M.Sc. ANALYTICAL CHEMISTRY

CHOICE BASED CREDIT SYSTEM

(For Vikrama Simhapuri University Campus)

(Effective from the Academic Year 2022-2023)

DEPARTMENT OF CHEMISTRY
VIKRAMA SIMHAPURI UNIVERSITY
NELLORE – 524324

08/02/2023
HEAD
Department of Chemistry
VIKRAMA SIMHAPURI UNIVERSITY
KAKUTUR, NELLORE-524 320 (A.P.)

The mission and vision of the organization help in preparation of strategic plan.

Mission:

- To develop the student as researcher/scientist in chemical science through post-graduate education and research programme.
- To develop the competent manpower with technology based experimentation methodologies and value based practices for business and in lustries.
- To provide student centric learning facilities for the development of overall personality of learner.

Vision:

- Through a global teaching – learning and research, in the area of chemical sciences, by providing competitive trained chemists which will assist the chemical world and industries.

Program Educational Objectives (PEOs)

- The purpose of the postgraduate chemistry program at the University level is to provide the key knowledge base and laboratory resources to prepare students for careers as professionals in the field of chemistry.
- To develop various skills in planning, performing and handling modern techniques, equipment, laboratory experiments and various softwares.
- Students will learn fundamentals and advanced topics in the major fields of organic, inorganic, physical and analytical chemistry to improve their confidence levels to excel in teaching and research fields.
- Students will be encouraged to improve their skills to design molecules using retro synthetic analysis based on their theoretical understanding of the chemical sciences.
- Students are motivated to pursue higher studies in the chosen field.

Program Specific Outcomes (PSOs)

After the successful completion of M.Sc. chemistry program, the students will be able to

PSO-1: Core competency: The chemistry graduates are expected to gain knowledge of the fundamental concepts of chemistry and applied chemistry through theory and practical. These fundamental concepts would be reflected in the latest understanding of the field to keep continues its progression.

PSO-2: Critical thinking: Chemistry graduates are expected to achieve critical thinking ability to design, carry out, record and analyze the results of chemical reactions. To overcome many difficulties with the help of their sharp scientific knowledge and logical approaches.

PSO-3: Analytical skill development and job opportunity: Chemistry graduates are expected to possess sufficient knowledge how to synthesize a chemical compound and perform necessary characterization and analysis in support of the formation of the product by using modern analytical tools and advanced technologies. Because of this course curriculum chemistry graduates have lot of opportunity to get job not only in academic and administrative field but also in industry.

HEAD
Department of Chemistry
VIKRAMA SIMHAPURI UNIVERSITY
KAKUTUR, NELLORE-524 320 (A.P.)

Program Outcomes (POs)

PO-1: Knowledge and skill: A graduate student is expected to be capable of demonstrating comprehensive knowledge and understanding both theoretical and practical knowledge in all disciplines of Chemistry. Students can solve their subjective problems very methodically, independently and finally draw a logical conclusion. Further, the student will be capable of applying modern technologies, handling advanced instruments and Chemistry related soft-wares for chemical analysis, characterization of materials and in separation technology.

PO-2: Problem solver: Identify, formulate, design, carryout, record and analyse the results of chemical reactions. Students will be able to apply evidence based comparative chemistry approach to explain chemical synthesis and analysis.

PO-3: Design/Development of solutions: The students will develop and design solutions for the target molecules to meet the specific needs for public health and environmental considerations.

PO-4: Sense of inquiry: It is expected that the course curriculum will develop an inquisitive characteristics among the students through appropriate questions, planning and reporting experimental investigation.

PO-5: Modern Techniques : Create, Select, and apply appropriate experimental techniques, resources and modern methods and modelling to complex problems with an understanding of the limitations.

PO-6: Ethical Awareness : A post graduate student requires understanding and developing ethical awareness or reasoning which is adequately provided through the course curriculum. Students can also create an awareness of the impact of chemistry on the environment, society, and also on scientific community.

PO-7: Individual and Team work : Function effectively as an individual by contributing in laboratory, as a member or leader in diverse teams, and in multi disciplinary settings.

PO-8: Skilled Communicator: The course curriculum incorporates basics and advanced training in order to make a graduate student capable of expressing the subject through technical writing as well as through oral presentation.

PO-9: Enterpreneur and Development: Demonstrate knowledge and understanding of the chemistry and management principles and apply these to once own work, and as a member and leader in a team, to manage projects as Enterpreneur in multi disciplinary environments.

PO-10 : Lifelong learning: The course curriculum is designed to inculcate the habit of learning continuously through use of advanced ICT technique and other available e-Techniques, e-books and e-journals for personal academic growth.

HEAD
Department of Chemistry
VIKRAMA SIMHAPURI UNIVERSITY
UTUR, NELLORE-524 320 (A.P.)

VIKRAMA SIMHAPURI UNIVERSITY:: NELLORE
(AP State University)
M.Sc. CHEMISTRY Syllabus

(NEP -2020 CBCS Pattern With effect from 2022-23)
The course of Study and Scheme of Examinations

SEMESTER-I
(M.Sc. Chemistry)

Sl. No.	Course Code	Components of Study	Title of the Course	Credit Hrs/ Week	No. of Credits	IA Marks	SEM End Exam Marks	Total
1	CHE 101	Core-Theory	Inorganic Chemistry- I	4	4	30	70	100
2	CHE 102	Core-Theory	Organic Chemistry- I	4	4	30	70	100
3	CHE 103	*Compulsory Foundation	a) Physical Chemistry- I b) Environmental Chemistry	4	4	30	70	100
4	CHE 104	* Elective Foundation	a) General Chemistry- I b) Industrial Applications of Chemistry	4	4	30	70	100
5	CHE 105	Practicals (Core)	Inorganic Chemistry Lab-I	6	4	30	70	100
6	CHE 106	Practicals (Core)	Organic Chemistry Lab - I	6	4	30	70	100
7	CHE 107	Practicals (Core)	Physical Chemistry Lab -I	6	4	30	70	100
8	CHE 108**	Audit Course-I	Chemistry of Advanced Materials	0	0	**50**	0	0
19	CHELS 109	Life Skill Course-I	Cyber Security	4	4	30	70	100
		Total		**38**	**32**			**800**

***A student shall choose anyone from each of the Compulsory Foundation and Elective Foundation**

****Audit Course: 50 marks (Internal Assessment)**

HEAD
Department of Chemistry
VIKRAMA SIMHAPURI UNIVERSITY
KAKUTUR, NELLORE-524 320 (A.P.)

SEMESTER-II
(M.Sc. Chemistry)

Sl. No.	Course Code	Components of Study	Title of the Course	Credit Hrs/ Week	No. of Credits	IA Marks	SEM End Exam Marks	Total
1	CHE 201	Core-Theory	Inorganic Chemistry- II	4	4	30	70	100
2	CHE 202	Core-Theory	Organic Chemistry- II	4	4	30	70	100
3	CHE 203	* Compulsory Foundation	a) Physical Chemistry- II b) Environmental Pollution	4	4	30	70	100
4	CHE 204	* Elective Foundation	a) General Chemistry- II b) Spectroscopic Techniques	4	4	30	70	100
5	CHE 205	Practicals (Core)	Inorganic Chemistry Lab -II	6	4	30	70	100
6	CHE 206	Practicals (Core)	Organic Chemistry Lab -II	6	4	30	70	100
7	CHE 207	Practicals (Core)	Physical Chemistry Lab - II	6	4	30	70	100
8	CHE 208**	Audit Course-II	Energy and Its Various Forms	0	0	**50**	0	0
9	CHELS 209	Life skill Course-II	Personality Enhancement & Leadership	4	4	30	70	100
		Total		**38**	**32**			**800**

***A student shall choose anyone from each of the Compulsory Foundation and Elective Foundation**

****Audit Course: 50 marks (Internal Assessment)**

HEAD
Department of Chemistry
VIKRAMA SIMHAPURI UNIVERSITY
KAKUTUR, NELLORE-524 320 (A.P.)

M.Sc. ANALYTICAL CHEMISTRY

SEMESTER-III

Sl. No	Course Code	Components of Study	Title of the Course	Credit Hrs/ Week	No. of Credits	IA Marks	SEM End Exam Marks	Total
1	CHEAC 301	Core-Theory	Fundamentals of Analytical Chemistry	4	4	30	70	100
2	CHEAC 302	Core-Theory	Quality Assurance and Quality Control	4	4	30	70	100
3	CHEAC 303	* Generic Elective	(a) Analytical Spectroscopy (b) Forensic Analysis	4	4	30	70	100
4	CHEAC 304	*Compulsory foundation	(a) SWAYAM/MOOCs/ NPTEL (b) Research Process and Methodology	4	4	30	70	100
5	CHEAC 305	Skill Oriented Course (theory)	Instrumental Methods of Analysis	4	4	30	70	100
6	CHEAC 306	Core & Gen. Practicals	Practical I - Analysis of Mixtures, Ores and Cement.	6	4	30	70	100
7	CHEAC 307	Skill Oriented Course (Practicals)	Practical II- Estimations	6	4	30	70	100
		Total		**32**	**28**			**700**

All core papers are mandatory

***A student shall choose anyone from each of the Generic Elective and Compulsory Foundation**

HEAD
Department of Chemistry
VIKRAMA SIMHAPURI UNIVERSITY
KAKUTUR, NELLORE-524 320 (A.P.)

SEMESTER-IV

Sl. No	Course Code	Components of Study	Title of the Course	Credit Hrs/ Week	No. of Credits	IA Marks	SEM End Exam Marks	Total
1	CHEAC 401	Core-Theory	Analysis of Natural and Commercial Materials	4	4	30	70	100
2	CHEAC 402	Core-Theory	Applied Analysis	4	4	30	70	100
3	CHEAC 403	Generic Elective* (Related to Subject)	(a) Bioinorganic, Bioorganic, Biophysical and Nanomaterials (b) Chromatographic techniques	4	4	30	70	100
4	CHEAC 404	Core & Gen. Practicals	Practical I-Water Analysis, Seperation and Polorographic Techniques	6	4	30	70	100
5	CHEAC 405	Project work	Practical II- Project Work	12	8	60	140	200
6	CHEAC 406	Open Elective **(For other departments)**	(a) Aapplications of Analytical Chemistry in Environmental Science (b) Principles of IPR and Patent laws	4	4	30	70	100
		Total		34	28			700
			Grand total	**142**	**120**			**3000**

*** All core papers are mandatory**

Generic Electives: choose one paper

Project Work: (Group wise) Collaboration with various firms/ companies/ Research labs

Open Electives are for the students of other Departments. Minimum one paper should be opted.

HEAD
Department of Chemistry
VIKRAMA SIMHAPURI UNIVERSITY
KAKUTUR, NELLORE-524 320 (A.P.)

SEMESTER - I

CHE 101: INORGANIC CHEMISTRY – I

Semester	Course Code	Course Title	Hours/Week	Hours	Credits
I	CHE 101	INORGANIC CHEMISTRY– I	4	60	4

UNIT – I: CO-ORDINATION COMPLEXES **15 hr**

Introduction to Crystal field theory, Types of ligands, Spectrophotochemical series, Salient features of CFT, CFSE and its calculation, Pairing Energy, Splitting of d orbitals in octahedral, tetrahedral, square planar, square pyramidal and trigonal bipyramidal geometries. High spin and low spin octahedral complexes. Factors affecting the magnitude of crystal field splitting. Jahn-Teller effect, Applications of CFT, OSSE, Site selection in spinels and limitations of CFT.

UNIT - II: REACTION MECHANISMS OF METALCOMPLEXES **15 hr**

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 and factors affecting acid hydrolysis. Base hydrolysis, conjugate base mechanism, Anation reactions, Substitution reactions in square planar complexes - Trans effect, Mechanisms of trans effect, Theories of trans effect - Polarization theory and π-bonding theory. Electron transfer reactions - Inner sphere and outer sphere mechanisms, Marcus theory.

UNIT – III: ORGANOMETALLIC CHEMISTRY **15 hr**

Classification and nomenclature of Organometallic complexes, Stoichiometric reactions in catalysis; homogeneous catalytic hydrogenation; hydroformylation (oxoreaction); isomerization; Zeigler-Natta polymerization of olefins; oxopalladation reactions; Hapticity, fluxionality and dynamic equilibria in compounds such as η^2-olefin, η^3-allyl and dienyl complexes. Applications of Organometallic complexes.

HEAD
Department of Chemistry
VIKRAMA SIMHAPURI UNIVERSITY
KAKUTUR, NELLORE-524 320 (A.P.)

UNIT – IV: METAL CARBONYLS AND NITROSYLS

15hr

Metal Carbonyls – Synthesis of metal carbonyls, Structure of metal carbonyls of the types M(CO)n (M = Cr, Fe, Ni; n = 4-6), $M_2(CO)n$ (M = Co, Fe, Mn; n = 8-10), $M_3(CO)_{12}$ (M = Fe, Ru and Os), $M_4(CO)_{12}$ (M = Co, Rh, Ir). IR spectra of metal carbonyls – (i) Detection of bridging CO ligand, (ii) Determination of molecular symmetry and (iii) Determination of bond angles in metal carbonyls, Synergistic effect, EAN and 18- electron rule as applied to metal carbonyls, Electron counting methods – (i) Oxidation State method and (ii) Neutral Atom method.

Metal Nitrosyls: Synthesis of metal Nitrosyls, Bonding, Electron donation by nitric oxide, Principles of Stoichiomerty, Modes for NO bonding – (i) Covalent model and (ii) Ionic models, Structures of Metal nitrosyls (1) $[IrCl(PPh_3)(CO)(NO)]^+$, (2) $[RuCl(PPh_3)_2(NO)_2]^+$, (3) $[(Cp)CrCl(NO)_2]$, (4) $[(Cp)_2Cr_2Cl(NO)_4]$, Applications of Metal Nitrosyls.

References:

1. Inorganic Chemistry, J. E. Huheey, E. A. Keiterand R. L. Keiter, 4th edition, Harper Collins College Publishers.
2. Concepts and models of Inorganic Chemistry, B.E. Douglas, D.H. McDaniel and J.J. Alexander, 3rd edition, John-Wiley.3. Inorganic Chemistry, D.F. Shriver and P.W. Atkins, 3rd edition, Oxford.
3. Advanced Inorganic Chemistry, F.A. Cotton and G. Wilkinson, 6th edition, Wiley Interscience.
4. Inorganic Chemistry, G.L. Miessler and D.A. Tarr, 3rd edition, Low Price edition.
5. Inorganic Chemistry, K.F. Purcell and J.C. Kotz, Holt – Saunders International Edition.
6. Coordination Chemistry, F. Basolo and R. Johnson, Benzamin Inc.
7. Concise Inorganic Chemistry, J. D. Lee, Blackwell Science.
8. Metal complexes in aqueous solutions, A.E. Martell and R.D. Hancock, Plenum Press.

	Description of CO	Knowledge
CO1	Discuss the properties of Coordination complexes, Categorize types of Coordination complexes and splitting of "d" orbitals, summarize the applications of CFT.	K_2, K_5, K_2
CO2	Explain the properties of Inert and labile complexes, Review to the reaction mechanisms of Metal complexes, Discuss the theories of trans effect and Marcus theory	K_2, K_2, K_2
CO3	Generalized characteristic features of Organometallic complexes, understanding the role of organometallic complexes in various important reactions like	K_5, K_4 ,K_2

HEAD
Department of Chemistry
VIKRAMA SIMHAPURI UNIVERSITY
KAKUTUR, NELLORE-524 320 (A.P.)

	hydroformylation and oxopalladation and Ziegler-Natta polymerization.	
CO4	Classify types of Carbonyls and Nitrosyls, Synthesize metal carbonyls and Nitrosyls, Differentiate Effective Atomic Number(EAN) and 18 electron Rule	K_5, K_4, K_2

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	2	-	3	-	-	-	-	-	-	-	1	-	-
CO2	-	2	-	-	-	-	-	-	-	-	-	-	2
CO3	2	-	-	-	-	-	-	-	-	-	-	2	-
CO4	3	-	-	-	-	-	-	-	-	-	-	2	-

NOTE: 1-LOW, 2-MEDIUM, 3-HIGH

HEAD
Department of Chemistry
VIKRAMA SIMHAPURI UNIVERSITY
KAKUTUR, NELLORE-524 320 (A.P.)

CHE 102: ORGANIC CHEMISTRY – I

Semester	Course Code	Course Title	Hours/Week	Hours	Credits
I	CHE 102	ORGANIC CHEMISTRY – I	4	60	4

UNIT-I: AROMATICITY

15hr

Huckle's rule and the concept of aromaticity, aromaticity in benzenoid and non benzenoid compounds, alternant and non-alternant hydrocarbons. Metallocenes-preparations and properties of ferrocene, azulenes, annulenes, fulvenes. Anti-aromaticity, pseudo-aromaticity, homo-aromaticity.

UNIT-II: REACTION MECHANISMS-I (Substitution Reactions)

15hr

Aliphatic Nucleophilic Substitutions: The S_N2, S_N1, mixed S_N1 and S_N2, Definition and types of ambident nucleophiles, SET mechanisms. The neighbouring group mechanism, neighbouring group participation by σ and π- bonds, anchimeric assistance. Classical and nonclassical carbocations, phenonium ions, norbornyl system, common carbocation rearrangements–primary,secondary and tertiary. The S_N^i mechanism, Nucleophilic substitution at an allylic, aliphatic trigonal and a vinylic carbon. Reactivity effects of substrate, attacking nucleophile, leaving group and reaction medium.

Aromatic Nucleophilic Substitution: The S_NAr, S_N1, benzyne mechanisms. The Von Richter, Sommelet-Hauser and Smiles rearrangements.

UNIT-III: REACTIVE INTERMEDIATES

15 hr

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

UNIT-IV: HETEROCYCLIC COMPOUNDS

15hr

Introduction and importance. Replacement and systematic nomenclature (Hantzsch-Widman) for three, four, five, six membered, fused and bridged heterocycles.

HEAD
Department of Chemistry
VIKRAMA SIMHAPURI UNIVERSITY
KAKUTUR, NELLORE-524 320 (A.P.)

Three and four membered heterocycles: Synthesis and reactions of aziridines, oxiranes, thiiranes, azetidines, oxetanes and thietanes.

References:

1. Advanced Organic Chemistry-Reactions, Mechanism and Structure, Jerry March, JohnWiley.
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. 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 & Professional.
6. Reaction Mechanism in Organic Chemistry, P.S. Kalsi, New Age International
7. Heterocyclic Chemistry, T.L. Gilchrist, Longman Scientific Technical.
8. An Introduction to the Heterocyclic Compounds, R.M. Acheson, Jonn Wiley.
9. Organic Chemistry, Vol I, I.L.Finar, ELBS Eds.
10. Principles of Modern Heterocyclic Chemistry, L.A. Paquett.

	Description of CO	Knowledge
CO1	Explain the structural and electronic criteria of aromaticity and its applications in benzenoid & non-benzenoid, alternant and non-alternant hydrocarbon.	K1
CO2	Discuss the basics of reaction mechanism of the S_N1, S_N2, SET, S_Ni and S_NAr reactions and their applications through the name reactions Distinguish the reaction mechanisms of aliphatic and aromatic nucleophilic substitution reactions and their applications via the name reactions.	K1, K2, K3
CO3	Outline detailed knowledge on reactive intermediates like carbocations carbanions etc. To learn the physical parameters and potential energy diagrams of transition states and intermediates of organic reactions.	K1, K2, K3, K4, K5
CO4	Explain the basic knowledge on Hantszsch-widmann nomenclature of different heterocycles and synthesis & properties of three and four membered heterocycles	K1, K3, K5

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	2	-	3	-	-	-	-	-	-	-	2	-	-
CO2	3	2	2	-	-	-	-	-	-	-	3	1	2
CO3	2	2	-	1	-	-	-	-	-	-	3	2	2
CO4	3	-	1	3	-	-	-	-	-	1	3	2	2

NOTE: 1-LOW, 2-MEDIUM, 3-HIGH

HEAD
Department of Chemistry
VIKRAMA SIMHAPURI UNIVERSITY
KAKUTUR, NELLORE-524 320 (A.P.)

CHE103a: PHYSICAL CHEMISTRY – I

Semester	Course Code	Course Title	Hours/Week	Hours	Credits
I	CHE 103a	PHYSICAL CHEMISTRY – I	4	60	4

UNIT I: THERMODYNAMICS-1

15hr

Thermodynamic system-Surroundings-Types of systems-Thermodynamic variables (or) State variables. Thermodynamic process. Exact and inexact differentials. Internal energy- Nature of work and heat- Zeroth law of Thermodynamics-First law of Thermodynamics- Mathematical formulation of the first law of Thermodynamics. Heat changes- Heat content (Enthalpy) – Heat Capacity- Heat Capacity at constant volume and Heat capacity at constant Pressure. Applications of first law of Thermodynamics : C_p-C_v = R derivation – Maxwell Relations – chemical potential – derivation of Gibb's Duhem equation – Fugacity and its determination

UNIT II: QUANTUM CHEMISTRY-I

15hr

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- operator's∇ 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-III: CHEMICAL KINETICS- I

15hr

Rate- Rate laws – order of reaction- molecularity of reaction- difference between order of reaction and molecularity. Theories of reaction rates: Collision Theory of bimolecular reactions- Collision Theory of unimolecular reactions. Theories of absolute reaction rates- Translate state theory- mathematical treatment of transition state theory, Lindemen's Theory of unimolecular reactions, RRKM theory. Chain reactions: Reaction kinetics of hydrogen-bromine reaction- reaction kinetics of Hydrogen- chlorine reactions. H_2O_2 explosion reactions.

HEAD
Department of Chemistry
VIKRAMA SIMHAPURI UNIVERSITY
KAKUTUR, NELLORE-524 320 (A.P.)

UNIT-IV: ELECTROCHEMISTRY-I 15hr

Thermodynamic and kinetic derivation of Nernst equation-chemical and concentration cells with and without transference- liquid junction potential- derivation of the expression liquid junction potential- it's determination and elimination- Applications of conductance Measurements (i) solubility product(ii) pH determination (iii) potentiometric titrations, Conductance, resistance, specific conductance and conductometric titrations. Classification of electrochemical cells. Selection and characterization of electro chemical cells.

References:

1.Thermodynamics for Chemists by Glasstone.
2. An introduction to Thermodynamics by Rastogi and Misra.
3. Thermodynamics for students of chemistry by J.Kuriakose and Rajaram.
4. Basic Thermodynamics by Gupta.
5. Chemical Kinetics by K. J.Laidler.
6. Kinetics and mechanisms of Chemical transformations by J.Kuriakose and Rajaram.
7. Introduction to Electrochemistry by S. Glasstone.
8. Modern Electrochemistry by J.O.M.Bockris and A.K.N.Reddy.
9. Soviet Electrochemistry by C.Ansvipov.
10. Quantum Chemistry by A.K.Chandra.

	Description of CO	Knowledge
CO1	Acquire in depth knowledge in quantum mechanics, quantum chemistry, chemicalkinetics thermodynamics and electrochemistry.	K1
CO2	Describe the principles and applications of plank's equation,bohr'smodel,Schrodinger wave equation - Eigen values and Eigen functions.	K1, K3, K4
CO3	Illustrate the order of reaction- molecularity of reaction- difference between order of reaction and molecularity.	K1, K3
CO4	Apply the knowledge to calculate conductance measurements.	K3, K4, K6

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	2	-	-	1	2	-	-	-	-	-	1	-	-
CO2	2	1	-	-	-	-	-	-	-	-	-	-	-
CO3	2	-	-	2	1	-	-	-	-	-	2	2	-
CO4	3	2	-	2	2	-	-	1	1	-	2	2	1

NOTE: 1-LOW, 2-MEDIUM, 3-HIGH

HEAD
Department of Chemistry
VIKRAMA SIMHAPURI UNIVERSITY
KAKUTUR, NELLORE-524 320 (A.P.)

CHE 103b: ENVIRONMENTAL CHEMISTRY

Semester	Course Code	Course Title	Hours/Week	Hours	Credits
I	CHE103b	ENVIRONMENTAL CHEMISTRY	4	60	4

UNIT – I : ATMOSPHERIC CHEMISTRY **15hr**

Chemical reactions in the atmosphere – Aerosol types, production and distribution – Aerosols and radiation – Atmospheric turbidity and related environmental problems - Inversions – Global climate and photochemical reactions – Global warming – Greenhouse effect – Ozone depletion – Acid rain – Corrosion mechanism – Prevention – Particles in Atmosphere – Composition sources, Types and effects.

UNIT – II : TOXICOLOGICAL CHEMISTRY **15hr**

Introduction to toxicology and toxicological Chemistry – Toxicants – Dose Response Relationships – Biochemical aspects of As, Cd, Pb, Hg, Co, PAN, CO, Pesticides, MIC and carcinogens in air. Chemistry of Ozone layer, Light absorption and principles of photo chemistry, Catalytic and non-catalytic destruction of ozone, Ozone depleting substances, Biological consequences of ozone depletion.

UNIT – III: SOIL CHEMISTRY **15hr**

Soil formation and development, Morphology - Texture, structure physico and chemical properties of soil. Micro and Macronutrients – Inorganic and Organic contaminants in the soil – Biodegradation – Nondegradable waste and its effect on the environment –Bioremediation of surface soils.

UNIT – IV : WATER CHEMISTRY **15hr**

Water pollutants – Types – Sources – Heavy metals – Metalloids – Organic, Inorganic, Biological and Radioactive – Types of reactions in various water bodies including marine environment – Eutrophication – Ground water – Potable water.

References:

1. Sharma, B.K. Kaur H., Environmental Chemistry, Goel Publishing House (1995).
2. Tyagi O.D. and Mehra M, Text Book of Environmental Chemistry, Anmol Publications (1990).
3. Johnson D.O., Netterville J.T., Wood J.C. and James M, Chemistry and the Environment, W.B.Saunders Company Philadelphia (1972).
4. Bailey R.A., Clerke H.M., Ferris J.P., Krause S and Strong R.L., Chemistry of the Environment, Academic Press., New York (1978).
5. Stanley E Manahan, Environmental Chemistry, Lewis Publishers (2001).
6. Thomas G Spiro and William M Stigliani, Chemistry of the Environment,Prentice Hall of India (2004).
7. Rashmi Sanghi and Srivastava M.M., Green Chemistry, Narosa (2006).

	Description of CO	Knowledge
CO1	Acquire Knowledge on chemical reactions in atmosphere. To learn about greenhouse effect, ozone depletion, acid rains and prevention methods	K1, K2.
CO2	Describe about toxicants and biochemical aspects of metals. Illustrate ozone depletion and its consequences..	K3, K4.
CO3	Apply the knowledge of soil and its morphology. Discuss non degradable waste and its effect on environment.	K6, K4.
CO4	Outline various types of pollutants in detail and its irradication methods.	K1, K5.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	2	-	-	1	2	-	-	-	-	-	1	-	2
CO2	2	1	-	-	-	2	-	1	-	-	-	-	-
CO3	2	-	-	2	1	-	-	-	-	-	2	2	-
CO4	3	2	-	2	2	-	-	1	1	-	2	2	1

NOTE: 1-LOW, 2-MEDIUM, 3-HIGH

HEAD
Department of Chemistry
VIKRAMA SIMHAPURI UNIVERSITY
KAKUTUR, NELLORE-524 320 (A.P.)

CHE 104a: GENERAL CHEMISTRY-I

Semester	Course Code	Course Title	Hours/Week	Hours	Credits
I	CHE104a	GENERAL CHEMISTRY-I	4	60	4

UNIT I : MATHEMATICAL CONCEPTS AND COMPUTERS

(A) Mathematical Concepts **15hr**

Logarithmic relations, curve sketching, linear graphs and calculation of slopes, differentiation of functions like k_x, e^x, x^n, sin x, log x; maxima and minima, partial differentiation and reciprocity relations. Integration of some useful/relevant functions; permutations and combinations. Factorials. Probability.

(B) Computers

General introduction to computers, different components of a computer, hardware and software, input-output devices; binary numbers and arithmetic; introduction to computer languages. Programming, operating systems.

UNIT II : POLYMERS

15hr

Classification based upon polymerization mechanism- classification based upon polymer structure-Thermoplastics and Thermo sets- polymerization techniques: Bulk polymerization, solution polymerization and suspension polymerization, emulsion polymerization and plasma polymerization. The management of plastics in the environment: (1) Recycling (2) Incineration (3) Biodegradation- conductive polymers- photoconductive polymers in Biomedical Engineering and drugs delivery- kidney dialysis- Applications in Electronics.

UNIT-III : ELECTROCHEMICAL BATTERIES

15hr

Introduction- primary batteries- secondary batteries lead storage batteries- dry-cell batteries Nickel- Cadmium batteries- Nickel-metal hydride batteries Lithium and Lithium –ion batteries and its Applications. Fuel-cells-H_2-O_2 Fuel cell- Direct methanol fuel cell Proton Exchange Membrane (PEM) fuel cells and its applications. Solar- cells.

HEAD
Department of Chemistry
VIKRAMA SIMHAPURI UNIVERSITY
KAKUTUR, NELLORE-524 320 (A.P.)

UNIT IV : SOLID STATE CHEMISTRY **15hr**

Introduction to solid state materials –bonding in solids-Ionic, covalent, metallic, hydrogen and Vander Waals (molecular) bondings-cohesive energy –defects in crystals-imperfections in solids-line defects-surface imperfections-twin boundary volume defects, crystal systems and X-ray diffraction. Electrode potential –oxidation and reduction potential-electrolyte – electrolysis-catalyst. Physical Vapour Deposition, chemical bath deposition -advantages-limits-DSSCs (dye-sensitized solar cells)-Organic solar cell, XRD (X-ray diffraction) –principal-application-Optical absorption spectroscopy –Raman and IR spectroscopy –XPS (X-ray Photo electron Spectroscopy) –SEM (Scanning Electron Microscopy).

References:

1. Physical Methods in Chemistry.- Russell S Drago, Reinhold Publications Co ,1965
2. Chemical Structure and Bonding.- R.L.Decock and H.B Gray.
3. Fundamentals of Molecular Russell S Drago –C.N.Banwell& E.A. Mc Cash, 4th Ed.
4. Molecular Structure and Spectroscopy – G. Aruldhas.
5. Co ordination Chemistry ; Experimental Methods –K.Burger, London Butter Worths, 1973.
6. Physical Methods in Chemistry; Russell S Drago, W.B. Saunders, Co 1997.
7. Modern Spectroscopy-J.M.Hoilas, John Willey.
8. Introduction to Molecular Spectroscopy – G.M. Barrow, Mc Graw Hill.

	Description of CO	Knowledge
CO1	Describe functions, differential equations, probability, vectors, matrices and determinants To learn about the introduction to the computer and computer languages.	K1, K2, K3, K6
CO2	Enriching and appreciating the basic concepts and polymers and understand the significance of co-polymerization, coordination and conducting polymers and molecular weight concept of polymers and its determination.	K1, K3, K5
CO3	Application of batteries especially for primary and secondary batteries, dry cells, fuel cells and solar cells.	K1, K2, K3
CO4	Explain the structural aspects of materials in solid sate by XRD, XPS and SEM Describe the fundamental principles of molecular spectroscopy including IR, and Raman spectroscopies and various rules involved.	K1, K3, K4

HEAD
Department of Chemistry
VIKRAMA SIMHAPURI UNIVERSITY
KAKUTUR, NELLORE-524 320 (A.P.)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	2	-	2	-	-	-	-	-	-	-	1	-	-
CO2	3	2	-	2	2	-	-	-	-	2	2	-	2
CO3	2	-	2	-	1	-	-	-	1	2	2	2	2
CO4	3	-	2	-	-	-	-	-	-	-	2	2	1

NOTE: 1-LOW, 2-MEDIUM, 3-HIGH

HEAD
Department of Chemistry
VIKRAMA SIMHAPURI UNIVERSITY
KAKUTUR, NELLORE-524 320 (A.P.)

CHE 104b: INDUSTRIAL APPLICATIONS OF CHEMISTRY

Semester	Course Code	Course Title	Hours/Week	Hours	Credits
I	CHE104b	INDUSTRIAL APPLICATIONS OF CHEMISTRY	4	60	4

UNIT- I: DAIRY CHEMISTRY **15hr**

Milk and milk products, composition and structure of milk, milk proteins, enzymes, vitamins, minerals, density and viscosity of milk, effect of heat on milk, milk processing, basic milk categories, butter, ghee and clarified butter.

UNIT-II: LEATHER CHEMISTRY **15hr**

Introduction, constituents of animal skin, manufacture and preparation of hides, cleaning, soaking, limiting and degreasing, finishing and sharing, tanning; leather, vegetable, chrome, tanning effluents; pollution and control.

UNIT III: PHOSPHORUS AND SULPHUR CHEMISTRY **15hr**

Calcium phosphate, manufacture of phosphoric acid, single and triple super phosphate, baking powder and DAP. Mining and manufacture of sulphur and manufacture of sulphuric acid by contact process.

UNIT IV: GLASS AND REFRACTORY MATERIALS **15hr**

Raw materials, Soda glass, borosilicate glass, Lead Glass, Colored Glass, Refractory: Raw materials, clay pots, Zeolites, Industrial Applications of Silicates.

References:

1. N. N. Melnikow: Chemistry of Pesticides, Springer
2. M. B. Green, G. S. Hartley West: Chemicals for Crop Protection and Pest Management,Pergamon.
3. R. Cremlyn: Pesticides
4. K.H. Buchel: Chemistry of Pesticides.

HEAD
Department of Chemistry
VIKRAMA SIMHAPURI UNIVERSITY
KAKUTUR, NELLORE-524 320 (A.P.)

5. H.B. Scher: Advances in pesticides formulation Technology (ACS)
6. F A Henglein: Chemical Technology (pergamon).
7. R.W. Thomas and P. Farago: Industrial Chemistry (HEB).
8. K. Bhogavathi Somdavi: Applied Chemistry, MJP Publications, 2006.
9. C.K. Sharma: Industrial Chemistry, Goel Publishing House, Meerut, 2011

	Description of CO	Knowledge
CO1	Discuss about milk and its composition including proteins, enzymes, vitamins and other factors like density and viscocity.	K1, K3, K4
CO2	To learn leather, tanning effluents and preparation of hides.	K2, K5
CO3	Illustrate the manufacturing of sulphuric acid and phosphoric acids.	K3, K5.
CO4	Explain glass and its types. Applications of Glass.	K5, K4

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	2	-	2	-	-	2	-	-	-	-	1	-	-
CO2	3	2	-	2	2	-	-	-	-	2	2	-	2
CO3	2	-	2	-	1	-	-	-	1	2	2	2	2
CO4	3	-	2	-	-	-	1	-	-	-	2	2	1

NOTE: 1-LOW, 2-MEDIUM, 3-HIGH

HEAD
Department of Chemistry
VIKRAMA SIMHAPURI UNIVERSITY
KAKUTUR, NELLORE-524 320 (A.P.)

CHE 105: INORGANIC CHEMISTRY LAB - I

Course Objectives:

The main objectives of this course are:

Gain knowledge on analysis of rare earth metals and identification of cations present in the mixture by adopting systematic procedure.

Expected Course Outcomes:

On the successful completion of the course, student will be able

To improve the skills in analysis of rare earth metals and inorganic mixtures.

---

1. **Reactions of rare earth metals**
   - (i) Reactions of Molybdenum (Mo)
   - (ii) Reactions of Vanadium (V)
   - (iii) Reactions of Zirconium (Zr)
   - (iv) Reactions of Tungsten (W)
   - (v) Reactions of Cerium (Ce)
   - (vi) Reactions of Lithium (Li)

2. **Qualitative analysis of Inorganic Mixtures**
   - (i) Systematic semi micro qualitative analysis of an inorganic mixture - I
   - (ii) Systematic semi micro qualitative analysis of an inorganic mixture -II
   - (iii) Systematic semi micro qualitative analysis of an inorganic mixture - III
   - (iv) Systematic semi micro qualitative analysis of an inorganic mixture - IV

References:

1. Vogel's Text Book of Qualitative Inorganic analysis.
2. Inorganic semi micro qualitative analysis, V.V. Ramanujam, The National Publishing Company.
3. Practical Inorganic Chemistry, G. Marr and B.W. Rockett, Van Nostrand Reinhold Company.
4. Practical Inorganic Chemistry. G. Pass and H. Sutcliff, 2nd edition, John – Wiley & Sons.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
	2	-	-	2	2	1	2	-	-	1	3	-	1

HEAD
Department of Chemistry
VIKRAMA SIMHAPURI UNIVERSITY
KAKUTUR, NELLORE-524 320 (A.P.)

CHE106: ORGANIC CHEMISTRY LAB - I

Course Objectives:

The main objectives of this course are:

- To understand the basic principles of purification methods such as recrystallization, sublimation and distillation.
- To understand the preparation, purification and identification of organic compounds through single step synthesis.

Expected Course Outcomes:

On the successful completion of the course, student will be able:

- To attain hands on experience on the named reactions and simple organic synthetic methods like methylation, nitration, oxidation, reduction, condensation, addition etc.
- To attain hands on experience in the purification methods like recrystallisation.

A. Give a brief introduction on

(a) Recrystallization (b) Sublimation (c) Distillation (d) Melting point and boiling point

B. Single step preparations (Any five preparations)

1. Preparation of *p*-nitroacetanilide
2. Preparation of Aspirin
3. Preparation of Nerolin
4. Preparation of Phthaliimide
5. Preparation of chalcone
6. Preparation of *p*-bromoaniline
7. Preparation of Hippuric acid
8. Preparation of Diels alder adduct

References:

1. Vogel's Text Book of Quantitative Chemical Analysis, J. Mendham, R. C. Denney, J. D. Barnes and M. J. Thomas, 4th & 6th Ed. (Pearson Education Asia).
2. Vogel's Text Book of Practical Organic Chemistry, B.S. Furniss, A.J. Hannaford, P.W.G. Smith, A.R. Tatchell, 5 Ed. (Longman Scientific & Technical)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
	3	2	1	2	2	2	2	1	1	-	3	2	2

HEAD
Department of Chemistry
VIKRAMA SIMHAPURI UNIVERSITY
KAKUTUR, NELLORE-524 320 (A.P.)

CHE 107: PHYSICAL CHEMISTRY LAB - I

Expected Course Outcomes:

On the successful completion of the course, student will be able:

- To prepare the chemicals with statistical analysis of molar solutions
- To develop knowledge in the determination of eutectic composition and distribution coefficient.
- To interpret the experimental results by adsorption isotherms.
- Impart training in operating calibration of volumetric apparatus and find statistical data of various chemical compositions..

1. Preparation of Solutions (1M HCl, 1M acetic acid, 1M H_2SO_4, 1M NaOH) and Calibration of volumetric apparatus and statistical analysis of the data.
2. Preparation of reagents any five (Starch solution, Chromic acid, Schiff's reagent, Tollen's reagent, Fehling's solution, Phenolphthalein indicator)
3. Preparation of Standard solution: i). To prepare 0.05M solution of oxalic acid in 250ml of volumetric flask. ii). To prepare 0.05M standard sodium carbonate solution in 250ml volumetric flask.
4. Determination of Eutectic composition and temperature of binary system
5. Determination of distribution coefficient of benzoic acid between water and benzene.
6. Study the adsorption of acetic acid on charcoal and analysis of the data on the basis of Langmuir and Freundlich adsorption isotherms.
7. Determination of rate constant of acid hydrolysis of an ester and investigate the effect of catalyst concentration, reactant concentration and temperature.

References:

1. Senior Practical Physical Chemistry – B.D.Khosla, G.C.Garg
2. Vogel's Textbook of Quantitative Chemical Analysis, Revised by G.H.Jeffery, J.Bassett, J.Mendham, R.C.Denney, ELBS

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
	3	2	1	1	-	-	2	-	1	-	2	-	-

HEAD
Department of Chemistry
VIKRAMA SIMHAPURI UNIVERSITY
VAKUTUR, NELLORE-524 ...

CHE 108: CHEMISTRY OF ADVANCED MATERIALS
(Audit course-I)

Semester	Course Code	Course Title	Hours/Week	Hours	Credits
I	CHE 108	CHEMISTRY OF ADVANCED MATERIALS	0	0	0

UNIT-I: METAL AND ALLOYS — 15 hr

Introduction, General characteristic features of Alloys, Properties, Application of iron, nickel, copper, chromium, aluminum and their alloys.

UNIT-II: APPLICATIONS OF POLYMERS — 15 hr

Introduction, Polymerization, Types of polymers – Thermoplastics and Thermosetting plastics applications, importance of molecular weight in polymers, Biodegradable polymers, Medical applications of polymers.

UNIT-III: CERAMICS — 15 hr

Definition, Scope of ceramics and ceramic materials, classification of ceramic materials-conventional and advanced, types of glazes and enamels, applications of ceramics.

UNIT-IV: COMPOSITES — 15 hr

Definition of composite materials; classification: particulate and dispersion hardened composites, continuous and discontinuous fiber reinforced composites, metal-matrix composites, carbon-carbon composites, applications of composites.

References:

1. C N R Rao, Chemistry of advanced materials , Blackwell Publishing Ltd
2. F.L. Matthews and R.D. Rawlings, Composite Materials: Engineering and Science, Chapman & Hall, London,
3. Dysons R. W. , Speciality Polymers, Chapman & Hall, New York
4. Alain Nouailhat, An Introduction To Nanosciences And Nanotechnology, John wiley and sons

HEAD
Department of Chemistry
VIKRAMA SIMHAPURI UNIVERSITY
KAKUTUR, NELLORE-524 320 (A.P.)

	Description of CO	Knowledge
CO1	Outline the general characteristics of alloys and their applications.	K1, K2
CO2	To learn and understand the aspects of polymerization and emulsions.	K3, K5
CO3	Acquire the fundamental knowledge of ceramics.	K4, K5, K6
CO4	To learn in details about composites, their properties and applications.	K2, K4 ,K5

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	2	-	2	-	-	2	-	-	-	-	1	-	-
CO2	3	2	-	2	2	-	-	1	-	2	2	-	2
CO3	2	-	2	-	1	-	-	-	1	2	2	2	2
CO4	3	-	2	-	-	-	1	-	-	-	2	2	1

NOTE: 1-LOW, 2-MEDIUM, 3-HIGH

HEAD
Department of Chemistry
VIKRAMA SIMHAPURI UNIVERSITY
KAKUTUR, NELLORE-524 320 (A.P.)

CHELS 109: CYBER SECURITY

(LIFE SKILL COURSE)

Semester	Course Code	Course Title	Hours/Week	Hours	Credits
I	CHELS 109	CYBER SECURITY	4	60	4

UNIT -1: OVERVIEW OF CYBER SECURITY — 15 hr

Cyber security increasing threat landscape, Cyber security terminologies- Cyberspace, attack, attack vector, attack surface, threat, risk, vulnerability, exploit, exploitation, hacker., Non-state actors, Cyber terrorism, Protection of end user machine, Critical IT and National Critical Infrastructure, Cyberwarfare, Case Studies.

UNIT -2: CYBER CRIMES — 15 hr

Cyber crimes targeting Computer systems and Mobiles- data diddling attacks, spyware, logic bombs, DoS, DDoS, APTs, virus, Trojans, ransomware, data breach., Online scams and frauds- email scams, Phishing, Vishing, Smishing, Online job fraud, Online sextortion, Debit/ credit card fraud, Online payment fraud, Cyberbullying, website defacement, Cyber- squatting, Pharming, Cyber espionage, Cryptojacking, Darknet- illegal trades, drug trafficking, human trafficking., Social Media Scams & Frauds- impersonation, identity theft, job scams, misinformation, fake newscyber crime against persons - cyber grooming, child pornography, cyber stalking., Social Engineering attacks, Cyber Police stations, Crime reporting procedure, Case studies.

UNIT-3: CYBER LAW — 15 hr

Cyber crime and legal landscape around the world, IT Act, 2000 and its amendments. Limitations of IT Act, 2000. Cyber crime and punishments, Cyber Laws and Legal and ethical aspects related to new technologies- AI/ML, IoT, Blockchain, Darknet and Social media, Cyber Laws of other countries, Case Studies.

HEAD
Department of Chemistry
VIKRAMA SIMHAPURI UNIVERSITY
KAKUTUR, NELLORE-524 320 (A.P.)

UNIT -4: DATA PRIVACY AND DATA SECURITY **15 hr**

Defining data, meta-data, big data, non- personal data. Data protection, Data privacy and data security, Personal Data Protection Bill and its compliance, Data protection principles, Big data security issues and challenges, Data protection regulations of other countries- General Data Protection Regulations(GDPR),2016 Personal Information Protection and Electronic Documents Act (PIPEDA)., Social media- data privacy and security issues.

UNIT -5: CYBER SECURITY MANAGEMENT, COMPLIANCE AND GOVERNANCE 15 hr

Cyber security Plan- cyber security policy, cyber crises management plan., Business continuity, Risk assessment, Types of security controls and their goals, Cyber security audit and compliance, National cyber security policy and strategy.

References:

1. Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives by Sumit Belapure and Nina Godbole, Wiley India Pvt. Ltd.
2. Information Warfare and Security by Dorothy F. Denning, Addison Wesley.
3. Security in the Digital Age: Social Media Security Threats and Vulnerabilities by Henry A. Oliver, Create Space Independent Publishing Platform.
4. Data Privacy Principles and Practice by Natraj Venkataramanan and Ashwin Shriram, CRC Press.
5. Information Security Governance, Guidance for Information Security Managers by W. KragBrothy, 1st Edition, Wiley Publication.
6. Auditing IT Infrastructures for Compliance By Martin Weiss, Michael G. Solomon, 2nd Edition, Jones Bartlett Learning.

	Description of CO	Knowledge
CO1	To Understand the overview of cyber security and technologies. To gain the knowledge on cyber warfare and case studies.	K1, K2, K3, K6
CO2	To learn the basics of cyber crimes and cyber espionage. To know the social media scams and frauds in cyber crimes.	K1, K3, K5
CO3	To learn the fundamentals of cyber crime and	K2, K3,K6

HEAD
Department of Chemistry
VIKRAMA SIMHAPURI UNIVERSITY
KAKUTUR, NELLORE-524 320 (A.P.)

	punishments. To create awareness on cyber laws and legal and ethical aspects.	
CO4	To acquire sufficient knowledge on data privacy and security. To understand the data protection regulations and personal information protection.	K3, K4
CO5	To discuss cyber security plan, cyber crisis and risk assessment. To understand the types of security controls and their goals.	K3,K6

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	2	-	2	-	-	-	-	-	-	-	1	-	-
CO2	3	2	-	2	2	-	-	-	-	2	2	-	2
CO3	2	-	2	-	1	-	-	-	1	2	2	2	2
CO4	3	-	2	-	-	-	-	-	-	-	2	2	1
CO5	-	3	-	2	-	-	1	2	-	-	-	2	-

NOTE: 1-LOW, 2-MEDIUM, 3-HIGH

HEAD
Department of Chemistry
VIKRAMA SIMHAPURI UNIVERSITY
KAKUTUR, NELLORE-524 320 (A.P.)

SEMESTER -II
CHE 201: INORGANIC CHEMISTRY-II

Semester	Course Code	Course Title	Hours/Week	Hours	Credits
II	CHE 201	INORGANIC CHEMISTRY-II	4	60	4

UNIT – I: MAGNETOCHEMISTRY OF TRANSITION METAL COMPLEXES 15 hr

Introduction to Magneto Chemistry, Magnetic Induction, Permeability, Types of magnetism - Dia, para, ferro and anti ferromagnetism, Curie law and Curie-Weiss law. Behaviour of Dia, para, ferro and antiferromagnetic substances with temperature. Temperature Independent Paramagnetism (TIP), Magnetic exchange behaviour in copper (II) acetate, Magnetic susceptibility and determination of magnetic susceptibility by Guoy's method.

UNIT – II : ELECTRONIC SPECTROSCOPY OF TRANSITION METAL COMPLEXES 15 hr

Free ion Terms and Energy Levels: Configurations, Terms, States and Microstates. Calculation of Microstates for p^2 and d^2 configurations, L-S (Russel-Sanders) Coupling Schemes, J-J Coupling Scheme, derivation of terms for p^2 and d^2 configuration. Hole formulation, Energy ordering of terms (Hund's rules), Selection rules: Laporte orbital selection rule, Spin selection rules, Splitting of energy levels and spectroscopic states. Orgel diagrams of d^1 to d^9 metal complexes. Interpretation of electronic spectra of aqua complexes of Ti(III), V(III), Cr(III), Mn(II), Fe(II), Fe(III), Co(II), Ni(II) and Cu(II). Tanabe-Sugano diagrams for d^2 and d^6 octahedral complexes. Charge transfer (L→M and M←L) spectra of metal complexes.

UNIT – III: ELECTRON SPIN RESONANCE SPECTROSCOPY 15 hr

Principles of ESR spectroscopy, Instrumentation. Presentation of ESR spectrum. Spectroscopic splitting factor (g value) and its significance, factors affecting g value. Hyperfine coupling. ESR spectrum of hydrogen atom, ESR spectra of organic and inorganic radicals: methyl, ethyl, t-butyl, tropylium, benzene, naphthalene, p-benzosemiquinone radicals. Application of ESR

spectroscopy to transition metal complexes having one unpaired electron. Zero field splitting and Kramer's degeneracy.

UNIT –I V: METAL – LIGAND EQUILIBRIA IN SOLUTION **15 hr**

Stability of metal complexes-thermodynamic stability and kinetic stability. Types of stability constants - Concentration, conditional, stepwise and overall stability constants. Relation between stepwise and overall stability constants of a metal complex. Trends in step wise stability constants. Factors influencing the stability of metal complexes with reference to metal and the ligand. Chelate effect and Macrocyclic effect. HSAB rule and its application to stability of complexes and metal-ligand interaction in biological systems. Determination of stability constants of metal complexes by spectrophotometric and pH-metric methods.

References:

1. Inorganic Chemistry, J. E. Huheey, E. A. Keiterand R. L. Keiter, 4th edition, Harper Collins College Publishers.
2. Concepts and models of Inorganic Chemistry, B.E. Douglas, D.H. McDaniel and J.J. Alexander, 3rd edition, John-Wiley.
3. Inorganic Chemistry, D.F. Shriver and P.W. Atkins, 3rd edition, Oxford.
4. Advanced Inorganic Chemistry, F.A. Cotton and G. Wilkinson, 6th edition, Wiley Interscience.
5. Concise Inorganic Chemistry, J.D. Lee, Blackwell Science.
6. Magnetochemistry, R.L. Carlin, Springer-verlag.
7. Elements of magnetochemistry, R.L. Dutta and A. Syamal, Affiliated East-west.

	Description of CO	Knowledge
CO1	Outline the properties of dia and para magnetism, Describe the Curie law and Curie-Wiess Law, Explain the Temperature Independent Paramagnetism (TIP)	K_2, K_4, K_6
CO2	Write the principle of LS Coupling(Russel-Saunders),Compare the Leporte orbital selection rule and spin selection rule, Discuss the Charge Transfer of Metal Complexes	K_2, K_3, K_6
CO3	Define the principle of ESR spectroscopy, explain ESR spectrum of organic and inorganic radicals, discuss the applications of ESR spectroscopy.	K_1, K_2, K_3
CO4	Differentiate the stepwise and overall stability constants, state the HSAB principle, Demonstrate the stability constants of metal complexes by spectrophotometric and pH metric methods.	K_1, K_3, K_4

HEAD
Department of Chemistry
VIKRAMA SIMHAPURI UNIVERSITY
KAKUTUR, NELLORE-524 320 (A.P.)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	2	-	3	-	-	-	-	-	-	-	1	-	-
CO2	-	2	-	-	-	-	-	-	-	-	-	-	2
CO3	2	-	-	-	-	-	-	-	-	-	-	2	-
CO4	3	-	-	-	-	-	-	-	-	-	-	2	-

NOTE: 1-LOW, 2-MEDIUM, 3-HIGH

HEAD
Department of Chemistry
VIKRAMA SIMHAPURI UNIVERSITY
KAKUTUR, NELLORE-524 320 (A.P.)

CHE 202: ORGANIC CHEMISTRY – II

Semester	Course Code	Course Title	Hours/Week	Hours	Credits
II	CHE 202	ORGANIC CHEMISTRY – II	4	60	4

UNIT-I: REACTION MECHANISMS II (Addition and Elimination reactions) **15 hr**

Addition reactions : Stereoselective addition to carbon – carbon double bond, anti addition – Bromination and epoxidation followed by ring opening. Hydroboration. Michael reaction, Robinson annulation, Perkin reaction, Aldol condensation, Cannizaro reaction, Knoevenagel reaction and Dieckmann reaction.

Elimination reaction: E_1, E_2, E_{1CB} mechanisms, orientation and stereoselectivity in E_2 eliminations. Pyrolitic syn elimination and α - elimination, elimination vs substitution. Factors influencing the elimination reactions.

UNIT-II: STEREOCHEMISTRY **15 hr**

Optical isomerism: Molecular Symmetry and Chirality - Stereoisomers - Classification - Configuration - *R, S* - nomenclature - Axial Chirality - Stereochemistry of allenes, spiranes, biphenyl derivatives and atropisomerism - Planar chirality - Ansa compounds and *trans* - Cycloalkenes - Helicity.

Geometrical isomerism: *E, Z* – nomenclature, Physical and Chemical methods of determining the configuration of geometrical isomers - Stereoisomerism in cyclic compounds.

Conformational analysis: Conformations of disubstituted cyclohexane - Compounds having intramolecular hydrogen bonding- Ethylene glycol, butane 2,3- diol, Amino alcohols, halohydrin.

UNIT- III :ALKALOIDS **15 hr**

Occurance, isolation, general methods of structural elucidation and physiological action, Classification based on nitrogen heterocycle ring, Structural elucidation and Synthesis of the following – Atropine, Papaverine and Nicotine

UNIT- IV: TERPENOIDS **15 hr**

HEAD
Department of Chemistry
VIKRAMA SIMHAPURI UNIVERSITY
KAKUTUR, NELLORE-524 320 (A.P.)

Definition and classification – Occurrence, isolation and general methods of structural determination. Isoprene and special isoprene rule. Structural elucidation and Synthesis of the following – α- Terpinenol (Mono terpenoid), Abietic acid (Diterpenoid) and Farnesol (Sesquiterpenoid).

References:

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. Modern Organic Reactions, H.O. House, Benjamin.
5. Reaction Mechanism in Organic Chemistry, P.S. Kalsi, New Age International
6. Stereochemistry to Organic Compounds, E.L. Eliel and others, John Wiley.
7. Stereochemistry to Organic Compounds, D. Nasipuri, New Age International.
8. Stereochemistry, P.S.Kalsi, Wiley Eastern.
9. Some Modern Methods of Organic Synthesis, W. Carruthers, Cambridge University Press.
10. Organic Chemistry, Vol. 2, I. L. Finar, ELBS.
11. Chemistry of Natural Products P.S. Kalsi, Kalyani Publishers
12. Chemistry of Organic Natural Products, O.P. Agarwal, Vols., 1 & 2, Goel Pub

	Description of CO	Knowledge
CO1	Illustrate the mechanism and stereochemical aspects of addition reactions involving electrophiles, nucleophiles and free radicals. Explain the mechanism and stereochemical aspects of variety of elimination reactions like E1, E2 and E1cB etc.	K_1, K_2
CO2	Describe the concept of axial chirality and planer chirality ansa compounds and healicity. Compare the different classification of stereo isomers Discuss conformation analysis of acyclic and alicyclic systems.	K_1, K_2, K_4
CO3	State the occurrence, isolation and classification of alkaloids	K_1, K_2
CO4	Define the isolation, isoprene rule and classification and synthesis of terpenoids	K_1, K_2

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	2	2	2	2	-	1	-	-	2	-	2	1	3
CO2	3	2	2	2	-	-	-	-	-	-	2	1	-
CO3	2	2	-	-	-	-	1	-	-	-	2	2	1
CO4	3	2	-	-	-	-	1	-	-	-	2	2	1

NOTE: 1-LOW, 2-MEDIUM, 3-HIGH

HEAD
Department of Chemistry
VIKRAMA SIMHAPURI UNIVERSITY
KAKUTUR, NELLORE-524 320 (A.P.)

CHE 203: a) PHYSICAL CHEMISTRY – II

Semester	Course Code	Course Title	Hours/Week	Hours	Credits
II	CHE 203a	PHYSICAL CHEMISTRY – II	4	60	4

UNIT-I : STATISTICAL THERMODYNAMICS 15hr

Entropy, Probability- Relationship between entropy and probability, Thermodynamic probability- microstate-macro-state system-assembly and ensemble- classification of ensembles, configuration-distribution-Distribution number

Derivation of Boltzmann distribution law- partition function- physical significance of partition function. factoriztion of partition function-translation-rotational-vibrational and electronic and nucleus partition. Relation between patition function and Thermodynamic functions (internal energy, enthalpy, work function, entropy, equilibrium constant). The sacur-tetrode equation derivation.

UNIT-II: QUANTUM CHEMISTRY-II 15hr

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-III: SYMMETRY AND GROUP THEORY 15hr

Definition of a group, rules that are set for a group, sub-group, order of a group, Relation between order of a finite group and its sub-group, conjugacy relation and class of a group, symmetry elements and symmetry operation. Symmetry point group (MLS, MHS and MSS), Schoenflies symbols - Representation of groups by matrices (representation for C_n, C_{nv}, D_{nh} etc. groups to be worked out explicitly), character of a representation, group multiplication tables, reducible - irreducible representations The great orthogonality theorem (without proof) - character tables (H_2O,NH_3) and their use in spectroscopy, Mulliken character tables.

HEAD
Department of Chemistry
VIKRAMA SIMHAPURI UNIVERSITY
KAKUTUR, NELLORE-524 320 (A.P.)

UNIT-IV: ELECTROCHEMISTRY-II **15hr**

Concept of activity –activity of a gas – concept of activity coefficient-activity and activity coefficient of solution-activity and activity coefficient of strong electrolytes, meanactivity and meanactivity coefficient- Debye- Huckel-limiting law-verification of Debye- Huckel-limiting law- Experimental determination of activity coefficient of electrolytes: solubility method- EMF method.Corrosion and its examples- theories of corrosion, dry corrosion –wet corrosion-factors affecting corrosion-protection against corrosion–sacrificial anodic protection-Impressed current cathodic protection.

References:

1. Symmetry and Spectroscopy Molecules- K.Veera Reddy, New Age Publications , New Delhi.
2. Chemical Applications of Group Theory by Bhattacharya.
3. Group Theory by Habl Bishop.
4. Vogal Text book of Quantitative Chemical Analysis revised by G.H. Jeffrey et al, (5th EDITION ELBS Longman Group, New York).
5. Instrumental Methods of Analysis ,6th EDITION - Willard, Merritt, Dean, Settle, CBS Publications, 1986

	Description of CO	Knowledge
CO1	Apply a vast knowledge in the interpretation of various physical quantities involved in Thermodynamics, enthalpy, work function, entropy and equilibrium constant etc.,	K_3, K_4
CO2	Analyze the theories and applications of quantum mechanical treatment of Schrodinger wave equation to hydrogen atom and perturbation Theory	K_4, K_6
CO3	Identify the concepts and applications of symmetries, group multiplication tables and mulliken character tables	K_1, K_2
CO4	Define the applicative aspects of Debye- Huckel-limiting law and corrosion-factors	K_1, K_4

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	2	2	3	1	-	-	1	-	-	-	1	2	-
CO2	2	2	1	-	-	2	-	-	-	-	2	-	1
CO3	2	1	-	2	-	-	-	-	-	-	2	2	-
CO4	3	2	1	1	-	-	-	-	-	-	1	2	1

NOTE: 1-LOW, 2-MEDIUM, 3-HIGH

HEAD
Department of Chemistry
VIKRAMA SIMHAPURI UNIVERSITY
KAKUTUR, NELLORE-524 320 (A.P.)

CHE 203: b) ENVIRONMENTAL POLLUTION

Semester	Course Code	Course Title	Hours/Week	Hours	Credits
I	CHE203b	ENVIRONMENTAL POLLUTION	4	60	4

UNIT – I : ATMOSPHERIC POLLUTION 15hr

Sampling and analysis of SO_2, NOx, NO_2, CO_2, fluoride, hydrocarbons and particulates – Cryogenic sampling – Impinges – Scrubbers – Adsorption – Absorption for analysis of SO_2, NO_2, CO_2, fluoride and hydrocarbons – Automobile emissions – Types and their control methods, Impact of automobile technology and fuels, National and Euro standards.

UNIT – II: WATER POLLUTION 15hr

Sampling, analysis and prevention – Determination of pH, DO, BOD, COD, Solids, colour, turbidity, various forms nitrogen, phosphates, fluorides, sulphates, hardness, heavy metals, oil and grease, phenols, pesticides and radio nuclides.

UNIT – III: SOIL POLLUTION 15hr

Sources of Soil pollution – Industrial wastes, pesticides, fertilizers and manures, discarded wastes, radioactive and other pollutants. Salination of soil, Control of soil pollution. Sampling, analysis and prevention – Determination of pH –Marine Pollution: Marine – Material addition – Natural and Anthropogenic activity – Oil pollution and effects on marine organisms – Control methods.

UNIT – IV: NOISE POLLUTION 15hr

Introduction of noise pollution, transmission of sound, measurement of sound, Sources – Noise indices – Classification of Noise loads –Effect of noise pollution – Effect on hearing ability, Effect on general health and other effects, Effect of noise on biota and human health – Control and prevention methods. Noise pollution control in India.

References:

1. Henry C Perkins, Air Pollution, McGraw-Hill (1974).
2. Chhatwal G.R, Mehra M.O., Katyal T, Satake K Mohan Katyal and Nagahiro T, Environmental Noise Pollution and its Control, Anmol Publications (1989).
3. Trivedy R.K. and Goel P.K., An Introduction to Air Pollution, Techno Science Publications, Jaipur (1995).
4. Kudesia V.P., Water Pollution, Pragati Prakashan Publications (1985).
5. Sharma P.D., Environmental Biology, Rastogi and Co (1995).
6. Harrison, R.M., Pollution – Causes, Effects and Control, Royal Society of Chemistry (1990).
7. Handbook of Nanofabrication. Edited by Gary W iederrcht.Elsevier, 2010.
8. Introduction to Nanoscience by Gabor L. Hornyak, Joydeep Dutta, Harry F. Tibbals, Anil K. Rao. CRC Press, 2008.

	Description of CO	Knowledge
CO1	Explain the gases that acts as pollutants, types and their control methods.	K2, K5
CO2	Determination of different parameters in water and their analysis techniques.	K4, K5
CO3	To learn about Industrial wastes ,sampling analysis and control methods.	K2, K4, K6
CO4	Describe the noise loads and effects on Human health.	K2, K3

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	2	-	2	-	-	-	-	-	-	-	1	-	-
CO2	3	2	-	2	2	-	1	-	-	2	2	-	2
CO3	2	-	2	-	1	-	-	-	1	2	2	2	2
CO4	3	-	2	-	-	-	-	2	-	-	2	2	1

NOTE: 1-LOW, 2-MEDIUM, 3-HIGH

HEAD
Department of Chemistry
VIKRAMA SIMHAPURI UNIVERSITY
KAKUTUR, NELLORE-524 320 (A.P.)

CHE 204: a) GENERAL CHEMISTRY-II

Semester	Course Code	Course Title	Hours/Week	Hours	Credits
II	CHE204a	GENERAL CHEMISTRY-II	4	60	4

UNIT-1: TREATMENT OF ANALYTICAL DATA 15 hr

Precision and accuracy- Mean and Median values, Standard deviation, Co efficient of variation, Types of errors, determinate and indeterminate errors, confidence limits, significant figures, computations, minimization of errors, statistical evaluation of data – T-test, F- test, χ^2 – test. Correlation co-efficient and coefficient of determination, Limit of detection, Limit of determination, Sensitivity and selectivity of an analytical methods.

UNIT-2: FLAME EMISSION AND ATOMIC ABSORPTION SPECTROSCOPY 15hr

Flame Emission Spectroscopy: Principles, Chemical reactions in flame, Interferences, Instrumentation, Types of emission spectra, Applications, Advantages and disadvantages of Emission Spectroscopy.

Atomic Absorption Spectroscopy: Principle, Instrumentation, Sources of radiation (HCL &EDL), Different types of burners, Interferences- Physical, chemical, spectral and back ground correction, Differences and comparison between AAS & FES, Advantages and disadvantages of Atomic Absorption Spectroscopy.

UNIT – III: MOSSBAUER AND NQR SPECTROSCOPY 15 hr

Mossbauer spectroscopy – Principles and Instrumentation. Presentation of Mössbauer spectrum, Factors influencing absorption of γ-rays by nucleus – Isomeric shift, quadrupole interactions and magnetic interactions. Application of the technique in the study of iron and tin compounds with respect to a) spin nature b) structural elucidation c) nature of metal-ligand bonding d) oxidation states and e) electronegativity of groups.

Nuclear quadrupole resonance spectroscopy – Principle, Instrumentation, Quadrupole nuclei, Quadrupole moments, Electric field gradient and Applications.

HEAD
Department of Chemistry
VIKRAMA SIMHAPURI UNIVERSITY
KAKUTUR, NELLORE-524 320 (A.P.)

UNIT – IV: CATALYSIS **15 hr**

Homogeneous catalysis, Metal ion catalyzed reactions – Redox potentials and processes – Mechanisms of redox processes involving ligands – Factors affecting redox potentials – other types of metal catalyzed reactions – Reactions involving Ag(I), Cu(II) and Os (VIII) – Reactions of oxyanions – Factors affecting rate (General discussion only) – Induced reactions – Free radical reactions – Thermal decomposition of peroxydisulphate – Fe(III) – S_2O_8 reactions – chain reactions – HBr reactions, H_2O_2 – S_2O_2 reactions.

References:

1 Vogel Text book of Quantitative Chemical Analysis revised by G.H. Jeffrey et al, (5th EDITION ELBS Longman Group, New York).
2. Instrumental Methods of Analysis ,6th EDITION - Willard, Merritt, Dean, Settle, CBS Publications, 1986.
3. Chemical Structure and Bonding.- R.L.Decock and H.B Gray.
4. Fundamentals of Molecular Russell S Drago –C.N.Banwell& E.A. Mc Cash, 4th Ed.
5. Molecular Structure and Spectroscopy – G. Aruldhas.
6. Co ordination Chemistry ; Experimental Methods –K.Burger, London Butter Worths, 1973.

	Description of CO	Knowledge
CO1	Compare Precision and accuracy, relate the statistical evaluation of Data T-Test and F-Test, Write the importance of Significant figures.	K_6, K_4, K_3
CO2	State the principles of fame emission spectroscopy and atomic absorption spectroscopy, write the difference between AAS and FES, Explain the advantages and disadvantages of AAS and FES.	K_1, K_3, K_6
CO3	State the principles of Mossbauer and NQR spectroscopy, Illustrate the applications of Mossbauer and NQR spectroscopy, Discuss the Factors influencing absorbtion of Gamma rays nucleus.	K_1,K_2, K_3
CO4	Outline the Homogeneous catalysis, Analyse the hydrogen bromide(HBr) and Hydrogen peroxide(H_2O_2) reactions, Discuss the factors affecting Redox potentials.	K_1, K_4, K_2.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	2	-	3	-	-	-	-	-	-	-	1	-	-
CO2	-	2	-	-	-	-	-	-	-	-	-	-	2
CO3	2	-	-	-	-	-	-	-	-	-	-	2	-
CO4	3	-	-	-	-	-	-	-	-	-	-	2	-

NOTE: 1-LOW, 2-MEDIUM, 3-HIGH

HEAD
Department of Chemistry
VIKRAMA SIMHAPURI UNIVERSITY
KAKUTUR, NELLORE-524 320 (A.P.)

CHE-204: b) SPECTROSCOPIC TECHNIQUES

Semester	Course Code	Course Title	Hours/Week	Hours	Credits
II	CHE204b	SPECTROSCOPIC TECHNIQUES	4	60	4

UNIT I: UV-VISIBLE SPECTROSCOPY **15 hr**

Principle, Beer Lamberts law Instrumentation – Single beam and double beam, applications, Principle in UV Spectrophotometer, Electronic transition and excitation process, Types of electronic transitions, Instrumentation, applications.

UNIT II: INFRARED SPECTROSCOPY **15 hr**

Introduction, Principle, Types of vibrations: Stretching - Symmetrical & Asymmetrical, Bending - In plane bending – Scissoring & Rocking out of plane bending – wagging & Twisting, Instrumentation, Source, Sample handling, Monochromator, Detector, Recorder/Plotter, Types of instruments, Absorptions of common functional groups, Applications.

UNIT III: NMR SPECTROSCOPY **15 hr**

Introduction, Principle, Relaxation Process, Instrumentation-RF transmitter, RF Reciever/Detector, Sweep generator, Recorder, Sample cell, Solvent Requirements, Shielding and Deshielding, Chemical Shift, Reference Standard, Applications

UNIT IV: MASS SPECTROMETRY **15 hr**

Introduction, Principle, Instrumentation, Types of Mass Spectrometers, Fragmentation of Simple Organic Molecules- alkanes, alcohols, Behavior of Ions in electric and magnetic fields, Molecular ions and adducts, Types of Peaks, Applications.

HEAD
Department of Chemistry
VIKRAMA SIMHAPURI UNIVERSITY
KAKUTUR, NELLORE-524 320 (A.P.)

References:

1. Practical NMR Spectyroscopy, M.L.Martin, J.J.Deepish and G.J. Martin, Heyden.
2. Spectrometric Identification of organic Compounds, R.M. Silverstein, G.C.Bassler, T.C.Morril and John Willey.
3. Introduction to NMR Spectroscopy, R.J.Abraham, J.fisher and p.loftus, willey.
4. Applications of spectroscopy of Organic Compounds, J.R.dyer Prentice Hall.
5. Spectroscopic Methods in Organic chemistry D.H. Williams, I.fleming, Tata mc Graw-hill.
6. W.Kemp,Organic Spectroscopy, 3rd edition,wiley,1995.
7. Introduction to Spectroscopy : Donald L. Pavia, Thompson,2009.
8. Modern NMR Techniques for chemistry Research, A.E. Derome, Pergamon.
9. Physical Methods in Chemistry, R.S. Drago, Saunders College.
10. Chemical Applications of Group theory, F.A. Cotton

	Description of CO	Knowledge
CO1	To learn Beer-Lamberts law, instrumentation and application of uv-vis spectroscopy.	K_1, K_2
CO2	To acquire stretching and vibration of molecules	K_4, K_5
CO3	To familiarize the shielding effect ,chemical shift in molecules. To learn about Instrumentation and applications of NMR.	K_1,K_4, K_3
CO4	To describe the principle and Instrumentation of Mass spectrometers and its applications.	K_3, K_5, K_2.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	2	-	3	-	-	-	-	-	-	-	1	-	-
CO2	-	2	-	-	-	-	-	-	-	-	-	-	2
CO3	2	-	-	-	1	-	-	-	-	-	-	2	-
CO4	3	-	-	-	-	-	-	-	-	-	-	2	-

NOTE: 1-LOW, 2-MEDIUM, 3-HIGH

HEAD
Department of Chemistry
VIKRAMA SIMHAPURI UNIVERSITY
KAKUTUR, NELLORE-524 320 (A.P.)

CHE 205: INORGANIC CHEMISTRY LAB –II

Course Outcomes:

On the successful completion of the course, student will be able:
To gain knowledge on Preparation of Co-ordination complexes

1. Preparation of Co-ordination complexes

a) Chloropentamminecobalt(III)chloride
b) *Bis*(oxalate)cuprate(II)dehydrate
c) *Tris*(oxalato)ferrate(III)
d) Hexaamminenickel(II)chloride
e) Tetra (ammine) copper(II) sulphate.

References:

1. Vogel's Text Book of Qualitative Inorganic analysis.
2. Inorganic semi micro qualitative analysis, V.V. Ramanujam, The National Publishing Company.
3. Practical Inorganic Chemistry, G. Marr and B.W. Rockett, Van Nostrand Reinhold Company.
4. Practical Inorganic Chemistry. G. Pass and H. Sutcliff, 2nd edition, John – Wiley & Sons.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
	2	1	2	1	-	-	2	-	1	-	1	2	-

HEAD
Department of Chemistry
VIKRAMA SIMHAPURI UNIVERSITY
KAKUTUR, NELLORE-524 320 (A.P.)

CHE 206: ORGANIC CHEMISTRY LAB –II

Course Objectives:

The main objective of this course is:

To understand the basic principles of method of separation of binary mixture of organic compounds

Expected Course Outcomes:

On the successful completion of the course, student will be able:

Identification of various functional groups in organic compounds and their conformations.

Systematic qualitative analysis of an organic mixture containing two compounds (Identification, method of separation and the functional group (s) present in each of them and preparation of one solid derivative for the conformation of each of the functional group (s)

1. Acid + neutral
2. Base + Neutral
3. Phenol + Neutral
4. Neutral + Neutral

References:

1. Practical organic chemistry, Vogel
2. Practical organic chemistry, Mann and Saunders

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
	3	1	2	1	-	-	1	-	2	-	2	1	-

HEAD
Department of Chemistry
VIKRAMA SIMHAPURI UNIVERSITY
KAKUTUR, NELLORE-524 320 (A.P.)

CHE 207: PHYSICAL CHEMISTRY LAB – II

Course Outcomes:

On the successful completion of the course, student will be able:

To conduct the experiments of critical solution temperature of phenol-water system

To develop knowledge in the determination of rate constant of acid hydrolysis of an ester and investigate the effect of catalyst concentration, reactant concentration and temperature.

To interpret the experimental results obtained by conductometryand potentiometry.

Apply concepts of Physical Chemistry and Analytical Chemistry through experimentation.

1. Determination of distribution coefficient of iodine between water and CCl_4.
2. **Conductometry**
   a. Determination of cell constant
   b. Verification of Onsager equation
   c. Determination of dissociation constant of a weak acid
   d. Titration of a strong acid with a strong base
   e. Titration of a weak acid with a strong base
3. **Potentiometry**
   a. Titration of a strong acid with a strong base
   b. Titration of a weak acid with a strong base
   c. Redox titration
4. **Colorimetry:** Verification of Beer's Law, Estimation of Potassium dichromate, Estimation of Potassium permanganate, Estimation of Manganese, Estimation of Iron.
5. **pH metry:** Strong acid, Strong base titrations.
6. Determination of critical solution temperature of phenol-water system and study the effect of electrolyte on CST.

References:

1. Senior Practical Physical Chemistry – B.D.Khosla, G.C.Garg
2. Vogel's Textbook of Quantitative Chemical Analysis, Revised by G.H.Jeffery,J.Bassett, J.Mendham, R.C.Denney, ELBS

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
	2	2	1	1	-	-	2	-	1	-	2	2	-

HEAD
Department of Chemistry
VIKRAMA SIMHAPURI UNIVERSITY
KAKUTUR, NELLORE-524 320 (A.P.)

CHE 208: ENERGY AND ITS VARIOUS FORMS

(Audit course-II)

Semester	Course Code	Course Title	Hours/Week	Hours	Credits
II	CHE 208	ENERGY AND ITS VARIOUS FORMS	0	0	0

UNIT -I: ELECTRICAL ENERGY **15hr**

Basics of electricity, DC-AC currents, electricity tariff, load management and maximum demand control, power factor, application of DC and AC.

UNIT -II: SOLAR ENERGY **15hr**

Sun as a source of energy, solar radiation, solar radiation at the earth's surface, measurement of solar radiation-pyroheliometer, pyranomater, sunshine recorder, prediction of available solar radiation, solar energy- importance, storage of solar energy, solar pond.

UNIT -III: WIND ENERGY **15hr**

Fundamentals of Wind energy, Definition, wind turbine and wind farm, wind turbine blades, blade element theory, wind powered pumps, wind energy economics.

UNIT -IV: BIOENERGY **15hr**

Concepts of bioenergy, Introduction, Biopower, Bioheat, Biofuels, advanced liquid fuels, Biobased products, emission of biomass to power generation applications.

References:

1. Energy Dictionary, Van Nostrand Reinhold Company, New York - V Daniel Hunt.
2. Cleaner Production – Energy Efficiency Manual for GERIAP, UNEP, Bangkok preparedby National Productivity Council
3. Solar Energy- Fundamentals, design, modeling & applications, G.N. TiwariNarosa Pub.,2005.
4. Solar Energy-Principles of thermal energy collection & storage, S.P. Sukhatme,

Tata Mc-Graw Hill Publishers, 1999.
5. Solar Photovoltaics- Fundamentals, technologies and applications, Chetan Singh Solanki, PHILearning Pvt. Ltd
6. Wind Energy Explained: Theory, Design, and Application, By James F. Manwell, Jon G.McGowan, and Anthony L. Rogers, Wiley; 2 edition (February 2010)
7. Wind Power Plants: Fundamentals, Design, Construction and Operation, Gasch, Robert, Twele, Jochen (Eds.) Springer-Verlag Berlin Heidelberg; 2 edition (2012)

	Description of CO	Knowledge
CO1	To Understand basics of electricity and electricity tariff. To gain detailed knowledge on Direct Current (DC)and Alternate Current (AC).	K1, K2, K3, K6
CO2	To learn the basics of solar Radiation and measurement of solar Radiation. To acquire thoroughness in applications of solar energy.	K1, K3, K5
CO3	To learn the fundamentals of wind energy, wind farm and wind turbines. To understand the theories of wind energy.	K2, K3
CO4	To acquire sufficient knowledge on concepts of bioenergy, biopower and biofuels. To provide opportunities to students to understand various types of bioenergy generation applications.	K3, K4

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	2	-	2	-	-	-	-	-	-	-	1	-	-
CO2	3	2	-	2	2	-	-	-	-	2	2	-	2
CO3	2	-	2	-	1	-	-	-	1	2	2	2	2
CO4	3	-	2	-	-	-	-	-	-	-	2	2	1

NOTE: 1-LOW, 2-MEDIUM, 3-HIGH

HEAD
Department of Chemistry
VIKRAMA SIMHAPURI UNIVERSITY
KAKUTUR, NELLORE-524 320 (A.P.)

CHELS 209: PERSONALITY ENHANCEMENT & LEADERSHIP

(LIFE SKILL COURSE- II)

Semester	Course Code	Course Title	Hours/Week	Hours	Credits
II	CHELS 209	PERSONALITY ENHANCEMENT & LEADERSHIP	4	60	4

UNIT- I : INTRODUCTION TO PERSONALITY ENHANCEMENT 15hr

The concept personality Dimensions of theories of Freud & Erickson- personality - significant of personality development. The concept of success and failure: What is success? - Hurdles in achieving success - Overcoming hurdles - Factors responsible for success - What is failure - Causes of failure. SWOT analyses.

UNIT- II :ATTITUDE & MOTIVATION 15hr

Attitude - Concept - Significance - Factors affecting attitudes - Positive attitude - Advantages - Negative attitude - Disadvantages - Ways to develop positive attitude - Difference between personalities having positive and negative attitude. Concept of motivation - Significance - Intemal and extemal motives - Importance of self-motivation- Factors leading to de-motivation.

UNIT -III : SELF-ESTEEM 15hr

Term self-esteem - Symptoms - Advantages - Do's and Don'ts to develop positive self-esteem - Low selfesteem - Symptoms - Personality having low selfesteem - Positive and negative self-esteem. Interpersonal Relationships - Defining the difference between aggressive, submissive and assertive behaviours - Lateral thinking.

UNIT-IV: INTRODUCTION TO LEADERSHIP 15hr

Definition and meaning, Importance, Leadership and Management, Leader vs Manager, Essential qualities of an effective leader. Theories of Leadership: Trait theory, Behavioral theories, Contingency theory.

UNIT-V: LEADERSHIP CHARACTERISTICS

15hr

Types of Leaders - Importance of Leadership - Leadership Skills - Building and Leading Efficient Teams - Leadership styles: Tradilional, Transactional, Transformational, Inspirational and servant leadership and Emerging issues in leadership: Emotional Intelligence and leadership, Trust as a factor, Gender and Leadership. Leadership Qualities of Abraham Lincoln, Mahatma Gandhi, Prakasam Pantulu, Dr. B.R. Ambedkar and J.R.D. Tata.

References:

1. Hang, Soto, Christopher, Billy, expectations and abilities to meet them as possible mechanisms of youth personality development.
2. Rothbart, Ahadi, Evans (2000) Temperament and personality: Origins and Outcomes.
3. Roberts,Caspi,Moffitt (2001), Growth and stability in personality development from Adolescence to Adulthood.
4. Bass (1985), Leadership and performance beyond expectations , Newyork, Free Press.
5. Avery (2005), Understanding Leadership, London, Sage Publications.

	Description of CO	Knowledge
CO1	To gain knowledge on introduction to personality enhancement. To discuss what are the factors responsible for success.	K1, K2, K3, K6
CO2	To describe the concepts of attitude and motivation. To learn the importance of self motivation.	K1, K3, K5
CO3	To give the awareness on positive and negative self esteem. To understand what are the do's and don'ts to develop positive self esteem.	K2, K3
CO4	To acquire knowledge on importance of leadership qualities. To describe the theories of leadership.	K3, K4
CO5	To discuss leadership characteristics and building and leading efficient teams. To gain in depth knowledge on emotional intelligence and leadership.	K2, K3, K6

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	2	-	2	-	-	-	-	-	-	-	1	-	-
CO2	3	2	-	2	2	-	-	-	-	2	2	-	2
CO3	2	-	2	-	1	-	-	-	1	2	2	2	2
CO4	3	-	2	-	-	-	-	-	-	-	2	2	1
CO5	-	3	-	2	-	-	1	2	-	-	-	2	-

NOTE: 1-LOW, 2-MEDIUM, 3-HIGH

HEAD
Department of Chemistry
VIKRAMA SIMHAPURI UNIVERSITY
KAKUTUR, NELLORE 524 320 (A.P.)

SEMESTER - III

CHE AC 301: FUNDAMENTALS OF ANALYTICAL CHEMISTRY

Semester	Course Code	Course Title	Hours/Week	Hours	Credits
III	CHEAC 301	FUNDAMENTALS OF ANALYTICAL CHEMISTRY	4	60	4

UNIT –I : CHEMICALS, APPARATUS AND UNIT OPERATIONS **15hr**

Selecting and handling reagents and other chemicals. Cleaning and marking of labware, calibration of common volumetric glassware, measuring mass, weighing equipment, water quality for laboratory use, preparation of lab water, filtration and ignition of solids, measuring volume, laboratory note book, Safety in the laboratory, Do's and don'ts in a chemical laboratory.

UNIT –II : SAMPLING **15 hr**

Definition of sampling and representative sample, purpose of sampling, sampling of gases, ambient and stock sampling, sampling of liquids, sampling of Heterogeneous and Homogeneous liquids. Sampling of static and flowing liquids. Sampling of solids, sample size. Gross sample, representative sample, Size reduction, Different sampling equipment and methods of subsampling, treatment of laboratory sample and their storage.

UNIT-III: SAMPLE DISSOLUTION AND PRECONCENTRATION METHODS 15hr

Decomposition and dissolution of solid sample: Decomposition of the sample by using fluxes, wet digestion, dry ashing, combustion with oxygen, microwave decomposition.

Separation and Preconcentration methods: Introduction, separation methods, crystallisation and precipitation based methods, solvent extraction, solid phase extraction, ion exchange separations, dialysis and lyophilisation, basics of chromatographic separations, electrophoresis, capillary electrophoresis, cloud point extraction, comparison of separation efficiencies. Kinetic factors, rate theory, Sulphide separations, Separations by organic precipitants like DMG, 8-hydroxyquinoline. One or two examples under each method.

UNIT – IV: METHODS FOR TRACE ANALYASIS

15 hr

Definition of macro, micro, trace and ultra trace level concentrations, list of determination methods for trace level constituents (trace elements), principles of absorption spectroscopic methods, emission spectroscopic methods, fluorescence methods, chromatographic methods and electrochemical methods. Concept of hyphenated techniques with two examples.

References:

1. Treatise on Analytical Chemistry by I.M.KOLTHOFF, part-I, Chapter-2, Sampling.
2. Principles of Analytical Chemistry by Skoog, West and Holler, 4th Edition.
3. Environmental Chemistry by I.M.Mahanam.
4. Fundamental concepts of Analytical Chemistry by C.D.GARY.
5. Instrumental method of Chemical analysis – Galen.W.Ewing.
6. Modern Analytical Chemistry by David and Harvey Mc Graw Hill Publications.
7. Quantitative analysis by Day and Underwood, 4th Edition, Mc Graw Hill Publications.
8. Environmental Chemistry by A.K.De.
9. A Text book of Qualitative analysis by C.T.Kenner.
10. Environmental Chemistry by Ohra and Tyagi.

	Description of CO	Knowledge
CO1	Generalised units, apparatus and safety measures in laboratory	K_2, K_4
CO2	Outline Seperation techniques of homogeneous and heterogeneous liquids.	K_4 ,K_5
CO3	Explain Seperation methods of solvents and by using organic precipitants.	K_5 ,K_3
CO4	Describe the micro, macro, trace and ultra trace level concentrations and their determination methods.	K_6, K_2

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	2	-	1	-	-	-	1	-	-	-	1	-	2
CO2	2	1	2	2	1	-	-	-	-	-	2	1	2
CO3	3	3	3	-	2	-	2	-	-	-	2	2	-
CO4	3	-	-	3	-	-	-	-	2	-	-	2	3

NOTE: 1-LOW, 2-MEDIUM, 3-HIGH

HEAD
Department of Chemistry
VIKRAMA SIMHAPURI UNIVERSITY
KAKUTUR, NELLORE-524 320 (A.P.)

CHE AC 302: QUALITY ASSURANCE AND QUALITY CONTROL

Semester	Course Code	Course Title	Hours/Week	Hours	Credits
III	CHEAC 302	QUALITY ASSURANCE AND QUALITY CONTROL	4	60	4

UNIT-I: BASICS IN ANALYTICAL CALCULATIONS AND USE OF SPREAD SHEETS

15 hr

Fundamental and derived units, universal constants, preparation of solutions, evaluation of concentrations, chemical stoichiometry, keeping records and making calculations, use of spreadsheets for calculations and practice. Quality Management System: The laboratory product, Laboratory process, 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: STATISTICS AND DATA HANDLING IN ANALYTICAL CHEMISTRY

15 hr

Errors, Types of errors-- Sources of determinate errors and their elimination, random errors, Precision and accuracy, standard deviation, coefficient of variation, confidence interval, and their distribution, propagation of determinate errors and random errors, Control charts, Statistical tools – 't' test, 'F' test and 'Q' test; Method of least squares; Correlation coefficient and coefficient of determination; Limit of detection (LOQ); Limit of determination (LOD), Sensitivity and selectivity of an analytical method.

UNIT–III: TOTAL QUALITY MANAGEMENT (TQM) SYSTEMS 15hr

Definitions of Quality, Quality control and quality assessment. Internal methods of quality assessment, external methods of quality assessment, evaluating quality assurance data, Standards and reference materials, Comparison of standards. Standard operation procedures (SOPs), Data collection, control charts, data records, evaluation of data, data archiving, documentation, Good laboratory practices, Laboratory safety and good housekeeping practices, Automation and mechanization and data retrieval, audits and accreditation.

Quality Management System: The laboratory product, Laboratory process, Customer Satisfaction, Improvement, Documentation Requirements, Management Responsibility-Quality Policy, Responsibility, Authority and Communication, Introduction to ISO 17025.

UNIT – IV: ANALYTICAL METHOD DEVELOPMENT AND VALIDATION **15hr**

Back ground, Introduction; defining the Objectives/ Requirements of the method, Specifications for Method Development, International Guidelines, The Method Development, its Life Cycle-Over view. Policy on Method Development/Validation, Illustration of method Requirements, Information gathering, Resources/Instrumentation/Materials and Standards, Development Plan. Method development-General considerations; Initial Method Development, method Optimization, method Pre-validation evaluation, robustness system suitability, Method Development-Experimental Considerations.

References:

1. Handbook of Instrumental Techniques for Analytical Chemistry, F. Serlie, Prentice Hall.
2. Vogels Text book of Quantitative Chemical Analysis, Basett, Denny Jebbary, 5th Ed. ELBs 1990.
3. Instrumental Methods of Chemical Analysis, Willard Merrit, Dean, Stella Jr 6th Edition.
4. Instrumental Methods of Analysis, Seventh Edition, Willard, Merrit, Dean, Settle
5. Vogel's Qualitative Inorganic Analysis, Seventh Edition, G. Svehla
6. Vogels Text book of Quantitative Chemical Analysis, Basett, Denny, Barnes Jebbary.

	Description of CO	Knowledge
CO1	Recall the basics of analytical calculations and quality management system.	K_1, K_4
CO2	Describe Errors and types of errors. Applying different statistical tools like F-test,T-Test and Q-Test.	K_3, K_4, K_6
CO3	Examine Quality and their control and assessment.	K_4, K_2
CO4	Develop different policy on method validation and development techniques.	K_5., K_1

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	2	-	3	-	-	-	-	1	-	-	3	1	-
CO2	3	2	2	-	1	-	-	-	-	1	-	2	2
CO3	2	-	-	-	2	1	-	-	1	-	-	2	3
CO4	3	2	1	2	-	2	-	-	-	-	2	2	3

NOTE: 1-LOW, 2-MEDIUM, 3-HIGH

HEAD
Department of Chemistry
VIKRAMA SIMHAPURI UNIVERSITY
KAKUTUR, NELLORE-524 320 (A.P.)

CHEAC 303: a) ANALYTICAL SPECTROSCOPY

Semester	Course Code	Course Title	Hours/Week	Hours	Credits
III	CHEAC 303a	ANALYTICAL SPECTROSCOPY	4	60	4

UNIT – I : INTRODUCTION TO ELECTRONICS AND INSTRUMENTAL DEVICES

15 hr

Semiconductors, Introduction to electronics, signal generation, operational amplifiers, preamplifiers, SCA, signal to noise, background reduction methods, computers in instrumentation, interfacing computers with instruments, basics of hardware and software, data storage and retrieval, archiving data records and automation.

UNIT II : ATOMIC EMISSION SPECTROMETRY **15 hr**

Principles of atomization, sources for atomization, chemical reactions in flames. Dissociation equilibria, ionization in flames, Interferences, use of organic solvents, atomization by inductively coupled plasma (ICP), types of instruments used, flame photometer and experimental technique, Applications, advantages, procedure for determinations, limitations and disadvantages. Principles of emission spectroscopy, process of atomization and excitation plasma as an excited source, inductively coupled plasma source, ICP-AES, instrumentation, application of plasma spectroscopy.

Atomic Fluorescence Spectroscopy (AFS): Introduction, AFS Transitions, Instrumentatal Analysis, Atomic Fluorescence Spectroscopy as an analytical tool, Limitations of Atomic Fluorescence Spectroscopy, Chemical Interferences, Spectral Interferences, Accuracy, Precision, Detection limits, Multi-elemental Analytical Applications.

X-ray Fluorescence Spectroscopy: Principle, energy dispersive X-ray fluorescence (EDXRF), Wavelength dispersive X-ray fluorescence (WDXRF), applications.

UNIT III: ATOMIC ABSORPTION SPECTROMETRY AND APPLICATIONS 15hr

Atomic Absorption Spectroscopy: Introduction, Principles, relation between emission and absorption and band width, Instrumentation, Interferences, background correction, accuracy, precision, sensitivity and detection limits. Applications, determination of chromium, Be, Hg, Mo, analysis of water. Graphite furnace absorption spectrometry.

Analysis of Industrial samples: Lead in paint, Hg in Hg containing pharmaceuticals, Heavy metals in fertilizers, Determination of Pb in gasoline. Comparison of determination of heavy elements by ICP-AES and AAS.

UNIT – IV : NEPHELOMETRY, TURBIDIMETRY, FLUORIMETRY& PHOSPHORIMETRY

15hr

(a) Nephelometry and Turbidimetry: Light scattering in Nephelometry and Turbidometry - Choice between Nephelometry and Fluorometry, theory affecting concentration particle size and wavelength on scattering. Instrumentation, applications of Nephelometry and turbidometry, Turbidometric titration. Analysis of sulphate, phosphate, phosphate by Nephelometric titrations.

(b) Fluorometry and Phosphorimetry: Introduction, principles, fluorescence, phosphorescence and Chemiluminescence basic instrumentation, Fluorescence spectra, application of fluorometric titration, qualitative and quantitative analysis, analysis of Aluminum, Zinc.

(c) Flow injection analysis: flow injection analysis (FIA), theoretical consideration of FIA, factors affecting the peak height, 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. Application of flow injection analysis.

References:

1. Spectroscopy by Chatwal &Anand, Himalaya Publishing House.
2. Analytical Chemistry Instrumental Techniques by Mahinder Singh, Dominant Publishers.
3. Analytical atomic Absorption spectroscopy by Jon C. Von Loon, Academic press, 1980, London.
4. Principles of Instrumental analysis. 5th Edition by James B. Robinson.
5. Undergraduate Instrumental analysis. 3rd Edition by James B. Robinson.
6. Fundamentals of Analytical Chemistry by Skoog West and Holler, Saunder's Publications.
7. Basic concepts of Analytical Chemistry by S.M. Khopkar, 2nd Edition, New Age international Publishers.
8. Spectroscopy by Kaur, Goel Publications.

HEAD
Department of Chemistry
VIKRAMA SIMHAPURI UNIVERSITY
KAKUTUR, NELLORE-524 320 (A.P.)

9. Instrumental methods of chemical analysis. 5th Edition by Ewing, Mc Graw Hill International Edition.
10. Instrumental methods of analysis. By Willard, Merit and Dean 7th Edition.
11. Vogel's text book of Quantitative Inorganic analysis, English Language Book Society.
12. Instrumental methods of chemical analysis by M.S. Yadav, Campus Books International, New Delhi.
13. Handbook of Analytical Instrumentation by R.S. Khandpur, Tata McGraw Company.

	Description of CO	Knowledge
CO1	Recall semiconductors ,Interpret the applications of computers in analytical data storage and retrieval.	K_1, K_3
CO2	Demonstrate Atomic Emission spectroscopy, Atomic Flouresence spectroscopy and XFS , Principle and Applications.	K_3, K_5
CO3	Describe the principle involved in AAS and its applications in analysis of Industrial samples.	K_6 K_4
CO4	Discuss the light scattering effect in Nephelometry and turbidimetry ,demonstrate principle and applications of Flouremetry and phosphorimetry, Flow injection analysis.	K_2, K_3, K_4

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	1	2	-	-	2	-	-	-	2	3	-	2
CO2	3	2	2	-	2	-	-	-	-	-	-	-	2
CO3	2	2	2	-	2	-	-	-	-	-	-	2	3
CO4	3	3	1	-	3	-	-	2	-	-	-	2	3

NOTE: 1-LOW, 2-MEDIUM, 3-HIGH

HEAD
Department of Chemistry
VIKRAMA SIMHAPURI UNIVERSITY
KAKUTUR, NELLORE-524 320 (A.P.)

CHEAC 303:b) FORENSIC ANALYSIS

Semester	Course Code	Course Title	Hours/Week	Hours	Credits
III	CHEAC 303b	FORENSIC ANALYSIS	4	60	4

UNIT – I: INTRODUCTION TO FORENSIC CHEMISTRY 15 hr

Introduction and significance; Types of cases, preliminary screening, different types of Tests- Colour /Spot tests , examination procedure by standard methods, chemistry of fire – Fire triangle; definition of Arson and incendiary fire; motive of arson – indicators of arsons in SOC; collection for evidence; chemical analysis of arson residues and charred debris; Drug – Definition, Uses and misuses, Drug dependence and chemistry of addiction, drug receptors and Brain chemistry.

UNIT – II: ANALYTICAL CHEMISTRY IN FORENSIC SCIENCE 15 hr

Bloodstain characteristics, impact of blood stain patterns, Analysis of biological stains and materials including semen and saliva (qualitative and quantitative); isolation, sample preparation, identification and determination of *narcotics*: heroine, morphine and cocaine; *stimulants*: amphetamines, cocaine and caffeine; *depressants*: benzodiazepines, barbiturates and mandrax.

UNIT – III: LABORATORY METHODS IN FORENSIC ANALYSIS 15 hr

Application of spectroscopic techniques- GC-MS, FT-IR, UV-visible spectroscopy, Atomic Absorption Spectroscopy and chromatographic techniques- TLC, Paper chromatography, HPLC, Gas Chromatography, Ion Exchange Chromatography for chemical analysis of forensic samples.

UNIT-IV: FORENSIC TOXICOLOGY 15 hr

Significance of toxicological findings: techniques used in toxicology, toxicological analysis and chemical intoxication tests, Classification of poisons- physio chemical characteristics and mode of action of poisons, Accidental, suicidal, homicidal poisonings, alcoholic and non-alcoholic illicit liquors, Analysis and estimation of alcohol content in blood and urine. Crime scene management in illicit liquor cases.

References:

1. W.J.Tilstone, M.L. hastrup and C.hald, fisher's, Techniques of crime scene investigation, CRC Press,Boca raton (2013)
2. J.D.Dehaan, Kirk's fire Investigation, 3rd edition , prentice hall, New Jersey(1991)
3. Forensic Chemistry by A Lucas, Publisher: Forgotten Books (5 May 2017), ISBN-13: 978-1330672037.
4. Forensic Chemistry (Advanced Forensic Science Series) by Max M. Houck, Publisher:Academic Press(12 January 2015), ISBN-13: 978-0128006061.
5. Morgan B.J.T (1996) Statistics in toxicology, Clarendon press,19 parikh C.K.
6. Curry. A.S. (1976) Poison Detection in Human Organs.
7. Kuby Immunology by Judith A. Owen, Jenni Punt , Sharon A. Stranford , Patricia P. Jones, Publisher: W H Freeman & Co (Sd); 7 edition (25 January 2013), ISBN-13: 978-1429219198.
8. Roitt's Essential Immunology (Essentials) by by Peter J. Delves and Seamus J. Martin, Publisher: Wiley-Blackwell; 13 Pap/Psc edition (13 January 2017), ISBN-13: 978-118415771.
9. Frank.A.settle (1997) Handbook of Instrumental Techniques in Analytical Chemistry.
10. Wildard ,H.H.,et al: Instrumental Method of Analysis, 1974.
11. Textbook of forensic Chemistry Hardcover by Udai Arvind, Publisher: Centrum Press. (2014), ISBN-13: 978-9350843031.
12. Basic Principles of Forensic Chemistry, Thomas J. Kennedy Donnell R. Christian Jr., Publisher: Humana Press; 2012 edition (28 January 2014), ISBN-13: 978-1627038928.

	Description of CO	Knowledge
CO1	To understand the forensic analysis and relevant regulations . To discuss the tests of samples collected at crime scene.	K_4, K_5
CO2	To understand the principles and chemical methods of forensic analysis. To gain detailed knowledge on analysis of biological stains and materials including semen and saliva.	K_2, K_3, K_5
CO3	To understand principles of spectroscopic techniques. To learn the applications of spectroscopic techniques.	K_1, K_4, K_5
CO4	Outline the significance of toxicological findings and classification of poisons. To explain physiochemical characteristics and mode of action of poisons.	K_{4+}, K_5, K_6

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	1	2	1	-	-	2	-	-	-	2	-	1
CO2	2	1	2	-	1	-	1	-	-	-	-	-	2
CO3	1	2	-	1	-	1	1	-	-	-	-	2	1
CO4	3	1	-	1	1	-	1	-	-	-	2	2	-

NOTE: 1-LOW, 2-MEDIUM, 3-HIGH

HEAD
Department of Chemistry
VIKRAMA SIMHAPURI UNIVERSITY
KAKUTUR, NELLORE-524 320 (A.P.)

CHEAC 304: a) SWAYAM/MOOCs/NPTEL

This course is intended to provide opportunity to students to acquire knowledge on important topics of chemistry designed and lectured by eminent faculty of famous institutions through SWAYAM/MOOCs/NPTEL platforms.

SWAYAM /MOOCs/ NPTEL programme based on student choice related to Analytical Chemistry (**links have been provided below**)

1. **Biological process design for waste water Treatment**
   https://www.google.com/url?q=https://nptel.ac.in/courses/103107217&sa=D&source=editors&ust=1674558282589957&usg=AOvVaw0TYBMLtKh7jugAUqLFHt4H

2. **Introduction to process modelling in the membrane separation process**
   https://www.google.com/url?q=https://nptel.ac.in/courses/103105121&sa=D&source=editors&ust=1674558282590590&usg=AOvVaw1gVgAJXUa3xOkdLKrCrH3-

3. **Transition metal organometallics in catalysis and biology**
   https://www.google.com/url?q=https://nptel.ac.in/courses/104101123&sa=D&source=editors&ust=1674558282601232&usg=AOvVaw2O5FJFYvzAonNTfwWLlhLm

4. **Inorganic Chemical Technology**
   https://www.google.com/url?q=https://nptel.ac.in/courses/103103218&sa=D&source=editors&ust=1674626634781896&usg=AOvVaw1U6sXdoAp0G-oEMyq6At3H

HEAD
Department of Chemistry
VIKRAMA SIMHAPURI UNIVERSITY
KAKUTUR, NELLORE-524 320 (A.P.)

CHEAC 304: b) RESEARCH PROCESS AND METHODOLOGY

Semester	Course Code	Course Title	Hours/Week	Hours	Credits
III	CHEAC 304b	RESEARCH PROCESS AND METHODOLOGY	4	60	4

UNIT-I : FUNDAMENTALS OF RESEARCH **15hr**

Definition, meaning, objective and importance of research methodology, types of research (basic, applied and patent oriented), defining research problem, research design including various methods, research process and steps involved. Literature survey and documentation.

UNIT-II : DATA COLLECTION, ANALYSIS AND HYPOTHESIS TESTING **15hr**

Classification of data, methods of data collection, sample size, sampling procedure and methods. Statistical inference and hypothesis: Types of hypothesis (experimental and non-experimental), hypothesis testing-SSE, Chi square Analysis, generalization and interpretation of results. Use of statistical softwares/ packages in data analysis (SPSS, ORIGIN). Data processing and graphical representation of data.

UNIT-III : RESEARCH ETHICS, PLAGIARISM AND IMPACT OF RESEARCH 15hr

Research ethics, responsibility and accountability of the researchers, ethical consideration for research guidelines. Plagiarism and use of plagiarism detection softwares such as-TURNITIN,URKUND. Impact of research on environment and society, commercialization of research, intellectual ownership.

UNIT-IV : TECHNICAL WRITING AND REPORTING OF RESEARCH **15hr**

Types of research report: Dissertation and thesis, research paper, review article, short communication, conference presentation, meeting report etc. Structure and organization of research reports: Title, abstract, key words, introduction, methodology, results, discussion, conclusion, acknowledgement, references, footnotes, tables and illustrations. Impact factor, rating, indexing and citation of journals.

References:

1. Kothari C.R., Research Methodology Methods and Techniques, Wishwa Prakashan, New Delhi.
2. Lokesh K., Methodology of Educational research, Vikash Publishing House Pvt. Ltd., New Delhi.
3. Kumar R., Research Methodology, Dorling Kindersley (India) Pvt. Ltd., New Delhi.
4. Rao G.N., Research Methodology and Qualitative Methods, B.S. Publications, Hyderabad.
5. Saunders M., Lewis P. and Thornhill A., Research Methods for Business Students, DorlingKindersley (India) Pvt. Ltd., New Delhi.
6. Bolton S. and Bon C., Pharmaceutical Statistics: Practical and Clinical Applications, Marcel Dekker,New York.
7. Garg, B.L., Karadia, R., Agarwal, F. and Agarwal, An introduction to Research Methodology, RBSAPublishers, Jaipur.
8. Fisher R.A. Statistical Methods for Research Works, Oliver and Boyd, Edinburgh.
9. Chow S.S. and Liu J.P., Statistical Design and Analysis in Pharmaceutical Sciences, Marcel Dekker,New York.
10. Buncher C.R., Statistics in the Pharmaceutical Industry, Marcel Dekker, New York.

	Description of CO	**Knowledge**
CO1	Analyze the fundamentals of research and literature survey. To understand research problem, research design and documentation.	K_4, K_2
CO2	To know the classification of data and methods of data collection. To analyze the interpretation of results by using SPSS and ORIGIN tools.	K_3, K_4
CO3	To understand research ethics, guidelines and plagiarism. To discuss impact of research on environment and society.	K_2, K_5
CO4	To discuss how to write dissertation and thesis and research papers. To learn how to write the paper and to submit the journals..	K_5, K_4, K_1

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PSO1**	**PSO2**	**PSO3**
CO1	2	3	3	-	-	-	-	-	2	1	1	-	-
CO2	3	2	-	1	2	-	-	-	-	-	3	-	2
CO3	3	-	-	-	-	-	-	-	-	-	-	2	3
CO4	3	1	2	-	-	1	-	-	-	-	2	2	2

NOTE: 1-LOW, 2-MEDIUM, 3-HIGH

HEAD
Department of Chemistry
VIKRAMA SIMHAPURI UNIVERSITY
KAKUTUR, NELLORE-524 320 (A.P.)

CHEAC 305: INSTRUMENTAL METHODS OF ANALYSIS

Semester	Course Code	Course Title	Hours/Week	Hours	Credits
III	CHEAC 305	INSTRUMENTAL METHODS OF ANALYSIS	4	60	4

UNIT –I: CHROMATOGRAPHIC METHODS **15 hr**

Principles of liquid chromatography and gas chromatography. **High Performance Liquid Chromatography (HPLC):** Theory and Instrumentation, Solvent delivery system, sample introduction, gradient elution, columns and detectors.Partition Chromatography, adsorption chromatography, Gel permeation chromatography. **Capillary Electrophoresis:** Principle, Electroosmotic flow, Instrumentation, Applications to separate small ions, separation of Molecular Species.**Supercritical-fluid chromatography:** Supercritical-fluids and phase rule, Instrumentation and operating parameters, Applications

UNIT –II: MASS SPECTROMETRY BASED TECHNIQUES **15 hr**

Mass Spectroscopy: Principle, basic instrumentation, Ionization methods, Electron impact and Chemical ionization methods, Mass Analyzers, resolution,- Quadrupole Mass analyzer and Time- of- Flight mass Analyzer. **Gas Chromatography- Mass spectrometry:** Introduction, GC – MS interface , instrumentation, processing of GC – MS data, ion chromatogram Quantitative measurement, sample preparation, Selected ion monitoring – Application of GC-MS for Trace constituents. Drugs analysis, Environmental analysis and others. **Liquid chromatography-Mass spectrometry** – Introduction, Instrumentation , liquid chromatograph – Mass spectrometer Interface, Processing LC-MS data , ion chromatograms, Sample preparation and injection, spectrum analysis Application of LC-MS for Drug analysis, Environmental samples and others.

UNIT –III:THERMAL ANALYSIS METHODS AND RADIO ANALYTICAL METHODS

15 hr

Mass changes as a function of heating, thermogram (TG), instrumentation for obtaining TG, thermos balance, Differential thermogravimetry (DTG), methodology of TG, Mass spectral

analysis, Evolved gas analysis, Differential scanning Calorimetry, Detailed instrumentation, standards like calcium carbonate, characterization of manganese hydrogen phosphate, Introduction to radioisotopes, radiations and isotope tracers, XRF, NAA and other texcniques, GM counters scintillators and concept of gamma spectrometers.

UNIT- IV: ELECTRO ANALYTICAL METHODS **15 hr**

DC pology graphy. Alternating current-polarography. Square wave polarography. Cylic voltammetry: Principle, Stripping voltammetry: Introduction. Types of stripping analysis. Pre-concentration step and mass transport in voltammetry. Electroanalytical stripping techniques, Differential pulse anodic stripping voltammetry. Potentiometric stripping analysis. **Anodic stripping voltametry**: principle, instrumentation, Hanging mercury drop electrode, application in the analysis of Pb and Cd in environmental samples, principle of cathode stripping voltametry.**Coulometric analysis**: principles of coulometric analysis with constant current, coulometric analysis with controlled potential, applications of coulometric methods for the analysis of cations-As(III), Fe(II) and $I^-$and S^{2-} by using I_2 liberations and Ce^{4+} liberation in solutions.**Ion Selective Electrodes**: types of ion selective electrodes, potentials and construction, calibration of ion selective electrodes, ion selective electrodes with fixed membrane sites, silver, lead, cadmium, sulfide, fluoride, cyanide and glass electrodes, applications in the analysis of air and water pollutants, principles of liquid membrane, gas sensing and enzyme based electrode

References:

1. Analytical Chemistry, G.D. Christan, J. Willey.
2. Fundamentals of Analytical Chemistry, D.A. Skoog, D.M. West and F.J. Holler, W.B. Saunders.
3. Analytical Chemistry Principles and Techniques, I.G. Harge, Prentice Hall.
4. Principles of Instrumental analysis, D.A. Skoog and J.L. Loacy, W.B. Saunders.
5. Environmental Solution Analysi, S.M. Khopkar, Willey Eastern.
6. Basic concepts of Analytical Chemistry, S.M. Khopkar, Willey Eastern.
7. Handbook of Instrumental Techniques for Analytical Chemistry, F. Serlie, Prentice Hall.
8. Vogels Text book of Quantitative Chemical Analysis, Basett, Denny Jebbary, 5th Ed. ELBs 1990.
9. Instrumental Methods of Chemical Analysis, Willard Merrit, Dean, Stella Jr 6th Edition.
10. P.W Scott, Techniques and practice of Chromatography, Marel Dekker Inc., New York

	Description of CO	Knowledge
CO1	Memorize the Chromatographic techniques like HPLC,Electrophoresis and super critical fluid chromatography.	K_1, K_4, K_6
CO2	Relate the Mass spectrometry with Gas chromatography and liquid Chromatography.	K_4, K_3
CO3	Explain various thermal analysis methods like TG,DTG,DSC and Radio analytical techniques like XRF,NAA.	K_5, K_2
CO4	Describe DC Polorography, Cyclic Voltammetry, Anodic stripping voltammetry, Coulometric analysis and ion selective electrodes.	K_6, K_4

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	3	3	2	2	1	-	-	-	2	1	-	3
CO2	3	2	3	3	-	-	-	1	-	1	2	2	2
CO3	2	2	2	3	-	2	-	2	-	3	3	2	3
CO4	3	3	3	2	-	-	-	-	-	3	2	2	2

NOTE: 1-LOW, 2-MEDIUM, 3-HIGH

HEAD
Department of Chemistry
VIKRAMA SIMHAPURI UNIVERSITY
KAKUTUR, NELLORE-524 320 (A.P.)

CHEAC 306 : PRACTICAL –I : ANALYSIS OF MIXTURES, ORES AND CEMENT

1. Analysis of two component mixtures
   a. Determination of Zn (III) and Fe(III)
   b. Determination of Cu (II) and Zn(II)
   c. Determination of Ca(II) and Mg(II)
   d. Determination of Cu (II) and Ni(II)
2. Analysis of Iron Ore
3. Analysis of cement

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
	3	2	1	2	2	1	2	-	1	2	3	2	3

CHEAC 307 : PRACTICAL –II : ESTIMATIONS

1. Verification of Beer-Lambert's Law- Colorimetry
2. Estimation of Ferrous iron by Dichrometry
3. Estimation of copper in brass by Iodometric titration
4. Determination of strength of an acid in Pd-Acid battery
5. Estimation of carbonates in water
6. Estimation of Bicarbonates in water
7. Estimation of ammonia in water
8. Estimation of Hardness of water
9. Estimation of Alkalinity of water
10. Estimation of nitrates in water
11. Preparation of a polymer
12. Preparation of Nanomaterials

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
	3	2	1	1	-	-	2	-	1	-	3	2	2

HEAD
Department of Chemistry
VIKRAMA SIMHAPURI UNIVERSITY
KAKUTUR, NELLORE-524 320 (A.P.)

SEMESTER - IV

CHEAC 401: ANALYSIS OF NATURAL AND COMMERCIAL MATERIALS

Semester	Course Code	Course Title	Hours/Week	Hours	Credits
IV	CHEAC 401	ANALYSIS OF NATURAL AND COMMERCIAL MATERIALS	4	60	4

UNIT – I: WATER ANALYSIS AND ASSESSMENT OF WATER QUALITY **15 hr**

Chemical composition of water bodies, streams and wet lands, Hydrological cybers. Aquatic pollution, organic pesticides, agricultural, industrial and sewage detergents. Oil spills and pollutants, Water quality parameters, DO, COD, BOD. Solids metals, Constants of Chloride, Sulphate, Phosphate, Nitrate and micro organisms. Analytical methods of measuring Anions F^-, PO_4^{3-}, NO_3^-, NO_2^-, Cations: Cr^{6+}, As^{5+}, Pb^{2+}, Hg^{2+}, Cd^{2+}, and Determination of Dissolved oxygen(D.O), Biochemical Oxygen Demand(BOD) and Chemical Oxygen Demand(COD), residual chlorine and chlorine demand. Purification and treatment of water.

UNIT II: ANALYSIS OF MINERALS, ORES AND FUELS **15 hr**

Analysis of Minerals and Ores: Limestone, Ilmenite, Chalcopylites and Beryl. Analysis of Cement, Ceramics and glass.**Analysis of Fuels:** Coal, proximate and ultimate analysis, heating valves and grading of coal.**Liquid Fuels:** Flash point, aniline point, octane number and carbon residue.**Analysis of Gaseous Fuels:** Producer gas, Water gas, Calorific values

UNIT III : ANALYSIS OF PLANT PIGMENTS AND CEMENT **15 hr**

(a) Analysis of plant 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.

HEAD
Department of Chemistry
VIKRAMA SIMHAPURI UNIVERSITY
KAKUTUR, NELLORE-524 320 (A.P.)

(b)Analysis of cement:

Loss on ignition insoluble residue; total silica sesquioxides lime, magnesia, ferric oxide, sulphuric anhydride. Air and dust pollution from cement plants, atmosphericdispersion of pollutants in cement industry.

UNIT-IV : ANALYSIS OF FOOD, DAIRY PRODUCTS AND FORENSIC PRODUCTS

15 hr

(a) Food Analysis: Moisture, ash, crude protein fat, crude fiber carbohydrate, calcium, potassium, sodium and phosphate . Food adulteration common adulteration of food, contain of food contain of food stuff microscopic contention of foods for adulterations, food stuffs pesticide analysis in food products , extraction and purification of food sample the tests in the presence of carbohydrates fats, and proteins in food stuffs rice, butter milk and boiled eggs ,grapes, potato's and apple and estimate in the percentage (%) of ACETIC ACID in vinegar . HPLC and gas chromatography food processing

(b) 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.

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

References:

1. Vogel's Text book of Quantitative analysis 3rd Edition.
2. Environmental Chemistry by Mahanan, 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.
10. Standard methods of chemical analysis by Scott & Scott.
11. Environmental Pollution and Control in Chemical process industries by S.K.Bhatia.

	Description of CO	Knowledge
CO1	Analyze different water bodies,quality parameters like DO,BOD,COD and analytical methods for measuring cations and Anions.	K_4, K_2
CO2	Interpret the analysis of minerals, ores, fuels-Liquid and Gaseous.	K_3, K_4
CO3	Describe the analysis of Plant pigments and cement and their compositions.	K_2, K_5
CO4	Explain the constituents in food and their analysis method. Identify different dairy products and forensic analysis.	K_5, K_4, K_1

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	2	3	3	-	-	-	-	-	2	1	1	-	-
CO2	3	2	-	1	2	-	-	-	-	-	3	-	2
CO3	3	-	-	-	-	-	-	-	-	-	-	2	3
CO4	3	1	2	-	-	1	-	-	-	-	2	2	2

NOTE: 1-LOW, 2-MEDIUM, 3-HIGH

HEAD
Department of Chemistry
VIKRAMA SIMHAPURI UNIVERSITY
KAKUTUR, NELLORE-524 320 (A.P.)

CHEAC 402 : APPLIED ANALYSIS

Semester	Course Code	Course Title	Hours/Week	Hours	Credits
IV	CHEAC402	APPLIED ANALYSIS	4	60	4

UNIT – I: DISPOSAL OF SEWAGE AND BIODEGRADABILITY 15 hr

(a) Sewage Disposal: Introduction, objectives of sewage treatment, sewage treatment methods, sewage and its decomposition, bacteriology of sewage treatment, properties of sewage, primary or mechanical treatment, secondary or biological treatment, cycle of decomposition, analysis of sewage, physical test, chemical test, methods of sewage disposals.

(b) Biodegradability: Classification of hazardous substances and waste. Chemical classification of hazardous wastes. Hazardous substance analysis, its Nature, and Source, treatment and disposal of hazardous waste, toxic substances, physical and chemical methods of waste treatment and preparation of waste and ultimate disposal of hazardous waste.

UNIT II: ANALYSIS OF INDUSTRIAL PRODUCTS 15 hr

Analysis of Alloys : Analysis of non ferrous alloys, Bronze, German Silver, Brass, Solder, Steels containing elements such as Mo,Co,V, Cr, Si and Ni, Analysis of Ferro manganese, ferro-silicon, Ferro-vanadium and silico –manganese alloys..

Analysis of Oils:

Natural fats, edible and industrial oils, unsaturated oils, saponification value, iodine number acid values, refractive indexes values.

Analysis of Explosives :

Introduction, Classification, Deflagrating or low explosives, Characteristics of explosives, analysis of Nitrocellulose, PETN or PENTHRIT, Di-nitrobenzene (DNB), Trinitrobenzene (TNB), Trinitrotoluene (TNT), Picric acid, Ammonium picrate, Nitroglycerine and dynamite, Cordite, Gun powder, RDX or cyclonite, EDNA, HMX, Tetryl, Petryl, Hexyl, Lead azide, Dinol and Tetracene.

UNIT-III: ANALYSIS OF AGRO CHEMICALS **15 hr**

Soil analysis: Soil moisture, pH, total nitrogen, Phosphorus, silica, boron and metals (Cd, Cu, Fe, Mn, and zinc) in soil. **Fertilizer analysis**: Analysis of Ammonical fertilizers, Phosphate fertilizers, Nitrate fertilizers. **Pesticide Analysis:** Analysis of organo chlorine pesticides by gas chromatography, Determination of DDT residue in vegetable and food grains. Analysis of organo phosphorous pesticides (Malathion, parathion) by spectrophotometric and chromatographic methods.

UNIT -IV: CLINICAL CHEMISTRY, ANALYSIS OF DRUGS AND ANTIBIOTICS 15 hr

i) (a) Clinical Chemistry: Clinical analysis of the composition of blood collection and prevention of the sample. Clinical analysis blood glucose, blood urea nitrogen, immunoassay. The blood gas analyzer, trace elements in the body.

b) Drug analysis: Natural and some of drugs, study of drugs, Classification and nomenclature; Biological and Chemical classification of drugs, gas and TLC. Screaning test and spectrophotometric methods for measurement drugs. Determination of the concentration of ethyl alcohol in pharmaceutical preparation and alcoholic beverage.

(ii) Analysis of Drugs: Classification of antibiotics based on terms chemical structures;, Synthesis Structure properties, and assay of some antibiotics.(1) Penicillin (2) streptomycin. Determination of the following Drugs: Acetyl salicylic acid (Antipyretic – Analgesic) Testosterone, progesterone and cortisone (Steroids and corticoids) Sulphadiazine (sulphadrugs), Phenobarbitone (Barbituric acid derivatives), Chloramphenicol, Benzyl penicillin and Tetracycline (Antibiotics) Thiamine (B1), Riboflavin (B2) and ascorbic acid [Vitamins], Isoniazid (Antimicrobacterial agents).

References:

1. Standard methods of Chemical analysis by Welcher.
2. Text book of quantitative analysis by A.I.Vogel, IIIrd Edition.
3. Fundamental of Analytical Chemistry by Christon Genus D
4. Environmental Pollution and control in Chemical process Industries by S.C. Bhatia.
5. Industrial Chemistry by B.K.Sharma, Giocal Publications.
6. Standard Methods of Chemical analysis by Scott and Ferman.
7. Comprehensive experimental Chemistry by V.K. Ahluwalia and SudhaRagav, New Age International, New Delhi.
8. Analytical Chemistry, Gary D. Christian, John Laliley and Senes, New York, 6th Ed., 2007.

HEAD
Department of Chemistry
VIKRAMA SIMHAPURI UNIVERSITY
KAKUTUR, NELLORE-524 320 (A.P.)

	Description of CO	Knowledge
CO1	Practice the biodegradability and sewage disposal techniques.	K_3, K_4
CO2	Infer the analysis of constituents of alloys ,oils and explosives.	K_2, K_5
CO3	Analyze soils, fertilizers and pesticides.	K_4, K_1, K_6
CO4	Evaluate the drugs, antibiotics and blood compositions.	K_6, K_3

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	-	3	-	-	-	-	-	-	-	1	-	3
CO2	2	2	-	-	2	-	-	-	-	1	-	1	2
CO3	2	2	-	-	-	2	-	-	2	-	-	2	2
CO4	3	-	1	-	3	-	2	-	-	2	-	2	3

NOTE: 1-LOW, 2-MEDIUM, 3-HIGH

HEAD
Department of Chemistry
VIKRAMA SIMHAPURI UNIVERSITY
KAKUTUR, NELLORE-524 320 (A.P.)

CHEAC 403: a) BIOINORGANIC, BIOORGANIC, BIOPHYSICAL AND NANO MATERIALS

Semester	Course Code	Course Title	Hours/Week	Hours	Credits
IV	CHEAC 403a	BIOINORGANIC, BIOORGANIC, BIOPHYSICAL AND NANO MATERIALS	4	60	4

UNIT – I: BIOINORGANIC CHEMISTRY 15 hr

i) Essential and trace elements in biology : Classification, Concept of essentially, Evaluation of essentially trace elements, Role of bulk (structural) elements and minerals, working of essential trace elements, Deficiency signs and specific function of essentially trace elements (Fe, Cu, Co, Ni, Zn, F, I, Se). ii) Oxygen uptake proteins structural and functional aspects of Haemoglobin(Hb), Myoglobin(Mb), Haemoerithrin(He) and Haemocyanin(Hc).

UNIT – II - BIOORGANIC CHEMISTRY 15 hr

Carbohydrates: Structure and biological functions of mucopolysaccharides, glycoproteins, and glycolipids- Role of sugars in biological recognition

Lipids: Essential fatty acids-structure and function of triglycerols, Glycerophospholipids, bile acids, prostaglandins- composition and functioning of lipoproteins

Enzymes: Nomenclature and classification, properties, factors affecting enzyme catalysis, enzyme inhibition- reversible and irreversible inhibition. Uses of enzymes in industry and clinical laboratories.

UNIT III – BIOPHYSICAL CHEMISTRY 15 hr

Standard free energy change in biochemical reactions, exergonic and endergonic reactions, hydrolysis of ATP, thermodynamics of biopolymer solutions, chain configuration of bio polymers, calculation of average dimensions. Membrane equilibrium, ion transport through cell membrane.dialosis and its function. Structure and functions of proteins, enzymes, DNA and RNA in living systems.

UNIT – IV: NANOMATERIALS **15 hr**

Definition, Introduction, classification and properties of nano particles, Preparation of nano particles (a) Physical / Aerosol methods – Vapour condensation method, Spray pyrolysis (b) Chemical methods – Sol-gel Micelles/reverse microemulsion method. Characterization of nano particles using X-Ray diffraction (XRD), Scanning Electron Microscopy (SEM) and Transmission electron microscopy (TEM). Applications of carbon nano particles.

References:

1. Principles of Bioinorganic Chemistry, S. J. Lippard and Berg.
2. Bioinorganic chemistry, I. Bertini, H.B. Gray, S.J. Lippard and S.J. Valentine, Viva Low-Priced Student edition. A Text book of Biochemistry ,A.V.S.S.Rama Rao
3 Physical chemistry by Atkenes
4 Physical chemistry by Albertz.
5 Bio physical chemistry by Van Holde
6 Bio Physics by Narayanam
7 Organic Chemistry, Vol. 2, I. L. Finar, ELBS.
8. Chemistry of Natural Products, P.S.Kalsi, Kalyani Publishers.
9. Chemistry of Organic Natural Products, O. P. Agarwal, Vols., 1 & 2, Geol Pubs.
10 Natural products Chemistry K.B.G. Torssell, John Wiley, 1983.
11. Burger's Medicinal Chemistry, M.E. Wolff, John Wiley
12. Medicinal Chemistry, A. Kar, New Age International

	Description of CO	Knowledge
CO1	Demonstrate the structure and functional aspects of oxygen uptaking proteins.	K_3, K_4
CO2	Indicate the functional importance of Carbohydrates,lipids and enzymes in human body.	K_2, K_5, K_2
CO3	Outline the standard free energy and different biophysical processes in human body.	K_4, K_1
CO4	Prepare Nanomaterials by different synthesis methods and their characterizations and their applications of Carbon nanomaterials.	K_3, K_5

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	2	-	3	-	-	-	-	-	-	2	1	2	-
CO2	3	-	-	-	-	3	-	-	-	-	3	-	2
CO3	2	2	-	-	-	2	-	-	-	-	-	2	-
CO4	3	2	2	-	3	-	-	-	-	-	-	2	3

NOTE: 1-LOW, 2-MEDIUM, 3-HIGH

HEAD
Department of Chemistry
VIKRAMA SIMHAPURI UNIVERSITY
524 320 (A.P.)

CHEAC 403: b) CHROMATOGRAPHIC TECHNIQUES

Semester	Course Code	Course Title	Hours/Week	Hours	Credits
III	CHEAC 403b	CHROMATOGRAPHIC TECHNIQUES	4	60	4

UNIT –I: COLUMN CHROMATOGRAPHY **15hr**

Introduction - Principle of column chromatography, stationary phase, mobile phase, column characteristics, preparation of column, Injection of sample, development technique, detection and recovery of components, factors affecting column efficiency, applications , advantages and disadvantages of column chromatography.

UNIT–II: THIN-LAYER CHROMATOGRAPHY (TLC)/ PAPER CHROMATOGRAPHY **15hr**

Introduction, principle of Thin layer chromatography, preparation and activation of TLC plates, development technique, qualitative analysis and quantitative analysis, applications of TLC, HPTLC, Principle of paper chromatography and applications of paper chromatography.

UNIT –III: HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY (HPLC) **15hr**

Comparison of classic column chromatography with HPLC, types of HPLC Techniques, Instrumental requirements, detectors, Parameter used in HPLC, applications of HPLC.

UNIT-IV: GAS CHROMATOGRAPHY **15hr**

Introduction, principle of Separation, Criteria for analysis by gas chromatography, practical requirements for GC, columns, detectors, parameters used in GC- Retention time, Retention volume, separation factor, resolution, Applications of GC.

References:

1. Modern Analytical Chemistry : David Harvey DePauw University Willard, Merrit and Dean, Instrumental Methods of Chemical Analysis
2. Chatwal, Instrumental Methods of Analysis
3. Kenner, Analytical Separations and Determinations
4. Sharma, Chromatography
5. Analytical chemistry: G L David Krupadanam, D. Vijaya prsad, K. Varaprasad Rao, KLNReddy, C. Sudhakar.
6. Analytical chemistry: Skoog West Holler.
7. Sharma, Instrumental Methods of Chemical Analysis

	Description of CO	Knowledge
CO1	To understand the principles and applications of column chromatography. To discuss the instrumentation of column chromatography.	K_4, K_2, K_6
CO2	To understand the fundamentals of paper chromatography and preparation of TLC plates. To provide opportunities to students to understand various kinds of paper chromatographic techniques.	K_3, K_4
CO3	To describe the analysis of Metal ions by HPLC To discuss instrumentation of HPLC.	K_2, K_1
CO4	Explain the separation process by gas chromatography. To discuss applications of gas chromatography.	K_5, K_4, K_1

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	2	3	3	-	-	-	-	-	2	1	1	-	-
CO2	3	2	-	1	2	-	-	-	-	-	3	-	2
CO3	3	-	-	-	-	-	-	-	-	-	-	2	3
CO4	3	1	2	-	-	1	-	-	-	-	2	2	2

NOTE: 1-LOW, 2-MEDIUM, 3-HIGH

HEAD
Department of Chemistry
VIKRAMA SIMHAPURI UNIVERSITY
NELLORE-524 320 (A.P.)

CHEAC 404 : PRACTICAL –I: WATER ANALYSIS, SEPARATION AND POLAROGRAPHIC TECHNIQUES

1.Water Analysis

a) Determination of dissolved Oxygen
b) Determination of BOD of Waste water
c) Determination of COD of Waste water
d) Hardness of Water

2. Separation of Metal ion by Solvent Extraction /Ion exchange.
3. TLC/Paper chromatographic separation.
4. Determination of Pesticide residues by gas chromatographic method
5. Polarography:
a) Determination of E ½ of Zn and Cd
b) Determination of amounts of Zn and Cd

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
	3	2	1	1	2	-	2	-	1	2	3	2	3

CHEAC 405 : PRACTICAL –II: PROJECTWORK

As Analytical Chemistry has an important role in material science, pharmaceutical industry and other industries, electrical laboratories and environmental regulations for decision making. To provide an opportunity to understand the requirements of the above systems, students will make industrial trips, interact with industrial and lab personnel and will be in a position to identify important problems. Teachers and industrial personnel help students in choosing a problem to work on. This will provide students required impetus to identify a problem, plan a research oriented approach and carryout experimental work. This will help in writing a report tabulation of data, analysis of data and discussions and conclusions.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
	2	2	1	1	2	1	2	-	1	-	2	2	3

CHEAC 406:a) APPLICATIONS OF ANALYTICAL CHEMISTRY IN ENVIRONMENTAL SCIENCE

Semester	Course Code	Course Title	Hours/Week	Hours	Credits
IV	CHEAC406a	APPLICATIONS OF ANALYTICAL CHEMISTRY IN ENVIRONMENTAL SCIENCE	4	60	4

UNIT -I : ENVIRONMENT AND ANALYTICAL CHEMISTRY 15 hr

Concept of Environmental Chemistry, Environment, Changes in Environment with time, Interference of man with Environment, Segments of Environment, Biochemical cycles in Environment, Concept of pollution, Natural and man made pollution, Role of Analytical Chemistry in Environmental studies, List of Analytical methods and principles.

UNIT – II: GREEN CHEMISTRY AND TOXICOLOGY 15 hr

(a) Introduction to Green Chemistry: Definition of Green Chemistry, Twelve Principles of Green Chemistry, Experimental systems. Historical approach, tools of green Chemistry, Catalysis and bio catalyses of Green Chemistry, examples of Green Chemistry, Pharmaceutical industry and Green Chemistry, Pesticides, Solvents, Green Chemistry, Sugar and distilleries, wastes and future trends in Green Chemistry.

(b) Environmental Toxicological Chemistry: Introduction to toxicological chemistry, dose response relationship, relative toxicities. Teratogenesis, mutagenesis, carcinogenesis, Immune system effects, Health hazards, Toxic elements and elemental forms, Toxic inorganic compounds, Toxicology of organic compounds, Effect of Toxic chemicals on enzymes, biochemical effects of As, Cd, Hg and Oxides of Sulphur and nitrogen.

UNIT – III: AIR POLLUTION MONITORING METHODS & INSTRUMENTAL TECHNIQUES 15 hr

(a) Air Pollution Monitoring Methods: Analysis of gaseous pollutants –SO_2 H_2S, NO-NOx, NH_3, CO, CO_2, Ozone, organic gases and vapours. Continuous monitoring of air pollutants –

principles, monitoring instruments, monitoring of SO_2,H_2S,NO-NO_X, CO,CO_2,hydrocarbons ozone suspended particulate matter, chemical and photo chemical reactions in atmospheres.

b) Instrumental Techniques in Environmental Chemical Analysis: Basic Principles, Instrumentation, outlines of procedures and applications of the techniques - AAS and ICP AES, X-ray fluorescence spectrometry, Neutron activation analysis, Other radio analytical techniques.

UNIT – IV: INDUSTRIAL POLLUTANTS 15 hr

(a) Petrochemical Industry and Pollution Control Methods

Introduction, Raw materials, Saturated hydro carbons from natural gas, Uses of saturated hydro carbons, Unsaturated hydro carbons-Acetylene, Ethylene, Propylene, Butylenes. Aromatic hydro carbons, Toluene Xylene , Chemical processing of paraffin hydro carbons, Chemical processing of ethylene hydro carbons, Chemical processing of acetylene, Chemical processing of Aromatic hydrocarbons. Pollution control in petro chemical manufacture; water pollution control, air pollution control, solid waste disposal.

(b) Sugar Industry, Paper and pulp industry, polymer drugs, radio nuclide analysis, disposal of waste and their management.

References

1. Environmental Chemistry by Moore & Moore.
2. Environmental Chemistry by Mahanan, VIth Edition, Lewis Publications.
3. Environmental Chemistry by B.K.Sharma. Goel Publications.
4. Environmental Chemistry by Ohra&Thyogi.
5. Environmental Chemistry byBenargi.
6. Environmental Pollution and control in chemical process and industries by S.K.Bhatia.
7. Environmental Pollution by S.S.Dara.
8. Environmental Pollution analysis by S.M.Khopkar.
9. Industrial chemistry by B.K Sharma;Goel Publications

	Description of CO	Knowledge
CO1	Discuss Biochemical cycles in environment and role of analytical chemistry in environmental studies.	K_2, K_3
CO2	Examine historical approach of green chemistry in pharmaceutical industry and toxicology chemistry.	K_4, K_5
CO3	Illustrate different air pollution monitoring methods and instrumental techniques in environmental chemical analysis.	K_3, K_6, K_4
CO4	Describe the role of saturated, unsaturated and aromatic saturated hydrocarbons in petrochemical industry.	K_6, K_2

HEAD
Department of Chemistry
VIKRAMA SIMHAPURI UNIVERSITY
KAKUTUR, NELLORE-524 320 (A.P.)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	2	1	3	-	-	-	-	-	-	-	1	-	2
CO2	2	2	-	-	2	-	-	-	-	-	-	1	2
CO3	2	-	-	-	-	1	-	-	-	-	-	2	3
CO4	3	-	-	2	-	-	-	-	1	-	-	2	3

NOTE: 1-LOW, 2-MEDIUM, 3-HIGH

HEAD
Department of Chemistry
VIKRAMA SIMHAPURI UNIVERSITY
KAKUTUR, NELLORE-524 320 (A.P.)

CHEAC 406: b) PRINCIPLES OF IPR AND PATENT LAWS

Semester	Course Code	Course Title	Hours/Week	Hours	Credits
IV	CHEAC 406 b	PRINCIPLES OF IPR AND PATENT LAWS	4	60	4

UNIT –I : INTRODUCTION TO INTELLECTUAL PROPERTY RIGHTS **15 hr**

Concept and Theories, Kinds of Intellectual Property Rights, Economic analysis of Intellectual Property Rights, Need for Private Rights versus Public Interests, Advantages and Disadvantages of IPR.

UNIT –II: PATENT LAW **15 hr**

Research exemption Introduction to Patents Overview, Concepts, Novelty, Utility Rights of patentee Procedure for granting a patent and obtaining patents Grounds for opposition, Working of Patents, Compulsory License Acquisition, Surrender, Revocation, Restoration, Transfer of patent rights.

UNIT –III: COPYRIGHT LAW **15 hr**

Concept and Principles, Historical background and Development of Copyright Law, Copyright Registrar and Copyright Board-Power and Procedure Copyright Societies, Ownership, Assignment, License, Translation of Copyright, Compulsory Licenses, Infringement-Criteria of Infringement, Infringement of Copyright-Films, Literary and Dramatic works, Importation and Infringement.

UNIT –IV: EMERGING ISSUES AND CHALLENGES **15 hr**

Public health and Intellectual Property Rights, Case study -Novartis Pharmaceuticals, Bayer Pharmaceuticals, Traditional knowledge and IPR, Bio piracy, Domain Name Disputes and Cyber squatting.

References:

1. D.P. Mittal (Taxman Publication), Indian Patents Law and Procedure
2. P. Narayanan (Eastern Law House), Intellectual Property Law
3. N.S. Gopalakrishnan & T.G. Agitha, Principles of Intellectual Property (2009), Eastern BookCompany, Lucknow
4. Dr. B.L. Wadhera, Law Relating to Patent, Trademarks, Copyright & Designs
5. P. Narayanan (Eastern Law House), Intellectual Property Law
6. W. Cornish (Universal Publication), Intellectual Property Law
7. Merges, Patent Law and Policy: Cases and Materials, 1996
8. Brian C. Reid, A Practical Guide to Patent Law, 2nd Edition, 1993

	Description of CO	Knowledge
CO1	To understand concept and theories of intellectual property rights (IPR) To know advantages and disadvantages of IPR.	K_3, K_4, K_5
CO2	To understand how to write the patent and utility rights of patentee. To explain patent laws.	K_2, K_5,
CO3	Outline the concept and principles of copyright law. To discuss copyright films and dramatic works.	K_4, K_1, K_2
CO4	To discuss intellectual property rights and case study. To know the rules of emerging issues and challenges.	K_3, K_5, K_6

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	2	-	3	-	-	-	-	-	-	2	1	2	-
CO2	3	-	-	-	-	3	-	-	-	-	3	-	2
CO3	2	2	-	-	-	2	-	-	-	-	-	2	-
CO4	3	2	2	-	3	-	-	-	-	-	-	2	3

NOTE: 1-LOW, 2-MEDIUM, 3-HIGH

HEAD
Department of Chemistry
VIKRAMA SIMHAPURI UNIVERSITY
KAKUTUR, NELLORE-524 320 (A.P.)