AKKINENI NAGESWARA RAO COLLEGE
POST GRADUATION DEPARTMENT OF CHEMISTRY
(AUTONOMOUS)
SYLLABUS FOR M.Sc (CHEMISTRY)
FROM THE YEAR 2020 -2021

Syllabus

M.Sc. Chemistry

PG DEPARTMENT OF CHEMISTRY
AKKINENI NAGESWARA RAO COLLEGE

Approved syllabus for M.Sc. Chemistry by the members of Board of Studies for the

The syllabus with the paper combinations is as under

Semester – I

Paper	Title of the Paper	Instruction Hours Per Week			Credits	Evaluation		
		L	T	P		CIA MARKS	SEE	
							MARKS	DURATION
Paper-I	General Chemistry - I	4	--	--	4	30	70	4 hours
Paper-II	Organic Chemistry - I	4	--	--	4	30	70	4 hours
Paper-III	Inorganic Chemistry - I	4	--	--	4	30	70	4 hours
Paper-IV	Physical Chemistry - I	4	--	--	4	30	70	4 hours
Laboratory Course I	Organic Chemistry Practical I	--	--	8	4	30	70	8 hours
Laboratory Course II	Inorganic Chemistry Practical	--	--	8	4	30	70	8 hours
			Total		24 credits			32 hours per week

Semester – II

Paper	Title of the Paper	Instruction Hours Per Week			Credits	Evaluation		
		L	T	P		CIA MARKS	SEE MARKS	SEE DURATION
Paper-I	Organic Spectroscopy	4	--	--	4	30	70	4 hours
Paper-II	Organic Chemistry – II	4	--	--	4	30	70	4 hours
Paper-III	Inorganic Chemistry – II	4	--	--	4	30	70	4 hours
Paper-IV	Physical Chemistry – II	4	--	--	4	30	70	4 hours
Laboratory Course I	Organic Chemistry Practical II	--	--	8	4	30	70	8 hours
Laboratory Course II	Physical Chemistry	--	--	8	4	30	70	8 hours
	Open Elective-I	4			4			4 hours
		Total		28 credits				36 hours per week

Open elective offered to the other departments

Course Code	Name of the course	Semester	Credits
	Chemistry in daily Life	II	4
	CHEMISTRY OF ENERGY MATERIALS	II	4
	Chemistry of Nanomaterials and applications	II	4

NAME OF THE PROGRAMME: M.Sc. CHEMISTRY
PROGRAM OUTCOMES

At the end of the program, the student will be able

PO1:Critical Thinking:

Think critically and analyze chemical problems related to Inorganic, Organic, Physical and Analytical.

PO2:Effective Communication:

Understand the need for scientific communication in both written & oral forms and as well as the role of computers and software in solving problems related to chemistry and can use modern library tools to locate and retrieve scientific information about a topic, chemical or technique relating to chemistry.

PO3: Social Interaction:

Function individually and as a member or leader in team with the fundamental and advanced knowledge gained in the field of chemistry and other allied fields.

PO4:Effective Citizenship:

Apply conceptual knowledge gained in the field of chemistry to assess social, health, safety, legal and cultural issues and the relevant consequences of it.

PO5: Ethics:

Record and analyze the experimental results by maintaining professional ethics, responsibilities and norms of the scientific practices.

PO6:Environment and sustainability:

Understand the issues of environmental pollution and sustainable development.

PO7:Self directed & lifelong learning:

Engage in independent and lifelong learning of the concepts related to chemistry in broadest context of socio-technological changes.

PROGRAM SPECIFIC OUTCOMES

After successful completion of the programme, the graduate will be able all to acquire

PSO1: Self-motivation towards global level research opportunities to pursue Ph.D programme targeted approach of CSIR – NET examination.

PSO2:Required skill to have specific placement in R&D, pharmaceutical Industry and allied divisions.

PSO3:Required knowledge to clear discipline specific competitive exams conducted by service commission and other organizations.

M.Sc.CHEMISTRY								
Common Framework of CBCS for ANR COLLEGE- GUDIVADA - COUSE STRUCTURE 2020-21								
S. NO	SEM. NO	TITLE OF THE COURSE	COURSE CODE	TOT. MARKS	I .A TEST	SEM END EXAM	TEACHING HOURS	CREDITS
1	I	General Chemistry	20CHE101	100	30	70	60	4
		Organic Chemistry - I	20CHE102	100	30	70	60	4
		Inorganic Chemistry - I	20CHE103	100	30	70	60	4
		Physical Chemistry - I	20CHE104	100	30	70	60	4
		Laboratory Course-I Inorganic Chemistry	20CHE105(p)	100	30	70	80	4
		Laboratory Course-II Organic Chemistry	20CHE106(p)	100	30	70	80	4
2	II	Molecular spectroscopy	20CHE201	100	30	70	60	4
		Organic Chemistry - II	20CHE202	100	30	70	60	4
		Inorganic Chemistry - II	20CHE203	100	30	70	60	4
		Physical Chemistry - II	20CHE204	100	30	70	60	4
		Laboratory Course - II Organic Chemistry	20CHE205(p)	100	30	70	80	4
		Laboratory Course - III Physical Chemistry	20CHE206(p)	100	30	70	80	4

The syllabus for M.Sc. Chemistry is hereby approved for the sessions 2020 -21

M.Sc. CHEMISTRY

SEMESTER – I

Subject Code	**20CHE101**	I A Marks	30
No. of Lecture Hours / Week	4	End Exam Marks	70
Total Number of Lecture Hours	60	Total Marks	100
Seminar	---	Exam Hours	03

Objectives : 1. To generalize the analytical and quantitative skills gained in this course and to apply them in more advanced course.
2. To specify the principles and applications of stoichiometry, titrimetry etc.,
3. To learn problem solving and learning skills to interpret the data to employ valid and Efficient methods of analysis and to assess whether or not the results and Calculations are reasonable.

Course: General Chemistry (Code 20CHE101)			
S.No	COURSE OUTCOMES	PO`S	PSO's
	The student will be able to		
1	Understand the significance of statistical rules and principles in quantitative analysis.	1,2,5	2,3
2	Apply the knowledge of Spectroscopy in establishing the structure of molecules, qualitative and quantitative analysis.	1,2,6	3
3	The scope of scattering and electron transition in acquiring the knowledge of structure and bonding of molecules	1,2,7	1
4	. The importance of symmetry elements, symmetry operations and application to various molecules	1,2,7	3
5	Construction of Character tables and assessing the physical, chemical and spectral properties of molecules	1,2,7	3

PAPER – I, GENERAL CHEMISTRY 60Hrs. (4Hrs./Week) Code: 20CHE101

UNIT I

Treatment of analytical data : Classification of errors - Determinate and indeterminate errors -Minimisation of errors - Accuracy and precision - Distribution of random errors - Gaussian distribution - Measures of central tendency - Measures of precision - Standard deviation - Standard error of mean - student's t test - Confidence interval of mean - Testing for significance - Comparison of two means – F - test - Criteria of rejection of an observation - propagation of errors - Significant figures and computation rules - Control charts - Regression analysis - Linear least squares analysis.

UNIT-II

Microwave Spectroscopy and Rotational Vibrational Spectroscopyl: Motion of molecules-Degrees of freedom –Energy associates with the degrees of freedom Type of spectra**. Microwave**

spectroscopy: Classification molecules, rigid rotator model, effect of isotopic substitution on the transition frequencies, Intensities non-rigid rotator-Microwave spectra of polyatomic molecules. **Rotational Vibrational Spectroscopy**: Harmonic oscillator, vibrational energies of diatomic molecules, zero-point energy, force constant and bond strengths, anharmonicity Morse potential energy diagram.

UNIT –III

Rotational Vibrational Spectroscopy II & Raman Spectroscopy:

Vibration – rotation spectroscopy. PQR branches, Born–Openheimer approximation, selection rules, normal modes of vibration group frequencies, overtones, hot bands, applications.
Classical and quantum theories of Raman effects, pure rotational, vibrational and Vibrational-rotational Raman spectra, selection rules, mutual exclusion principle.

UNIT –IV

Symmetry and Group theory in Chemistry I

Symmetry elements [Rotational axis of symmetry (C n), Plane of Symmetry(σ) & Classification ofplanes of symmetry i.e., Vertical plane(σ v) Dihedral Plane(σ d) and Horizontal Plane(σ h), Improperrotational axis of symmetry(S n), Inversion centre or Centre of symmetry(i) and Identityelement(E)]. Identification of possible symmetry elements in the molecules H 2 O, NH 3 , BF 3 , CH 4 ,[PtCl 4] -2 , C 6 H 6 , sysymmetry operation, Axioms of group theory- definition of group, sub group(Trivial and non-trivial sub groups), GMT tables-construction of GMT table Abelian(C2v) and non abelian groups(C3v), relation between order of a finite group and its sub group. Point symmetry group. Schoenflies symbols, Group generating elements, Classification of molecules- MLS, MHS,& MSS. Procedure to Find out Point group of a molecule (yes or no Method),

UNIT – V

Symmetry and Group theory in Chemistry II

Representation of groups by Matrices (representation for the Cn, Cnv, Cnh, Dn etc. groups to be worked out explicitly). Definition of Class and importance of similarity transformation in identifying symmetry class with c3v as example, Character of a representation. Reducible and Irreducible representations - Mulliken notations for Irreducible representations The great orthogonality theorem (without proof) and its importance. Character tables and their use. Construction of Character table (C2v and C3v only). Application of group theory in IR and Raman spectroscopy taking H2O, NH3, BF3 examples. Mutual Exclusion principle with special reference to cis N2F2 and trans N_2F_2.

REFERENCES:

1. Vogel's text book of quantitative analysis. (3rd edition)Addition Wesley Longmann Inc.
2. Quantitative analysis R.A Day and A.L.Underwood. Prentice Hall Pvt.Ltd.
5. Fundamentals of Analytical Chemistry – Skoog and West
6. Instrumental Methods of analysis – B K Sharma.
7. Introductory Group Theory for Chemists – George Davidson
8.Group theory for chemistry – A.K.Bhattacharya
9. Group Theory for Chemistry – A.K.Bhatacharya, Himalaya Publishing House – 1999, revised.
10. Chemical Application of Group theory – F.A.Cotton, Wiley India Pvt. Ltd., - 3rd edition, 2008.

PAPER–II:ORGANIC CHEMISTRY-I 60Hrs.(4Hrs./Week)**Code:20CHE102**

Subject Code	**20CHE102**	I A Marks	30
No. of Lecture Hours / Week	4	End Exam Marks	70
Total Number of Lecture Hours	60	Total Marks	100
Seminar	----	Exam Hours	03

Objectives: 1. To provide proper insight on the topics of aromaticity and antiaromaticity in benzenoid & non-benzenoid aromatic compounds.
2. To emphasize the significance of reactive intermediates in organic synthesis.
3. To provide ample knowledge on the topic of Addition , Elimination, Substitution Reactions.

Course: Organic Chemistry (Code 20CHE102)			
S.No	COURSE OUTCOMES	PO`S	PSO's
	The post graduate will be able to		
1	Interpret the concept of aromaticity and the main properties of benzenoid and non-benzenoid aromatic compounds and distinguish between aromatic, non-aromatic and anti aromatic compounds by their structures and chemical consequence of aromaticity.	1,7,2	2,3
2	Know the various types of organic reactions, their mechanisms and intermediates involved, and their applications in synthesis.	1,4,7	1
3	Have a clear conceptual understanding of the nature of carbon-carbon multiple bond, various types of additions, with various reagents, mechanism, orientation and stereochemistry and also aknowledge some important synthetic reactions of CO and CN and crams rule	1,2,4	2
4	Understand the definitiontypes of elimination reactions and differentiate between the various mechanisms, orientation rules and perceives factors favouring elimination over substitution.	1,7,2	1
5	Have knowledge and understanding of various types of aliphatic and aromatic nucleophilic substitution reactions, their mechanisms, stereochemistry and various factors affecting nucleophilic substitution reactions.	1,7,6	2

Unit-I: Nature of bonding and Aromaticity: Nature of bonding: Inductive effect, Mesomeric effect (Resonance), localized and delocalized covalent bonds, conjugation, cross conjugation, Hyperconjugation, Steric effect, Tautomerism and their applications. **Aromaticity:** Aromaticity in benzenoid

non-benzenoid compounds, Benzene, Cyclobutadiene, Tropyllium cation, 1,3,5,7-Cyclooctatetraene, aromaticity of Hetero-aromatic Systems, Annulenes:[10] Annulenes- [12], [14], [16] and [18] annulenes, azulenes, anti- aromaticity and homo-aromaticity.

Unit-II: Reactive intermediates & Reactive Species: Reactive intermediates: Generation, Structure, Stability, Detection and Reactivity of Carbocations, Carbanions, Free radicals, Carbenes, Nitrenes and Arynes. **Reactive Species:** Generation and reactivity of Electrophiles, Nucleophiles, Dienophiles, Ylids, Enophiles.

Unit-III: Addition Reactions: Mechanistic and stereo chemical aspects of addition reactions involving electrophiles, nucleophiles and free radicals, regio and chemo selectivity, orientation and reactivity, Hydrogenation of double and triple bonds, hydrogenation of aromatic rings, Hydroboration.

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

Unit-V: Substitution Reactions: Aliphatic Nucleophilic Substitution Reactions: The SN^2, SN^1, mixed SN^1 and SN^2 reactions and their mechanisms, Neighboring Group Participation by NGP by O, S, N, sigma and pi bonds, Anchimeric assistance. **Aromatic Nucleophilic substitution Reactions:** SN^2 (Ar) (Addition–Elimination), SN^1(Ar) and benzyne mechanisms (Elimination -Addition); evidence for the structure of benzyne. Von Richter, Sommelet-Hauser rearrangements.

PAPER–III INORGANIC CHEMISTRY-I 60Hrs.(4Hrs./Week) Code :20CHE103

Subject Code	**20CHE103**	I A Marks	30
No. of Lecture Hours / Week	4	End Exam Marks	70
Total Number of Lecture Hours	60	Total Marks	100
Seminar	----	Exam Hours	03

Objectives: 1. To impart knowledge on basic & advanced aspects of Inorganic Chemistry.
2. To specify the need of modern theories of atomic structure and chemical bonding and their applications to molecular and metallic structures and coordination chemistry.
3.To equip the students with the fundamental principles and advanced aspects of Quantum chemistry.

Course: Inorganic Chemistry (Code 20CHE103)			
S.No	COURSE OUTCOMES	PO`S	PSO's
	The post graduate will be able to		
1	Understand the postulates, basic theory and advanced theory of Quantum chemistry.	1,2	1
2	Take up the knowledge of preparation, structure, bonding aspects and chemical properties of metal pi complexes, compounds of non – transitional elements and also spectral properties, magnetic properties and applications of Lanthanides and actinide complexes.	1,2,4	3
3	Assimilate the knowledge of non-valence cohesive forces, VSEPR theory, MO theory, MO diagrams and implications of MO theory.	1,2,7	3

4	Comprehend the bonding, structural aspects, properties and applications of complexes basing on CFT & MO theory and evidences in support of M-L bond.	1,2,3	1,3
5	Identify the significance of the thermodynamic stability of complexes, factors effecting, theories to explain stability and methods of determining the stability constant of complexes.	1,2,5	3

Unit-I: Introduction to Exact Quantum Mechanical Results: Schrodinger equation, importance of wave function, Operators, Eigen values and Eigen functions, derivation of wave equation using operator concept. Discussion of solutions of Schrodinger's equation to some model systems viz. particle in one dimensional box (applications), three-dimensional box, Rigid rotator system and the Hydrogen atom. Variation theorem, linear variation principle, perturbation theory (first order and non-degenerate), Application of variation method to the Hydrogen atom.

Unit-II: Chemistry of non- transition elements: Inter halogen compounds, Halogen oxides and oxyfluorides, Clathrate compounds, Spectral and Magnetic properties of Lanthanides and Actinides. Analytical applications of Lanthanides and Actinides. Synthesis, properties and structure of B-N, S-N, P-N cyclic compounds. Intercalation compounds.
Metal π- complexes: preparation, structure and bonding in Nitrosyl, Dinitrogen and Dioxygen complexes.

Unit-III: Structure and Bonding: pπ-dπ bonding, Bent's rule, Non-valence cohesive forces, VSEPR theory. Molecular Orbital theory, Symmetry of Molecular orbitals, Molecular orbitals in triatomic (BeH_2) molecules and ions (NO_2^-) and energy level diagrams. Walsh diagrams for linear (BeH_2) and bent (H_2O) molecules.

Unit-IV: Metal–ligand bonding: Crystal Field Theory of bonding in transition metal complexes-Splitting of d-orbitals in octahedral, tetrahedral, square planar and Trigonal bipyramidal and Square pyramidal fields. Tetragonal distortions - Jahn-Teller effect. Applications and limitations of CFT. Experimental evidences for covalence in complexes. Molecular Orbital Theory of bonding for Octahedral, tetrahedral and square planar complexes. π-bonding and MOT - Effect of π - donor and π -acceptor ligands on Δo. Experimental evidence for π - bonding in complexes.

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

PAPER – IV, PHYSICAL CHEMISTRY-I 60Hrs.(4Hrs./Week) 20CHE104

Subject Code	**20CHE104**	I A Marks	30
No. of Lecture Hours / Week	4	End Exam Marks	70
Total Number of Lecture Hours	60	Total Marks	100
Seminar	----	Exam Hours	03

Objectives: 1. The main objective of the course is to impart the theoretical knowledge and applications of the important terms and laws of Physical Chemistry.
2. The course provides a basic understanding of the core areas of physical chemistry based around the theme of systems, states and processes topics covered on thermodynamic, kinetics and electro Chemistry.
3. The objective of the course is to understand and apply the laws of the thermodynamics and kinetics.

Course: Physical Chemistry (Code 20CHE104)			
S.No	COURSE OUTCOMES	PO`S	PSO's
	The student will be able to		
1	Understand the core areas of physical chemistry based around the theme of systems, states and process covered on thermodynamics.	1,2,7	1
2	Understand the important aspects of surface phenomenan and the physical chemistry involved in it.	1,2,5	2
3	Understand the basic concepts of electrochemical cells, concentration cells in producing electricity from chemicals.	1,2,7	2
4	Understand the theories of reaction rates, mechanisms of Collision theory, primary and secondary salt effects.	1,3,7	1,3
5	Assimilate the knowledge of various kinds of reactions, titrations and their applications..	1,2,6	3

Unit-I: Thermodynamics–I: Classical thermodynamics - Brief review of first and second laws of thermodynamics - Entropy change in reversible and irreversible processes - Entropy of mixing of ideal gases - Entropy and disorder – Free energy functions - Gibbs-Helmholtz equation - Maxwell partial relations. Conditions of equilibrium and spontaneity - Free energy changes in chemical reactions, Van't Hoff reaction isotherm - Van't Hoff equation – Classiuss - Clapeyron equation -partial molar quantities - Chemical potential - Gibbs- Duhem equation - partial molar volume -determination of partial molar quantities - Fugacity - Determination of fugacity - Thermodynamic derivation of Raoult's law.

Unit-II: Surface phenomena and phase equilibria: Surface tension - capillary action – pressure difference -across curved surface (young - Laplace equation) - Vapour pressure of small droplets (Kelvin equation) -Gibbs-Adsorption equation - BET equation - Estimation of surface area -catalytic activity of surfaces - ESCA, X- ray fluorescence and Auger electron spectroscopy. **Surface active agents** - classification of surface-active agents - Micellization – critical Micelle concentration (CMC) - factors affecting the CMC of surfactants, Micro emulsions - Reverse micelles.

Unit-III: Electrochemistry-1: Electrochemical cells - Measurement of EMF - Nernst equation – Equilibrium constant from EMF Data - pH and EMF data -Determination of solubility product from EMF measurements. Concentration cells with and without transference – Liquid junction potential and its determination - Activity and activity coefficients - Debye Huckel limiting law and its verification. Effect of dilution on equivalent conductance of electrolytes - Anomalous behavior of strong electrolytes. Debye Huckel-Onsagar equation - verification and limitations - Bjerrum treatment of electrolytes.

Unit-IV: Chemical kinetics: Methods of deriving rate laws - complex reactions - Rate expressions for opposing, parallel and consecutive reactions involving unimolecular steps. Theories of reaction rates - collision theory - Steric factor - Activated complex theory - Thermodynamic aspects – Unimolecular reactions - Lindemann's theory - Lindemann-Hinshelwood theory. Primary and secondary salt effects. Elementary account of linear free energy relationships - Hammet - Taft equation - Chain reactions - Rate laws of H2-Br2, photochemical reaction of H2 - Cl2. Decomposition of acetaldehyde and ethane - Rice-Hertzfeld mechanism.

Unit-V: Titrimetric Analysis: Classification of reactions in titrimetric analysis- Primary and secondary standards- Neutralization Titrations-Theory of neutralization indicators-Mixed indicators- Neutralisation curves- Displacement titrations. Precipitation titrations-Indicators for precipitation titrations-Volhard's method-Mohr's method- Theory of adsorption indicators-Oxidation reduction titrations-Change of electrode potentials during titration of Fe (II) with Ce (IV)-Detection of end point in redox titrations-Complexometric titrations.

Laboratory Course I Organic Chemistry Code: 20CHE105(P)

List of experiments:

1. Separation of Binary mixtures of Carboxylic acid + Neutral organic compounds (Solvent extraction method).
2. Separation of Binary mixtures of Basic nature + Neutral organic compounds (Solvent extraction method).
3. Separation of Binary mixtures of Phenolic compounds + Neutral organic compounds (Solvent extraction method).
4. Preparation of Phthalimide from Phthalic anhydride – High Temperature. 5.

Preparation of p-nitro acetanilide – Low temperature.

6. Preparation of Iodoform – Room temperature.
7. Column chromatography - separate the given mixture of o-and p-nitro aniline. 8.

Paper chromatography - separate the given mixture of sugars or amino acids.

9. Thin layer chromatography - separate the given mixture of phenols or 2,4-DNP derivatives of carbonyls compounds.
10. Preparation of Sodium wire - to make Sodium Wire for solvent drying. 11.

Preparation of Sodium Granules.

12. Preparation of Sodium t-butoxide.
13. Preparation of Grignard Reagent and its usage one reaction. 14.

Preparation of Wittig reagent.

15. Preparation of Butyl Lithium.

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

Text books/ Reference books:

1. A.I. Vogel, "A Text Book of Practical Organic Chemistry", Longman **2.** A.I. Vogel, "Elementary Practical Organic Chemistry", Longman

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

4. Reaction and Synthesis in Organic Laboratory, B.S. Furniss, A.J. Hannaford, Tatchell, University Science Books mills valley.

5. Purification of Laboratory chemicals, manual, W.L.F. Armarego EDD Perrin

6. Reaction and Synthesis in Organic Chemistry Laboratory, Lutz-Friedjan- Tietze, Theophil Eicher, University Science Book.

Laboratory Course II Inorganic Chemistry practical 20CHE 106(P)

List of experiments:

1. Preparation of Potassium trisoxalato ferrate (III). 2.

Preparation of Tris thiourea copper (1) sulphate.

3. Preparation of Cis and trans potassium diaquodioxalato chromium (III). 4.

Preparation of Hexa ammine cobalt (III) chloride.

5. Determination of Zn^{2+} with potassium Ferro cyanide. 6.

Determination of Mg^{2+} using EDTA.

7. Determination of Ni^{2+} using EDTA.
8. Determination of hardness of water using EDTA.
9. Gravimetric determination of nickel using dimethyl glyoxime.
10. Gravimetric determination of Copper using ammonium thio cyanate.

11. Gravimetric determination of Zn using diammonium hydrogen phosphate. 12. Semi micro qualitative analysis of six radical mixtures

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

Anions: S^{2-} , SO^{2-} ,$2Cl^{-}$, Br^{-}, I^{-} , NO_3^{-} , SO_4^{2-}, CH_3COO^{-},$C_2O_4^{-2}$, $C_4H_4O_6^{-2}$, PO_4^{3-}, CrO_4^{2-}, BO_3^{3-}. Cations: Ammonium (NH_4^{+})

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

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

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

4^{th} group: Zn^{+2}, Mn^{+2}, Co^{+2}, Ni^{+2}. 5^{th} group: Ca^{+2}, Ba^{+2}, Sr^{+2}.

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

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

Text books/ Reference books:

1. Vogels Text Book of Quantitative analysis, revised. J. Bassett, R.C. Denny, G.H. Jeffery and J. Mendhan, ELBS.
2. Synthesis and Characterization of Inorganic Compounds, W.L. Jolly. Prentice Hall.
3. Practical Inorganic Chemistry by G. Pass and H. Sutcliffe Chapman and Hall.
4. Practical Inorganic Chemistry by. K. Somasekhara Rao and K.N.K. Vani. Kalyani publishers.

AKKINENI NAGESWARA RAO COLLEGE OF ARTS & SCIENCE
DEPARTMENT OF CHEMISTRY
M.Sc – CHEMISTRY (ORGANIC CHEMISTRY)
II SEMESTER

Paper Code & Title: 20CHE201: ORGANIC SPECTROSCOPY - i

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

Course: Organic Spectroscopy		
S.No	COURSE OUTCOMES	PO`S
	The graduate will be able to	
1	Memorize the basic principles and theory involved in molecular absorption spectroscopy.	2,7
2	Comprehend the advanced concepts of molecular absorption spectroscopy.	1,2,5

3	Apply the knowledge of spectroscopy in establishing the structure of organic molecules.	1,5,7
4	Analyze the spectral data to ascertain the structure of unknown molecules.	1,4,2

UNIT- I

UV- Visible Spectroscopy:

Mechanics of measurement – Energy transitions – Simple chromophores – Auxochrome, Absorption shifts (Bathochromic shifts, Hypsocromic shift, Hyper chromic shift, Hypo chromic shift). UV absorption of Alkenes – polyenes, unsaturated cyclic systems .

UV absorption of Carbonyl compounds α,β-unsaturated carbonyl systems - UV absorption aromatic systems – solvent effects – geometrical isomerism – acid and base effects – typical examples – calculation of λ_{max} values for simple molecules using Woodward -Fieser rules.

UNIT – II

IR Spectroscopy:

Mechanics of measurement – Fundamental modes of vibrations -Stretching and bending vibrations – Factors effecting vibrational frequency-hydrogen bonding.

Finger print region and its importance. Typical group frequencies for – CH, -OH, -NH, -CC, -CO and aromatic systems - Application in structural determination examples – simple problems.

UNIT – III

Nuclear Magnetic Resonance Spectroscopy (1HNMR – First Order PMR):

Introduction: Nuclear spin- Basic principle of -NMR - nuclear resonance –saturation-Larmor's frequency-Relaxation- Instrumentation(Cw and FT) shielding and de shielding of magnetic nuclei- chemical shift and its measurements, factors influencing chemical shift, spin–spin interactions and factors influencing spin -spin coupling- Dynamic NMR- coupling constant J. and factors effecting J value.

UNIT – IV

Mass Spectrometry I

Introduction- ionization methods-EI, CI, ES, MALDI and FAB – advantages and disadvantages-molecular ion peak and its importance, meta stable peak, Nitrogen rule and extension of nitrogen rule. Determination of Molecular weight and determination of molecular formulae- Isotopic Peaks- Identification of single chlorine atom and double chlorine atom single bromine atom and double bromine atoms in organic compounds. Instrumentation.

UNIT – V

Mass Spectrometry II

Fundamental fragmentation process- Stevenson's rule- radical site initiated cleavage-charge site initiated cleavage- two bond cleavage- Retrodielalder cleavage- Mc-Lafferty rearrangement and other cleavages. Mass spectral fragmentation of alkanes, cycloalkanes, alkenes, alkynes, aromatic hydrocarbons, alcohols, phenols, thiols, ethers, carbonyl containing compounds (Aldehydes, ketones, esters and carboxylic acids), nitrogen compounds, alkyl chlorides and alkyl bromides, Examples of mass spectral fragmentation of organic compounds with respect to their structure determination.

Text books/ Reference books:

1. Introduction to Spectroscopy – D. L. Pavia, G.M. Lampman, G. S. Kriz, 3rd Ed. (Harcourt college publishers).
2. Spectrometric identification of organic compounds R. M. Silverstein, F. X. Webster, 6th Ed. John Wiley and Sons.
3. Spectroscopic methods in organic chemistry - D. H. Williams and I. Flemming Mc.Graw Hill.
4. Absorption spectroscopy of organic molecules – V. M. Parikh
5. Nuclear Magnetic Resonance – Basic Principles- Atta-Ur-Rehman, Springer-Verlag (1986).
6. One- and Two-dimensional NMR Spectroscopy – Atta-Ur-Rehman, Elsevier (1989).
7. Organic structure Analysis- Phillip Crews, Rodriguez, Jaspars, Oxford University Press (1998).
8. Organic structural Spectroscopy- Joseph B. Lambert, Shurvell, Lightner, Cooks, Prentice-Hall (1998).

9. Organic structures from spectra –Field L.D., Kalman J.R. and Sternhell S. 4th Ed. John Wiley and sons Ltd.

AKKINENI NAGESWARA RAOCOLLEGE OF ARTS & SCIENCE
DEPARTMENT OF CHEMISTRY
M.Sc – CHEMISTRY (ORGANIC CHEMISTRY)
II SEMESTER

Paper Code & Title: 20CHE202: INORGANIC CHEMISTRY-II

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

Course: Inorganic chemistry (code 20CH2T2)		
S.No	COURSE OUTCOMES	PO`s
	The graduate will be able to	
1	Memorize the fundamental concepts of Metallic & non metallic clusters, Inorganic reaction mechanisms, organo metallic chemistry, electronic spectra & magnetic properties of complexes and bioinorganic chemistry.	2,7
2	Comprehend the basic and advanced concepts of metallic & non metallic clusters, Inorganic reaction mechanisms, organo metallic chemistry, electronic & magnetic properties of complexes and bioinorganic chemistry.	1,2,6
3	Apply the conceptual knowledge gained in the concepts of metallic & nonmetallic clusters, inorganic reaction mechanisms, organo metallic chemistry, electronic & magnetic properties of complexes and bio inorganic chemistry in other fields of chemistry as well as in research.	1,2,7
4	Analyze the role of metallic & non metallic clusters / cages, inorganic reaction mechanisms, organo metallic chemistry, electronic & magnetic properties of complexes and bio inorganic chemistry in understanding the similarities and differences among the concepts of chemistry.	1,3,2
5	Assess that how far the concepts of metallic & non metallic clusters, Inorganic reaction mechanisms, organo metallic chemistry, electronic & magnetic properties of complexes and bioinorganic chemistry are useful in rendering theoretical explanations for the concepts in chemistry.	1,7,2

Unit-I: Non-metal cages and metal clusters:
Structure and bonding in phosphorous-oxygen, phosphorous-Sulphur cages; structure and bonding in higher boranes with (special reference to B_{12} icosahedra). Carboranes, metalloboranes, metallocarboranes. Classification- LNCs and HNCs**,** Isoelectronic and Isolobal relationships, electron counting rules: Wade's and Lauher's rules. M-M multiple bonding; preparation, structure and bonding in dinuclear $[Re_2Cl_8]$ 2- ion, trinuclear $[Re_3Cl_9]$, tetra nuclear W4(OR)16, hexa nuclear $[Mo_6Cl_8]^{4+}$ and $[Nb_6Cl_{12}]^{2-}$.

Unit-II: Organometallic chemistry of transition metals:
Classification and electron counting rules, hapticity, synthesis, structure and bonding of Olefinic complexes, Acetylene complexes, ferrocene, dibenzene chromium, cyclo heptatriene and tropylium complexes of transition metals. Reactions of organometallic compounds - oxidative addition reductive elimination, insertion and elimination. Applications of organometallic compounds, Catalytic hydrogenation,
Hydroformylation, alkene polymerization.

Unit-III: Reaction mechanism of transition metal complexes:
Kinetics of octahedral substitution, acid hydrolysis, base hydrolysis-conjugate base (CB) mechanism. Direct and indirect evidences in favour of CB mechanism. Anation reactions. Reactions without metal-ligand bond cleavage. Factors affecting the substitution reactions in octahedral complexes. Trans effect on substitution reactions in square planar complexes. Mechanism of redox reactions, outer sphere mechanism, cross reactions and Marcus –Hush equation, inner sphere mechanism.

Unit-IV: Term symbols and Electronic spectra:
Term symbols and their derivation, Microstates, Hunds rules to predict ground terms and ground states. List of ground energy and higher energy terms from d^1 - d^9 configurations;
Electronic spectra of transition metal complexes:
Spectroscopic terms. Selection rules, Slator–Condon parameters, Racah parameters, Term separation energies for dn configurations, Orgel diagrams. Tanabe-Sugano diagrams for d1 to d9 configurations. Calculations of Dq, B and β parameters. Charge transfer spectra.

Unit-V: Bio-inorganic chemistry and Magnetic properties of complexes:
Storage and transport of di-oxygen by Hemoglobin and Myoglobin, Vitamin B_{12} and its importance.
Magnetic properties of transition metal complexes:
Types of magnetism, factors affecting Para magnetism, anomalous magnetic moments - Orbital and spin contribution, spin-orbit coupling and magnetic moments chiro optical properties, cotton effect and Faraday effect.

Text books/ Reference books:

1. Inorganic Chemistry by Huheey. Harper and Row.
2. Concise inorganic chemistry by J. D. Lee, ELBS.
3. Inorganic chemistry, K.F. Purcell and J.C. Kotz, Holt Saunders international
4. Organometallic chemistry by R.C. Mehrotra and A. Singh. New Age International.
5. Advanced Inorganic Chemistry by Cotton and Wilkinson, Wiley Eastern
6. Inorganic reaction mechanism by Basolo and Pearson, Wiley Eastern
7. Bioinorganic Chemistry by K. Hussan Reddy
8. Biological Aspects of inorganic chemistry by A. W.Addiso, W. R. Cullen, D.Dorphin and G. J. James. Weliey Interscience.
9. Photochemistry of coordination compounds by V. Balzaniand V.Carassiti. Academic Press.
10. Text book of Coordination chemistry by K. Soma Sekhara Rao and K.N.K. Vani, Kalyani Publishers.

NOTE: Percentage of Change - 0%

AKKINENI NAGESWARA RAOCOLLEGE OF ARTS & SCIENCE
DEPARTMENT OF CHEMISTRY
M.Sc – CHEMISTRY (ORGANIC CHEMISTRY)
II SEMESTER

Paper Code & Title: 20CHE203: ORGANIC CHEMISTRY -II

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

Course: Organic chemistry (code 20CH2T3)		
S.No	COURSE OUTCOMES	PO`s
	The student will be able to	
1	Understand the basic and advanced concepts of stereochemistry, conformational analysis, green chemistry, nanochemistry and named reactions.	2,7
2	Apply the concepts related to stereochemistry, conformational analysis, green and nano chemistry in establishing the mechanism of the reaction.	1,2,3
3	Assess that how far the knowledge gained in stereochemistry, green chemistry and nanochemistry is useful in understanding the nature of product.	1,5,6
4	Evaluate the role of stereochemistry, green principles and nano chemistry in establishing the mechanism of a reaction as well as in other areas of chemistry.	1,4,7

Unit-I: Named reactions:
Aldol condensation, Benzoin condensation, Cannizzaro condensation, claisen condensation, Dieckmann condensation, Perkin condensation, Stobbe condensation, Reformatsky reaction, Mannich reaction, Reimer-Tiemann reaction, Vilsmeier-Haack reaction, Shapiro reaction, McMurray reaction, Michael addition reaction, Wittig reaction, Stork – Enamine reaction, Acyloin condensation, Robinson ring annulation and Simmon-Smith reaction.

Unit-II: Stereo Chemistry-I:
Concept of chirality, Recognition of Symmetry elements. Definition and classification of Stereoisomers, Enantiomer, Diastereomer, Homomer, Epimer, Anomer, Configuration and Conformation, Configurational nomenclature: D,L and R, S nomenclature. Molecular representation of organic molecules: Fischer, Newman and Sawhorse projections and their inter-conversions. Geometrical Isomerism. Cis-trans, E, Z- and Syn and anti nomenclature, Methods of determining configuration of Geometrical isomers using physical, spectral and chemical methods.

Unit-III: Stereo Chemistry-II:
Definition of Conformation, Conformational analysis of acyclic molecules – alkanes and substituted alkanes. Conformational analysis of monocyclic molecules – cyclohexane – chair, boat and twist boat - mono and disubstituted cyclohexanes and conformation around carbon hetero atom bonds having C–O & C–N. Confirmation and intramolecular hydrogen bonding.

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

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

Text books:

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

NOTE: Percentage of Change - 80%
Unit – 4,5 (shuffled from semester – III), Unit – 2,3 (shuffled from semester – I)

AKKINENI NAGESWARA RAOCOLLEGE OF ARTS & SCIENCE
DEPARTMENT OF CHEMISTRY
M.Sc – CHEMISTRY (ORGANIC CHEMISTRY)
II SEMESTER

Paper Code & Title: 20CH2T4: PHYSICAL CHEMISTRY-II

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

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

Course: Physical chemistry (code 20CH2T4)		
S.No	COURSE OUTCOMES	PO`S
	The student will be able to	
1	Remember the concepts of thermodynamics, polymer chemistry, electro chemistry, chemical kinetics, photo chemistry and Radio chemistry.	1,2,7
2	Understand the concepts of thermodynamics, polymer chemistry, electro chemistry, chemical kinetics, photo chemistry and Radio chemistry.	1,2,7
3	Apply the concepts of thermodynamics, polymer chemistry, electro chemistry, chemical kinetics, photo chemistry and Radio chemistry in research and other allied fields.	1,2,4
4	Analyze the role and significance of concepts of thermodynamics, polymer chemistry, electro chemistry, chemical kinetics, photo chemistry and Radio chemistry.	1,2,7
5	Evaluate the role of concepts of thermodynamics, polymer chemistry, electro chemistry, chemical kinetics, photo chemistry and Radio chemistry in understanding the named concepts in chemistry.	1,2,7

Unit-I: Third law of Thermodynamics and Statistical thermodynamics:
Nernst Heat theorem - Third law of thermodynamics - Its limitations - Determination of absolute entropy - Thermodynamic probability and most probable distribution, Entropy and probability - Boltzmann-Plank's equation. Ensembles, Maxwell-Boltzmann distribution, Fermi-Dirac statistics, Bose Einstein statistics. Partition function - calculation of thermodynamic properties in terms of partition function - Chemical equilibrium and partition function - Translational, rotational and electronic partition function - Entropy of Monoatomic gases (Sackur-Tetrode equation).

Unit-II: Polymer chemistry and Raman Spectroscopy:
Classification of polymers - Free radical, ionic and Zeigler -Natta Polymerization - kinetics of free radical polymerization -Techniques of polymerization -Glass transition temperature - Factors influencing the glass transition temperature. Polydispersity index, Number average and Weight average, Molecular weights – molecular weights determinations – Membrane Osmometry, Light scattering phenomenon. Classical and quantum theories of Raman effects, pure rotational, vibrational and Vibrational- rotational Raman spectra, selection rules,
mutual exclusion principle.

Unit-III: Electro Chemistry-II:
Reference electrode - Standard hydrogen electrode. Calomel electrode -Indicator electrodes: Metal-metal ion electrodes - Inert electrodes -Membrane electrodes - theory of glass membrane potential, potentiometric titrations, advantages of potentiometric titrations, Conductometric titrations. Electrode potentials - Double layer at the interface - rate of charge transfer - Decomposition potential - Over potential - Tafel plots - Derivation of Butler- Volmer equation for one electron transfer - electro chemical potential.

Unit-IV: Chemical kinetics and Photo chemistry:
Branching Chain Reactions – Hydrogenoxygen reaction - lower and upper explosion limits - Fast reactions - Study of kinetics by flow methods - Relaxation methods - Flash photolysis. Acid base catalysis –protolytic and prototropic mechanism. Enzyme catalysis - Michelis-Menten kinetics.

Photochemistry:
Quantum yield and its determination, Actinometry, Reactions with low and high quantum yields, Photo sensitization, Exciplexes and Excimers, Photochemical equilibrium, Kinetics of collisional quenching - Stern-Volmer equation.

Unit-V:

Radioactivity and Isotopes: Introduction to radioactivity, properties of alpha, beta and gamma rays, theory of radioactive disintegration, rate of disintegration, Geiger – Nuttall rule, radioactive equilibrium. Isotopes - radioactive and non-radioactive isotopes, group displacement law. Analysis of isotopes – Aston's mass spectrograph, Dempster's method, Bainbridge's method. Separation methods of isotopes. Applications of Radio isotopes in Industry and medicine.

Course Learning Outcome(S):

After studying this paper, students will acquire the knowledge of Third law of Thermodynamics and Statistical thermodynamics, Polymer chemistry and Raman Spectroscopy, Electro Chemistry, Chemical kinetics and Photo chemistry, Radio activity and isotopes.

Text books/ Reference books:

1. Physical chemistry, G.K. Vemulapalli (Prentice Hall of India).
2. Physical chemistry, P.W. Atkins. ELBS**.**
3. Chemical kinetics - K.J. Laidler, McGraw Hill Pub.
4. Text book of Physical Chemistry, Samuel Glasstone, Macmillan pub.
5. Statistical Thermodynamics - M.C.Gupta.
6. Polymer Sceince, Gowriker,Viswanadham, Sreedhar.
7. Quantitative Analysis, A.I. Vogel, Addison Wesley Longmann Inc.
8. Physical Chemistry by G.W.Castellan, Narosa Publishing House, Prentice Hall.
9. Physical Chemistry by W.J. Moore, Prentice Hall.
10. Polymer Chemistry by Billmayer.
11. Fundamentals of Physical Chemistry by K K. Rohatgi-Mukherjee. Wiley Eastern Ltd publications.
12. Statistical Thermodynamics by M.Dole.
13. Fundamentals of photochemistry by Rohatgimukherjee, New Age international Publications.
14. Essentials of Nuclear chemistry by H.J.Armikar, New Age international Publications.

NOTE: Percentage of Change – Unit - V-20%

AKKINENI NAGESWARA RAOCOLLEGE OF ARTS & SCIENCE
DEPARTMENT OF CHEMISTRY
M.Sc – CHEMISTRY (ORGANIC CHEMISTRY)
II SEMESTER

Paper Code & Title: 20CHE205: ORGANIC CHEMISTRY PRACTICAL-II

No. of hours per week: 06 **Total credits: 03**
Total marks: 100 **(Internal: 30 M & External: 70M)**

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

List of experiments:

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

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

Text books/ Reference books:

1. A.I.Vogel, "A Text Book of Practical Organic Chemistry", Longman
2. A.I.Vogel, "Elementary Practical Organic Chemistry", Longman
3. Practical Organic Chemistry, F.G.Mann and B.C.Saunders, Longman.
4. Reaction and Synthesis in Organic Laboratory, B.S.Furniss, A.J.Hannaford, Tatchell, University Science Books Mills valley.
5. Purification of Laboratory chemicals, manual, W.L.F. Armarego EDD Perrin.
6. Reaction and Synthesis in Organic Chemistry Laboratory, Lutz-Friedjan-Tietze, TheophilEicher, University Science Book.

NOTE: Percentage of Change - 0%

AKKINENI NAGESWARA RAOCOLLEGE OF ARTS & SCIENCE
DEPARTMENT OF CHEMISTRY
M.Sc – CHEMISTRY (ORGANIC CHEMISTRY)
II SEMESTER

Paper Code & Title: 20CHE206: PHYSICAL CHEMISTRY PRACTIAL

No. of hours per week: 06 **Total credits: 03**
Total marks: 100 **(Internal: 30 M & External: 70M)**

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

List of experiments:

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

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

Text books/ Reference books:

1. Experimental Physical chemistry by V.D. Athawale, Parul Mathur, New Age International publishers.
2. Physical chemistry experiments by V. P. Kudesia, Pragati Prakasan publishers.
3. Advanced practical Physical chemistry by J.B. Yadav, Krishna's educational publishers.

NOTE: Percentage of Change – 27% (Increment)

Open Electives offered by Chemistry department
DEPARTMENT OF CHEMISTRY

Subject Code	Title of the Subject	L	T	P	C
	CHEMISTRY OF ENERGY MATERIALS	2	1	-	3

COURSE OBJECTIVES	
1	To make the student understand basic electrochemical principles such as standard electrode potentials, emf and applications of electrochemical principles in the design of batteries.
2	To understand the basic concepts of processing and limitations of fossil fuels and Fuel cells & their applications.
3	To impart knowledge to the students about fundamental concepts of hydrogen storage in different materials and liquefaction method
4	Necessasity of harnessing alternate energy resources such as solar energy and its basic concepts.
5	To understand and apply the basics of calculations related to material and energy flow in the processes.

COURSE OUTCOMES	
CO1	Solve the problems based on electrode potential,Describe the Galvanic Cell Differentiate between Lead acid and Lithium ion batteries, Illustrate the electrical double layer
CO2	Describe the working Principle of Fuel cell, Explain the efficiency of the fuel cell Discuss about the Basic design of fuel cells, Classify the fuel cell
CO3	Differentiate Chemical and Physical methods of hydrogen storage,Discuss the metal organic frame work, Illustrate the carbon and metal oxide porous structures Describe the liquification methods
CO4	Apply the photo voltaic technology,Demonstrate about solar energy and prospects Illustrate the Solar cells,Discuss about concentrated solar power
CO5	Differentiate between Photo and Photo electrochemical Conversions,Illustrate the photochemical cells, Identify the applications of photochemical reactions, Interpret advantages of photoelectron catalytic conversion

<u>Mapping between Course Outcomes and Programme Outcomes</u>

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

SYLLABUS

UNIT-1: Electrochemical Systems: Galvanic cell, standard electrode potential, application of EMF, Electrode mechanism, polarization, Batteries-Lead-acid and Lithium ion batterie**s.**

UNIT-2: Fuel Cells: Basic design of fuel cell, Fuel cell working principle, Fuel cell efficiency Classification of fuel cells, Polymer electrolyte membrane (PEM) fuel cells, Solid-oxide fuel cells (SOFC), and their applications.

UNIT-3: Hydrogen Storage: Hydrogen Storage, Chemical and Physical methods of hydrogen storage, Hydrogen Storage in metal hydrides, metal organic frame works (MOF), Carbon structures (Carbon nano tubes, fullerenes), metal oxide porous structures, hydrogel storage by high pressure methods. Liquefaction method.

UNIT-4:Solar Energy: Solar energy introduction and prospects, photo voltaic (PV) technology, concentrated solar power (CSP), Solar Fuels – Hydrogen: Ammonia& Hydrazine, Solar cells (Si-Te & Cd-Te), advantages and disadvantages.

UNIT-5: Photo and Photo electrochemical Conversions: Photochemical cells and applications of photochemical reactions, specificity of photo electrochemical cell, advantage of photoelectron catalytic conversions.

TEXT BOOKS:

1. Essentials of Physical Chemistry, Bahl and Bahl and Tuli.
2. Fuel Cell Hand Book 7^{th} Edition, by US Department of Energy (EG&G technical services and corporation).

REFERENCE BOOKS :

1. Physical chemistry by Ira N. Levine
2. Inorganic Chemistry, Silver and Atkins
3. Hand book of solar energy and applications by Arvind Tiwari and Shyam.
4. Solar energy fundamental, technology and systems by Klaus Jagar et.al.
5. Hydrogen storage by Levine Klebonoff

AKKINENI NAGESWARA RAOCOLLEGE OF ARTS & SCIENCE
DEPARTMENT OF CHEMISTRY
M.Sc – CHEMISTRY (ORGANIC CHEMISTRY)
II SEMESTER
Paper Code & Title: 20OECHE: (OPEN ELECTIVE-I)
CHEMISTRY IN DAILY LIFE

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

Course: CHEMISTRY IN DAILY LIFE (code 20OECH)		
S.No	COURSE OUTCOMES	PO`S
	The graduate will be able to	
1	Memorize the basic concepts related to chemistry in daily life like – chemistry Laboratory safety symbols, environmental chemistry, bioinorganic chemistry, vitamins, antibiotics and hormones.	2,7
2	Understand the concepts like chemistry Laboratory safety symbols, environmental chemistry, bioinorganic chemistry, vitamins, antibiotics and hormones.	1,2,6
3	Apply the knowledge gained in the concepts like chemistry Laboratory safety symbols, environmental chemistry, bioinorganic chemistry, vitamins, antibiotics and hormones in future job roles.	1,4,7

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

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

Unit-II: Environmental Chemistry:
Ambient air quality standards, Climate change: Acid rain, Smog, Greenhouse effect, , Renewable and Nonrenewable energy resources, DO, COD, BOD, Toxicity of lead, mercury, arsenic and Cadmium, Industrials accidents- Case study- Bhopal gas tragedy, Vishakhapatnam polymer industry tragedy

Unit-III: Bioinorganic Chemistry:
Essential elements, biological significance of Na, K, Mg, Ca, Fe, Metalloporphyrin – Structure and functions of hemoglobin, Myoglobin.

Unit-IV: Biological functions of Hormones:
Introduction,Types of harmones, Role of Anderstrone, Progestrone and thyroxin, action of cortisone, Insulin.

Unit-V: Medicinal Chemistry:
The role of vitamins – K,E,D,C,B – complex, classification of antibiotics, mechanism of antibiotics action - role of ampicillin, chloromycetin and amoxicillin as antibiotics.

Text books/ Reference books:

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

Subject Code	Title of the Subject	L	T	P	C
	Chemistry of Nanomaterials and applications	4	0	-	4

COURSE OBJECTIVES	
1	To understand synthetic principles of Nanomaterials by various methods
2	And also characterize the synthetic nanomaterials by various instrumental methods
3	To enumerate the applications of nanomaterials in engineering

COURSE OUTCOMES	
CO1	Classify the nanostructure materials, Describe scope of nano science and technology, Explain different synthetic methods of nano materials, Identify the synthetic methods of nanomaterial which is suitable for preparation of particular material
CO2	Describe the top down approach, Explain aerosol synthesis and plasma arc technique, Differentiate chemical vapour deposition method and electrodeposition method, Discuss about high energy ball milling.
CO3	Discuss different technique for characterization of nanomaterial, Explain electron microscopy techniques for characterization of nanomaterial, Describe BET method for surface area analysis, Apply different spectroscopic techniques for characterization
CO4	Explain synthesis and properties and applications of nanaomaterials, Discuss about fullerenes and carbon nanotubes, Differentiate nanomagnetic materials and thermoelectric materials, Describe liquid crystals
CO5	Illustrate applications of nanaomaterials, Discuss the magnetic applications of nanomaterials, list the applications of non-linear optical materials, Describe the applications fullerenes, carbon nanotubes

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

SYLLABUS

Unit – I : Introduction to nanoscience

Introduction**,**importance of nano materials, nanoscience in nature, classification of nanostructured materials, properties , scope of nanoscience and nanotechnology&applications.

Unit – II : Synthesis of nanomaterials

Bottom-Up approach**:-** Sol-gel synthesis, microemulsions or reverse micelles, co-precipitation method, solvothermal synthesis, hydrothermal synthesis.

Top-Down approach:- Arc discharge Plasma arc method, aerosol synthesis, ion sputtering, laser pyrolysis,laser ablation, chemical vapour deposition method, electrodeposition method, and high energy ball milling.

UNIT-III: Characterization nanomaterials.

Techniques for characterization:Dynamic light scattering for particle size determination, Diffraction technique,electron microscopy techniques for the characterization of nanomaterials, BET method for surface area analysis.

UNIT-IV: Structural studies of nanomaterials

Properties of nanomaterials: fullerenes, carbon nanotubes, core-shell nanoparticles. Nano-crystalline materials, magnetic nanoparticles and important properties in relation to nano-magnetic materials, thermoelectric materials, non-linear optical materials, liquid crystals.

UNIT.V: Applications of Nanomaterials

Engineering, medicine, aerospace applications of nanomaterials

TEXT BOOKS:

1. **NANO: The Essentials :** T Pradeep, MaGraw-Hill, 2007.
2. **Textbook of Nanoscience and nanotechnology:** B S Murty, P Shankar, Baldev Rai, BB Rath and James Murday, Univ. Press, 2012.

REFERENCE BOOKS:

1. Concepts of Nanochemistry; Ludovico Cademrtiri and Geoffrey A. Ozin & Geoffrey A. Ozin, Wiley-VCH, 2011.

2. **Nanostructures & Nanomaterials; Synthesis, Properties & Applications:** Guozhong Cao, Imperial College Press, 2007.
3. **Nanomaterials Chemistry**, C. N. R. Rao, Achim Muller, K.Cheetham, Wiley-VCH, 2007.

AKKINENI NAGESWARA RAO COLLEGE OF ARTS & SCIENCE

DEPARTMENT OF CHEMISTRY

M.Sc – CHEMISTRY (ORGANIC CHEMISTRY)

III SEMESTER

20CHE301: ADVANCED ORGANIC SPECTROSCOPY

Course: Advanced Organic Spectroscopy **(code 20CHE301)**		
S.No	COURSE OUTCOMES	PO`s
	The student will be able to	
1	Sumarize the principle, theory and advanced aspects of ^{1}HNMR, ^{13}C NMR, 2D NMR, ORD & CD spectroscopic techniques.	1,2,7
2	Display the knowledge gained in the areas of ^{1}HNMR, ^{13}C NMR, 2D NMR, ORD & CD spectroscopic techniques in chosen job role.	1,6,7
3	Interpret the spectral data of ^{1}HNMR, ^{13}C NMR, 2D NMR, ORD & CD in elucidating the structure of the molecule.	1,5,7
4	Assess that how far the spectral data of ^{1}HNMR, ^{13}C NMR, 2D NMR, ORD & CD are useful in establishing the structure of the molecule.	1,4,7

UNIT – I

Proton NMR Spectrscopy:

Determination of structure of organic compounds using PMR data. Spin system, Nomenclature of spin system, spin system of simple and complex PMR spectrum (Study of AB – A_2 – AB_2. ABX – ABC – AMX interactions)

Simplification of complex spectra- nuclear magnetic double resonance, chemical shift reagents, solvent effects on PMR Spectrum . Nuclear Overhauser Effect (NOE).

UNIT-II

13C-NMR spectroscopy:

Similarities and Difference between PMR and CMR-CMR recording techniques -BBC-BBD-SFORD-Gate pulse CMR spectrum.

General considerations, chemical shift (aliphatic, olefinic, alkyne, aromatic, heteroaromatic and carbonylcarbon), coupling constants.Typical examples of CMR spectroscopy – simple problems.

UNIT-III

ORD& CD Curves:

Optical rotatory dispersion : Theory of optical rotatory dispersion – Cotton effect –CD curves-types of ORD and CD curves-similarities and difference between ORD and CD curves. α- Halo keto rule, Octant rule – application in structural studies.

UNIT-IV

2D NMR spectroscopy:

Definitions and importance of COSY, DEPT, HOMCOR, HETCOR,INADEQUATE, INDOR, INEPT, NOESY, HOM2DJ, HET2DJ.

Study of COSY ,DEPT, HOMCOR, HETCOR, INADEQUATE INDOR INEPT ,NOESY HOM2DJ, HET2DJ, taking simple organic compounds as examples.

UNIT –V

Structural Elucidation of Organic compounds Using UV, IR, 1H-NMR, 13C-NMR and Mass spectroscopy.

References :

1. Introduction to Spectroscopy – D. L. Pavia, G.M. Lampman, G. S. Kriz, 3rd Ed.

   (Harcourt College publishers).

2. Spectrometric identification of organic compounds R. M. Silverstein, F. X. Webster,

   6th Ed.John Wiley and Sons.

3. Spectroscopic methods in organic chemistry - D. H. Williams and I Flemming

   McGraw Hill, 4th edition.

4. Absorption spectroscopy of organic molecules – V. M. Parikh

5. Organic structural Spectroscopy- Joseph B.Lambert, Shurvell, Lightner, Cooks,

   Prentice-Hall (1998).

6. Organic structures from spectra –Field L.D., Kalman J.R. and Sternhell S. 4th Ed.

   John Wiley and sons Ltd.

7. Organic spectroscopy – Principle & Applications – Jag Mohan, Narosa, 2nd edition,

   Publishing house.

20CHE302: ORGANIC REACTIONS & MECHANISMS

Course: Organic Reactions, Mechanisms & Photo Chemistry (code 20CHE302)		
S.No	COURSE OUTCOMES	PO`S
	The student will be able to	
1	Acquire sound knowledge of oxidations, reductions, molecular rearrangements, pericyclic reactions and photo chemistry.	2
2	Understand the concepts involved in oxidations, reductions, molecular rearrangements, pericyclic reactions and photo chemistry.	1,7
3	Apply the conceptual knowledge gained in oxidations, reductions, molecular rearrangements, pericyclic reactions and photo chemistry in chosen fields.	1,5,6
4	Analyse and categorise the various types oxidations, reductions, molecular rearrangements, pericyclic reactions and photo chemistry in a given reactions.	1,7,4

UNIT-I

Oxidations

Definition and types of Oxidations, oxidations with ruthenium tetroxide, iodobenzenediacetate, Tl(III) nitrate, Chromium (VI) oxidants, Lead tetra acetate, SeO_2, MnO_2, Ag_2CO_3, Oppenauer oxidation, perhydroxylation using $KMnO_4$, OsO_4, HIO_4, oxidation with iodine silver carboxylate (Woodward and Prevost conditions), Definition & mechanism of epoxidation by peracids.

UNIT-II

Reductions

Definition and types of reductions, reduction by dissolving metals - Reduction with metal and liquid ammonia (Birch Reduction of aromatic compounds), Reduction with metal acid - Clemensons reduction, Reduction by hydride transfer reagents, Aluminium alkoxide - Meerwein Pondorf Verley Reduction, $LiAlH_4$, $NaBH_4$, Diisobutylaluminium hydride(DIBAL), Sodium cyano borohydride, trialkyl borohydrides, Reduction with diimide,. Wolff-Kishner reduction.

UNIT-III

Molecular Rearrangements

Migration to electron deficient carbon atom**.** Pinacole-Pinacolone rearrangement, Wagner-Meerwein rearrangement, Dienone-Phenol rearrangement, Benzil-Benzilic acid rearrangement, Favorski rearrangement.

Migration to electron deficient hetero atom:.Wolf, Hofmann, Curtius, Schmidt, Beckmann rearrangement, Baeyer-Villiger rearrangement, Stevens, Neber rearrangements. Fries, Fischer-Hepp, Orton, Bamberger, Dakin, Cumene Hydroperoxide rearrangement.

UNIT-IV

Pericyclic Reactions – I:

Definition, classification of pericyclic reactions, Molecular Orbital energy level diagrams, electronic configuration in ground and first excited states of Ethylene, 1,3-Butadiene, 1,3,5 – Hexatriene, allyl system, stereo chemical notations – suprafacial, antarafacial, conrotatory and disrotatory modes, Woodward and Hoffmann selection rules.

Electrocyclic reactions: Mechanism, Stereochemistry of (4n) and (4n+2) π systems. PMO, FMO and correlation methods.

Cyclo additions: Mechanism, stereochemistry of (2+2) and (4+2) π systems, PMO, FMO and correlation methods.

Sigmatropic rearrangements: Classification, mechanism for FMO and PMO approach under thermal and photo chemical conditions. (Detailed treatment of Claisen, Cope rearrangements fluxional molecules, aza-cope rearrangements).

UNIT-V

Photochemistry:

Photochemical processes: Energy transfer, sensitization and quenching. Singlet and triplet states and their reactivity. Photochemistry of olefins – conjugated olefins, Aromatic compounds–isomerisation–additions. Photochemistry of carbonyl compounds – Norrish type I and II reactions –Paterno – Buchi Reaction.

Photoreduction, Photochemical rearrangements–Photo Fries rearrangement, Di-π-methane rearrangement, Barton reaction.

References:

1. Molecular reactions and Photochemistry by Charles Dupey and O. Chapman, Prentice Hall.
2. Reaction mechanism in organic chemistry. 3rd edition, S.M.Mukherji & singh.
3. Advanced Organic Chemistry-Reactions, Mechanisms and Structure, Jerry March, John Wiley and sons, 6th edition.
4.. Advanced Organic Chemistry, F.A. Carey and R.J Sundberg, Plenum.
5. Modern methods of organic synthesis, Cambridge University press, 3rd edition, W.Carruthers.
6. Organic Reaction Mechanisms, V.K.Ahluwalia, 4th edition, Narosa.
7. Reactions, rearrangements and reagents.S.N.Sanyal,4th edition.
8. Organic Photo chemistry and Pericyclic reactions' M.G.Arora Anmol Publications Pvt. Ltd.
9. Fundamentals of Photochemistry by K.K.Rohatgi–Mukherjee New Age international publishers.

20CHE303A: ORGANIC SYNTHESIS

Course: Organic Synthesis (code 20CHE303)		
S.No	COURSE OUTCOMES	PO`S
	The student will be able to	
1	Memorize the concepts, principles and theories related to formation of C – C single bond, C – C double bond, Diel's Alder related reactions. Protecting groups and disconnection approach in organic synthesis.	2
2	Understand the role and significance of formation of C – C single bond, C – C double bond, Diel's Alder related reactions. Protecting groups and disconnection approach in organic synthesis.	1,7
3	Apply the conceptual knowledge gained in formation of C – C single bond, C – C double bond, Diel's Alder related reactions. Protecting groups and disconnection approach in organic synthesis as and when required.	1,6,4
4	Analyze the role of various reagents in carrying out the organic reactions like formation of C – C single bond,C – C double bond, Diel's Alder related reactions.Protecting groups and disconnection approach in organic synthesis.	1,3,5

UNIT-I

Formation of carbon-carbon single bonds:

Alkylation of relatively acidic methylene groups, alkylation of ketones, enamine and related reactions, umplong (dipole inversion).

Allylic alkylation of alkenes, alkylation of α-thiocarbanions- α-selenocarbanions, formation of carbon carbon single bonds by the addition of free radicals to alkenes, synthetic applications of carbenes and carbenoids.

UNIT-II

Formation of carbon-carbon double bonds

Pyrolytic syn elimination reactions sulphoxide-sulphonate rearrangement, synthesis of allyl alcohols, the witting reaction, alkenes from sulphones, decarboxylation of β-lactones, alkenes.

Stereo selective synthesis of tri and tetra substituted alkenes, oxidative decarboxylation of carboxylic acids, stereospecific synthesis from 1,2-diols, reductive dimerization of carbonyl compounds.

UNIT-III

Diels–Aider and related reactions: The dienophile, heterodienophile, oxygen as dienophile, The diene, acyclic dienes, heterodienes, 1,2-dimethylene cycloalkanes, vinyl cycloalkenes, and vinyl arenes, cyclic dienes and furans.

Intra molecular Diels –Alder reactions, stereochemistry and mechanism of Diels – Alder reaction, retro Diels – Alder reaction, catalysis by lewis acids, photosensitized Diels- Alder reactions and 1,3-dipolar cycloaddition reactions.

UNIT-IV

Disconnection approach

Introduction to Retro-synthetic analysis, Disconnection approach with suitable examples, Definitions: FGI, Disconnection, synthons, synthetic equivalent, reagent, target molecule, General strategy: choosing a disconnection, greatest simplification, symmetry, high yielding steps, recognizable starting materials.

Chemo, regio and stereo selectivity with examples. One group C-C disconnections-Alcohols, carbonyl compounds, alkene synthesis, two group disconnections: 1,3 – dicarbonyl compounds, α,β – unsaturated carbonyl compounds.

UNIT-V

Protecting groups:

Theory and importance of functional group protection and deprotection in organic

synthesis:-Protecting agents for the protection of functional groups: Hydroxyl group, Amino group, Carbonyl group and Carboxylic acid group

carbon-carbon multiple bonds; chemo- and regioselective protection and deprotection. Illustration of protection and deprotection in organic synthesis.

References:

1. Modern methods of Organic synthesis , W. Carruthers Cambridge Press (3rd edition)

2. Principles of Organic synthesis by, ROC Norman, 3rd edition, CRC press.

3. Modern Method of Organic Synthesis ,Carruthers and Coldham Sachinkumar Ghosh,

   Canbridge New Central Book Agency,1st edition.

4. Advances in Organic Reaction mechanism and structure, J. March, 6th edition, McGrew Hill

5. Organic Synthesis: Ratna kumar kar, vol – II, NCBA Publications.

20CHE303 B: ASYMMETRIC SYNTHESIS, PHOSPHORUS & SULPHUR REAGENTS, SYNTHETIC POLYMERS, BIOMOLECULES & BIO ORGANIC CHEMISTRY

Course: ASYMMETRIC SYNTHESIS, PHOSPHORUS & SULPHUR REAGENTS, SYNTHETIC POLYMERS, BIOMOLECULES & BIO ORGANIC CHEMISTRY (code 20CHE303B)		
S.No	COURSE OUTCOMES	PO`S
	The student will be able to	
1	Memorize the concepts of asymmetric synthesis, formation of carbon double bond, synthetic polymers, biomolecules and bio inorganic chemistry.	1,2,4,7
2	Comprehend various organic synthesis.	1,2,4,7
3	Apply the conceptual knowledge gained in determining the mechanism involved in asymmetric synthesis, as well as reactions involving various reagents.	1,2,7
4	Analyse as to how far various reagents are useful in carrying out asymmetric synthesis and other organic reactions.	1,3,4
5	Evaluate the role of various reagents in asymmetric synthesis and other organic reactions.	1,2,6,7

UNIT – I

Asymmetric Synthesis

Topocity - Prochirality- Substrate selectivity - Diastereoselectivity and enantioselectivity-Substrate controlled methods-use of chiral substrates - examples

Auxiliary controlled methods-Use of chiral auxiliaries-Chiral enolates-alkylation of chiral imines – Stereoselective Diels-Alder reaction

Reagent controlled methods-Use of chiral reagents-Asymmetric oxidation-Sharpless epoxidation-Asymmetric reduction-Use of lithium aluminium hydride and borate reagents.

UNIT – II

Phosphorus Reagents

Formation of carbon-carbon double bonds-Functional group transformations – deoxygenation reactions-reactivity as electrophiles- conversitoon of alcohols to alkyl halides, Witting reaction and nucleophiles - Corey-Winters reaction, Michaelis-Arbusov reaction-Perkow reaction and Mitsnobu reaction.

Sulphur Reagents- Sulphur ylides, stabilized and non-stabilized – Preparation and reactivity Pummerer reaction – sulphonyl carbanions-Julia reaction.

UNIT – III

Synthetic Polymers

Polymer Reactions-Addition and condensation polymerization processes- Bulk, Solution, Suspension and Emulsion polymerization.

Stereospecific Polymers-Preparation and significance- classification of polymers based on physical properties-Thermoplastics-Thermosetting plastics-Fibers and elastomers- General applications.

Preparation of Polymers-Preparation of Polymers based on different types of monomers Industrial applications-olefin polymers-Diene polymers-nylons-Glyptal resins-Urea-formaldehyde, phenol-formaldehyde and melamine resins- Epoxy resins - Ion exchange resins.

UNIT – IV

Biomolecules

Peptides and Proteins-Methods of peptide synthesis, sequence determination, structure of oxytocin, proteins-classification, structure, conformation and properties. Nucleic acids- Nucleosides, Nucleotides, DNA and RNA, structure and conformations, replication, translation of genetic material, genetic code, gene expression, gene mutation, protein synthesis.

ons, replication, translation of genetic material, genetic code, gene expression, gene mutation, protein synthesis.

UNIT – V

Bioorganic Chemistry

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

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

References:

1. Advanced Organic Chemistry-Reactions, Mechanism and Structure, Jerry March, John Wiley.
2. Polymer Chemistry by V.R.Goweriker, N.V.Viswanathan, Jayader Sreedhar, New Age International (P) Limited, Publishers.
3. Advanced Organic Chemistry, F.A. Carey and R.J Sundberg, Plenum.
4. Principles of Organic Synthesis, R.O.C. Norman and J.M Coxon, Blackie
5. Structure and Mechanism in Organic Chemistry C.K.Inglod, Cornell University Press.
6. Modern Synthetic Reactions, H.O. House, W.A. Benjamin.

20CHE304 A: ENVIRONMENTAL CHEMISTRY AND ANALYSIS

Course: ENVIRONMENTAL CHEMISTRY AND ANALYSIS (code 20CHE304A)		
S.No	COURSE OUTCOMES	PO`S
	The student will be able to	
1	Memorize the concepts of envirometry and its analysis.	
2	Understand the basic significance of segments of environment and soil erosion, soil fertility as well as soil analysis	
3	Apply the knowledge of environmental chemistry in addressing the present environmental conditions.	
4	Analyse different problems related to environmental issues.	
5	Evaluate that how far the existing solutions related to environmental issues can be useful to overcome the novel problems of environment.	

UNIT-I

Significance of basic segments of Environment-Nomenclature in the study of Environmental Chemistry., SOIL CHEMISTRY & POLLUUTION STUDIES:Principles of weathering-effect of temperature, water, air, plants and animals on weathering., Soil formation/development-factors affecting soil development-physical properties of soil; soil colloids-ion exchange proerties.,Soil fertility, productivity- Soil nutrients-micro and macro.

UNIT II

STUDY OF WATER POLLUTION AND MONITORING AND TREATMENT METHODS OF WATER POLLUTANTS: Hydrosphere-water resources-hydrological cycle-unique properties of water- water quality parameters., Pollution from Domestic water ,industrial, agricultural, solid waste, shipping, radioactive waste & thermal pollution , Effect of specific pollutants like mercury, lead, arsenic, selenium, nitrates, oil.,

Unit- III

Effects of soaps, detergents, pesticides, hydrocarbon with regard to water pollution., Techniques of water treatment-Primary, secondary and tertiary methods-use of coagulants-flash distillation-solar stills, ion exchange reverse osmosis, electro dialysis.

UNIT -IV

STUDY OF AIR POLLUTION AND MONITORING AND TREATMENT METHODS IN CASE OF AIR POLLUTION: Atmospheric sources and emission of air pollutants-carbon monoxide-sulphur ,oxides-oxides of nitrogen,organic pollutants and photo chemical smog-particulates-acid rain and radioactive substances. Continuous monitoring of air pollutants-Principles,Monitoring instruments,monitoring of sulphur dioxide,hydrogen sulphide,oxides of nitrogen, oxides of carbon, hydrocarbons, ozone and suspended particulate matter and radioactive substances.

UNIT-V

ENVIRONMENTAL CHEMICAL ANALYSIS: Analysis of soil: Sampling,determination of moisture,total nitrogen, phosphorus, silicon, lime, humus, nitrogen, alkali salts., Analysis of water samples : Dissolcved oxuygen,Chemical oxygen demand ,Biological oxygen demand,Phosphates,nitrogen compounds.analysis of metalic constitutents, Analysis of Air samples: carbon mono oxide,carbon dioxide,sulphur dioxide,hydrogen sulfide,oxides of nitrogen,ammonia,ozone, hydrocarbons and aromatic hydrocarbons.,

SUGGESTED BOOKS:,

1.Environmental Chemsitry by A.K.De, Wiley Eastern Limited, New Delhi

2.A Text Book of Environmental Chemistry by O.D.Tyagia and M.Mehra-Anmol Publicaitons, 3.Environmental Pollution Control and Engineering by C.S.Rao , Wiley Eastern Limited,

4.Environmental Chemistry by P.S.Sindhu,-New Age International Publishers

5.A Text Book of Environmental Chemistry and Poolution Control by S.S.Dara ,S.Chand & Co 6.Environmental Pollution Analysis by S.M.Khopkar, Wiley Eastern Limited, New Delhi

7.Aanalytical Agricultrual Chemistry by S.L.Chopra & J.S.Kanwar -- Kalyani Publishers

8.Mannual of soil, plant, water and fertilizer analysis, R.M.Upadhyay and N.L 5harma, Kalyani Publishers, New Delhi

9.Environmental Chemistry by B.K.Sharma- Goel Publishing House, Meerut.

10.Soil Chemical Analysis by M.L.Jsackson,Prentice-Hall India Pvt Ltd, New Delhi

20CHE304B: CHEMISTRY OF NATURAL PRODUCTS

Course: CHEMISTRY OF NATURAL PRODUCTS (code 20CHE304B)		
S.No	COURSE OUTCOMES	PO`S
	The student will be able to	
1	Memorize the concepts related to Alkaloids, Terpenoids, Steroids, Flavonoids and Isoflavonoids and Pigments.	2
2	Understand the chemical role of Alkaloids, Terpenoids, Steroids, Flavonoids and Isoflavonoids and Pigments.	1,7
3	Execute the conceptual knowledge gained in the areas of Alkaloids, Terpenoids, Steroids, Flavonoids and Isoflavonoids and Pigments.	1,6
4	Analyze the role of methods involved in structure elucidation of Alkaloids, Terpenoids, Steroids, Flavonoids and Isoflavonoids and Pigments.	1,7

UNIT-I

Alkaloids: Introduction, Definition, occurrence, nomenclature, role of alkaloids in plants, stereochemistry, physiological action, classification, isolation and general methods for structural elucidation of alkaloids. Structure elucidation and synthesis of Quinine and Reserpine.

UNIT-II

Terpenoids: Introduction, Definition, nomenclature, classification, isolation, isoprene rule and general methods for structural elucidation of Terpenoids. Occurrence, isolation, physiological action, Structure elucidation and synthesis of Zingiberene and Santonin.

UNIT-III

Steroids: Introduction, Definition, nomenclature, classification and general methods of structural elucidation of steroids. Occurrence, isolation, physiological action, structure elucidation and synthesis of Ttestosterone and Progesterone.

UNIT-IV

Flavonoids and Isoflavonoids: Introduction, Definition,nomenclature, classification and general methods for structural elucidation of flavonoids.Occurrence, isolation, physiological action, structure elucidation and sunthesis of Kaempferol and Quercetin.

UNIT-V

Pigments: Introduction, classification of natural pigments, introduction and classification of carotenoids, functions of carotenoids in plants and animals, structure and synthesis of α – carotene and β – carotene.

References:

1. Organic Chemistry, Vol:2, I.L.Finar, 5th Edition.

2. Chemistry of Natural Products,K.W.Bentley

3. ChemistryofNaturalproductsbyP.S.KalsiKalyaniPublishers.1983, low cost university edition.

4. Chemistry and physiology of alkaloids by Manske Vol.I&II,VII

Paper Code & Title: 20OECHE - 2: (OPEN ELECTIVE-II)

POLYMER CHEMISTRY

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

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

Course:POLYMERCHEMISTRY (code 20OECHE - 2)		
S.No	COURSE OUTCOMES	PO`S
	The graduate will be able to	
1	Memorize the concepts related to polymer chemistry	2,7
2	Understand the concepts of polymer chemistry	1,7
3	Apply the knowledge gained in polymer chemistry in chosen job role.	1,6,7

Course Learning Objective(S): The main objective of this paper is to give a basic andupdatedknowledgeforthestudentsonPolymerchemistry.

UNIT – I: Introduction, Classification of polymers, Polymerization, chain polymerization,steppolymerization,Copolymerization,Freeradicalchain polymerization,cationicpolymerization,anionicpolymerization,PolymerizationTechniques,GraftandBlockCopolymers.

UNIT–II: PolymerSynthesis,IsolationandPurificationofpolymers,PolymerFractionation, Molecularweightdetermination,Molecularweightdeterminationcurve,ProcessingTechniques.

UNIT–III: PolymerReactions–Introduction,Hydrolysis,Acidolysis,Aminolysis,Hydrogenation, AdditionandSubstitutionReactions, Cyclisationreactions, Cross-linkingReactions.

UNIT – IV: Polymer Degradation – Definition, Types of Degradation, Thermal Degradation,Mechanical Degradation, Degradation by Ultrasonic Waves, Photodegradation, DegradationbyHigh-EnergyRadiation,OxidativeDegradation,HydrolyticDegradation.

UNIT–V: Plastics,Fibres,Elastomers-Polyethylene,Polystyrene,PolyEsters,PolyAcrylonitrile,Polyurethanes,PolyvinylChloride,Polyisoprenes .Resins–PhenolFormaldehydeResin,UreaFormaldehydeandMelamine–FormaldehydeResins,EpoxyPolymers,SiliconPolymers.

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Referencebooks:

1. TextbookofPolymerSciencebyFrod,W.Billmayer,

2. An IntroductiontoPolymerChemistrybyMoore.

3. PolymerChemistry-AnIntroductionbyM.P.Stevens.
4. PolymerScience –VRGowariker,NVViswanathan,JayadevSreedhar.

M.Sc. DEGREE EXAMINATION

THIRD SEMESTER

Paper-I:: ADVANCED ORGANIC SPECTROSCOPY

Code::20CHE301

Time: 3 hours **Maximum Marks: 70**

SECTION – A

Answer all the questions. Each question carries 2 marks. (10x2M=20M)

1) Explain the importance of Double irradiation.

2) Write a short note on nomenclature of spin systems.

3)Explain the α, β & γ effects in 13 C NMR with suitable examples.

4) Discuss the importance of off resonance decoupling CMR spectrum.

5) What is Cotton effect?

6)Predict the sign of cotton effect in 3-methyl cyclo haxanone when substituent is in equatorial position.

7) What information is possible from the COSY experiment?

8) Discuss about various periods involved in 2D NMR.

9) Discuss briefly the IR signals for the compound $C_6H_5 – CH_2 – O – CO – CH_3$.

10) Predict the possible number of ^1H NMR signals for the compound $CH_3 – (CO) – CH_2 – CH_3$.

SECTION – B **(10x5=50M)**

UNIT - I

11. a) Explain the effect of solvent on PMR spectrum.

(Or)

b) Differentiate between first order and non first order PMR spectrums with example

UNIT – II

12. a) Discuss the importance of BBD & SFORD techniques in 13C NMR spectroscopy.

(Or)

b) A compound of MF C_4H_{10} in its CMR Spectrum show 17.1(q) 67.4(T). Determine the structure of compound by using CMR data.

UNIT – III

13. a) Explain the following i) Axial halo ketone rule ii) Types of optical rotatory dispersion curves.

(Or)

b) Explain the applications of Octant rule.

UNIT – IV

14 a) What information about a compound can be obtained from the 2D INADEQUATE experiment?

b) Discuss the importance of NOESY technique with suitable example.

UNIT – V

15 a) Deduce the structure of the compound consistent with the following data elemental analysis: C=32.14%H 5.35% and Cl 62.5% UV: No absorption above 210 nm, IR (CCl4) 2941,2265 and 1460cm-1PMR δ 2.72(septet,J=6.7,1H),1.33 (doublet, J=6.7,6H)

(Or)

b) Deduce the structure of the compound consistent with the following data elemental analysis:

C=32.14%H 5.35% and Cl 62.5% UV: No absorption above 210 nm IR (CCl4) 2940,1265 and 690cm-1 and PMR δ3.5(2H,D),3.3(1H,m) and 1.25(3H,d)

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M.Sc. DEGREE EXAMINATION

THIRD SEMESTER

Paper-II:: ORGANIC REACTIONS & MECHANISMS

Code::20CHE302

Time: 3 hours **Maximum Marks: 70**

SECTION – A

Answer all the questions. Each question carries 2 marks. (10x2M=20M)

1) Discuss oxidations with HIO_4.

2)Define oxidation and discuss the various types of oxidations.

3) Write notes on reduction with diimide.

4) Give the definition and mechanism of clemmenson's reduction.

5)Discuss Dienone phenol rearrangement.

6) Write an account of Wolf rearrangement.

7)What are pericyclic reactions? Give the classification.

8)Write the molecular orbital energy level diagram for 1,3 – Butadiene.

9) Write notes on energy transfer.

10) Explain Barton reaction.

SECTION – B **(5x10M=50M)**

UNIT - I

11.a) Explain oxidations with i) RuO_4 ii) SeO_2

(Or)

b) Explain oxidations with i) $KMnO_4$ ii) MnO_2

UNIT – II

12. a) Discuss Birch reduction of aromatic compounds.

(Or)

b) Discuss the reductions with $LiAlH_4$.

UNIT – III

13 a) Explain the following

i) Wagner Meerwein rearrangement ii) Benzil – Benzilic acid rearrangement.

(Or)

i) Baeyer Villiger rearrangement ii) Cumene hydroperoxide rearrangement.

UNIT - IV

14. a) Apply correlation method to 4nπ electrocyclic reaction for thermal and photochemical conditions.

(Or)

b) Apply FMO method to 1,5 sigmatropic shift and write Woodward and Hoffmann rules by PMO method.

UNIT - V

15 a) Discuss Norish type – I and type – II reactions. **(Or)**

b) Explain the following i) photochemistry of olefins ii) Di – π – methane rearrangement.

M.Sc. DEGREE EXAMINATION

THIRD SEMESTER

Paper-III:: ORGANIC SYNTHESIS

CODE::20CHE303A

Time: 3 hours **Maximum Marks: 70**

SECTION – A

Answer all the questions. Each question carries 2 marks. (10x2M=20M)

1) What are acidic methylene groups?

2) Explain about carbenes.

3) Discuss in short about syn elimination.

4) Elaborate Wittig reaction with an example.

5) Describe dienophile with an example.

6) What are lewis acids? Explain with an example.

7)Enumerate the significance of Disconnection approach in organic synthesis.

8)Write a short note on synthon.

9) Discuss the role of functional group protection & deprotection in organic synthesis.

10) Explain the importance of regioselective protection.

SECTION – B **(5x10M=50M)**

UNIT - I

11.a) Explain enamine and related reactions.

(Or)

b) Discuss in detail the synthetic applications of carbenes and carbenoids with examples.

UNIT – II

12 a) Write an account of reductive dimerisation of carbonyl compounds with examples.

(Or)

b) Discuss any three methods for the stereoselective synthesis of tri and tetra substituted alkenes.

UNIT – III

13. a) What is Diels Alder reaction? Discuss the mechanism and stereochemistry.

(Or)

b) Write note on 1,3 – dipolar cycloaddition reactions.

UNIT - IV

14. a) Discuss the various methods of disconnection of alcohols.

(Or)

b) Give an account of disconnections of 1,3 – dicarbonyl compounds.

UNIT – V

15. a) Discuss about the protecting agents to protect the following functional groups

(i) AMINO group (ii) carboxylic acid. **(Or)**

b) List out the reagents and apply them for the protection and deprotection of hydroxyl and carbonyl groups.

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M.Sc. DEGREE EXAMINATION

THIRD SEMESTER

Paper-IV:: CHEMISTRY OF NATURAL PRODUCTS

CODE::20CHE304B

Time: 3 hours **Maximum Marks: 70**

SECTION – A

Answer all the questions. Each question carries 2 marks. (10x2M=20M)

1) What are alkaloids? Explain.

2) Discuss the general classification of alkaloids.

3) Discuss Isoprene rule.

4) Write the structure of Zingiberine.

5) Write physiological action of steroids.

6) Discuss the nomenclature of steroids.

7)Give a short notes on classification of flavonoids?

8)Discuss the isolation of flavonoids and isoflavonoids.

9)Discuss the classification of natural pigments.

10)Discuss the functions of carotenoids in plants.

SECTION – B **(5×10=50M)**

UNIT - I

11. a) Outline the synthesis of Reserpine.

(Or)

b) Discuss the structure elucidation of Quinine.

UNIT – II

12. a) Explain the structure elucidation of santonin.

(Or)

b) Write notes on structure elucidation of Zingeberene.

UNIT – III

13. a) Establish the structure of testosterone and write the synthesis.

(Or)

b) Establish the structure of progesterone and write any one method of synthesis.

UNIT - IV

14. a) Write structure elucidation of kaempferol.

(Or)

b) Write structure elucidation of Quercetin.

UNIT - V

15. a) Discuss the structure elucidation of α – carotene. **(Or)**

b) Discuss the structure elucidation of β - carotene

AKKINENI NAGESWARA RAO COLLEGE : GUDIVADA
DEPARTMENT OF PG CHEMISTRY
M.Sc – CHEMISTRY (ORGANIC CHEMISTRY)
IV SEMESTER

20MO7401 : MOOCS – ORGANIC CHEMISTRY - I

Course: MOOCS – ORGANIC CHEMISTRY - I		
S.No	COURSE OUTCOMES	PO`s
	The student will be able to	
1	Recollect the concepts of stereochemistry, conformational analysis, CD & ORD, nature of bonding, aromaticity, chemical kinetics and reactive intermediates.	2,7
2	Identify the role of stereochemistry, conformational analysis, CD & ORD, nature of bonding, aromaticity, chemical kinetics and reactive intermediates.	1,2,3
3	Demonstrate the knowledge of stereochemistry, conformational analysis, CD & ORD, nature of bonding, aromaticity, chemical kinetics and reactive intermediates in chosen fields..	1,6,7
4	Analyse the conceptual knowledge in stereochemistry, conformational analysis, CD & ORD, nature of bonding, aromaticity, chemical kinetics and reactive intermediates in the reactions.	1,5,6

Course Learning Objective(S): The main objective of this paper is to give a basic and updated knowledge for the students on Heterocyclic Chemistry.

UNIT-I

Stereo Chemistry : Concept of chirality, Recognition of Symmetry elements. Definition and classification of Stereoisomers, Enantiomer, Diastereomer, Homomer, Epimer, Anomer, Configuration and Conformation, Configurational nomenclature: D,L and R, S nomenclature. Molecular representation of organic molecules: Fischer, Newman and Sawhorse projections and their inter-conversions. Geometrical isomerism. Cis-trans, E, Z- and Syn and Anti nomenclature, Methods of determining configuration of Geometrical isomers using physical, spectral and chemical methods.

UNIT-II

Conformational Analysis and ORD, CD Curves:
Definition of Conformation, Conformational analysis of acyclic molecules – alkanes and substituted alkanes. Conformational analysis of monocyclic molecules – cyclohexane – chair, boat and twist boat - mono and disubstituted cyclohexanes and conformation around carbon hetero atom bonds having C–O & C–N. Confirmation and intramolecular hydrogen bonding.

Optical rotatory dispersion: Theory of optical rotatory dispersion – Cotton effect –CD curves-types of ORD and CD curves-similarities and difference between ORD and CD curves. α- Halo keto rule, Octant rule – application in structural studies.

UNIT-III

Nature of bonding and Aromaticity: Nature of bonding: Localised and Delocalized, Delocalised chemical bonding, conjugation, cross conjugation, hyper conjugation, Tautomerism.
Aromaticity: Concept of Aromaticity, Aromaticity of five membered, six membered rings - Non benzonoid aromatic compounds:- cyclopropenylcation, Cyclobutadienyldication, cyclopentadienyl anion-tropyllium cation and cyclooctatetraenyl dianion. Homoaromaticity, Anti aromaticity.
Aromatic Nucleophilic substitution: The SNAr (Addition – Elimination), SN1(Ar) mechanisms and benzyne mechanism (Elimination – Addition). Reactivity- effect of substrate structure, leaving group and attacking nucleophile. The Von-Richter, Sommelet – Hauser and Smiles rearrangements.

UNIT-IV

Chemical kinetics- Methods of deriving rate laws - complex reactions - Rate expressions for opposing, parallel and consecutive reactions involving unimolecular steps. Theories of reaction rates -collision theory - Steric factor - Activated complex theory - Thermodynamic aspects – Unimolecular reactions - Lindemann's theory - Lindemann-Hinshelwood theory. Reactions in solutions - Influence of solvent - Primary and secondary salt effects.

UNIT- V

Reactive intermediates, Reactive Species, Linear free energy relations: Generation, Structure, Stability, Detection and Reactivity of Carbocations, Carbanions, Free radicals, Carbenes, Nitrenes and Arynes.
Reactive Species: Generation and reactivity of Electrophiles, Nucleophiles, Dienophiles, Ylids.
Elementary account of linear free energy relationships - Hammet - Taft equation - Chain reactions – Rate laws of H_2-Br_2, photochemical reaction of H_2 - Cl_2, Decomposition of acetaldehyde and ethane - Rice- Herzfeld mechanism.

Referencebooks:

1. Some Modem Methods of Organic Synthesis W.Caruthers, Cambridge University Press, Cambridge.
2. Organic Synthesis viz Boranes, HerbetC. BrownGray, W.KramerAlan B.Levyand M.MarkMidl and John Willy & Sons, NewYork.
3. Heterochemistry, T.L.Gilchrist, Longmanscienceandtech.
4. Anintroduction to the Chemistry of Heterocyclic Compounds, R.M.Acheson, Interscience Publishers, NewYork
5. Principle of Organic Chemistry, RocNorman, J.M.Coxon, NelsonThroms
6. Advanced Organic Chemistry, F.ACarey and R.J.Sundberg.Plenum.
7. Heterocyclic chemistry by JaiJackLie, Springer publications.
8. Chemical kinetics - K.J.Laidler, McGraw Hill Pub.

20CHE402A : HETERO CYCLIC CHEMISTRY

Course: HETERO CYCLIC CHEMISTRY		
S.No	COURSE OUTCOMES	PO`S
	The student will be able to	
1	Memorize the synthetic routes and reactions related to three, four, five, six membered and fused heterocyclic compounds.	2,7
2	Understand the concepts of synthesis and reactions of three, four, five, six membered and fused heterocyclic compounds.	1,7
3	Apply the conceptual knowledge gained in the synthesis and reactions of organic synthesis three, four, five, six membered and fused heterocyclic compounds as and when required.	1,6,4
4	Analyse and categorize the various reactions involved in the synthesis of three, four, five, six membered and fused heterocyclic compounds	1,5,7

Course Learning Objective(S): The main objective of this paper is to give a basic and updated knowledge for the students on Heterocyclic Chemistry.

UNIT-I

Definition, Classification and Nomenclature (Hantzsch Widman System) of hetero cycles.
Three membered Heterocyclic Compounds: Synthesis, reactivity, and importance of the following ring systems: Aziridines, Oxiranes, Thiiranes, azirine.

UNIT-II

Four membered Heterocyclic Compounds: Synthesis, reactivity, and importance of the following ring systems : Azitidines, oxetanes, Thietanes.

UNIT-III

Five membered Heterocyclic Compounds with two hetero atoms: Synthesis, reactivity, aromatic character, and importance of the following heterocycles: Pyrazole, Imidazole, Oxazole, Isoxazole, Thiazole.
Fused systems: Synthesis and reactivity of Indoles and Benzimidazoles.

UNIT-IV

Six-membered Heterocyclic Compounds with two hetero atoms: Synthesis, reactivity, aromatic character and importance of the following heterocycles: Pyridazines, Pyrazine, Oxazine, Thiazine.
Fused systems: Acridines and Benzodiazines.

UNIT- V

Larger ring and other Heterocycles: Synthesis and reactivity of Azepines, Oxepines and Thiepines..

Course Learning Outcome(S): After studying this paper, students will acquire the knowledge of Heterocyclic Chemistry.

Reference books:

1. Some Modem Methods of Organic Synthesis W.Caruthers, Cambridge University Press, Cambridge.
2. Organic Synthesis viz Boranes, HerbetC. BrownGray, W.KramerAlan B.Levy and M.MarkMidland John Willy&Sons, NewYork.
3. Heterochemistry, T.L.Gilchrist, Longman science and tech.
4. Anintroduction to the Chemistry of Heterocyclic Compounds, R.M.Acheson, Interscience Publishers, NewYork
5. Principle of Organic Chemistry, RocNorman, J.M.Coxon, Nelson Throms
6. Advanced Organic Chemistry, F.ACarey and R.J.Sundberg. Plenum.
7. Heterocyclic chemistry by Jai JackLie, Springer publications.

20CHE402 B : GREEN CHEMISTRY

Course: GREEN CHEMISTRY		
S.No	COURSE OUTCOMES	PO`S
	The student will be able to	
1	Memorize the principles of green chemistry and concepts related to green organic synthesis.	2,7
2	Understand the role and significance of green organic synthesis.	1,5,7
3	Exercise the basic and advanced knowledge gained on green organic synthesis in chosen job role.	1,4,6
4	Analyse how far green methods are environmentally benign over conventional methods of synthesis.	1,3

Unit-I

Principles of Green Chemistry: Priniciples of Green Chemistry-Prevention of waste / by-products, atom economy, Hazardous products-Designing of safer chemicals-energy requirements Selection of appropriate solvents and starting materials-Use of protecting groups and catalysis-Designing of biodegradable products. green organic synthesis of paracetamol, catechol, adipic acid, urethane and ibuprofen.

Unit-II

Microwave assisted reactions: Theory of Microwave, advantages, disadvantages, applications- water as solvent: Hoffmann elimination, hydrolysis, oxidation of Toluene, oxidation of alcohols, hydrolysis of methyl benzoate to benzoic acid.

Organic solvents: Esterification reactions, Fries rearrangement, Ortho ester Claisen rearrangement, DielsAlder reactions, synthesis of chalcones, decarboxylation.

Solid state reactions (solvent free): De acetylation, deprotection, saponification of esters, synthesis of anhydrides from dicarboxylic acid, synthesis of nitriles from aldehydes.

Unit-III

Ultrasound assisted green synthesis: Introduction, instrumentation, types of sono chemical reactions – Homogeneous reactions – Curtius rearrangement of Benzoyl azide to phenyl isocyanate. Heterogeneous Liquid-Liquid reactions - Esterification, saponification, Hydrolysis, substitutions, additions. Heterogeneous Solid – Liquid Reactions–oxidation, reduction, hydroboration, coupling, Bouveault reaction, Strecker reaction.

Unit-IV

Phase Transfer Catalysis: Definition, Mechanism, Types, advantages and applications of PTC – C-alkylation, N-alkylation, Darzen's reaction, Wittig reaction, Benzoyl cyanides from benzoyl chloride, alcohols from alkyl halides, Crown ethers **–** Introduction, synthetic applications: esterfication, saponification, Anhydride formation, $KMnO_4$ oxidation, aromatic substitution, elimination.

Unit-V

Ionic liquids: Definition-Types of Ionic Liquids- properties- Application in organic synthesis-alkylation, allylation, oxidation, hydrogenation, hydroformylation, alkoxycarbonylation, carbon-carbon bond forming reactions-suzuki coupling, Heck reaction, stille coupling.

Textbooks/Referencebooks:

1. New Trends in Green Chemistry by V.K.Ahluwalia, M.Kidwai.

2. Green Chemistry: Environment Friendly Alternatives by Rashmi Sanghi, M.M.Srivastava

3. Green Solvents for Organic Synthesis by V.K.Ahluwalia, RajenderS.Varma.

20CHE403B : CHROMATOGRAPHIC TECHNIQUES FOR MODERN INDUSTRIAL APPLICATIONS

COURSE :**CHROMATOGRAPHIC TECHNIQUES FOR MODERN INDUSTRIAL APPLICATIONS**		
S.No	COURSE OUTCOMES:	PO`S
	The student will be able to	
1	Comprehend the concepts of purification methods and chromatographic methods.	2,7
2	Exercise the knowledge gained in purification and chromatographic techniques in their chosen job role.	1,4,6
3	Exercise that how far the purification and chromatographic techniques are useful in assessing the purity of the compound.	1,3,7
4	Evaluate that how far a compound is purified / separated using purification and chromatographic techniques.	1,5,7

UNIT-I

Classical Methods of purification Recrystallization: Basic principle, choice of solvent, seeding, filtration, centrifugation and drying. Concepts of fractional crystallization.

Distillation: Basic principle. Distillation types- continuous distillation, batch distillation, fractional distillation, vacuum distillation and steam distillation.

UNIT-II

Thin Layer chromatography:

Basic Principle, Common stationary phases, Methods of preparing TLC plates, Selection of mobile phase, Development of TLC plates, Rf value. Application of TLC in monitoring organic reactions. identification and quantitative analysis.

UNIT-III

Paper chromatography:

Basic Principle, Ascending and descending types. Selection of mobile phase, Development of chromatograms, One and two dimensional paper chromatography, Applications of paper chromatography.

UNIT-IV

Gas chromatography:

Basic Principle, Different types of GC techniques. Selection of columns and carrier gases. Instrumentation. detectors; Rf values. Applications in the separation, identification and quantitative analysis of organic compounds.

UNIT-V

High Performance liquid chromatography(HPLC):

Basic Principle, Normal and reversed Phases. Selection of column and mobile phase. Instrumentation. Detectors; RD values. Applications in the separation, identification and quantitative estimation of organic compounds.

SUGGESTED BOOKS:

1. Principles of Instrumental Analysis by D. A. Skoog, F. J. Holler and T. A. Nieman, Harcourt College Pub.
2. Separation Techniques by M. N. Sastri, Himalaya Publishing House (HPH), Mumbai.
3. Bio Physical Chemistry by A. Upadhyay, K. Upadhyay and N. Nath,(HPH) , Mumbai.
4. A Hand Book of Instrumental Techniques for Analytical Chemistry- Ed-F. A. Settle, Prearson Edn, Delhi.27
5. Introduction to Organic Laboratory Techniques-D. L. Pavia, G. M. Lampman,G. S. Kriz and R. G. Engel, Saunders College Pub (NY).
6. Instrumental methods of Chemical Analysis by B. K. Sharma, Goel Publish House, Meerut.
7. Instrumental methods of Chemical Analysis by H. Kaur, Pragati Prakasan, Meerut.
8. Protein Purification-Principles and practice, III Edn- R. K. Scopes, Narosa Publishing House , Delhi.

20CHE403A : NANO CHEMISTRY

Course: NANO CHEMISTRY		
S.No	COURSE OUTCOMES	PO`S
	The student will be able to	
1	Will be able to memorize the basic concepts of nanochemistry and nano materials.	2,7
2	Understand the basic and advanced concepts of nanochemistry and nano materials	1,5,7
3	Apply the knowledge gained in the field of nanochemistry as and when required.	1,3,6
4	Analyse the role of nanochemistry in various interdisciplinary sciences.	1,5

Course Learning Objective(S): The main objective of this paper is to give a basic and updated knowledge for the students on Nano Chemistry.

Unit-I

Introduction to Nano chemistry: Definition of terms-nanoscale, nanomaterials, nanoscience, nanotechnology-scale of materials natural and manmade-nanoscience practiced during ancient and modern periods-contributors to the field of Nanochemistry.

Unit-II

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

Unit-III

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

Unit-IV

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

Unit-V

NanochemistryinNature: The science behind the nanotechnology in lotuseffect-self-cleaning property of lotus-gecko foot climbing ability of geckos-water strider-anti wetting property of water striders-spider silk mechanical properties of the spidersilk.

Textbooks/ Referencebooks:

1. Nano: The Essentials: Understanding Nanoscience and Nanotechnology, T.Pradeep, McGraw-Hill Professional Publishing,2008.
2. Introduction to Nanoscience, J.Dutta, H.F.Tibbals and G.L.Hornyak, CRCpress, BocaRaton, 2008.

20CH404 : ORGANO METALLIC REAGENTS

Course: ORGANO METALLIC REAGENTS		
S.No	COURSE OUTCOMES	PO`S
	The student will be able to	
1	Memorize the synthetic roots and applications of organo metallic reagents.	2,7
2	Appreciate the methods of synthesis and reactivity of various organo metallic reagents	1,3,7
3	Investigate the conceptual knowledge in various organo metallic reagents in organic synthesis	1,6,3
4	Assess the role of specific organic reaction reagents in the synthesis	1,6,5

Course Learning Objective(S): The main objective of this paper is to give a basic and updated knowledge for the students on Organometallic Reagents.

UNIT-I

Organo Magnesium and Lithium compounds: Preparation of Grignard reagents with alkyl, allyl, Aryl halides. Reactions with carbonyl compounds, esters, and nitriles, epoxides, acids, acid chlorides, carbondioxide. Preparation of alkyllithium reagents, Lithium Di isopropyl amide (LDA).Synthetic Application of Organo lithium Compounds.

Unit-II

Organo Copper and Zinc compounds: Organo copper reagents - preparation, reactions, organo cuprates, lithium organo cuprates (Gilmanreagents). Preparation of Organo Zinc Compounds and their Synthetic Applications, Reformatsky reaction,Simmon-Smith reaction.

Unit-III

Organo Palladium compounds: Preparation of palladium reagents, π-allyl palladium complexes – formations, reactions – prenylation, formation of conjugated dienes, synthesis of macro cyclic nitrogen hetero cyclic. Heck reaction, Stille coupling reaction, Sonogashira coupling reaction, suzuki coupling reaction.

Unit-IV

Organoboranes: Preparation of Organobornaes viz hydroboration with BH_3-THF, dicylohexyl boranes, disiamylborane, thexylborane, 9-BBN and catechol boranes .protonolysis, oxidation, isomerization and cyclization. Free radical reactions of organoboranes, reactions with α-bromoketones, α-bromoesters, carbonylation, the cyanoborate process and the reaction of alkenyl boranes and trialkyltrialkynyl borates.

Unit-V

Organosilanes: Synthetic applications of organo silicon compounds, protection of functional groups, trimethylsilly ethers, sillylenolethers, trimethylsilyliodide, trimethylsilyl triflate, Peterson

olefination. Synthetic applications of α-silylcarbanion and β-silylcarbonyl compounds, alkenylsilanes, Allylsilanes, the β-effect - control of rearrangement of carbonium ions by silicon.

Referencebooks:

1. Organometallic in Synthesis AManualby MSchlosser, L.Hegedus, B.Lipshutzetal, JohnWily&sons.

2. Modern methods of organic synthesis by W.Carruthers (Cambridge).

3. Organic synthesis by H.O.House.

4. Organo metallics: Aconcise introduction, ChristophElschenbroich, 3rdedition,Willey-VCH.

5. Advanced Organic Chemistry, F.ACarey and R.J.Sundberg.Plenum.

6. Transition metals in the synthesis of complex organic molecules, Hegedus, L.S,secondedition, University Science, Book ,CA,1999.

7. Organo metallic Chemistry and Catalysis, Astruc, D,Springer Verlag, 2007.

8. Organo transition metal chemistry: Applications to organic synthesis, Davies, S.G,Pergamon Press, NewYork, 1986.

20CHE405(P) : ORGANIC ESTIMATIONS

Course: **ORGANIC ESTIMATIONS** (20CHE405(P))		
S.No	COURSE OUTCOMES	PO`s
	The student will be able to	
1	Memorize the basic principles involved in organic quantitative analysis.	1,3,5
2	Understand the importance of organic quantitative analysis and their use on research and industry.	
3	Exercise the procedure of quantitative analysis in chosen job roles.	
4	Evaluate how far these methods are accurate in quantitative determinations.	

Expt. 1: Estimation of phenol (Bromination method)
Expt. 2: Estimation of aniline (Bromination method)
Expt.3: Estimation of sugars –Glucose and Sucrose by using Fehlings solution
Expt. 4: Determination of iodine value of oil or fat
Expt. 5: Determination of saponification value of oil or fat

Part-III: Record Submission **10M**

20CHE406(P) : PROJECT WORK

Project: PROJECT WORK (code 20CHE406(p))		
S.No.	COURSE OUTCOMES	PO`S
	The student will be able to	
1	Acquire required skills to implement theoretical knowledge gained.	1,3,4,7
2	Assimilate the required knowledge for future research through practical knowledge gained in the project work.	1,2,7
3	Gain the required ability to start up own industry.	1,4,5,6
4	Comprehend the ability to draft and communicate the practical work.	1,2,7

The project will be assigned in the final semester. The project will be performed at the established industry (or) in the department under the supervision of the faculty or research institutes. It may involve experimental and/or theoretical work as well as critical review of the literature. Each of the students has to carry out original research in a topic in accordance with the work chosen under the guidance and supervision of a teacher in the concerned Department of the college.

- Isolation and characterization of Natural Products.
- Synthesis and characterization of Hetero Cyclic Compounds.
- Spectral Characterization of Organic compounds.
- Industrial visit and submit research findings of their Industrial visit / IIT's, CSIR Lab's, NIT's Central Universities etc.,