ADITYA DEGREE & PG COLLEGE (A) KAKINADA
DEPARTMENT OF CHEMISTRY
M.SC., ORGANIC CHEMISTRY & M.SC., ANALYTICAL CHEMISTRY

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EXTERNAL EVALUATION-SCHEME OF QUESTION PAPER

SEMESTER-

Time: 3 hours **Max.Marks: 75 M**

PAPER TITLE:

PART -A 4x15=60M

Answer all the questions. Each question carries 15 Marks.

1.a. **Question from Unit – I**

(OR)

b. **Question from Unit -I**

2.a. **Question from Unit-II**

(OR)

b. **Question from Unit-II**

3.a. **Question from Unit – III**

(or)

b. **Question from Unit – III**

4. a. **Question from Unit – IV**

(OR)

b. **Question from Unit – IV**

PART-B 5x 3 = 15 M

Answer any FIVE questions. Each question carries 3 marks.

5. **Question from Unit-I**

6. **Question from Unit – I**

7. **Question from Unit – II**

8. **Question from Unit – II**

9. **Question from Unit – III**

10. **Question from Unit – III**

11. **Question from Unit – IV**

12. **Question from Unit – IV**

Course Structure of M.Sc. Organic Chemistry

S. No.	Semester	Title of the paper	Theory/ Practical /Viva	Internal marks	External marks	Total marks	Credits
1.	Semester-I	General Chemistry-I	T	25	75	100	4
2.		Inorganic Chemistry-I	T	25	75	100	4
3.		Organic Chemistry-I	T	25	75	100	4
4.		Physical Chemistry-I	T	25	75	100	4
5.		Inorganic Chemistry Practical-I	P	25	75	100	3
6.		Organic Chemistry Practical-I	P	25	75	100	3
7.		Physical Chemistry Practical-I	P	25	75	100	3
8.	Semester-II	General Chemistry-II	T	25	75	100	4
9.		Inorganic Chemistry-II	T	25	75	100	4
10.		Organic Chemistry-II	T	25	75	100	4
11.		Physical Chemistry-II	T	25	75	100	4
12.		Inorganic Chemistry Practical-II	P	25	75	100	3
13.		Organic Chemistry Practical-II	P	25	75	100	3
14.		Physical Chemistry Practical-II	P	25	75	100	3
15.	Semester-III	Organic Reaction Mechanisms-I and Pericyclic reactions-I	T	25	75	100	4
16.		Organic Spectroscopy-I	T	25	75	100	4
17.		Organic Synthesis-I	T	25	75	100	4
18.		Chemistry of Natural Products	T	25	75	100	4
19.		Multistep synthesis of Organic Compounds	P	25	75	100	4
20.		Estimations and Chromatography	P	25	75	100	4
21.	Semester-IV	Organic Reaction Mechanisms-II and Organic Photochemistry	T	25	75	100	4
22.		Organic Spectroscopy-II	T	25	75	100	4
23.		Organic Synthesis-II	T	25	75	100	4
24.		Bio-Organic Chemistry	T	25	75	100	4
25.		Chromatographic separation, Isolation and Identification of Natural Products	P	25	75	100	4
26.		Spectral Identification of Organic Compounds(UV, IR, ^{1}H-NMR, ^{13}C-NMR & MASS)	P	25	75	100	4
27.		Comprehensive viva-voce	V	----	50	50	2
		Total Credits					100

Note: I & II Semesters syllabus and course structure are common for M. Sc. Organic Chemistry/Analytical Chemistry ycourses.

Course Structure of M.Sc. Analytical Chemistry

S. No.	Semester	Title of the paper	Theory/ Practical /Viva	Internal marks	External marks	Total marks	Credits
1.	Semester- I	General Chemistry-I	T	25	75	100	4
2.		Inorganic Chemistry-I	T	25	75	100	4
3.		Organic Chemistry-I	T	25	75	100	4
4.		Physical Chemistry-I	T	25	75	100	4
5.		Inorganic Chemistry Practical-I	P	25	75	100	3
6.		Organic Chemistry Practical-I	P	25	75	100	3
7.		Physical Chemistry Practical-I	P	25	75	100	3
8.	Semester- II	General Chemistry-II	T	25	75	100	4
9.		Inorganic Chemistry-II	T	25	75	100	4
10.		Organic Chemistry-II	T	25	75	100	4
11.		Physical Chemistry-II	T	25	75	100	4
12.		Inorganic Chemistry Practical-II	P	25	75	100	3
13.		Organic Chemistry Practical-II	P	25	75	100	3
14.		Physical Chemistry Practical-II	P	25	75	100	3
15.	Semester- III	Separation Methods-I	T	25	75	100	4
16.		Quality Control & Traditional Methods of analysis-I	T	25	75	100	4
17.		Applied Analysis-I	T	25	75	100	4
18.		Instrumental Methods of Analysis-I	T	25	75	100	4
19.		Classical Methods of Analysis-I Lab -I	P	25	75	100	4
20.		Instrumental Methods of Analysis Lab-I	P	25	75	100	4
21.	Semester- IV	Separation Methods-II	T	25	75	100	4
22.		Quality Control & Traditional Methods of analysis-II	T	25	75	100	4
23.		Applied Analysis-II	T	25	75	100	4
24.		Instrumental Methods of Analysis-II	T	25	75	100	4
25.		Classical Methods of Analysis-I Lab -II	P	25	75	100	4
26.		Instrumental Methods of Analysis Lab-II	P	25	75	100	4
27.		Comprehensive viva-voce	V	----	50	50	2
		Total Credits					100

Note: I & II Semesters syllabus and course structure are common for M. Sc. Organic Chemistry/Analytical Chemistry courses.

ADITYA DEGREE & PG COLLEGE (A) KAKINADA
DEPARTMENT OF CHEMISTRY
FIRST SEMESTER- SYLLABUS
(With effect from 2024-25 admitted batch)

Paper- I: GENERAL CHEMISTRY-I

UNIT-1

Basic Quantum Chemistry-I- Wave equation-interpretation of wave function-properties of wave function-normalization and orthogonalisation, Operators- linear and non-linear- commutators of operators. Postulates of quantum mechanics; setting up of operators to observables; Hermitian operator- Eigen values and Eigen functions of Hermitian operator; Expansion theorems. Eigen functions of commuting operators-significance. Simultaneous measurement of properties and the uncertainty principle.

UNIT-II

Basic Quantum Chemistry-II- Wave mechanics of simple systems with constant potential energy, particle in one- dimensional box- factors influencing color transition- dipole integral, Symmetry arguments in deriving the selection rules, the concept of tunneling- particle in three -dimensional box. Calculations using wave functions of the particle in a box- Orthogonality, measurability of energy, position and momentum, average values and probabilities. Rigid rotor, Wave mechanics of systems with variable potential energy-simple harmonic oscillator- solution of wave equation- selection rules.

UNIT-III

Fundamentals of Molecular Spectroscopy-I: Microwave and IR- Spectroscopy- Rotational spectra of diatomic molecules- Rigid rotor-Selection rules- Calculations of bond length- Isotopic effect, Second order stark effect and its applications. Infrared spectra of diatomic molecules- harmonic and anharmonic oscillators-Selection rules- Overtones- Combination bands- Calculation of force constant, anharmonicity constant and zero point energy. Fermi resonance, simultaneous vibrational-rotational spectra of diatomic molecules.

UNIT- IV

Fundamentals of Molecular Spectroscopy-II: Raman and Electronic Spectra- Classical and quantum mechanical explanations- Rotational Raman and Vibrational Raman spectra. Electronic spectra of diatomic molecules- Vibrational Coarse structure- intensities of spectral lines- Franck-Condon principle- applications, Rotational Fine structure- band head and band shading. Charge transfer spectra

References/ Text books

1. Fundamentals of Molecular spectroscopy: by C.N. Banwell
2. Molecular spectroscopy: by B.K.Sharma
3. Molecular spectroscopy: by Aruldas
4. Introductory quantum mechanics: by A.K. Chandra
5. Quantum chemistry: by R.K. Prasad

ADITYA DEGREE & PG COLLEGE (A) KAKINADA
DEPARTMENT OF CHEMISTRY
FIRST SEMESTER- SYLLABUS
(With effect from 2024-25 admitted batch)

Paper- II: INORGANIC CHEMISTRY-I

UNIT-1

Structure & Bonding: Valence Bond Theory and Molecular orbital theories in explaining the structures of simple molecules like O_2, N_2, CO, NO - role of p and d orbitals in π-bonding. Application of MO theory to Tetrahedral $[CoCl_4]^{2-}$, Square planar ($[PtCl_4]^{2-}$) and Octahedral complexes ($[CoF_6]^{3-}$, $[Co(NH_3)_6]^{3+}$). Classification of ligands based on π-bonding using MO theory. Walsh diagram for H_2O molecule.

ADDITIONAL INPUT: WALSH diagram of linaear molecule BeH_2

(Questions should not be given in exams from additional inputs)

UNIT-II

Inorganic cage and ring compounds – preparation, structure and reactions of boranes, carboranes, metallocarboranes.Electron counting in boranes – Wades rules (Polyhedral skeletal electron pair theory). Heterocyclic inorganic ring systems: Boron–Nitrogen ($H_3B_3N_3H_3$), Phosphorus–Nitrogen ($N_3P_3Cl_6$) and Sulphur-Nitrogen(S_4N_4, $(SN)_x$) cyclic compounds.

Cage Compounds: Phosphorous oxides and Phosphorous sulphides.Isopoly and heteropoly anions.

ADDITIONAL INPUT: Phosphorous nitrogen system $(PNCl_2)_4$

(Questions should not be given in exams from additional inputs)

UNIT-III

Coordination compounds: Crystal field theory - crystal field splitting patterns in octahedral, tetrahedral, tetragonal, square planar, square pyramidal and trigonal bipyramidal geometries. Calculation of crystal field stabilization energies. Factors affecting crystal field splitting energies – Spectrochemical series – Jahn – Teller effect, nephelauxetic effect – ligand field theory.

Term symbols – Russell – Sanders coupling – derivation of term symbols for various configurations. Spectroscopic ground states.

UNIT- IV

Electronic spectra of transition metal complexes: Types of electronic transitions – d-d transitions - Selection rules, break down of selection rules – Orgel and Tanabe-Sugano diagrams for d^1 –d^9 octahedral and tetrahedral transition metal complexes of 3d series – Calculation of Dq, B and β parameters. Charge transfer spectra.

Magnetic properties of transition and inner transition metal complexes – spin and orbital moments – quenching of orbital momentum by crystal fields in complexes.

Reference books & Text books:

1. Advanced Inorganic Chemistry by F.A. Cotton and G. Wilkinson, IV Edition, John Wiley and Sons,New York.
2. Inorganic Chemistry by J.E. Huheey, III Edition, Harper International Edition.
3. Theoretical Inorganic Chemistry, II Edition by M.C. Day and J. Selbin,Affiliated East-West press pvt. Ltd., New Delhi.
4. Inorganic Chemistry by Shriver and Atkins, Oxford University Press
5. Inorganic Chemistry 5th Edition by Gary L. Miessler et al, Pearson Publications.

ADITYA DEGREE & PG COLLEGE (A) KAKINADA
DEPARTMENT OF CHEMISTRY
FIRST SEMESTER- SYLLABUS
(With effect from 2024-25 admitted batch)

Paper –III: ORGANIC CHEMISTRY -I

UNIT – I

Nature of bonding in organic molecules and Aromaticity 15 Hrs

(A) *Electronic Effects and Reactive intermediates:*-Definition and appliations of Inductive effect, Mesomeric effect (Resonance), Hyperconjugation, , Tautomerism, Generation, structure, stability and reactivity of carbocations, carbanions, free radicals, carbenes,nitrenes and arynes

(B) *Criteria of Aromaticity:*- Huckle`s rule and MO Theory, aromaticity in benzenoid non-benzenoid compounds, Aromaticity in Charged and Fused-Ring Systems, Hetero-aromatic Systems, Annulenes: Cyclobutadiene, Benzene,1,3,5,7- Cyclooctatetraene, [10] Annulenes- [12], [14], [16] and [18] annulenes, azulenes, fulvenes, fullerenes, ferrocene, anti- aromaticity and homo-aromaticity.

UNIT – II

Stereo Chemistry & Molecular representation of organic molecules 20 Hrs

(A) Molecular Symmetry and Chirality:- Molecular representations, Symmetry elements, Definition and classification of Stereoisomers, Enantiomer, Diastereomer, Homomer, Epimer, Anomer, Configuration and Conformation, Configurational nomenclature: D,L and R, S nomenclature, Molecules with a single chiral center: Molecules with two or more chiral centers.

(B) Geometrical Isomerism and Conformations of Cyclic Systems:- Cis-trans, E, Z- and Syn & anti nomenclature, Methods of determining configuration of Geometrical isomers using physical, spectral and chemical methods, Stability, Cis-trans inter conversion. Conformations of cyclobutane, cyclopentane, cyclohexane, mono and disubstituted cyclohaxanes.

(C) Prochirality and Prostereoisomerism:- Homotopic ligands and faces; enantiotopic ligands and faces; diastereotopic ligands and faces; nomenclature of enantiotopic ligands and faces (Pro-R, Pro-S, Re, Si carbonyl compounds and Alkenes)

(D) Stereoisomerism in molecules without chiral Center -Axial chirality Allenes, Alkylidene cycloalkanes, spiranes, nomenclature. Atropisomerism: Biphenyl derivatives, nomenclature. Planar chirality: Ansa compounds, paracyclophanes, trans-cyclooctene and Helicity.

UNIT – III

Heterocyclic compounds 15 Hrs

Importance of heterocyclic compounds as drugs. Nomenclature of heterocyclic systems based on ring size, number and nature of hetero atoms. Chemistry of heterocyclic compounds, synthesis and reactivity of the following systems: Quinoline, Isoquinoline, Indole, Pyrazole, Imidazole, Oxazole, Isoxazole, Pyridazine, pyrimidine and Pyrazine.

UNIT - IV

Chemistry of some typical natural products (Alkaloids and Terpenoids) 10 HrsA

study of the following compounds involving their isolation, structure elucidation, synthesis and biogenesis of

Alkaloids; Atropine, Nicotine, and Quinine.

Terpenoids: α- Terpeneol, α-Pinene and Camphor.

Books Suggested:

1. Advanced Organic Chemistry-Reactions, Mechanism and structure, Jerry March, 6th Ed. (John Wiley & Sons).
2. Organic Chemistry, Paula Yurkanis Bruice, 4th Ed. (Printice Hall)
3. Organic chemistry-Clayden J. (Oxford)
4. Organic Chemsitry, Wade, L.G. Jr. 5th Ed. (Pearson)
5. Advanced Organic Chemistry: Reactions and mechanisms, Miller Bernard & Other, 2nd Ed. (Pearson)
6. Mechanism and Theory in Organic Chemistry, Thomas H. Lowry, Kathleen S. Richardson, Harper & Row,(Publishers, Inc.).
7. A Guide Book to Mechanism in Organic Chemistry, Peter Sykes, 6th Ed., (Longman).
8. Reaction Mechanism in Organic Chemistry, P.S. Kalsi, 2nd Ed. (New Age International).
9. Organic Chemistry, R. T. Morrison and R. N. Boyd (Prentice-Hall)
10. Stereochemistry to Organic Compounds, E.L. Eliel (John Wiley).
11. Stereochemistry, P.S. Kalsi, 5th Ed. (New Age International).
12. Organic Chemistry Structure and Reactivity, Ege Seyhan, 3rd Ed. (AITBS)
13. Heterocyclic Chemistry, J.A.Joule, K. Kills and G. F. Smith, Chapman and Hall
14. Heterocyclic Chemistry, T.L.Gilchrist, Longman Scientific Technical
15. Heterocyclic Chemistry, Raj.K. Bansal.
16. An Introduction to the Heterocyclic Compounds, R. M. Acheson, John Wiley.

REFERENCE BOOKS:

1. Chemistry of Natural Products, K.W.Bentley
2. Stereochemistry of carbon compounds by E.Eliel, John Wiley & Sons, Inc.
3. Stereochemistry to Organic Compounds, D. Nasipuri, 2nd Ed. (New Age International).
4. Chemistry of Natural products by R.S. Kalsi Kalyani Publishers. .

ADITYA DEGREE & PG COLLEGE (A) KAKINADA
DEPARTMENT OF CHEMISTRY
FIRST SEMESTER- SYLLABUS
(With effect from 2024-25 admitted batch)

Paper – IV: PHYSICAL CHEMISTRY-I

UNIT-I:

Thermodynamics-I: Concepts of partial molar properties – partial molar volume and its significance; Determination of partial molar volume: Graphical method, intercept method and apparent molar volume method. Partial molar free energy, chemical potential, Variation of chemical potential with T and P. Gibbs-Duhem equation-derivation and significance. Phase equilibrium- Derivation of phase rule from the concept of chemical potential. *Ideal solutions* - Thermodynamic properties of ideal solutions mixing quantities; Vapour pressure-Raoult's law; Thermodynamic properties of ideally dilute solutions. Vapour pressure- Henry's law.
Non-ideal systems -Concept of fugacity, fugacity coefficient. Determination of fugacity; Non ideal solutions. Activities and activity coefficients; Standard-state conventions for non ideal solutions; Determination of activity coefficients from vapour pressure measurements. Activity coefficients of non-volatile solutes using Gibbs-Duhem equation. Chemical equilibrium- effect of temperature on equilibrium constant- Van'tHoff equation

UNIT-II:

Micelles and Macro molecules: Surface active agents, classification of surface active agents, micellization, hydrophobic interaction, critical micellar concentration (CMC), factors affecting the CMC of surfactants, counter ion binding to micelles, thermodynamics of micellization- phase separation and mass action models, Solubilization, micro emulsion, reverse micelles.
Polymer- definition, types of polymers, electrically conducting, fire resistant, liquid crystal polymers, kinetics of free radical polymerization. Molecular mass- Number and mass average molecular weight, molecular weight determination-End group analysis, Osmometry, viscometry, ultracentrifugation and light scattering methods.

UNIT-III:

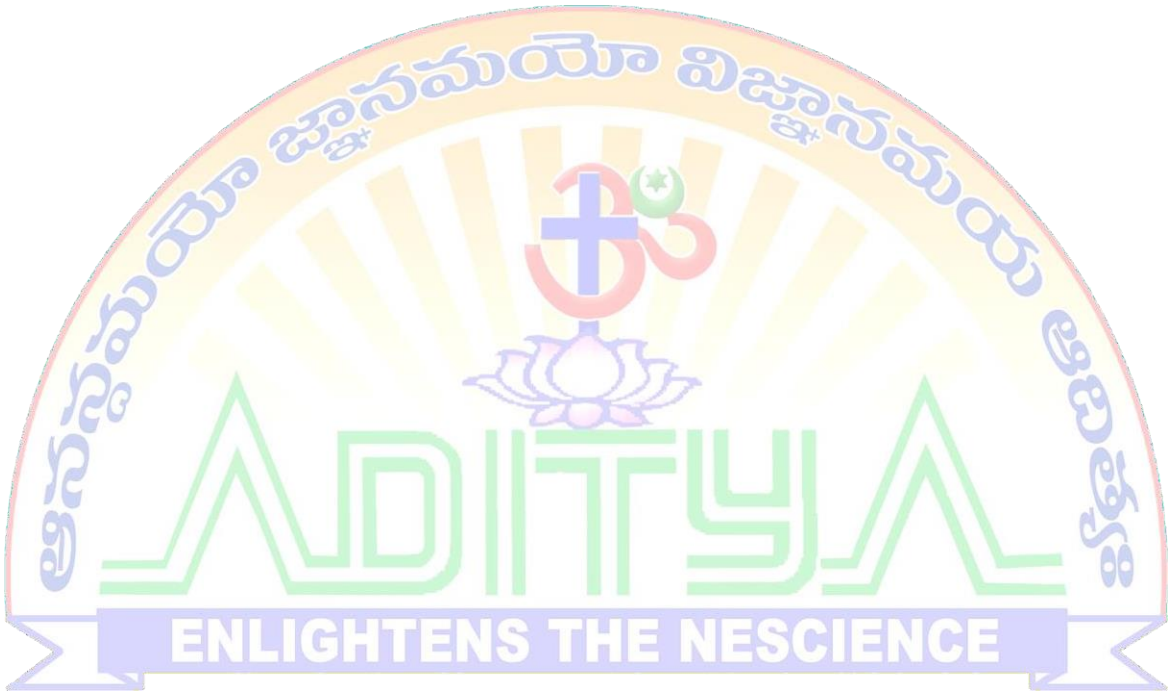
Chemical Kinetics: Theories of reaction rates- Collision theory- Limitations, Transition state theory. Effect of ionic strength - Debye Huckel theory-Primary and secondary salt effects; Effect of dielectric constant, effect of substituent, Hammett equation-limitations, Taft equation; Prediction of rate constants- Consecutive reactions, parallel reactions, opposing reactions (Uni molecular steps only, no derivation). Specific and general acid-base catalysis; Skrabal diagram; Fast reactions- different methods of studying fast reactions- flow methods, relaxation methods- temperature jump and pressure jump methods.

UNIT-IV:

Photochemistry: Electronic transitions in molecules, Franck-Condon principle. Electronically excited molecules- singletand triplet states, spin-orbit interaction. Quantum yield and its determination; Actinometry - ferrioxalate and uranyl oxalate actinometers-problems. Derivation of fluorescence and phosphorescence quantum yields. Quenching effect- Stern Volmer equation. Photochemical equilibrium and delayed fluorescence - E type and P type. Photochemical primary processes, types of photochemical reactions-photodissocoation, addition and isomerisation reactions with examples.

Books:

1. Physical Chemistry by Peter Atkins and Julio de Paula, Oxford University Press.
2. Physical Chemistry by G.W. Castellon, Narosha Publishing House
3. Physical Chemistry by W.J.Moore, Prentice Hall
4. Thermodynamics for Chemists, Samuel Glasstone
5. Chemical Kinetics by K.J.Laidler, McGraw Hill Pub.
6. Photochemistry, R.P. Kundall and A. Gilbert, Thomson Nelson.
7. Polymer Chemistry by Billmayer
8. Introduction to Polymer Science, V.R. Gowriker, N.V.Viswanadhan and J. Sreedhar., Wiley Easter.
9. Micells, Theoretical and applied aspects, V.Morol, Plenum publishers.



ADITYA DEGREE & PG COLLEGE (A) KAKINADA
DEPARTMENT OF CHEMISTRY
FIRST SEMESTER- SYLLABUS
(With effect from 2024-25 admitted batch)

LABORATORY WORK (6 hrs/week)

Practical-1

INORGANIC CHEMISTRY PRACTICALS - I

I. Inorganic Synthesis: Preparation of

(i) Tetraamminecopper(II) sulphate

(ii) Potassium tris(oxalato)ferrate(III) trihydrate

(iii) Tris(thiourea)copper(I) sulphate

II. Semi micro qualitative analysis of six radical mixtures

(One interfering anion and one less familiar cation for each mixture)

Anions: CO_3^{2-}, S^{2-}, SO_3^{2-}, Cl^-, Br^-, I^-, NO_3^-, SO_4^{2-}, CH_3COO^-
$C_2O_4^{2-}$, $C_4H_4O_6^{2-}$, PO_4^{3-}, CrO_4^{2-}, AsO_4^{3-}, F^-, BO_3^{3-}

Cations : Ammonium (NH_4^+)
1st group: Hg, Ag, Pb, Tl, W
2nd group: Hg, Pb, Bi, Cu, Cd, As, Sb, Sn, Mo
3rd group: Fe, Al, Cr, Ce, Th, Ti, Zr, V, U, Be
4th group: Zn, Mn, Co, Ni
5th group: Ca, Ba, Sr
6th group: Mg, K, Li

Recference books:

Vogel's textbook of semimicro qualitative analysis, 5th Edition by G. Svehla.

Practical-2

ORGANIC CHEMISTRY PRACTICALS -I

Preparation, recrystallization, and determination of melting point, & yield of the following compounds:

(i)	Aspirin,	(ii)	Nerolin,	(iii)	Chalcone,
(iv)	p-Nitro acetanilide,	(v)	2,4,6- Tribromoaniline,	(vi)	m-Dinitrobenzene,
(vii)	Phthalimide,	(viii)	Diels-Alder adduct.		

Books Suggested

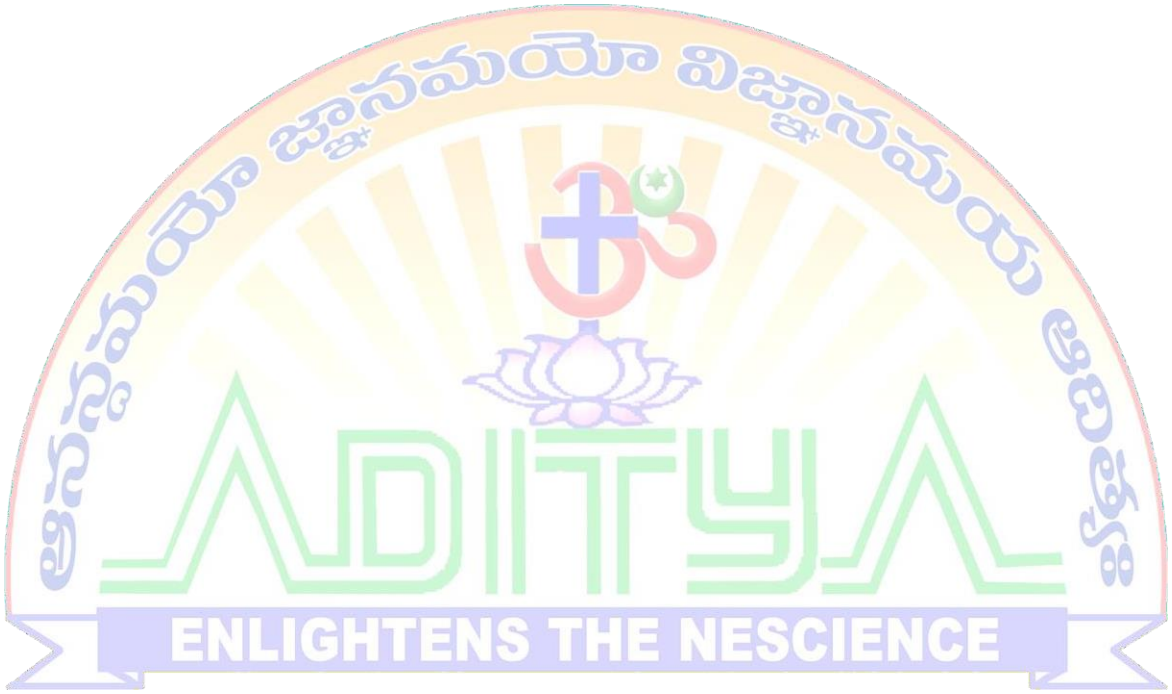
1. Vogel's Text Book of Quantitative Chemical Analysis, J. Mendham, R. C. Denney, J. D. Barnes and M. J. Thomas, 4th& 6th Ed. (Pearson Education Asia).

2. Vogel's Text Book of Practical Organic Chemistry, B.S. Furniss, A.J. Hannaford, P.W.G. Smith, A.R. Tatchell, 5 Ed.(Longman Scientific & Technical)

Practical-3

PHYSICAL CHEMSITRY PRACTICALS -I

1. Determination of critical solution temperature of phenol-water system.
2. Effect of added electrolyte on the CST of phenol-water system.
3. Conductometric titration of Strong acid versus Strong base
4. Dissociation constant of weak acid (CH_3COOH) by conductometric method.
5. Conductometric titration of Weak acid vs Strong base.
6. Determination of cell constant
7. Adsorption of acetic acid on animal charcoal or silica gel.
8. Acid-catalyzed hydrolysis of methyl acetate
9. Determination of partial molar volume of solute –H_2O system by apparent molar volume method.



ADITYA DEGREE & PG COLLEGE (A) KAKINADA
DEPARTMENT OF CHEMISTRY
SECOND SEMESTER- SYLLABUS
(With Effective from 2024-25 admitted batch)

Paper- I: GENERAL CHEMISTRY-II

UNIT-1

Basic Quantum Chemistry-III- Hydrogen atom- solution of R(r), Φ (ϕ) and Θ (θ) equations. Probability density in orbitals- shapes of orbitals- Perturbation theory- Time independent perturbation theory(only first order perturbation is to be dealt with)- application to ground state energy of Helium atom- Variation principle- applications- calculation of zero-point energy of harmonic oscillator- many electron atom- Hartee-Fock self-consistent field method(qualitative treatment only)

UNIT-II

Molecular symmetry and Group Theory in chemistry: Basic concepts of symmetry and Group theory- Symmetry elements, symmetry operations and point groups- Schoenflies symbols- Classification of molecules into point groups- Axioms of Group theory- Group multiplication tables for C_{2v} and C_{3v} point groups- Similarity transformations- and classes- Representations- reducible and irreducible representations, Mullikan symbols,

UNIT-III

Treatment of analytical data: Accuracy and precision- Classification of errors- Determinate and Indeterminate errors- Minimization of errors- Absolute and Relative errors, propagation of errors-Distribution of Indeterminate 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- Significant figures and computation rules.

UNIT- IV

Introduction to computer programming- FORTRAN 77: Basic structures and functioning of computer with P.C. as an illustrative example- Main memory- Secondary storage memory- input/output devices- computer languages- operating systems- principles of algorithms-and flow charts-constants and variables- Arithmetic expressions- Arithmetic statements- Replacement statement- IF statement- logical IF and BLOCK IF statements- GOTO statements-subscripted variable and DIMENSION statement. DO statement- Rules for DO statement- Functions and subroutines- Development of FORTRAN statements for simple formulae in chemistry such as Vander Waals equation- pH of a solution- First order rate equation- Cellconstant-Electrode potential.

Orthogonality theorem and its implications, Character table and its anatomy.

Flowcharts and computer programs for

a) Program for the calculation of Cell Constant, Specific Conductance and Equivalence.
b) Rate Constant of First order reaction or Beer's law by linear least square method.
c) Hydrogen ion concentration of a strong acid solution/Quadratic equation.
d) Solution for Vander Waals equation or Hydrogen ion concentration of a monoprotic weak acid
e) Standard deviation and Variance of univariant data

References/ Text books:

1. Introductory Quantum chemistry: by A.K. Chandra
2. Group theory for Chemistry: by A.K. Bhattacharya, 3. Chemical Applications of Group Theory by FA Cotton, 3rd Edition, Wiley Interscience Newyork
3. Vogel's text book of quantitative analysis: by Vogel
4. Fundamentals of Analytical chemistry: by Skog and West
5. Principles of computer programming(FORTRAN 77 IBM PC): by V.Rajaraman
6. Basics of computers for chemists: by P.C. Jurs

ADITYA DEGREE & PG COLLEGE (A) KAKINADA
DEPARTMENT OF CHEMISTRY
SECOND SEMESTER- SYLLABUS
(With Effective from 2024-25 admitted batch)

Paper- II: INORGANIC CHEMISTRY-II

UNIT-I

Metal cluster compounds - definition – evidences for existence of M-M bonds - conditions favorable for formation of M-Mbonds – preparation, structure and bonding of the following metal cluster compounds.

$Re_2Cl_8^{2-}$, $Mo_2Cl_8^{4-}$, $Re_2(RCOO)_4X_2$, $Mo_2(RCOO)_4(H_2O)_2$, $Cr_2(RCOO)_4(H_2O)_2$, $Cu_2(RCOO)_4(H_2O)_2$, $Cr_2Cl_9^{3-}$, $Mo_2Cl_9^{3-}$, $W_2Cl_9^{3-}$, Re_3Cl_9, $Re_3Cl_{12}^{3-}$, $Mo_6Cl_8^{4+}$, $Nb_6X_{12}^{2+}$, and $Ta_6X_{12}^{2+}$.

Polyatomic clusters – Zintle ions, Chevrel phases.

UNIT-II

Organometallic compounds - 16 and 18 electron rules. Isoelectronic relationship - Synthesis, structure, bonding and reactions of carbon monoxide, dinitrogen and nitric oxide complexes. Isolobal relationship – H, Cl, CH_3, $Mn(CO)_5$; S, CH_2, $Fe(CO)_4$; P, CH, $Co(CO)_3$. Synthesis, structure, bonding and reactions of metallocenes with special reference to ferrocene. Catalysis by Organometallic compounds – Homogeneous Catalysis – Alkene hydrogenation – Wilkinson's catalyst, Hydroformylation.

ADDITIONAL INPUT: Hapticity of ligands; π - acceptor behaviour of CO in metal carbonyls and Synergic effect and use of IR data to explain extent of back bonding,

(Questions should not be given in exams from additional inputs)

UNIT-III

Metal Ligand equilibria in solution: Stepwise and overall formation constants and their interaction– trends in stepwise constants – factors affecting the stability of metal complexes–Pearson's theory of hard and soft acids and bases (HSAB), chelate effect and its thermodynamic origin, determination of stability constants of complexes–spectrophotometric method and pH–metric method. Reactivity of metal complexes–inert and labile complexes. Explanation of lability on the basis of VBT & CFT.

Bio-Inorganic Chemistry: Metalloporphyrins with special reference to Haemoglobin. Biological role of alkali and alkaline earth metal ions with special reference to Ca^{2+}. Biological and abiological Nitrogen Fixation.

UNIT- IV

Inorganic Reaction Mechanisms: Substitution reactions of metal complexes – D, Id, Ia and A mechanisms – Ligand replacement reactions of octahedral complexes – Acid hydrolysis – factors affecting acid hydrolysis – Anation and Base hydrolysis of Cobalt(III) complexes. Ligand displacement reactions of square planar complexes of platinum (II). Factors affecting square planar substitution – trans effect (theories).

Electron transfer reactions of complexes – concept of complementary and non-complementary reactions with examples. Inner and outer sphere mechanisms.

Text books:

1. Advanced Inorganic Chemistry by F.A. Cotton and R.G. Wilkinson, IV Edition, John, John Wiley and Sons, New York,
2. Inorganic Chemistry by J.E. Huheey, III edition, Harper International Edition, .
3. Organometallic Chemistry-A unified approach by A. Singh and R.C. Mehrotra, Wiley Eastern Ltd.
4. Inorganic Chemistry by Shriver and Atkins, Oxford University Press
5. Theoretical Inorganic Chemistry, II Edition by M.C. Day and J. Selbin, Affiliated East-West press Pvt. Ltd..
6. Mechanisms of Inorganic reactions in solution by D.Benson, MCgraw Hill, London,
7. Inorganic chemistry by K.F. Purcell and J.C.Kotz, W.B. Saunders company, New York,
8. Elements of Bioinorganic Chemistry by G.N. Mukherjee and Arabinda Das, U.N. Dhur& sons Pvt. Ltd, Calcutta.

ADITYA DEGREE & PG COLLEGE (A) KAKINADA
DEPARTMENT OF CHEMISTRY
SECOND SEMESTER- SYLLABUS
(With Effective from 2024-25 admitted batch)

Paper-III: ORGANIC CHEMISTRY-II

UNIT-I

Reaction Mechanism **15Hrs**

(A) ***Aliphatic Nucleophilic Substitution and Nucleophilic Aromatic substitution:*** Stereochemistry of S_N2 and S_N1 mechanisms, Neighboring Group Participation (Anchimeric assistance), NGP by O, S, N: Aromatic Nucleophilic substitution: SN2 (Ar) (Addition – Elimination), SN1(Ar) and benzyne mechanisms (Elimination - Addition); evidence for the structure of benzyne. Von Richter Sommelet-Hauser rearrangements.

(B) ***Elimination Reactions:*** Type of elimination reactions (E^1, E^2, E^{1CB} mechanisms), dehydration, dehydrogenation, dehalogenation, decarboxylative eliminations. Stereochemistry and Orientation, Hofmann and Saytzeff rules: pyrolytic eliminations; Syn elimination versus anti-elimination, competition between elimination and substitution,

UNIT-II

Addition Reactions **15 Hrs**

(A) Addition to Carbon – Carbon Multiple Bonds: Mechanistic and stereo chemical aspects of addition reactions involving electrophiles, nucleophiles and free radicals, region and chemo selectivity, orientation and reactivity, Hydrogenation of double and triple bonds, hydrogenation of aromatic rings, Hydroboration.

(B) Addition to Carbon-Hetero Multiple Bonds: Mechanism & Steric course of addition reactions to C=O and C=N, Aldol, Cannizzaro, Perkin, Knoevenagel, Claisen- Schmidt, Claisen, Dieckman, Benzoin and Stobbe condensations, Reformatsky reaction, Tollen's reaction, Prins reaction: Wittig, Grignard, Mannich, and Michael reaction.

UNIT-III

Molecular Rearrangements **15 Hrs**

Types of molecular rearrangements*;* Rearrangements to electron deficient carbon: Pinacol-pinacolone, Wagner-Meerwein, Tiffeneau – Demjanov, Dienone – Phenol, Arndt-Eistert synthesis*;*

Rearrangements to electron deficient nitrogen: Beckmann, Hofmann, Curtius, Schmidt and Lossen rearrangements; *Rearrangements to electron deficient oxygen:* Baeyer-villiger, Hydro peroxide rearrangement and Dakin rearrangements; Neber rearrangement, Benzil-Benzilic acid and Favorskii rearrangements

UNIT-IV

Spectroscopy and Protecting Groups **10 Hrs**

A. i) U.V. Visible absorption laws, Electronic excitations and absorption shifts

ii) I.R. : Fundamental modes of vibrations in IR Spectroscopy, Finger Print Region and its importance.

iii) NMR: Principles of NMR, Chemical shift and its importance, Coupling constant and its importance, Factors affecting chemical shift, Dueteration-deuterium exchange and Deuterium Labeling.

iv) Mass: Some useful terms used in Mass spectrometry: Molecular ion, Fragmentation, Cleavage, Rearrangement, Loss of small molecules, Isotope Abundance, Metastable ions, Even-electron rule, Nitrogen rule, Mc Lafferty Rearrangement.

B. Protection of carbonyl, Hydroxyl, carboxylic and Amine groups **5Hrs**

Books Suggested:

1. Advanced Organic Chemistry-Reactions, Mechanism and structure, Jerry March, 6th Ed. (John Wiley & Sons).
2. Modern Organic Reactions, H. O. House (Benjamin)
3. Structure and Mechanism in Organic Chemistry C. K. Inglod (Comell University Press).
4. Organic Chemistry, Paula Yurkanis Bruice, 4th Ed. (Printice Hall)
5. Organic chemistry-Clayden J. (Oxford)
6. Organic Chemsitry, Wade, L.G. Jr. 5th Ed. (Pearson)
7. Organic Chemistry, Salmons, P.W. & Others, 8th Ed. (John Wiley & Sons)
8. Advanced Organic Chemistry: Reactions and mechanisms, Miller Bernard & Other, 2nd Ed. (Pearson)
9. Mechanism and Theory in Organic Chemistry, Thomas H. Lowry, Kathleen S. Richardson, Harper & Row,
10. (Publishers, Inc.).
11. A Guide Book to Mechanism in Organic Chemistry, Peter Sykes, 6th Ed., (Longman).
12. Reaction Mechanism in Organic Chemistry, P.S. Kalsi, 2nd Ed. (New Age International).
13. Stereochemistry to Organic Compounds, E.L. Eliel (John Wiley). 13. Stereochemistry to Organic Compounds,Nasipuri, 2nd Ed. (New Age International).
14. Stereochemistry, P.S. Kalsi, 5th Ed. (New Age International). Organic Chemistry Structure and Reactivity, EgeSeyhan, 3rd Ed. (AITBS)
15. Spectroscopic Methods in Organic Chemistry- Forth Edition, D.H. Williams and I. Fleming Tata - McGraw Hill,New Delhi, .
16. Organic Spectroscopy- Second Edition, W.Kemp, ELBS Macmillan,
17. Applications of absorption spectroscopy of Organic Compounds J.R.Dyer, Prentice Hall of India, New Delhi, 1984.
18. Spectrometric identification of Organic Compounds-Fourth Edition, R.M. Silverstein: G.C.Vassiellr and T.C.Merill, Johne Willey, Singapore, .
19. Introduction to spectroscopy-D.L.Pavia, G.M.Lampman, G.S.Kriz, 3rdEd (Harcourt college publishers).

ADITYA DEGREE & PG COLLEGE (A) KAKINADA
DEPARTMENT OF CHEMISTRY
SECOND SEMESTER- SYLLABUS
(With Effective from 2024-25 admitted batch)

Paper – IV: PHYSICAL CHEMISTRY-II

UNIT-I:

Physical methods of molecular structural elucidation: NMR: Principle and theory, Nature of spinning particle and its interaction with magnetic field. Chemical shift and its origin. Spin-Spin interaction, Application of NMR to structural elucidation- Structure of ethanol, dimethylformamide, styrene and acetophenone.

Electron Spin Resonance: Principle and experimental technique- g-factor, line shapes and line widths- hyperfine interactions- applications of ESR studies.

UNIT -II:

Thermodynamics-II- Brief review on entropy; entropy changes accompanying specific process – expansion, phase transition, heating, measurement of entropy. Nernst heat theorem; Third law of thermodynamics- Determination of the absolute entropy- Apparent exceptions to Third law of thermodynamics.

Statistical Thermodynamics: Objectives of statistical thermodynamics, Concept of distributions, Types of ensembles. Thermodynamic probability, Most probable distribution Law – Partition Function, (Definition and significance): Molar and molecular partitions-translational, rotational, vibrational and electronic partition functions- Relation between thermodynamicfunctions (E, H, S, G and C_v) and the partition functions

UNIT-III:

Electrochemistry I: Electrochemical cell- Galvanic and electrolytic cell. Concentration cell with and without transference, Effect of complexation on redox potential- ferricyanide/ ferrocyanide couple, Iron (III) phenonthroline / Iron (II) phenonthroline couple. Determination of standard potential, solubility product equilibrium constant and activity coefficients from EMF data.

Bjerrum theory of ion association (elementary treatment) Concept of activity and activity coefficients in electrolytic solutions. The mean ionic activity coefficient. Debye-Huckel theory of electrolytic solutions. Debye-Huckel limiting law (derivation not required), Calculation of mean ionic activity coefficient; Limitations of Debye-Huckel theory. Effect of dilution on equivalent conductance of electrolytes - Anomalous behavior of strong electrolytes. Debye Huckel- Onsagar equation – verification and limitations, Fuel Cells.

UNIT-IV:

Electrochemistry II: The electrode-electrolyte interface. The electric double layer. The Helmholtz-Perrin parallel-plate model, the Gouy-Chapman diffuse-charge model and the Stern model.

Electrodics: Charge transfer reactions at the electrode-electrolyte interface. Exchange current density and over-potential. Derivation of Butler-Volmer equation. High field approximation, Tafel equation, Low field equilibrium, Nernst equation. Voltametry-Concentration polarization, experimental techniques

Books:

1. Text book of Physical Chemistry by Samuel Glasstone, McMillan Pub.
2. Physical Chemistry by W.J.Moore, Prentice Hall
3. Physical Chemistry by G.W. Castellon, Narosha Publishing House
4. Physical Chemistry by Peter Atkins and Julio de Paula, Oxford University Press.
5. Modern Electrochemistry, 2A & 2B, JOM Bockris & A.K.N.Reddy, Plenum publishers
6. Introduction to Electrochemistry, S.Glasstone.
7. Fundamentals of Molecular Spectroscopy, Banwell

ADITYA DEGREE & PG COLLEGE (A) KAKINADA
DEPARTMENT OF CHEMISTRY
SECOND SEMESTER- SYLLABUS
(With Effective from 2024-25 admitted batch)

LABORATORY WORK (6 hrs/ week)

Practical-1

INORGANIC CHEMISTRY PRACTICALS –II

Quantitative analysis:

Volumetric:

1. Determination of Ferric iron by photochemical reduction
2. Determination of Nickel by EDTA
3. Determination of Calcium and Magnesium in a mixture by EDTA
4. Determination of Ferrocyanide by Ceric sulphate
5. Determination of Copper(II) in presence of iron(III)

Gravimetric:

6. Determination of Zinc as Zinc pyrophosphate
7. Determination of Nickel from a mixture of Copper and Nickel.

Reference books:

Vogel's textbook of quantitative chemical analysis, 5th edition by G.H. Jeffery et al.

Practical-2

ORGANIC CHEMISTRY PRACTICALS –II

Systematic qualitative analysis of an organic mixture containing two compounds

Identification of method of separation and the functional group (s) present in each of them and preparation of one solid derivative for the conformation of each of the functional group(s).

Practical-3

PHYSICAL CHEMISTRY PRACTICALS –II

1. Distribution of iodine between $CHCl_3$ and water
2. Distribution of I_2 between $CHCl_3$ and aq.KI solution- calculation of equilibrium constant.
3. Determination of Coordination number of cuprammonium cation.
4. Titration of mixture Strong acid and weak acid versus Strong base by conductometry.
5. Titration of Strong acid Vs Strong Base – pH – metry.
6. Titration of mixture of ($NaHCO_3$ + Na_2CO_3) Vs HCl – pH- metry.
7. Titration of Strong acid Vs Strong Base using Quinhydrone electrode.
8. Titration of Fe^{+2} Vs $K_2Cr_2O_7$ – potentiometry
9. Verification of Beer-Lambert's law by Iron-thiocyanate system –colorimetry.
10. Determination of single electrode potential of Cu^{2+}/Cu and estimate the given unknown concentration

ADITYA DEGREE & PG COLLEGE (A)
KAKINADA
M.Sc. DEGREE EXAMINATIONS
CHEMISTRY
FIRST SEMESTER
Paper –I – GENERAL CHEMISTRY – I
(*W.E.F. 2024-25 Admitted Batch*)
(Common for Analytical Chemistry, Organic Chemistry)

Time: 3 Hours Max. Marks: 75

SECTION A — (4 × 15 = 60 marks)
Answer ALL questions.

1. (a) Explain the following with examples.
   (i) Normalized and orthogonal functions.
   (ii) Hermitian operator and linear – operator.

   Or

   (b) State and explain the postulates of Quantum mechanics.

2. (a) (i) How does the Schrodinger wave equation help in finding the energy and position of a particle in an one-dimensional box?
   (ii) Explain the factors influencing color transition, dipole integral, symmetry arguments in deriving the selection rules.

   Or

   (b) Give an account of (i) measurability of energy, (ii) position and momentum, (iii) average values and probabilities.

3. (a) (i) Explain the classification of molecules in micro-wave spectroscopy.
   (ii) What is stark effect? Describe its origin, selection rules and its application.

   Or

   (b) (i) Describe the phenomenon of Fermi-resonance and overtones.
   (ii) What is the effect of isotropic substitution on the micro wave spectra of diatomic molecules? Explain its application.

4. (a) (i) Write the Rotational and vibrational Raman spectra.
   (ii) Discuss the Franck-Condon principle and its application.

   Or

   (b) How do you explain Raman spectra on the basis of classical and Quantum mechanical theories?

SECTION B — (5 × 3 = 15 marks)
Answer any FIVE questions.

5. (a) Explain physical significance and importance of wave function.
   (b) State and explain Heisenberg's uncertainty principle.
   (c) Explain the concept of tunneling.
   (d) Write short notes on orthogonality.
   (e) Give an account on combination bands.
   (f) Describe the calculation of force constant.
   (g) Explain vibrational coarse structure and intensities of spectral lines.
   (h) Discuss the charge transfer spectra.

ADITYA DEGREE & PG COLLEGE (A)
KAKINADA
M.Sc. DEGREE EXAMINATIONS
CHEMISTRY
FIRST SEMESTER
Paper – II – INORGANIC CHEMISTRY – I
(W.E.F. 2024-25 Admitted Batch)
(*Common for Analytical Chemistry, Organic Chemistry*)

Time: 3 Hours Max. Marks: 75

SECTION A — (4 × 15 = 60 marks)
Answer ALL questions.

1. (a) Discuss the application of MOT to square planar complex.

Or

(b) Write the applications of VBT theory in predicting the shapes of molecules.

2. (a) Write the preparation, structure, bonding and reactions of B-N cyclic compounds.

Or

(b) Write notes on Phosphorous Sulphides.

3. (a) Explain the crystal field splitting patterns in square pyramidal and trigonal bipyramidal geometries.

Or

(b) Write notes on (i) Spectro chemical series and (ii) R-S coupling

4. (a) Draw and explain Orgel and Tanabe-Sugano diagram of d^2 and d^8 octahedral complexes.

Or

(b) Write an essay on magnetic properties of transition and inner transition metal complexes.

SECTION B — (5 × 3 = 15 marks)
Answer any FIVE questions.

5. (a) Draw and explain Walsh diagram for H_2O molecule.
(b) Explain role of p and d orbitals in π -bonding.
(c) Write notes on polyhedral skeletal electron pair theory.
(d) Write notes on isopoly acids.
(e) Explain Nephelauxetic effect with example.
(f) Derive term symbols for d^3 and d^7 configurations.
(g) Write notes on selection rules and break down of selection rules.
(h) Explain charge transfer spectra.

ADITYA DEGREE & PG COLLEGE (A) KAKINADA
M.Sc. DEGREE EXAMINATIONS
CHEMISTRY
FIRST SEMESTER
Paper – III: ORGANIC CHEMISTRY – I
(*w.e.f. 2024-2025 Admitted Batch*)
(COMMON FOR ANALYTICAL CHEMISTRY, ORGANIC CHEMISTRY)

Time: 3 Hours Max. Marks: 75

SECTION A — (4 × 15 = 60 marks)
Answer ALL questions

1. (a) Describe the generation, structure, stability and reactivity of the following reactive intermediates.
(i) Carbenes (ii) Nitrenes (iii) Arynes

Or

(b) Explain the following with examples.
(i) Annulenes (ii) Fulvenes (iii) Ferrocene

2. (a) Describe the conformational analysis of cyclohexane and draw its potential energy diagram.

Or

(b) Discuss the following with examples.
(i) Cis - Trans isomerism (ii) Pro chirality (iii) Atropisomerism

3. (a) Give any three methods of synthesis of the following
(i) Isoquinoline (ii) Imidazole (iii) Isoxazole

Or

(b) Write any two methods of preparation and reactivity of the following
(i) Pyrazole (ii) Oxazole (iii) Pyridazine

4. (a) Explain the nomenclature and structural elucidation of 'Quinine'.

Or

(b) Discuss the structural elucidation and synthesis of α -pinene.

SECTION B — (5 × 3 = 15 marks)
Answer any FIVE of the following questions.

5. (a) Write notes on 'Huckle's rule' of aromaticity.
(b) Explain 'Anti-Aromaticity' with an example.
(c) What are 'Enantiotopic ligands'? Explain.
(d) Discuss the stereochemistry of 'spiranes'.
(e) Explain the importance of heterocyclic compounds in drug chemistry.
(f) Give the structure of pyrimidine and its biological importance.
(g) Describe the stereochemistry of Quinine.
(h) Write the structure of α -Terpeneol and camphor.

ADITYA DEGREE & PG COLLEGE (A)
KAKINADA
M.Sc. DEGREE EXAMINATIONS
CHEMISTRY
FIRST SEMESTER
Paper IV – PHYSICAL CHEMISTRY – I
(*w.e.f.* 2024–25 *Admitted Batch*)
(Common for Analytical Chemistry, Organic Chemistry)

Time: 3 Hours Max. Marks: 75

SECTION A — (4 × 15 = 60 marks)

Answer ALL the questions.

1. (a) (i) Derive Gibbs-Duhem equation and explain its significance.

(ii) Determine the activity coefficients from vapour pressure measurements.

Or

(b) (i) Write about the significance of partial molar properties.

(ii) Discuss about the chemical equilibrium and effect of temperature on chemical equilibrium constant and explain Van'tHoff equation.

2. (a) (i) Write notes on solubilization and micro emulsion.

(ii) What is simple definition of polymer? Explain the types of polymers.

Or

(b) (i) What is Critical Micellar Concentration (CMC)? Discuss the factors affecting CMC of surfactants.

(ii) How do you determine the molecular weight of a polymer by light scattering method?

3. (a) (i) Explain the effect of dielectric constant of solvent on the rates of reaction.

(ii) Explain how temperature jump and pressure jump methods used to study the fast reactions.

Or

(b) (i) Write a note on primary and secondary salt effects.

(ii) Give a brief note on consecutive reactions.

4. (a) (i) What is quantum yield? Explain its determination.

(ii) Explain the photochemical equilibrium and delayed fluorescence.

Or

(b) (i) Discuss the electronic transitions in molecules on the basis of photochemistry.

(ii) Explain the photo dissociation and addition reactions with examples.

SECTION B — (5 × 3 = 15 marks)

Answer any FIVE questions.

5. (a) Define chemical potential and give its physical significance.

(b) Write the concept of fugacity.

(c) Classify surface active agents based on their properties.

(d) What are liquid crystal polymers?

(e) Discuss the Hammett equation and its limitations.

(f) Draw the Skrabal diagram.

(g) Explain the Actinometry reactions with low quantum yield.

(h) Explain photochemical primary processes.

ADITYA DEGREE & PG COLLEGE (A)
KAKINADA
M.Sc. DEGREE EXAMINATIONS
CHEMISTRY
SECOND SEMESTER

Paper – I : GENERAL CHEMISTRY – II

(*w.e.f. 2024-25 Admitted batch*)

(Common for Analytical Chemistry, Organic Chemistry)

Time: 3 Hours Max. Marks: 75

SECTION A — (4 × 15 = 60 marks)

Answer ALL questions

1. (a) (i) Solve the Radial equation of Hydrogen atom.

(ii) Show the graphical representation of Radial Plots of orbitals.

Or

(b) (i) Explain the first order perturbation theory.

(ii) Explain the Hatree Fock self Consistent theory.

2. (a) (i) Write a short note on symmetry elements and symmetry operations.

(ii) Give the group multiplication table for C_{3v} point group.

Or

(b) (i) State the axioms of group theory. Show that c_{2v} is an abelian group.

(ii) State the orthogonality theorem and give its implications.

3. (a) (i) Explain the difference between determinate and indeterminate errors with examples.

(ii) Explain students t–test and F-test.

Or

(b) (i) Write a note on measures of central tendency, standard deviation and Gaussian distribution.

(ii) Explain the criteria for rejection of an observation.

4. (a) (i) What are the rules for writing logical IF and Block IF statements.

(ii) Write a FORTRAN program for determination of rate constant of a first order reaction.

Or

(b) (i) Give the flow chart for determination of hydrogen ion concentration of a strong acid.

(ii) Write a FORTRAN Program for determination of cell constant, specific conductance and equivalent conductance

SECTION B — (5 × 3 = 15 marks)

Answer any FIVE questions

5. (a) How do you calculate zero point energy of harmonic oscillator.

(b) What is the difference between Perturbation and Variation method.

(c) Give the point groups for NH_3, C_2H_4 and eclipsed C_2H_6.

(d) Write the representation for the effect of symmetry operations of C_2V point group on P orbitals.

(e) What is the difference between accuracy and precision?

(f) Write a note on significant figure.

(g) Give the syntax and rules for DIMENSION statement.

(h) What are the rules for Writing arithmetic statements?

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ADITYA DEGREE & PG COLLEGE (A)
KAKINADA
M.Sc. DEGREE EXAMINATIONS
CHEMISTRY
SECOND SEMESTER
Paper–II : INORGANIC CHEMISTRY–II
(*w.e.f. 2024-25 Admitted batch*)
(Common for Analytical Chemistry, Organic Chemistry)

Time: 3 Hours Max. Marks: 75

SECTION A — (4 × 15 = 60 marks)

Answer ALL questions

1. (a) Discuss the preparation, structure and bonding in $Mo_2 Cl_8^{4-}$ cluster.

Or

(b) Give an account on poly atomic clusters with examples.

2. (a) Write the synthesis, structure, bonding and reactions of nitric oxide complexes.

Or

(b) Explain isoelectronic and isolobal relationships with examples.

3. (a) Write an essay on Metalloporphyrins.

Or

(b) Explain Biological and abiological Nitrogen fixation.

4. (a) Discuss the mechanisms of substitution reactions of metal complexes.

Or

(b) Explain the mechanisms of electron transfer reactions of complexes.

SECTION B — (5 × 3 = 15 marks)

5. Answer any FIVE from the following

(a) Discuss the favorable conditions for the formation of M-M bonds in metal clusters.

(b) Describe the structure and bonding in $Cu_2(RCOO)_4(H_2O)_2$

(c) Write notes on the reactions of ferrocene.

(d) Discuss the role of Wilkinson's catalyst.

(e) Write the factors affecting the stability of metal complexes.

(f) Write notes on the Reactivity of metal complexes.

(g) Explain the factors affecting acid hydrolysis.

(h) Illustrate the concept of complementary and non-complementary reactions with examples.

ADITYA DEGREE & PG COLLEGE (A)
KAKINADA
M.Sc. DEGREE EXAMINATIONS
CHEMISTRY
SECOND SEMESTER

Paper – III : ORGANIC CHEMISTRY – II

(*w.e.f. 2024–25 Admitted Batch*)

(Common for Analytical Chemistry, Organic Chemistry)

Time: 3 Hours Max. Marks: 75

SECTION A — (4 × 15 = 60 marks)

Answer ALL questions

1. (a) (i) Explain SN^2 (Ar) and SN^1 (Ar) mechanisms, with examples.

(ii) Write notes on Von Richter rearrangement.

Or

(b) (i) Discuss the stereochemistry of elimination reactions.

(ii) Write notes on Hofmann and Saytzeff rules.

2. (a) (i) Explain the stereochemical aspects of addition reactions involving nucleophiles.

(ii) Write notes on region and chemo selectivity with examples.

Or

(b) (i) Explain the mechanism of Claisen-Schmidt condensation.

(ii) Write notes on Dieckman condensation and its mechanism.

3. (a) (i) Discuss various types of molecular rearrangements.

(ii) Discuss mechanism of Wagner Meerwein rearrangement

Or

(b) (i) Discuss the mechanisms of Hofmann and Curtius rearrangements.

(ii) Write notes on Hydro peroxide rearrangement.

4. (a) (i) Illustrate Finger print region and its importance.

(ii) Write notes on absorption laws.

Or

(b) (i) Write notes on Isotope abundance and Even-electron rule.

(ii) Discuss about the protection of Hydroxyl groups.

SECTION B — (5 × 3 = 15 marks)

Answer any FIVE questions

5. (a) Discuss the evidence for the structure of benzyme.

(b) Write notes on syn elimination versus anti-elimination.

(c) Write notes on Hydroboration.

(d) Write mechanism of Perkin Reaction.

(e) Discuss Pinacol-Pinacolone rearrangement.

(f) Write notes on Favorskii rearrangement.

(g) Explain coupling constant and its importance.

(h) Write notes on Mc Lafferty rearrangement.

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ADITYA DEGREE & PG COLLEGE (A)
KAKINADA
M.Sc. DEGREE EXAMINATIONS
CHEMISTRY
SECOND SEMESTER
Paper – IV : PHYSICAL CHEMISTRY – II
(*w.e.f. 2024–25 Admitted Batch*)
(Common for Analytical Chemistry, Organic Chemistry)

Time: 3 Hours Max. Marks: 75

SECTION A — (4 × 15 = 60 marks)

Answer ALL questions

1. (a) (i) Explain chemical shift in NMR. What are the factors affecting it?

(ii) Explain spin-spin interactions in NMR with examples.

Or

(b) (i) Explain the importance of g factor in ESR and the factors affecting it.

(ii) Write a note on line widths and line shapes in ESR.

2. (a) (i) Give expressions for entropy changes in phase transition and expansion.

(ii) Explain how Nernst heat theorem leads to third law of thermodynamics. Add a note on the exceptions to third law.

Or

(b) (i) Write a note on the different types of ensembles.

(ii) Derive the Maxwell-Boltzmann distribution law.

3. (a) (i) Discuss the effect of complexation on redox potential taking Fe(II) / Fe(III) phenantholine as example.

(ii) Describe how standard electrode potential is determined from EMF data.

Or

(b) (i) Explain the important features of Debye-Huckel theory of electrolytes.

(ii) What is the Debye-Huckel limiting law? What are the limitations?

4. (a) (i) Describe the Helmholtz-Perrin and Gouy Chapman theories for double layer.

(ii) Write a note on Over potential and concentration polarisation.

Or

(b) (i) Derive the High-field approximation case of Butler-Volmer equation.

(ii) Using diagram, explain the experimental technique of voltametry.

SECTION B — (5 × 3 = 15 marks)

5. Answer any FIVE questions

(a) Give the NMR spectrum of styrene.

(b) Show hyperfine interactions in methyl radical and give the ESR spectrum.

(c) Derive the translational partition functions.

(d) Give relation between partition function and entropy.

(e) Explain the difference between galvanic cell and electrolytic cell with examples.

(f) Explain the effect of dilution on equivalent conductance of electrolytes.

(g) Give the Tafel equation and its applications.

(h) Explain how the Stern model is better than Gouy-Chapman and Helmholtz-Perrin models.

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