P.R.GOVERNMENT COLLEGE (AUTONOMOUS)-KAKINADA III YEAR: SEMESTER-V Paper – V: (INORGANIC, PHYSICAL & ORGANIC CHEMISTRY)

OBJECTIVES:

- 1. Gains knowledge crystal field splitting energies.
- 2. Knowledge of spectral data of complexes.
- 3. Synthesis of Heterocyclic compounds.
- 4. Applications of Thermodynamics'.

INORGANIC CHEMISTRY UNIT – I

Coordination Chemistry:

IUPAC nomenclature - bonding theories - Review of Werner's theory and Sedgwick's concept of EAN rule, - Valence bond theory - geometries of coordination numbers 4-tetrahedral and square planar and 6-octahedral and its limitations, crystal filed theory - splitting of d-orbitals in octahedral, tetrahedral and square-planar complexes - low spin and high spin complexes - factors affecting crystal-field splitting energy, merits and demerits of crystal-field theory. Isomerism in coordination compounds - structural isomerism and stereo isomerism, stereochemistry of complexes with 4 and 6 coordination numbers.

UNIT-II

1. Spectral and magnetic properties of metal complexes:

Types of magnetic behavior, spin-only formula, calculation of magnetic moments, experimental determination of magnetic susceptibility-Gouy method.

ORGANIC CHEMISTRY

UNIT-III

Nitro hydrocarbons:

Nomenclature and classification-nitro hydrocarbons, structure -Tautomerism of nitro alkanes leading to aci and keto form, Preparation of Nitro alkanes, reactivity -halogenation, reaction with HONO (Nitrous acid), Nef reaction and Mannich reaction leading to Micheal addition and reduction.

<u>UNIT – IV</u>

Nitrogen compounds:

Amines (Aliphatic and Aromatic): Nomenclature, Classification into 1° , 2° , 3° Amines and Quarternary ammonium compounds. Preparative methods – 1. Ammonolysis of alkyl halides 2. Gabriel synthesis 3. Hoffman's bromamide reaction (mechanism). Reduction of Amides and Schmidt reaction.

45 hrs (3 h / w)

8h

4h

3h

10h

48 | P a g e

Physical properties and basic character - Comparative basic strength of Ammonia, methyl amine, dimethyl amine, trimethyl amine and aniline - comparative basic strength of aniline, N-methylaniline and N,N-dimethyl aniline (in aqueous and non-aqueous medium), steric effects and substituent effects. Chemical properties: a) Alkylation b) Acylation c) Carbylamine reaction d) Hinsberg separation e) Reaction with Nitrous acid of 1°, 2°, 3° (Aliphatic and aromatic amines). Electrophillic substitution of Aromatic amines – Bromination and Nitration. Oxidation of aryl and Tertiary amines, Diazotization.

Heterocyclic Compounds:

Introduction and definition: Simple five membered ring compounds with one hetero atom Ex. Furan. Thiophene and pyrrole - Aromatic character – Preparation from 1, 4 - di carbonyl compounds, Paul-Knorr synthesis. Properties: Acidic character of pyrrole - electrophillic substitution at 2 or 5 position, Halogenation, Nitration and Sulphonation under mild conditions -Diels Alder reaction in furan. Pyridine – Structure - Basicity - Aromaticity - Comparison with pyrrole - one method of preparation and properties - Reactivity towards Nucleophilic substitution reaction.

PHYSICAL CHEMISTRY

<u>UNIT- V</u>

Thermodynamics:

The first law of thermodynamics-statement, definition of internal energy and enthalpy. Heat capacities and their relationship. Joule-Thomson effect- coefficient. Calculation of w, for the expansion of perfect gas under isothermal and adiabatic conditions for reversible processes. State function. Temperature dependence of enthalpy of formation - Kirchhoff s equation. Second law of thermodynamics. Different Statements of the law. Carnot cycle and its efficiency. Carnot theorem. Concept of entropy, entropy as a state function, entropy changes in reversible and irreversible processes. Entropy changes in spontaneous and equilibrium processes.

List of Reference Books

- 1. Concise coordination chemistry by Gopalan and Ramalingam
- 2. Coordination Chemistry by Basalo and Johnson
- 3. Organic Chemistry by Mare loudan, Purdue Univ
- 4. Advanced Physical Chemistry by
- 5. Text book of physical chemistry by S Glasstone
- 6. Concise Inorganic Chemistry by J.D.Lee
- 7. Advanced Inorganic Chemistry Vol-I by Satyaprakash, Tuli, Basu and Madan
- 8. A Text Book of Organic Chemistry by Bahl and Arun bahl
- 9. A Text Book of Organic chemistry by I L Finar Vol I
- 10. Advanced physical chemistry by Gurudeep Raj

12h

8h

Weightage to Content Fifth semester Paper-V

S.No	Course Content	Long Answer	Short	Total marks
			Answer(SA)	
	Inorganic Chemistry			
1	Coordination Chemistry	3	2	40
2	Spectral and magnetic Properties		1	5
	Organic Chemistry			
1	Nitro hydro Carbons	1		10
2	Nitrogen Compounds	1	1	15
3	Heterocyclic compounds	1	1	15
	Physical Chemistry			
1	Thermodynamics	3	3	45
	TOTAL	9	8	130

P.R.COLLEGE (A), KAKINADA

III YEAR BSC-(Examination at the end of V semester)

MODEL PAPER

(Inorganic, Organic & Physical chemistry)

Paper-V

Time: 2 1/2Hrs

Max.Marks:60

Answer any FOUR questions choosing at least one question from each section

SECTION-I

4x10=40M

- 1. Write the salient features of Crystal field theory and explain the crystal field splitting of dorbitals in octahedral complexes.
- 2. Explain the Formation of $[Fe (CN)_6]^{4-}$ and $[Fe (CN)_6]^{3-}$ on the basis of Valence bond theory.
- 3. Explain about the optical isomerism in complex compounds having coordination numbers 4 and 6.

SECTION-II

- 4. Write note on
 - a) Nef reaction b) Michael reaction c) Mannich reaction
- 5. What are Amines? How the primary amines are prepared. Give the separation of amines by Hinsberg Method.
- Give any two methods of preparation of Pyrrole. Explain why electrophilic substitution in Furan takes place at 2-position rather than 3-position.

SECTION-III

- 7. State and explain 1st law of thermodynamics
- 8. Derive Kirchhoff's equation and mention its units.
- 9. Show that $PV^r = Constant$

SECTION-IV

Answer any Five questions

10. Explain the factors affecting crystal field splitting energy.

- 11. Explain EAN rule with two examples.
- 12 What are low spin and high spin complexes- Give examples.

13 How is furan prepared? Give its Diel's – Alder reaction.

- 14. Write about alkylation and acylation reactions of aniline
- 15. Prove that C_p - C_v =R
- 16. Write about Entropy
- 17. State and explain Joule- Thomson Effect
- 18. Discuss Chichibabin reaction.

4x5=20M

DEPARTMENT OF CHEMISTRY SEMESTER-V

PAPER-III

QUESTION BANK

ESSAY QUESTIONS:

1. Explain the Geometry and Magnetic Properties of

a) [Co(NH3)6]+3 b) [Fe(CN)6]+3 C) [Fe(CN)6]-3 d) [Cr(NH3)6]+3 e) [Fe(CN)6]-4

f) [Zn(NH3)6]+2 g) [Ni(CO)4] h) [Cu(NH3)4]+2 i) [Ni(CN)4]-2 J) [CO F6]-3

Complex compounds based on valence Bond theory.

2. Discuss the salient features of crystal field theory. Explain the Crystal field splitting of d- orbitals in Octahedral, Tetrahedral and Square planar complexes.

3. Describe the geometrical isomerism in compounds with coordination number 4 & 6

4. Explain the different types of Structural isomerism exhibited by complexes with examples.

- 5. Preparation and properties of Nitro alkanes.
- 6. Write note on

a) Nef b) Michael C) Mannich d) Schmidt e) Gabriel phthalamide reaction.

7. Explain Hinsberg method of separation of primary, Secondary, Tertiary Amines.

8. Write about Hoffmann bromide reaction with mechanism.

9. Preparations and properties of Amines.

10. Preparations and properties of pyrrole, Furan, Thiophene

11. State and explain first law of thermodynamics.

12. State and explain Second law of thermodynamics.

- 13. Explain Joule- Thomson effect
- 14. Show that PV^r constant
- 15. Derive Kirchhoff's equation. Mention its applications.
- 16. Explain Carnot cycle.
- 17. Show that C_P - C_V =R

SHORTANSWERS:

- 1. Explain Werner theory of complex compounds.
- 2. Effective atomic number (EAN)
- 3. Explain High spin and Low spin complexes with examples.
- 4. What is a chelating? Give two examples.
- 5. What is meant by crystal field stabilization energy?
- 6. Explain the electronic absorption spectrum of [Ti (H2O)₆]3+ ion
- 7. Preparation of Pyrrole, Furan, Thiophene (Paul-knorr synthesis)
- 8. Explain why electrophilic substitution reaction in furan takes place 2-position rather than 3-position.
- 9. Discuss the aromatic character of pyrrole, Furan, Thiophene
- 10. Write about a) Diels-Alder reaction b) Chichibabin reaction
- 11. Acidic and basic nature of pyrrole
- 12. Basic nature of pyridine.
- 13. Explain why pyridine is more basic than pyrrole.
- 14. Basic nature of amines.
- 15. Write about the concept of Entropy
- 16. Write briefly about enthalpy.
- 17. Explain the concept of internal energy.
- 18. Carbyl amine test.
- 19. Furan exhibits acidity. Why?
- 20. Explain Diazotization reaction.

LABORATORY COURSE – V Practical Paper – V Organic Chemistry (at the end of semester V) 30 hrs (2 h / W) Organic Qualitative Analysis: 50M

Analysis of an organic compound through systematic qualitative procedure for functional group identification including the determination of melting point and boiling point with suitable derivatives. Alcohols, Phenols, Aldehydes, Ketones, Carboxylic acids, Aromatic Primary Amines, Amides and Simple sugars.