic Absorption Spectroscopy: Flame AAS: Principle, Instrumentation - Sources of radiation (HCL and EDL), Different types of burners, Interferences- Physical, Chemical, spectral and back ground correction, and methods of minimization

Graphite Furnace AAS: Principle and technique -Comparison between Flame AAS and furnace AAS, Applications of AAS, Comparison between Atomic Absorption & Flame Photometry.

Books Suggested

1. H.W. Willard, LL. Merrit and J.A.Dean: Instrumental Methods of Analysis. Affiliated East-West).
2. G.H. JefferyJ. Bassett,J. Mendham and R.C. Denny Vogel"s Text Book of Quantitative Chemical Analysis (ELBS).
3. D.A. Skoog and D.M. West: Principles of Instrumental Analysis (Holt, Rinehart and Wilson).
4. J.G. Dick : Analytical Chemistry (McGraw Hill).
5. Instrumental Methods of Analysis H. Kaur

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SECOND SEMESTER

SOC 205- SKILL ORIENTED COURSE 3(B): MATERIALS CHEMISTRY

Theory **Credits: 3** **4Hrs/Week**

COURSE OUT COMES:

- To Gain knowledge on different Preparative methods
- Familiarize with characterization of materials, fuel cells and Batteries.

COURSE OUT COMES:

- To acquire knowledge on different preparative methods
- To understand Magnetic and optical properties of materials
- To know about XRD, SEM, TEM & AFM.
- To understand fuel cells & Batteries

UNIT-I: PREPARATION METHODS **15 Hrs**

Chemical precipitation and co-precipitation; metal nanocrystals by reduction; sol-gel synthesis; microemulsions or reverse micelles; solvothermal synthesis; microwave heating synthesis; sonochemical synthesis.

UNIT-II: CHARACTERIZATION OF MATERIALS **15 Hrs**

X-Ray diffraction (XRD); scanning electron microscopy (SEM); transmission electron microscopy (TEM); atomic force microscopy (AFM).

UNIT-III: MAGNETIC AND OPTICAL PROPERTIES OF MATERIALS **15 Hrs**

Magnetic properties - dia, para, ferro, anti-ferro and ferri magnetism; measurements - magnetic moment and magnetic susceptibility; optical properties - optical absorption and band gaps; luminescence: principle, characteristics and materials.

UNIT-IV: MATERIALS FOR FUEL CELLS AND BATTERIES **15 Hrs**

Proton exchange membrane fuel cells; material aspects; lithium battery materials; electrode and electrolyte materials.

Books Suggested:

1. Nanochemistry: A Chemical Approach to Nanomaterials; G.A. Ozin, A.C. Arsenault and L. Cademartiri (RSC, London).
2. Nanocomposite Science and Technology; P.M. Ajayan, L.Z. Schadler and P.V. Brown (Wiley).
3. Characterization of Nanophase Materials; Z.L. Wang (ed.) (Wiley-VCH).

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(Effective from Academic year 2025-2026)

SECOND SEMESTER

SOC 206- SKILL ORIENTED COURSE 4(A): HETEROCYCLIC CHEMISTRY

Theory **Credits: 3** **4Hrs/Week**

COURSE OBJECTIVES:

- Familiarize with Hantzsch Widman nomenclature of Heterocycles & synthesis of 3, 4-membered heterocycles
- Understand synthesis & reactivity of Benzo fused five and six membered heterocycles.

COURSE OUT COMES:

- To understand nomenclature and Synthesis of three membered heterocycles
- To know about 4 membered hetero cycles
- To understand five membered heterocycles with two hetero atoms
- To understand Synthesis & reactivity of Benzo fused heterocycles.

UNIT-I: THREE MEMBERED HETEROCYCLIC COMPOUNDS **15 Hrs**

Definition, Classification and Nomenclature (Hantzsch Widman System) of heterocycles. Synthesis and reactivity of Aziridines, Oxiranes and Thiiranes.

UNIT-II: FOUR MEMBERED HETEROCYCLIC COMPOUNDS **15 Hrs**

Synthesis and reactivity of Azitidines, Oxetanes, Thietanes.

UNIT-III: NOMENCLATURE AND FIVE MEMBERED HETEROCYCLES **15 Hrs**

Systematic nomenclature (Hantzsch-Widman nomenclature) for fused and bridged heterocycles, Five membered heterocycles with two heteroatoms: Synthesis and reactions of Pyrazole, Imidazole, Isoxazole, Oxazole, Isothiazole and Thiazole.

UNIT-IV: BENZOFUSED FIVE MEMBERED AND SIX MEMBERED HETEROCYCLES **15 Hrs**

Benzofused five membered heterocycles: Synthesis and reactions of Benzothiazole, Benzimidazoles and Benzoxazoles. Six Membered heterocycles with two or more heteroatoms: Synthesis and reactions of diazines (Pyridazine, Pyrimidine & Pyrazine).

Books Suggested:

1. Heterocyclic chemistry Vol. 1-3, R.R. Gupta, M.Kumar and V. Gupta, Springer Verlag.
2. The Chemistry of Heterocycles, T. Eicher and S. Hauptmann, Thieme.
3. Heterocyclic Chemistry, J.A. Joule, K. Mills and G.F. Smith, Chapman and Hall.
4. Heterocyclic Chemistry, T.L. Gilchrist, Longman Scientific Technical.
5. Contemporary Heterocyclic Chemistry, G.R. Newkome and W.W. Paudler, Wiley-Inter Science.
6. An Introduction to the Heterocyclic Compounds, R.M. Acheson, Jonn Wiley.

7. Comprehensive Heterocyclic Chemistry, A.R. Katritzky and C.W. Rees, eds. Pergamon Press.

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(Effective from Academic year 2025-2026)

SECOND SEMESTER

SOC 206- SKILL ORIENTED COURSE 4(B): BIO-ORGANIC CHEMISTRY

Theory **Credits: 3** **4Hrs/Week**

COURSE OBJECTIVES:

- To learn about Amino Acids & peptides.
- Study about Carbohydrates, Vitamins & Nucleic acid.

COURSE OUT COMES:

- To understand classification and synthesis of Amino Acids and peptides
- To know about Carbohydrates
- To understand structure & Synthesis of Vitamins
- To know about Nucleic acids and Prostaglandins.

UNIT-I: AMINO ACIDS AND PEPTIDES **15 Hrs**

Synthesis and reactions of amino acids; classification and nomenclature of peptides; Sanger and Edman methods of sequencing; cleavage of peptide bond by chemical methods; peptide synthesis: protection of amino group (Boc-, Cbz- and Fmoc-) and carboxyl group as alkyl and aryl esters; use of DCC, T3P, HOBt and active esters; acid halides; acid azides; anhydrides in peptide bond formation reactions; deprotection and racemization in peptide synthesis; solution and solid phase techniques; synthesis of oxytocin; introduction to peptidomimetics.

UNIT-II: CARBOHYDRATES **15 Hrs**

Types of naturally occurring sugars: deoxy sugars, amino sugars, branched chain sugars, methyl ethers and acid derivatives of sugars; general methods of structure elucidation and ring size determination with particular reference to maltose, lactose and sucrose; structure, degradation and biological functions of starch, cellulose and chitin.

UNIT-III: VITAMINS **15 Hrs**

Structure and synthesis of vitamin B complex: vitamin B1 (aneurin), vitamin B2 (riboflavin), vitamin Bs (pantothenic acid), vitamin B9 (folic acid), vitamin H (biotin), vitamin B6 (pyridoxine), vitamin B12 (cyanocobalamin) structure only - vitamin C (Ascarbic acid), vitamin E (atocopherol) - vitamin K (phylloquinone) and vitamin K2.

UNIT-IV: NUCLEIC ACIDS AND PROSTAGLANDINS **15 Hrs**

Nucleic acids. Purine and pyrimidine bases; structure of nucleosides and nucleotides; methods of formation of internucleotide bonds (DCC and phosphotriester approaches); structure of DNA (Watson-Crick model) and RNAs; biological importance of DNA and RNA; protein-nucleic acid interaction; chromatin and viral nuclear capsid.

Prostaglandins. Nomenclature and classification; structure and biological role of PGE1, PGE2 and PGE3.

Books Suggested:

1. Peptides Chemistry: A practical text book, M. Bodansky, Springer-Verlag NY, (1988).
2. Solid-phase peptide synthesis: A practical approach-E. Artherton, R.C. Sheppard, Oxford University Press (1989).
3. Peptides: Chemistry and Biology, N. Selwad, H.-D. Jakubke, Wiley-VCH, (2002).
4. Biochemistry, J. David Rawn, Neil Pattuson publishers, North Carolina, (USA), (1989).
5. Organic Chemistry. Vol I and II, I. L. Finar, 6th Ed., ELBS & Longman (London), (1975).
6. Introduction to Lipids, D. Chapman, McGraw-Hill, (1969).
7. Advanced General Organic Chemistry, S. K. Ghosh, D.K. and Allied publishers (UBS), Calcutta (1998).
8. Text book of Biochemistry, E. S. West, W. R. Todd, H. S. Mason, J. T. Van Bugen, 4th Ed., Amerind Publishing Co. (New Delhi) (1974).
9. Total Synthesis of Natural Products Vol. IV, Apsimon, John Wiley, New York (1981).

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(Effective from Academic year 2025-2026)

SECOND SEMESTER

P 207: Practical IV (related to SOC205 and SOC206)

Practical **Credits: 2** **6Hrs/Week**

COURSE OBJECTIVES:

- Familiarize with Chromatographic Separation.
- Understand Demonstration experiment in TLC & Paper chromatography
- Study on flame photometry
- Understand the Heterocycles.

COURSE OUT COMES:

- To know the TLC and paper chromatographic Separations
- To understand the Flame photometry
- To understand preparation and Identification of pechmann Condensation & Biginelli reaction
- To acquire knowledge in the preparation of Isoxazole and Pyrazole derivatives.

SOC 205- SKILL ORIENTED COURSE 3(A): INSTRUMENTAL METHODS

1. TLC/Paper chromatographic separation.
2. Flame Photometry: Determination of Na and K, Ca and Li in Water and Soil.

SOC 206- SKILL ORIENTED COURSE 4(A) PRACTICALS: HETEROCYCLES

Preparation and identification of the following Heterocycles:

1. Synthesis of7-Hydroxy 4-methylcoumarin(Pechmann condensation).
2. Synthesis of Dihydropyrimidones (Biginelli reaction).
3. Synthesis of Isoxazole derivative
4. Knorr synthesis of pyrazole derivative.

Audit Course : 209 : The Indian Knowledge System – II 4Hrs/Week

Learning Objectives :

- Gain an understanding of Indian knowledge system
- To Develop ethics, Ahimsa, Bhagavad Gita and Value of Education

Learning Out comes :

- To know about Ethics, Relations & Politics.
- To understand Ahimsa, Satya, Brahmacharya etc.
- To know about Bhagavad Gita, Buddhism & Jainism
- To know the value of Education, responsibilities, family etc.

UNIT –I: Definition and Nature of Ethics- Its relation to Religion, Politics, Business, Legal, Medical and Environment. Need and Importance of Professional Ethics - Goals - Ethical Values in various Professions.

UNIT- II: Ahimsa (Non-Violence), Satya (Truth), Brahmacharya (Celibacy), Asteya(Non possession) and Aparigraha(Non- stealing). Purusharthas(Cardinal virtues)-Dharma (Righteousness), Artha(Wealth), Kama(Fulfillment Bodily Desires), Moksha(Liberation).

UNIT-III : Bhagavad Gita- (a) Niskama karma. (b) Buddhism- The Four Noble Truths - Arya astangamarga, (c) Jainism- mahavratas and anuvratas. Values Embedded in Various Religions, Relirious Tolerance, Gandhian Ethics.

UNIT IV: Value Education- Definition - relevance to present day - Concept of Human Values - self introspection - Self esteem. Family values-Components,structure and responsibilities of family- Neutralization of anger - Adjustability - Threats of family life - Status of women in family and society - Caring for needy and elderly - Time allotment for sharing ideas and concerns.

Books for study:

1. John S Mackenjie: A manual of ethics.
2. “The Ethics of Management” by Larue Tone Hosmer, Richard D. Irwin Inc.
3. “Management Ethics - integrity at work’ by Joseph A. Petrick and John F. Quinn, Response Books: New Delhi.
4. “Ethics in Management” by S.A. Sherlekar, Himalaya Publishing House.
5. Harold H. Titus: Ethics for Today
6. Maitra, S.K: Hindu Ethics
7. William Lilly : Introduction to Ethics
8. Sinha: A Manual of Ethics
9. Manu: Manu Dharma Sastra or the Institute of Manu: Comprising the Indian System of Duties: Religious and Civil(ed.) G.C.Haughton.
10. SusrutaSamhita: Tr.KavirajKunjanlal, KunjalalBrishagratha, Chowkamba Sanskrit series, Vol I,II and III, Varnasi, Vol I OO, 16-20, 21-32 and 74-77 only.
11. CarakaSamhita :Tr. Dr.Ram Karan Sarma and Vaidya Bhagavan Dash, Chowkambha Sanskrit Series office, Varanasi I, II, III Vol I PP 183-191.
12. Ethics, Theory and Contemporary Issues., Barbara Mackinnon, Wadsworth/Thomson Learning, 2001.
13. Analyzing Moral Issues, Judith A. Boss, Mayfield Publishing Company, 1999.

14. An Introduction to Applied Ethics (Ed.) John H.Piet and Ayodhya Prasad, Cosmo Publications.
15. Text book for Intermediate logic, Ethics and Human Values , board of Intermediate Education& Telugu Academic Hyderabad
16. I.C Sharma Ethical Philosophy of India. Nagin&coJulundhar.

MODEL QUESTION PAPER FOR

SCIENCE PG EXAMINATIONS

(WITH EFFECT FROM 2025-26 ACADEMIC YEAR)

Time: 3 Hours **Max. Marks: 70**

PART A

Answer any **five** questions from the following. Each question carries 6 marks	5X6=30
1.	
2.	
3.	
4.	
5.	
6.	
7.	
8.	

PART B

Answer any **four** questions from the following. Each question carries 10 marks	4X10=40
Unit-I	
9(a)	
(Or)	
(b)	
Unit-II	
10(a)	
(Or)	
(b)	
Unit-III	
11(a)	
(Or)	
(b)	
Unit-IV	
12(a)	
(Or)	
(b)	

Note: Instruction to paper setter:

Two Questions must be given from each unit in part - A

MODEL QUESTION PAPER FOR

SCIENCE PG EXAMINATIONS

(WITH EFFECT FROM 2025-26 ACADEMIC YEAR)

Time: 3 Hours **Max. Marks: 50**

Answer any FIVE Questions.
Choosing atleast TWO questions from each section.
Each question carries 10 Marks
(5 X 10 = 50 Marks)

Section – A

1.

2.

3.

4.

Section – B

5.

6.

7.

8.

Note: Instruction to Paper Setters:
TWO questions must be given from each unit.