

**A.S.D. GOVT. DEGREE COLLEGE FOR WOMEN (A)**

(Re-Accredited by NAAC with 'B' Grade)

**KAKINADA – 533 002, EAST GODAVARI, A.P.**

**BOARD OF STUDIES OF CHEMISTRY**

**SYLLABUS & MODEL PAPERS**

**2019-2020**



*Convened on 26<sup>th</sup> February, 2019*

**DEPARTMENT OF CHEMISTRY**

**A.S.D. GOVT. DEGREE COLLEGE FOR WOMEN (A)**

**KAKINADA, EAST GODAVARI, A.P.**

**A.S.D. GOVT. DEGREE COLLEGE FOR WOMEN (AUTONOMOUS)  
KAKINADA – 533 002, EAST GODAVARI, A.P.**

**B.Sc. CHEMISTRY COURSE STRUCTURE (w.e.f. 2017-18)**

Semester	Course code	Course Title	Hrs./ Week	Credits	Max. Marks		
					Int	Ext	Total
<b>FIRST YEAR</b>							
I	CHE 1303	INORGANIC & ORGANIC CHEMISTRY - I	4	3	25	75	100
	CHE 1303P	LABORATORY COURSE - I	3	2	0	50	50
II	CHE 2303	PHYSICAL & GENERAL CHEMISTRY - II	4	3	25	75	100
	CHE 2303P	LABORATORY COURSE - II	3	2	0	50	50
<b>SECOND YEAR</b>							
III	CHE 3303	INORGANIC & ORGANIC CHEMISTRY - III	4	3	25	75	100
	CHE 3303P	LABORATORY COURSE - III	3	2	0	50	50
IV	CHE 4303	SPECTROSCOPY & PHYSICAL CHEMISTRY - IV	4	3	25	75	100
	CHE 4303P	LABORATORY COURSE - IV	3	2	0	50	50
<b>THIRD YEAR</b>							
V	CHE 5301	INORGANIC, ORGANIC & PHYSICAL CHEMISTRY-V	3	3	25	75	100
	CHE 5301P	Laboratory Course - V	3	2	0	50	50
	CHE 5302	INORGANIC, ORGANIC & PHYSICAL CHEMISTRY-VI	3	3	25	75	100
	CHE 5302P	Laboratory Course - VI	3	2	0	50	50
VI * Any one Paper from VII A, B and C	VII (A)*	Elective	3	3	25	75	100
		Practical - VII A	3	2	0	50	50
	VII (B)*	Elective	3	3	25	75	100
		Practical - VII B	3	2	0	50	50
	VII (C)*	Elective	3	3	25	75	100
		Practical - VII C	3	2	0	50	50
** Any one cluster from VIII, A, B and C	VIII (A)**	<b>Cluster Electives - I :</b>					
		VIII-A-1	3	3	25	75	100
		VIII-A-2	3	3	25	75	100
		VIII-A-3	3	3	25	75	100
			3	2	0	50	50
			3	2	0	50	50
			3	2	0	50	50
	VIII (B)**	<b>Cluster Electives - II ::</b>					
		VIII-B-1	3	3	25	75	100
		VIII- B-2	3	3	25	75	100
		VIII-B-3	3	3	25	75	100
			3	2	0	50	50
			3	2	0	50	50
			3	2	0	50	50
	VIII (C)**	<b>Cluster Electives - III ::</b>					
		VIII-C-1	3	3	25	75	100
		VIII-C-2	3	3	25	75	100
		VIII-C-3	3	3	25	75	100
			3	2	0	50	50
			3	2	0	50	50
			3	2	0	50	50
<b>TOTAL</b>			73	50	250	1250	1500

**A.S.D.GOVERNMENT DEGREE COLLEGE FOR WOMEN (A), KAKINADA**

**DEPARTMENT OF CHEMISTRY  
BOARD OF STUDIES: 2019-20  
FIRST YEAR, SEMESTER – I  
INORGANIC & ORGANIC CHEMISTRY**

**Dt:26<sup>th</sup> Feb, 2019  
60hrs (4h / w)**

**INORGANIC CHEMISTRY – I 30hrs (2h/W)**

**UNIT – I**

**P-BLOCK ELEMENTS - 1 15h**

**Group - 13:** Synthesis and structure of diborane and higher Boranes ( $B_4H_{10}$  and  $B_5H_9$ ), boron-Nitrogen compounds ( $B_3N_3H_6$  and BN)

**Group-14:** Preparation, applications of silanes, silicones and graphitic compounds.

**Group - 15:** Preparation and reactions of hydrazine, hydroxylamine and phosphazenes.

**UNIT – II**

**1. P-BLOCK ELEMENTS -11: 8h**

**Group – 16:** Classification of oxides based on (i) chemical behaviour and (ii) oxygen content

**Group – 17:** Inter halogen compounds and pseudo halogens.

**2. ORGANOMETALLIC CHEMISTRY: 7h**

Definition and classification of Organometallic compounds, Nomenclature, preparation, properties and applications of alkyls of Li and Mg elements.

**ORGANIC CHEMISTRY - I 30hrs (2h/W)**

**UNIT – III**

**1. STRUCTURAL THEORY IN ORGANIC CHEMISTRY 10 h**

Types of bond fission and organic reagents (Electrophilic, Nucleophilic, and free radical reagents including neutral molecules like  $H_2O$ ,  $NH_3$  &  $AlCl_3$ ).

**Bond polarization:** Factors influencing the polarization of covalent bonds, electro negativity – inductive effect. Application of inductive effect (a) Basicity of amines (b) Acidity of carboxylic acids (c) Stability of carbonium ions. Resonance or Mesomeric effect, application to (a) acidity of phenol, and (b) acidity of carboxylic acids. Hyper conjugation and its application to stability of carbonium ions, Free radicals and alkenes. Carbanions, carbenes and nitrenes.

**Types of Organic reactions:** Addition – electrophilic, nucleophilic and free radical. Substitution - electrophilic, nucleophilic and free radical. Elimination- Examples (mechanism not required).

**UNIT – IV**

**1. ACYCLIC HYDROCARBONS**

**6 h**

**Alkenes** – Preparation of alkenes. Addition of hydrogen – heat of hydrogenation and stability of alkenes. Addition of halogen and its mechanism. Addition of HX, Markonikov's rule, addition of  $H_2O$ , HOX,  $H_2SO_4$  with mechanism and addition of HBr in the presence of peroxide (anti – Markonikov's addition). Dienes- Types of dienes, reactions of conjugated dienes – 1, 2 and 1, 4 addition of HBr to 1, 3 – butadiene and Diel's – Alder reaction.

**2. ALICYCLIC HYDROCARBONS (CYCLOALKANES) 4 h**

Nomenclature, Preparation by Freunds methods, Wislicenus method. Properties – reactivity of cyclopropane and cyclobutane by comparing with alkanes, Stability of cycloalkanes – Baeyer's strain theory, Sachse and Mohr predictions and Pitzer's strain theory. Conformational structures of cyclobutane, cyclopentane, cyclohexane.

## UNIT – V

### **1. BENZENE AND ITS REACTIVITY**

**10 h**

Concept of resonance, resonance energy. Heat of hydrogenation, heat of combustion of Benzene, mention of C-C bond lengths and orbital picture of Benzene.

**Concept of aromaticity** – aromaticity (definition), Huckel's rule – application to Benzenoid (Benzene, Naphthalene) and Non-Benzenoid compounds (cyclopropenyl cation, cyclopentadienyl anion and tropylium cation)

Reactions – General mechanism of electrophilic substitution, mechanism of nitration. Friedel Craft's alkylation and acylation.

**Orientation of aromatic substitution** – Definition of ortho, para and meta directing groups. Ring activating and deactivating groups with examples (Electronic interpretation of various groups like NO<sub>2</sub> and Phenolic).

Orientation of (i)Amino, methoxy and methyl groups (ii) Carboxy, nitro, nitrile, carbonyl and sulphonic acid groups (iii)Halogens (Explanation by taking minimum of one example from each type)

**Additional Input :** Alkynes – Preparation by dehydrohalogenation of dihalides, dehalogenation of tetra halides, Properties; Acidity of acetylenic hydrogen (formation of Metal acetylides). Preparation of higher acetylenes, Metal ammonia reductions Physical properties. Chemical reactivity – electrophilic addition of X<sub>2</sub>, HX, H<sub>2</sub>O (Tautomerism), Oxidation with KMnO<sub>4</sub>, OsO<sub>4</sub>, reduction and Polymerisation reaction of acetylene.

**LABORATORY COURSE: 30 hrs (2h / w)**

**Practical – I Simple salt Analysis**

(At the end of Semester – I)

**Qualitative Inorganic analysis**

**50 Marks**

Analysis of simple salt containing one anion and cation from the following.

**Anions:** Carbonate, Sulphate, Chloride, Bromide, Acetate, Nitrate, Borate, Phosphate.

**Cations:** Lead, Copper, Iron, Aluminum, Zinc, Manganese, Nickel, Calcium, Strontium,  
Barium, Potassium and Ammonium.

**WEIGHTAGE TO THE COURSE CONTENT**

**First Year Semester - I**

**INORGANIC AND ORGANIC CHEMISTRY - I**

Sl. No.	COURSE CONTENT	ESSAY	SA
1	UNIT - I	2	2
2	UNIT - II	2	1
3	UNIT - III	2	2
4	UNIT - IV	2	2
5	UNIT - V	2	1
<b>Total</b>		<b>10</b>	<b>8</b>

**N.B: INTERNAL EVALUATION OF THEORY IN EACH SEMESTER:**

**MAX. MARKS: 25**

• Average of Two unit tests:	15 M
• Seminar/Quiz	05 M
• Assignment	<u>05 M</u>
Total	= <u>25 M</u>

**A.S.D.GOVERNMENT DEGREE COLLEGE FOR WOMEN (AUTONOMOUS) KAKINADA**  
**CHEMISTRY I YEAR SEMESTER – I MODEL PAPER (2019-20)**  
**INORGANIC AND ORGANIC CHEMISTRY - I**

**Time: 3 Hrs.**

**Max. Marks: 75**

**SECTION – A (Essay Questions)**

Answer **ALL** of the following questions (5x10 = 50M)

1. (a) What are electron deficient compounds? Write the synthesis and structure of Diborane.  
(or)  
(b) What are Silicones? Write the preparation and structure of Silicones.
2. (a) What are Inter halogen compounds? Discuss any two of their preparations and structures.  
(or)  
(b) What are Organometallic Compounds? Write the preparation and any two applications each for alkyls of Li and Mg.
3. (a) Explain the types of organic reactions with examples.  
(or)  
(b) Explain the following with examples  
(i) Inductive effect                      (ii) Mesomeric effect
4. (a) (i) Write any three general methods for the preparation of Alkenes.  
(ii) Explain the acidic nature of acetylenic hydrogen.  
(or)  
(b) What are cycloalkanes? Discuss Baeyer's strain theory for the stability of cycloalkanes.
5. (a) Explain the mechanisms of the following reactions on benzene ring.  
(i) Nitration                      (ii) Friedel Craft's alkylation  
(or)  
(b) Define Aromaticity? Explain the Aromaticity of Benzene and Naphthalene.

**SECTION – B (Short Answer Questions)**

Answer any **FIVE** from the following questions:                      (5x5 = 25M)

6. Write the preparation and structure of Borazole.
7. Write a note on Graphitic compounds.
8. What are pseudo halogens? Explain with an example.
9. What are electrophilic and nucleophilic reagents? Give an example each.
10. State and explain hyper conjugation with an example.
11. What is Markonikov's rule? Explain with an example.
12. Explain Diel's - Alder reaction with an example.
13. Define ortho, para and meta directing groups and give examples.

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**A.S.D.GOVERNMENT DEGREE COLLEGE FOR WOMEN (A), KAKINADA**

**DEPARTMENT OF CHEMISTRY**

**BOARD OF STUDIES: 2019-20**

**FIRST YEAR, SEMESTER - II**

**PHYSICAL & GENERAL CHEMISTRY – II**

**Dt: 26<sup>th</sup> Feb, 2019**

**PHYSICAL CHEMISTRY - II**

**30h (2h/W)**

**UNIT – I**

**1. SOLID STATE:**

**10h**

Symmetry in crystals. Law of constancy of interfacial angles. The Law of rationality of indices. The law of symmetry. Definition of lattice point, Space lattice, unit cell. Bravais lattice and crystal systems. X-ray diffraction and crystal structure. Bragg's law. Defects in Crystals: Stoichiometric and non-Stoichiometric defects.

**UNIT – II**

**1. GASEOUS STATE:**

**6h**

Compression factors, deviation of real gases from ideal behavior. Vander Waal's equation of state. P-V Isotherms of real gases, Andrew's isotherms of carbon dioxide, continuity of state. Critical phenomena. The vander Waal's equation and the critical state. Law of Corresponding states. Relationship between critical constants and vander Waal's constants. Joule Thomson effect.

**2. LIQUID STATE**

**4h**

Structural differences between solids, liquids and gases. Liquid crystals, the mesomorphic state. Classification of liquid crystals into Smectic and Nematic. Differences between liquid crystal and solid / liquid. Applications of liquid crystals as LCD devices.

**UNIT – III**

**1. SOLUTIONS**

**10h**

**Liquid-liquid - Ideal solutions** - Raoult's law. Ideally dilute solutions, Henry's law. Non-ideal solutions. Vapour pressure – composition and vapour pressure-temperature curves. Azeotropes- HCl-H<sub>2</sub>O, ethanol-water systems and fractional distillation.

**Partially miscible liquids** – phenol - water, trimethylamine-water, nicotine-water systems. Effect of impurity on consolute temperature.

**Immiscible liquids and steam distillation** - Nernst distribution law. Calculation of the partition coefficient. Applications of distribution law.

**UNIT – IV****1. SURFACE CHEMISTRY:****8h**

Definition of colloids. Solids in liquids(sols), preparation, purification, properties- kinetic, optical, electrical. Stability of colloids, Hardy-Schulze law, protective colloid

Liquids in liquids (emulsions) preparation, properties, uses. Liquids in solids (gels) preparation, uses.

**Adsorption:** Physical adsorption, chemisorption. Freundlich, Langmuir adsorption isotherms. Applications of adsorption.

**2. CHEMICAL BONDING****7 h**

VB theory, Hybridisation, VB theory as applied to  $\text{ClF}_3$ ,  $\text{Ni}(\text{CO})_4$ , Molecular orbital theory – LCAO method, Construction of M.O diagrams for homo-nuclear and hetero-nuclear diatomic molecules ( $\text{N}_2$ ,  $\text{O}_2$ ,  $\text{CO}$  and  $\text{NO}$ )

**UNIT – V****1. STEREOCHEMISTRY OF CARBON COMPOUNDS:****15h**

Molecular representations- Wedge, Fischer, Newman and Saw-Horse formulae.

Optical isomerism: optical activity-wave nature of light, plane polarized light, optical rotation and specific rotation.

Chiral molecules- definition and criteria(symmetry elements)-Definition of enantiomers and diastereomers – Explanation of optical isomerism with examples Glycerinaldehyde, Lactic acid, Alanine, Tartaric acid, 2,3-dibromopentane.

D,L and R,S configuration methods and E,Z- configuration with examples.



**LABORATORY COURSE: 30 hrs (2 h / w)**  
**Practical – II Analysis of Mixture Salt**  
(At the end of Semester – II)

**Qualitative Inorganic analysis**

Analysis of Mixture salts containing two anions and two cations (from two different groups) from the following:

**Anions:** Carbonate, Sulphate, Chloride, Bromide, Acetate, Nitrate, Borate, Phosphate.

**Cations:** Lead, Copper, Iron, Aluminum, Zinc, Manganese, Calcium, Strontium, Barium,  
Potassium and Ammonium.

**A.S.D.GOVERNMENT DEGREE COLLEGE FOR WOMEN (AUTONOMOUS) KAKINADA**  
**CHEMISTRY I YEAR SEMESTER – II MODEL PAPER (2019-20)**  
**PHYSICAL AND GENERAL CHEMISTRY - II**

**Time: 3 Hrs.**

**Max. Marks: 75**

**SECTION – A (Essay Questions)**

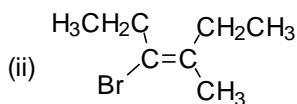
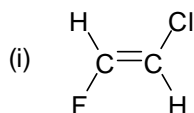
Answer **ALL** of the following questions (5x10 = 50M)

- (a) Derive Bragg's equation for the X-ray diffraction of crystals. (or)  
(b) What are crystal defects? Explain Schottky and Frenkel defects with examples.
- (a) What is meant by the term Compressibility factor? Explain diagrammatically the deviations of Real Gases from Ideal behaviour. (or)  
(b) Define Joule-Thomson effect. Explain the liquefaction of gases by Linde's method.
- (a) Define Raoult's law. Explain about the solutions that shows (i) positive deviation, (ii) negative deviation from Raoult's law. (or)  
(b) State Nernst distribution law. Derive the partition co-efficient for the distribution of Benzoic acid between Benzene – Water.
- (a) Define the term Colloid. Explain any two methods for the purification of a colloidal solution. (or)  
(b) What are bonding and anti-bonding orbitals? Write the molecular orbital diagram of O<sub>2</sub> and CO.
- (a) Define Stereoisomerism. Explain the conformational isomerism of Ethane molecule. (or)  
(b) What are racemic mixtures? Explain the resolution of a racemic mixture by diastereomeric method.

**SECTION – B (Short Answer Questions)**

Answer any **FIVE** from the following questions: (5x5 = 25M)

- Explain plane of symmetry and axis of symmetry with examples.
- What are Smectic and Nematic liquid crystals? Give any one example for each.
- State and explain Henry's law.
- What are the differences between Physical adsorption and Chemisorption?
- Define Enantiomers and Diastereomers. Give an example for each.
- Deduce E, Z- Configuration of the following molecules.



- What are n-type and p-type semi conductors?
- Write a note on Azeotropic mixtures.

**WEIGHTAGE TO THE COURSE CONTENT**  
**First Year Semester - II**  
**PHYSICAL AND GENERAL CHEMISTRY - II**

Sl. No.	COURSE CONTENT	ESSAY	SA
1	UNIT - I	2	2
2	UNIT - II	2	1
3	UNIT - III	2	2
4	UNIT - IV	2	1
5	UNIT - V	2	2
<b>Total</b>		<b>10</b>	<b>8</b>

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**N.B: INTERNAL EVALUATION OF THEORY IN EACH SEMESTER:      MAX. MARKS: 25**

• Average of Two unit tests:	<b>15 M</b>
• Seminar/Quiz	<b>05 M</b>
• Assignment	<b><u>05 M</u></b>
<b>Total</b>	<b>= <u>25 M</u></b>

**RECOMMENDED TEXT BOOKS AND REFERENCE BOOKS:**

**Inorganic Chemistry**

1. Concise Inorganic Chemistry by J.D.Lee
2. Basic Inorganic Chemistry by Cotton and Wilkinson
3. Advanced Inorganic Chemistry Vol-I by Satyaprakash, Tuli, Basu and Madan
4. Inorganic Chemistry by R R Heslop and P.L. Robinson
5. Modern Inorganic Chemistry by C F Bell and K A K Lott
6. University Chemistry by Bruce Mahan
7. Qualitative Inorganic analysis by A.I.Vogel
8. A textbook of qualitative inorganic analysis by A.I. Vogel
9. Inorganic Chemistry by J.E.Huheey
10. Inorganic Chemistry by Chopra and Kapoor
11. Coordination Chemistry by Basalo and Johnson
12. Organometallic Chemistry – An introduction by R.C.Mehrotra and A.Singh
13. Inorganic Chemistry by D.F.Shriver, P.W.Atkins and C.H.Langford
14. Inorganic Chemistry by Philips and Williams, Lab Manuals
15. Introduction to inorganic reactions mechanisms by A.C.Lockhart
16. Theoretical inorganic chemistry by McDay and J.Selbin
17. Chemical bonding and molecular geometry by R.J.Gillepsy and P.L.Popelier
18. Advanced Inorganic Chemistry By Gurudeep Raj
19. Analytical chemistry by Gary D Christian, Wiley India
20. Analytical Chemistry by G.L.David Krupadanam, et al, Univ. Press
21. Selected topics in inorganic chemistry by W.D.Malik, G..D.Tuli, R.D.Madan
22. Concepts and models of Inorganic Chemistry by Bodie Douglas, D.McDaniel and J.Alexander
23. Modern Inorganic Chemistry by William L. Jolly
24. Concise coordination chemistry by Gopalan and Ramalingam
25. Satyaprakash's modern inorganic chemistry by R.D.Madan.

## Organic Chemistry

1. Organic Chemistry By R T Morrison and R.N.Boyd
2. Organic Chemistry by T.J.Solomons
3. Organic Chemistry by L.G.Wade Sr
4. Organic Chemistry by D.Cram, G.S.Hammond and Herdricks
5. Modern Organic Chemistry by J.D.Roberts and M.C.Caserio
6. Text book of Organic Chemistry by Ferguson
7. Problems and their solutions in organic Chemistry by I.L.Finar
8. Reaction mechanisms in Organic Chemistry by S.M.Mukherji and S.P.Singh
9. A guide book to mechanisms in Organic Chemistry by Peter Sykes
10. Organic spectroscopy by J.R.Dyer
11. Organic Spectroscopy by William Kemp
12. Fundamentals of organic synthesis and retrosynthetic analysis by Ratna Kumar Kar
13. Comprehensive practical organic qualitative analysis by V.K.Ahluwalia & Sumta Dhingra
14. Comprehensive practical organic chemistry: Preparation and quantitative analysis by V.K.Ahluwalia and Reena Agarwal.
15. Organic Chemistry by Janice Gorzynski
16. Organic Chemistry by Stanley H Pine
17. Fundamentals of Organic Chemistry by John Mc Murray, Eric Simanek
18. Organic Chemistry by Francis A Carey
19. Text book of Organic Chemistry by K.S.Mukherjee
20. Organic Chemistry by Bhupinder Meha & Manju Mehta
21. Organic Chemistry by L.G.Wade Jr, Maya Shankar Singh
22. Elementary organic spectroscopy by Y.R. Sharma
23. Chemistry & Industry by Gurdeep R. Chatwal
24. Applied Chemistry by Jayashree Ghosh
25. Drugs by David Krupadanam
26. Pharmacodynamics by R.C.Srivastava, Subit Ghosh
27. Analytical Chemistry by David Krupadanam
28. Green Chemistry – V.K.Ahluwalia
29. Organic Synthesis by V.K.Ahluwalia and R.Agarwal
30. New trends in Green Chemistry –by V.K.Ahluwalia & M.Kidwai
31. Industrial Chemistry by B.K.Sharma
32. Industrial Chemistry by Banerji
33. Industrial Chemistry by M.G.Arora
34. Industrial Chemistry by O.P.Veramani & A.K.Narula
35. Synthetic Drugs by O.D.Tyagi & M.Yadav
36. Medicinal Chemistry by Ashutoshkar
37. Medicinal Chemistry by P.Parimoo
38. Pharmacology & Pharmacotherapeutics by R.S Satoshkar & S.D.Bhandenkar
39. Medicinal Chemistry by Kadametal P-I & P.II
40. European Pharmacopoeia
41. Vogel's Qualitative organic analysis.
42. Laboratory manual of Organic Chemistry by Raj K Bansal

## Physical Chemistry

1. Physical chemistry A molecular approach by Donald A. Mcquarrie and John D. Simon.
2. Physical chemistry by G M Barrow
3. Principles of physical chemistry by Prutton and Marron
4. Physical chemistry by Peter Atkins, Julio D. Paula
5. Physical Chemistry by Ira N Levine
6. Elements of Physical Chemistry by Peter Atkins, Julio D. Paula
7. Text book of Physical Chemistry by P.L.Soni, O.P.Dharmarha and Q.N.Dash
8. Solid State Chemistry and its applications by Anthony R. West
9. Text book of physical chemistry by K L Kapoor
10. Thermodynamics for Chemists by S Glasston
11. Chemical Kinetics by K J Laidler
12. An Introduction to Electrochemistry by S Glasston
13. Physical chemistry through problems By S K Dogra
14. Thermodynamics by J Jayaram and J C Kuriakose
15. Introductory Quantum Chemistry by A K Chandra
16. Physical Chemistry by J W Moore
17. Kinetics and mechanism by J W Moore and R G Pearson
18. Fundamentals of photochemistry by K K Rohtagi Mukharjee
19. Chemical thermodynamics by R P Rastogi and S S Misra
20. Advanced physical chemistry by Gurudeep Raj
21. Physical chemistry by G W castellan
22. Physical chemistry by Silbey, Alberty and Bawendi.
23. Elements of physical chemistry by Glasstone and Lewis
24. Text book of physical chemistry by S Glasstone
25. Fundamentals of Molecular spectroscopy by C.N.Banwell and E.M.McCash
26. Nanochemistry by Geoffrey Ozin and Andre Arsenault
27. Catalysis: Concepts and green applications by Gadi Rotherberg
28. Green Chemistry: Theory and practice by P.T.Anastas and J.C.Warner
29. Polymer Science by Gowriker, Viswanathan and Jayadev Sridhar
30. Introduction polymer Chemistry By G.S.Misra
31. Polymer Chemistry by Bilmayer
32. Kinetics and Mechanism of Chemical Transformations by Rajaram and Kuriacose.
33. Senior practical physical chemistry by Khosla

**A.S.D.GOVERNMENT DEGREE COLLEGE FOR WOMEN (A), KAKINADA**  
**DEPARTMENT OF CHEMISTRY**  
**BOARD OF STUDIES: 2019-20**  
**SECOND YEAR, SEMESTER – III**  
**Paper III (INORGANIC & ORGANIC CHEMISTRY) 60 hrs (4 h / w)**

Dt:26<sup>th</sup> Feb, 2019

**INORGANIC CHEMISTRY 30 hrs (2h / w)**

**UNIT – I**

**1. Chemistry of d-block elements:**

**9h**

Characteristics of d-block elements with special reference to electronic configuration, variable valence, magnetic properties, catalytic properties and ability to form complexes. Stability of various oxidation states.

**2. Theories of bonding in metals:**

**6h**

Metallic properties and its limitations, Valence bond theory, Free electron theory, Explanation of thermal and electrical conductivity of metals, limitations, Band theory, formation of bands, explanation of conductors, semiconductors and insulators.

**UNIT – II**

**3. Metal carbonyls and related compounds:**

**7h**

EAN rule, classification of metal carbonyls, structures and shapes of metal carbonyls of V, Cr, Mn, Fe, Co and Ni.

**4. Chemistry of f-block elements:**

**8h**

Chemistry of lanthanides - electronic structure, oxidation states, lanthanide contraction, consequences of lanthanide contraction, magnetic properties. Chemistry of actinides - electronic configuration, oxidation states, actinide contraction, comparison of lanthanides and actinides.

**ORGANIC CHEMISTRY 30 h (2h/w)**

**UNIT – III**

**1. Halogen compounds**

**5 h**

Nomenclature and classification of alkyl (into primary, secondary, tertiary), aryl, alkyl, allyl, vinyl, benzyl halides.

Nucleophilic aliphatic substitution reaction- classification into  $SN^1$  and  $SN^2$  – reaction mechanism with examples – Ethyl chloride, t-butyl chloride and optically active alkyl halide 2-bromobutane.

**2. Hydroxy compounds**

**5 h**

Nomenclature and classification of hydroxy compounds.

Alcohols: Preparation with hydroboration reaction, Grignard synthesis of alcohols. Phenols: Preparation i) from diazonium salt, ii) from aryl sulphonates, iii) from cumene. Physical properties- Hydrogen bonding (intermolecular and intramolecular). Effect of hydrogen bonding on boiling point and solubility in water.

Identification of alcohols by oxidation with  $\text{KMnO}_4$ , Ceric ammonium nitrate, Lucas reagent and phenols by reaction with  $\text{FeCl}_3$ .

Chemical properties:

- a) Dehydration of alcohols.
- b) Oxidation of alcohols by  $\text{CrO}_3$ ,  $\text{KMnO}_4$ .
- c) Special reaction of phenols: Bromination, Kolbe-Schmidt reaction, Reimer-Tiemann reaction, Fries rearrangement, azocoupling, Pinacol-Pinacolone rearrangement.

## **UNIT-IV**

### **Carbonyl compounds**

**10 h**

Nomenclature of aliphatic and aromatic carbonyl compounds, structure of the carbonyl group.

Synthesis of aldehydes from acid chlorides, synthesis of aldehydes and ketones using 1,3-dithianes, synthesis of ketones from nitriles and from carboxylic acids. Physical properties: Reactivity of carbonyl group in aldehydes and ketones.

Nucleophilic addition reaction with a)  $\text{NaHSO}_3$ , b)  $\text{HCN}$ , c)  $\text{RMgX}$ , d)  $\text{NH}_2\text{OH}$ , e)  $\text{PhNHNH}_2$ , f) 2,4-DNPH, g) Alcohols-formation of hemiacetal and acetal.

Base catalysed reactions: a) Aldol, b) Cannizzaro reaction, c) Perkin reaction, d) Benzoin condensation, e) Haloform reaction, f) Knoevenagel reaction.

Oxidation of aldehydes- Baeyer-Villiger oxidation of ketones.

Reduction: Clemmensen reduction, Wolf-Kishner reduction, MPV reduction, reduction with  $\text{LiAlH}_4$  and  $\text{NaBH}_4$ .

Analysis of aldehydes and ketones with a) 2,4-DNP test, b) Tollen's test, c) Fehling test, d) Schiff's test, e) Haloform test (with equation)

## **UNIT-V**

### **1. Carboxylic acids and derivatives**

**6 h**

Nomenclature, classification and structure of carboxylic acids.

Methods of preparation by

- a) Hydrolysis of nitriles, amides
- b) Hydrolysis of esters by acids and bases with mechanism
- c) Carbonation of Grignard reagents.

Special methods of preparation of aromatic acids by

- a) Oxidation of side chain.
- b) Hydrolysis by benzotrichlorides.
- c) Kolbe reaction.

**Physical properties:** Hydrogen bonding, dimeric association, acidity- strength of acids with examples of trimethyl acetic acid and trichloroacetic acid. Relative differences in the acidities of aromatic and aliphatic acids.

**Chemical properties:** Reactions involving H, OH and COOH groups- salt formation, anhydride formation, acid chloride formation, amide formation and esterification (mechanism). Degradation of carboxylic acids by Huns-Diecker reaction, decarboxylation by Schimdt reaction, Arndt-Eistert synthesis, halogenation by Hell-Volhard- Zelinsky reaction.

## **2. Active methylene compounds**

**4 h**

**Acetoacetic esters:** keto-enol tautomerism, preparation by Claisen condensation, Acid hydrolysis and ketonic hydrolysis. Preparation of a) monocarboxylic acids. b) Dicarboxylic acids. Reaction with urea

**Malonic ester:** preparation from acetic acid.

**Synthetic applications:** Preparation of a) monocarboxylic acids (propionic acid and n-butyric acid). b) Dicarboxylic acids (succinic acid and adipic acid)c)  $\alpha,\beta$ -unsaturated carboxylic acids (crotonic acid). Reaction with urea.

### **LABORATORY COURSE -III**

**30 hrs (2 h / w)**

**Practical Paper-III (At the end of Semester-III)**

#### **Titrimetric analysis and Organic functional group reactions : 50 Marks**

##### **Titrimetric Analysis**

**25M**

1. Determination of Fe (II) using  $\text{KMnO}_4$  with oxalic acid as primary standard.
2. Determination of Cu(II) using  $\text{Na}_2\text{S}_2\text{O}_3$  with  $\text{K}_2\text{Cr}_2\text{O}_7$  as primary standard.

##### **Organic Functional Group Reactions**

**25M**

3. Reactions of the following functional groups present in organic compounds (atleast four)

Alcohols, Phenols, Aldehydes, Ketones, Carboxylic acids and Amides



**List of Text Books**

1. Selected topics in inorganic chemistry by W.D.Malik, G..D.Tuli,R.D.Madan
2. Inorganic Chemistry J E Huheey, E A Keiter and R L Keiter
3. A Text Book of Organic Chemistry by Bahl and Arun bahl
4. A Text Book of Organic chemistry by I L Finar Vol I
5. Telugu Academy Textbook of Chemistry Vol- II (English medium)
6. Unified chemistry Vol- II by O.P.Agarwal
7. Unified chemistry Vol- II by K.Ramarao and Y. R. Sharma (KalyaniPublishers)

**List of Reference Books**

1. Organic chemistry by Bruice
2. Organic chemistry by Clayden
3. Advanced Inorganic chemistry by Gurudeep Raj
4. Basic Inorganic Chemistry by Cotton and Wilkinson
5. Concise Inorganic Chemistry by J.D.Lee

**A.S.D.GOVERNMENT DEGREE COLLEGE FOR WOMEN (AUTONOMOUS) KAKINADA**  
**CHEMISTRY II YEAR SEMESTER – III MODEL PAPER (2019-20)**  
**INORGANIC AND ORGANIC CHEMISTRY - II**

**Time: 3 Hrs.**

**Max. Marks: 75**

**SECTION – A (Essay Questions)**

Answer **ALL** of the following questions (5x10 = 50M)

1. (a)(i) Explain Variable Oxidation states and magnetic properties of d-block elements  
(or)  
(b) Give a detailed account of band theory of metals. How could you explain the properties of conductors, insulators and semi conductors basing on this theory
2. (a) Give the classification of metal carbonyls and write the structure and shapes of metal carbonyls of V, Co and Ni  
(or)  
(b) What is lanthanide contraction? What are its consequences
3. (a) Discuss the mechanism of stereochemistry of SN1 and SN2 reaction taking suitable examples  
(or)  
(b) Write notes on the following reactions with mechanisms  
(i) Kolbe Schmidt reaction (ii) Pinacol-Pinacalone rearrangement
4. (a) Give the mechanisms of (i) Aldol Condensation (ii) Cannizaros reaction  
(or)  
(b) Write the methods used for the synthesis of aldehydes and ketones explain the reactivity of carbonyl group in aldehydes.
5. (a) Write the Nomenclature preparation and write degradation of carboxylic acids by Huns-diecker reaction, decarboxylation by Schmidt reaction, Arndt Eister synthesis, Halogenation by Hell-Volhard-Zelinsky reaction  
(or)  
(b) How do you prepare malonic ester from acetic acid. How do you prepare the following from malonic ester (a) barbituric acid (b) Succinic acid (c) Crotonic acid

**SECTION – B (Short Answer Questions)**

Answer any **FIVE** from the following questions: (5x5 = 25M)

1. Write short note on Valence bond theory
2. What is EAN rule and explain with one example
3. What is Riemer Tiemann reaction
4. How do you prepare primary, secondary and tertiary alcohols
5. Write the mechanism of perkins reaction
6. What is Haloform reaction
7. Write note on keto-enol tautomerism
8. What is claisen condensation give its mechanism

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**WEIGHTAGE TO THE COURSE CONTENT**  
**Second Year Semester - III**  
**INORGANIC AND ORGANIC CHEMISTRY - III**

Sl. No.	COURSE CONTENT	ESSAY	SA
1	UNIT - I	2	1
2	UNIT - II	2	1
3	UNIT - III	2	2
4	UNIT - IV	2	2
5	UNIT - V	2	2
<b>Total</b>		<b>10</b>	<b>8</b>

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**N.B: INTERNAL EVALUATION OF THEORY IN EACH SEMESTER:      MAX. MARKS: 25**

- Average of Two unit tests: 15 M
  - Seminar/Quiz 05 M
  - Assignment 05 M
- Total = 25 M**

**A.S.D.GOVERNMENT DEGREE COLLEGE FOR WOMEN (A), KAKINADA**  
**DEPARTMENT OF CHEMISTRY**  
**BOARD OF STUDIES: 2019-20**  
**SECOND YEAR, SEMESTER - IV**  
**Paper IV - (SPECTROSCOPY & PHYSICAL CHEMISTRY)      60 hrs (4 h / w)**

**SPECTROSCOPY      30 hrs (2 h / w)**

**UNIT-I**

**6 h**

General features of absorption - Beer-Lambert's law and its limitations, transmittance, Absorbance, and molar absorptivity. Single and double beam spectrophotometers. Application of Beer-Lambert law for quantitative analysis of 1. Chromium in  $K_2Cr_2O_7$  2. Manganese in Manganous sulphate

**Electronic spectroscopy:**

Interaction of Electromagnetic radiation with molecules and types of molecular spectra. Energy levels of molecular orbitals ( $\sigma$ ,  $\pi$ ,  $n$ ). Selection rules for electronic spectra. Types of electronic transitions in molecules effect of conjugation. concept of chromophore and auxochrome.

**UNIT-II**

**Infra red spectroscopy**

**8h**

Different Regions in Infrared radiations. Modes of vibrations in diatomic and polyatomic molecules. Characteristic absorption bands of various functional groups. Interpretation of spectra-Alkanes, Aromatic Alcohols, carbonyls, and amines with one example to each.

**Proton magnetic resonance spectroscopy ( $^1H$ -NMR)**

**8h**

Principles of nuclear magnetic resonance, equivalent and non-equivalent protons, position of signals. Chemical shift, NMR splitting of signals - spin-spin coupling, coupling constants. Applications of NMR with suitable examples - ethyl bromide, ethanol, acetaldehyde, 1,1,2-tribromo ethane, ethyl acetate, toluene and acetophenone

**PHYSICAL CHEMISTRY      30 hrs (2h / w)**

**UNIT-III**

**Dilute solutions**

**10h**

Colligative properties. Raoult's law, relative lowering of vapour pressure, its relation to molecular weight of non-volatile solute. Elevation of boiling point and depression of freezing point. Derivation of relation between molecular weight and elevation in boiling point and depression in freezing point. Experimental methods of determination. Osmosis, osmotic pressure, experimental determination. Theory of dilute solutions. Determination of molecular weight of non-volatile solute from osmotic pressure. Abnormal Colligative properties - Van't Hoff factor.

## **UNIT-IV**

### **Electrochemistry-1**

**10 h**

Specific conductance, equivalent conductance. Variation of equivalent conductance with dilution. Migration of ions, Kohlrausch's law. Arrhenius theory of electrolyte dissociation and its limitations. Ostwald's dilution law. Debye-Huckel-Onsager's equation for strong electrolytes (elementary treatment only). Definition of transport number, determination by Hittorfs method. Application of conductivity measurements- conductometric titrations.

## **UNIT-V**

### **1. Electrochemistry-II**

**4h**

Single electrode potential, Sign convention, reversible and irreversible cells, convention, Reversible and irreversible cells, Nernst equation- reference electrode, Standard hydrogen electrode, calomel electrode, indicator electrode, metal-metal ion electrode, inert electrode, Determination of EMF of cell, Applications of EMF measurements - Potentiometric titrations.

### **2. Phase rule**

**6h**

Concept of phase, components, degree of freedom. Thermodynamics derivation of Gibbs phase rule. Phase equilibrium of one component - water system. Phase equilibrium of two- component system, solid-liquid equilibrium. Simple eutectic diagram of Pb-Ag system, desilverization of lead. Freezing mixtures.

**PRACTICAL EXAMINATIONS AT THE END OF SEMESTER - IV**  
**LABORATORY COURSE – IV**  
**(PHYSICAL CHEMISTRY AND IR SPECTRAL ANALYSIS)**  
**Practical Paper - IV (at the end of semester IV) 30 hrs (2 h / W)**

**25M**

### **Physical Chemistry**

1. Critical Solution Temperature – Phenol-Water system
2. Effect of NaCl on critical solution temperature (Phenol-Water system)
3. Determination of concentration of HCl conductometrically using standard NaOH solution.
4. Determination of concentration of acetic acid conductometrically using standard NaOH Solution.

### **IR Spectral Analysis**

**25 M**

5. IR Spectral Analysis of the following functional groups with examples
  - a) Hydroxyl groups
  - b) Carbonyl groups
  - c) Amino groups
  - d) Aromatic groups

**List of Text Books**

1. Advanced physical chemistry by Guru deep Raj
2. Introduction to Electrochemistry by S. Glasstone
3. Elementary organic spectroscopy by Y.R. Sharma
4. Spectroscopy by P.S. Kelsi
4. Unified chemistry Vol- II by O.P. Agarwal
5. Unified chemistry Vol- II by K. Ramarao and Y. R. Sharma (Kalyani Publishers)

**List of Reference Books**

1. Spectroscopy by William Kemp
2. Spectroscopy by Pavia
3. Organic Spectroscopy by J. R. Dyer
4. Modern Electrochemistry by J.O. M. Bockris and A.K.N. Reddy
5. Advanced Physical Chemistry by Atkins

**A.S.D.GOVERNMENT DEGREE COLLEGE FOR WOMEN (AUTONOMOUS) KAKINADA**  
**CHEMISTRY II YEAR SEMESTER – IV MODEL PAPER (2019-20)**  
**SPECTROSCOPY AND PHYSICAL CHEMISTRY**

**Time: 3 Hrs.**

**Max. Marks: 75**

**SECTION – A (Essay Questions)**

Answer **ALL** of the following questions (5x10 = 50M)

1. (a)(i) Explain types of Symmetry  
(ii) Write different types of electronic transition in a molecule  
(or)  
(b)(i) What is spin-spin coupling and splitting of signals in the NMR spectra  
(ii) Explain the characteristics absorption bands of various functional groups in Infrared spectroscopy.
2. (a) Explain single beam and double beam spectrophotometer  
(or)  
(b) Write the determination of manganese in manganous sulphate by spectrophotometry
3. (a) State Raoult's law of relative lowering of vapour pressure give its Limitations. (or)  
(b) What is meant by osmotic pressure? Describe any one method of determining the osmotic pressure of dilute solution
4. (a) What is Kohlrausch's law and how it is used for determining the equivalent conductivities of infinite dilution of electrolytes  
(or)  
(b) Define Transport number? Explain Hittorff's method for the determination of transport number
5. (a) Write notes of potentiometric titrations  
(or)  
(b) What is phase rule? Explain different terms involved in it

**SECTION – B (Short Answer Questions)**

Answer any **FIVE** from the following questions: (5x5 = 25M)

6. Write the selection rules for electronic spectra
7. Write the NMR spectrum of Ethanol and acetophenone
8. Explain Beer Lambert law
9. Write about Vant Hoff factor and degree of association
10. How is elevation of boiling point is determined experimentally
11. Write about Debye-Huckel-Onsager equation
12. Define specific conductance and equivalent conductance.
13. Write about Hydrogen electrode

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**A.S.D.GOVERNMENT DEGREE COLLEGE FOR WOMEN (A), KAKINADA**

**DEPARTMENT OF CHEMISTRY**

**BOARD OF STUDIES: 2019-20**

**THIRD YEAR, SEMESTER - V**

**Paper - V (INORGANIC, PHYSICAL & ORGANIC CHEMISTRY)**

**45 hrs (3 h / w)**

**INORGANIC CHEMISTRY**

**UNIT – I**

**Coordination Chemistry:**

**8h**

IUPAC nomenclature - bonding theories - Review of Werner's theory and Sidgwick's concept of coordination - Valence bond theory - geometries of coordination numbers 4-tetrahedral and square planar and 6-octahedral and its limitations, crystal field 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.Hard and Soft acids and bases:**

**4h**

Classification, Pearson's concept of hardness and softness- HSAB Principle and applications of HSAB Principle-stability of complexes, predicting the feasibility of a reaction.

**2. Stability of metal complexes:**

**3h**

Thermodynamic stability and kinetic stability, factors affecting the stability of metal complexes, chelate effect, determination of composition of complex by Job's method and mole ratio method.

**ORGANIC CHEMISTRY**

**UNIT- III**

**Nitro hydrocarbons:**

**3h**

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

**UNIT – IV**

**Nitrogen compounds:**

**12h**

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. 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). Electrophilic substitution of Aromatic amines – Bromination and Nitration. Oxidation of aryl and Tertiary amines, Diazotization.

## PHYSICAL CHEMISTRY

### UNIT- V

#### **Thermodynamics**

**15h**

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-Kirchoff 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.

### **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.

**A.S.D.GOVERNEMNT DEGREE COLLEGE FOR WOMEN (A),KAKINADA**

**III YEAR SEMESTER-V EXAMINATION**

**PAPER-VI; INORGANIC,ORGANIC & PHYSICAL CHEMISTRY**

**Time: 3 hours**

**Max.Marks: 75**

**SECTION-A**

Answer ALL the questions. Each question carries TEN marks 5 x 10 = 50 Marks

1.a) Write postulates of Werner's co-ordination theory

వెర్నర్ సమన్వయ సిద్ధాంతములోని ముఖ్యాంశాలను తెలుపుము  
(OR)

b) Explain the formation of  $[Fe(CN)_6]^{4-}$  and  $[Fe(CN)_6]^{3-}$  on the basis of valence bond theory.

వేలన్స్ బంధ సిద్ధాంతం ఆధారంగా  $[Fe(CN)_6]^{4-}$  మరియు  $[Fe(CN)_6]^{3-}$  ఏర్పడుటను వివరించుము

2. a) How do you determine the magnetic susceptibility of metal complexes using Guoy balance method?

గాయ్ తుల పద్ధతి ద్వారా లోహ సంశ్లిష్టాల అయస్కాంత ఆవశ్యకతను ప్రయోగ పూర్వకంగా యెట్లు నిర్ణయించెదవు?

(OR)

b) Explain the factors that effect the stability of complexes.

సంశ్లిష్టాల స్థిరత్వమును ప్రభావితం చేయు అంశాలను గూర్చి వివరించుము

3. a) Write the methods of preparation of nitroalkanes.

నైట్రో ఆల్కేన్ల తయారీ పద్ధతులను గూర్చి వ్రాయుము  
(OR)

b) Explain about the Mannich reaction and Micheal addition reaction.

మానిచ్ చర్య మరియు మైఖేల్ సంకలన చర్యను గూర్చి వివరింపుము

4. a) How amines are prepared from Gabriel synthesis and Hoffmann bromamide method?

గాబ్రియల్ సంశ్లేషణ మరియు హాఫ్ మన్ బ్రోమమైడ్ పద్ధతుల ద్వారా ఏమీన్లను యెట్లు తయారు చేయుదురు

(OR)

b) Write any four electrophilic substitution reactions of aromatic reactions.

ఆరోమేటిక్ ఏమీన్ల యొక్క ఏవేని నాలుగు ఎలక్ట్రోఫిలిక్ ప్రతిక్షేపణ చర్యలను వ్రాయుము

5.a) Derive Kirckoff's equation. కిర్కాఫ్ సమీకరణమును ఉత్పాదించుము

(OR)

b) Describe the Carnot Cycle. కార్నాట్ చక్రమును వర్ణించుము

**SECTION – B**

Answer any FIVE of the following. Each question carries 5 marks. 5 x 5 = 25 Marks

6. Explain the EAN rule. Give any two complexes which don't obey this rule.

EAN నియమమును వివరించుము .ఈ నియమమును పాటించని రెండు సంశ్లేషాలను తెలుపుము

7. Briefly explain the crystal field theory. స్పటిక క్షేత్ర సిద్ధాంతమును గూర్చి క్లుప్తంగా వివరించుము

8. Differentiate the thermodynamic stability and kinetic stability of complexes.

సంశ్లేషాల యొక్క ఉష్ణ గతిక స్థిరత్వము మరియు గతి స్థిరత్వములను భేదించుము

9. Nef reaction. నెఫ్ చర్య

10. Explain the basicity of Amines. ఎమీన్ల క్షారత్వమును గూర్చి వివరించుము

11. Write notes on Diazotization. డయజోనికరణము గూర్చి వ్యాఖ్య వ్రాయుము

12. State and explain Joule-Thomson effect. జౌల్ - థామ్సన్ ఫలితమును తెల్పి ,వివరించుము

13. Write about Entropy. ఎంట్రోపీ గూర్చి వ్రాయుము

### **List of Reference Books**

1. Concise coordination chemistry by Gopalan and Ramalingam
2. Coordination Chemistry by Basalo and Johnson
3. Organic Chemistry by G.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



**A.S.D.GOVERNMENT DEGREE COLLEGE FOR WOMEN (A), KAKINADA**

**DEPARTMENT OF CHEMISTRY**

**BOARD OF STUDIES: 2019-20**

**THIRD YEAR, SEMESTER - V**

**Paper - VI (INORGANIC, ORGANIC & PHYSICAL CHEMISTRY)**

**45 hrs (3 h / w)**

**INORGANIC CHEMISTRY**

**UNIT-I**

**1. Reactivity of metal complexes: 4h**

Labile and inert complexes, ligand substitution reactions -  $SN^1$  and  $SN^2$ , substitution reactions of square planar complexes - Trans effect and applications of trans effect.

**2. Bioinorganic chemistry: 4h**

Essential elements, biological significance of Na, K, Mg, Ca, Fe, Co, Ni, Cu, Zn and Cl<sup>-</sup>. Metalloporphyrins – Structure and functions of hemoglobin, Myoglobin and Chlorophyll.

**PHYSICAL CHEMISTRY**

**UNIT-II**

**1. Chemical kinetics 8h**

Rate of reaction - Definition of order and molecularity. Derivation of rate constants for first, second, third and zero order reactions and examples. Derivation for time half change. Methods to determine the order of reactions. Effect of temperature on rate of reaction, Arrhenius equation, concept of activation energy.

**2. Photochemistry 5h**

Difference between thermal and photochemical processes. Laws of photochemistry- Grothus-Draper's law and Stark-Einstein's law of photochemical equivalence. Quantum yield-Photochemical reaction mechanism- hydrogen- chlorine, hydrogen- bromine reaction. Qualitative description of fluorescence, phosphorescence, Photosensitized reactions- energy transfer processes (simple example)

**ORGANIC CHEMISTRY**

**UNIT- III**

**Heterocyclic Compounds 7h**

Introduction and definition: Simple five membered ring compounds with one hetero atom Ex.Furan. Thiophene and pyrrole - Aromatic character – Preparation from 1,4,- dicarbonyl compounds, Paul-Knorr synthesis.

Properties : Acidic character of pyrrole - electrophilic 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.

## UNIT-IV

### **Carbohydrates**

**8h**

Monosaccharides: (+) Glucose (aldo hexose) - Evidence for cyclic structure of glucose (some negative aldehydes tests and mutarotation) - Proof for the ring size (methylation, hydrolysis and oxidation reactions) - Pyranose structure (Haworth formula and chair conformational formula).

(-) Fructose (keto hexose) - Evidence of 2 - keto hexose structure (formation of pentaacetate, formation of cyanohydrin its hydrolysis and reduction by HI). Cyclic structure for fructose (Furanose structure and Haworth formula) - osazone formation from glucose and fructose – Definition of anomers with examples.

Interconversion of Monosaccharides: Aldopentose to Aldo hexose (Arabinose to

D- Glucose, D-Mannose) (Kiliani - Fischer method). Epimers, Epimerisation - Lobry de bruyn van Ekenstein rearrangement. Aldo hexose to Aldopentose (D-Glucose to

D- Arabinose) by Ruff degradation. Aldo hexose to Keto hexose

[(+) Glucose to (-) Fructose] and Keto hexose to Aldo hexose (Fructose to Glucose)

## UNIT- V

### **Amino acids and proteins**

**7h**

Introduction: Definition of Amino acids, classification of Amino acids into alpha, beta, and gamma amino acids. Natural and essential amino acids - definition and examples, classification of alpha amino acids into acidic, basic and neutral amino acids with examples. Methods of synthesis: General methods of synthesis of alpha amino acids (specific examples - Glycine, Alanine, valine and leucine) by following methods: a) from halogenated carboxylic acid b) Malonic ester synthesis c) strecker's synthesis.

Physical properties: Zwitter ion structure - salt like character - solubility, melting points, amphoteric character, definition of isoelectric point.

Chemical properties: General reactions due to amino and carboxyl groups - lactams from gamma and delta amino acids by heating peptide bond (amide linkage). Structure and nomenclature of peptides and proteins.



**LABORATORY COURSE – VI**  
**Practical Paper – VI Physical Chemistry**  
**(at the end of semester V)**

**30 hrs (2 h/W)**

1. Determination of rate constant for acid catalyzed ester hydrolysis.
2. Determination of molecular status and partition coefficient of benzoic acid in Benzene and water.
3. Determination of Surface tension of liquid
4. Determination of Viscosity of liquid.
5. Adsorption of acetic acid on animal charcoal, verification of Freundlich isotherm.

**A.S.D.GOVERNEMNT DEGREE COLLEGE FOR WOMEN (A),KAKINADA**

**III YEAR SEMESTER-V EXAMINATION**

**PAPER-VI; INORGANIC,ORGANIC & PHYSICAL CHEMISTRY**

**Time: 3 hours**  
**75**

**Max.Marks:**

**SECTION-A**

Answer ALL the questions. Each question carries TEN marks 5 x 10 = 50 Marks

1.a) Describe the substitution reactions of metal complexes.

లోహ సంశ్లేషాల ప్రతిక్షేపణ చర్యలను వర్ణించుము  
(OR)

b) Write the structure and functions of haemoglobin.

హెమోగ్లోబిన్ యొక్క నిర్మాణము మరియు విధులను వ్రాయుము

2.a) Give in detail the various methods of determining the order of a chemical reaction.

ఒక చర్య యొక్క క్రమాంకమును కనుగొనుటకు గల వేర్వేరు పద్ధతులను తెలుపుము  
(OR)

b) Explain the photochemical reaction mechanisms of hydrogen-chlorine and hydrogen-bromine

reactions. హైడ్రోజన్ -క్లోరిన్ మరియు హైడ్రోజన్ -బ్రోమిన్ చర్యల యొక్క కాంతి రసాయన

చర్య

విధానమును వివరింపుము

3.a) What are heterocyclic compounds? Discuss the aromatic character of pyrrole, furan and

thiophene. విజాతీయ వలయ సమ్మేళనాలు అనగా నేమి ? ఫిర్రోల్ ,ఫ్యూరాన్ మరియు

థయోఫీన్ల యొక్క

అరోమాటిక్ స్వభావమును గూర్చి చర్చించుము  
(OR)

b) Illustrate the substitution reactions of Pyridine

ఫిరిడిన్ యొక్క ప్రతిక్షేపణ చర్యలను సోదాహరణంగా తెలుపుము

4.a) Discuss the cyclic structure of glucose. గ్లూకోజ్ యొక్క వలయ నిర్మాణమును చర్చించుము

(OR)

b) i) What are epimers? Give example. ఎఫిమర్లు అనగా నేమి ? ఉదాహరణ నిమ్ము

ii) Write about the formation of glucosazone. గ్లూకోసజోన్ ఏర్పడుటను గూర్చి వ్రాయుము

5.a) Give any three methods of preparation of alanine.

ఎలనీన్ తయారుచేయుటకు ఏవేని మూడు పద్ధతులను తెలుపుము

b) Describe the structure of proteins. ప్రోటీన్ల నిర్మాణమును వర్ణించుము

**SECTION-B**

Answer any FIVE of the following.Each question carries 5 marks. 5 x 5 = 25 Marks

6. Define labile and inert complexes with suitable examples.

అస్థిరశీల మరియు జడ సంక్లిష్టాలను తగిన ఉదాహరణతో వివరించుము

7. Explain the biological significance of sodium and potassium

సోడియం మరియు పొటాషియం ల యొక్క జీవ ప్రాముఖ్యతను వివరింపుము

8. Discuss about zero order reactions. శూన్య క్రమాంక చర్యలను గూర్చి వ్రాయుము

9. Write effect of temperature on the rate of a reaction.

చర్య రేటు పై ఉష్ణోగ్రత ప్రభావమును గూర్చి వ్రాయుము

10. What are photosensitized reactions? Give one example.

కాంతి స్పందన చర్యలు అనగా నేమి ? ఒక ఉదాహరణ నిమ్ము .

11. Explain the nature of pyrrole and pyridine.

ఫిరోల్ మరియు పిరిడిన్ ల యొక్క స్వభావమును గూర్చి వివరించుము

12. Kiliani – Fischer method. కిలియానీ - ఫిషర్ పద్ధతి

13. Write notes on Zwitter ion. జ్వీట్టర్ అయాన్ గూర్చి వ్యాఖ్య వ్రాయుము

### **List of Reference Books**

1. Concise coordination chemistry by Gopalan and Ramalingam
2. Coordination Chemistry by Basalo and Johnson
3. Organic Chemistry by G.Mare loudan, Purdue Univ
4. Advanced Physical Chemistry by Atkins
5. Text book of physical chemistry by S Glasstone
7. Instrumentation and Techniques by Chatwal and Anand
8. Essentials of nano chemistry by pradeep
9. A Textbook of Physical Chemistry by Puri and Sharma
10. Advanced physical chemistry by Gurudeep Raj



Definition – Sources of air pollution – Classification of air pollution – Acid rain – Photochemical smog – Green house effect – Formation and depletion of ozone – Bhopal gas disaster – Controlling methods of air pollution.

### **UNIT-III**

#### **Water pollution**

**9h**

Unique physical and chemical properties of water – water quality and criteria for finding of water quality – Dissolved oxygen – BOD, COD, Suspended solids, total dissolved solids, alkalinity – Hardness of water – Methods to convert temporary hard water into soft water – Methods to convert permanent hard water into soft water – eutrophication and its effects – principal wastage treatment – Industrial waste water treatment.

### **UNIT-IV**

#### **Chemical Toxicology**

**9h**

Toxic chemicals in the environment – effects of toxic chemicals – cyanide and its toxic effects – pesticides and its biochemical effects – toxicity of lead, mercury, arsenic and cadmium.

### **UNIT-V**

#### **Ecosystem and biodiversity**

**9h**

##### **Ecosystem**

Concepts – structure – Functions and types of ecosystem – Abiotic and biotic components – Energy flow and Energy dynamics of ecosystem – Food chains – Food web – Tropic levels – Biogeochemical cycles (carbon, nitrogen and phosphorus)

##### **Biodiversity**

Definition – level and types of biodiversity – concept - significance – magnitude and distribution of biodiversity – trends - biogeographical classification of india – biodiversity at national, global and regional level.

#### **List of Reference books**

1. Fundamentals of ecology by M.C.Dash
2. A Text book of Environmental chemistry by W. Moore and F.A. Moore
3. Environmental Chemistry by Samir k. Banerji

### **LABORATORY COURSE – VII-B**

**Practical Paper – Elective VII B (at the end of semester VI) 30 hrs (2 h / W)**

**50 Marks**



1. a) Explain the segments of the environment.

(OR)

b) Write about renewable energy sources.

2. a) Discuss in detail about air pollution.

(OR)

b) Describe the green house effect.

3. a) What are the quality parameters of water?

(OR)

b) Give the methods to convert permanent hard water to soft water.

4. a) What are the toxic effects of cyanide on the environment?

(OR)

b) Explain the biochemical effects of pesticides.

5. a) Describe the types of ecosystem.

(OR)

b) Give detailed account on biodiversity.

**SECTION -B**

**5 x 5 = 25**

**Marks**

Answer any **FIVE** of the following questions. Each carries **FIVE** marks.

6. Explain the importance of environment in now-a-days.

7. Write about hydrological cycle.

8. Short note on acid rains.

9. What is Bhopal gas disaster?

10. Give about the hardness of water.

11. Explain the toxicity of mercury.

12. What are the functions of eco system?

13. Discuss briefly about food chain.

**SYLLABUS FOR VI SEMESTER  
CHEMISTRY CLUSTER ELECTIVE-VIII-A-1**

**PAPER – VIII-A-1: POLYMER CHEMISTRY**

**UNIT-I**

**45 hrs (3 h / w)  
12h**



**Introduction of polymers:**

Basic definitions, degree of polymerization, classification of polymers- Natural and Synthetic polymers, Organic and Inorganic polymers, Thermoplastic and Thermosetting polymers, Plastics, Elastomers, Fibers and Resins, Linear, Branched and Cross Linked polymers, Addition polymers and Condensation Polymers, mechanism of polymerization. Free radical and Zeigler – Natta polymerization.

**UNIT-II****10h**

**Techniques of Polymerization:** Bulk polymerization, solution polymerization, suspension and Emulsion polymerization.

**Molecular weights of polymers:** Number average and weight average molecular weights Determination of molecular weight of polymers by Viscometry, Osmometry methods.

**UNIT-III****6h**

Kinetics of Free radical polymerization, Glass Transition temperature(T<sub>g</sub>) and Determination of T<sub>g</sub>:

Free volume theory, WLF equation, factors affecting glass transition temperature (T<sub>g</sub>).

**UNIT-IV****9h****Polymer additives:**

Introduction to plastic additives – fillers, Plasticizers and Softeners, Lubricants and Flow Promoters, Anti aging additives, Flame Retardants, Colourants, Blowing agents, Cross linking agents,

**UNIT-V****8h****Polymers and their applications:**

Preparation and industrial applications of Polyethylene, Polyvinyl chloride, Teflon, Polyacrylonitrile, Terelene, Nylon6.6 silicones.

**Additional Input (Not for semester exam paper setting):**

Plastic additives: Photo stabilizers, Nucleating agents.

**Reference Books:**

1. Seymour, R.B. & Carraher, C.E. *Polymer Chemistry: An Introduction*, Marcel Dekker, Inc. New York, 1981.
2. Odian, G. *Principles of Polymerization*, 4th Ed. Wiley, 2004.
3. Billmeyer, F.W. *Textbook of Polymer Science*, 2nd Ed. Wiley Interscience, 1971.
4. Ghosh, P. *Polymer Science & Technology*, Tata McGraw-Hill Education, 1991.34
5. Lenz, R.W. *Organic Chemistry of Synthetic High Polymers*. Interscience Publishers, New York, 1967.

**SYLLABUS FOR VI SEMESTER  
CHEMISTRY CLUSTER ELECTIVE-VIII-A-2**

**PAPER – VIII-A-2: INSTRUMENTAL METHODS OF ANALYSIS**

**45 hrs (3 h / w)**

**UNIT – I****Introduction to spectroscopic methods of analysis:****4 h**

Recap of the spectroscopic methods covered in detail in the core chemistry syllabus; Treatment of analytical data including error analysis (*viz.*, Absolute and Relative error; Accuracy and Precision; Significant figures; Determinate and Indeterminate errors). Classification of analytical methods, and types of instrumental methods. Characteristics of electromagnetic radiation.

## UNIT – II

### Molecular spectroscopy:

8h

#### *Infrared spectroscopy:*

Interactions with molecules: absorption and scattering. Means of excitation (light sources), separation of spectrum (wavelength dispersion, time resolution), detection of the signal (heat, differential detection), interpretation of spectrum (qualitative, mixtures, resolution), advantages of Fourier Transform (FTIR). Samples and results expected. Applications: Qualitative and Quantitative.

**Additional Input (Not for semester exam paper setting):** Special problems for portable instrumentation and rapid fluorescence.

## UNIT – III

10h

*UV-Visible/ Near IR* – emission, absorption, fluorescence and photoacoustic effect. Excitation sources (lasers, time resolution), wavelength dispersion (gratings, prisms, interference filters, laser, placement of sample relative to dispersion, resolution), Detection of signal (Barrier layer cell/ photovoltaic cell, phototubes or photocells, photomultiplier tubes), Single and Double Beam instruments, Interpretation (quantification, mixtures, absorption vs. fluorescence).

**Additional Input (Not for semester exam paper setting):** Sensitivity and Detection Limit; use of time, fluorescent tags.

## UNIT – IV

### Separation techniques

15h

#### *Chromatography:*

(08h)

Gas chromatography, liquid chromatography, supercritical fluids, Importance of column technology (packing, capillaries), Separation based on increasing number of factors (volatility, solubility, interactions with stationary phase, size, electrical field), Detection: simple vs. specific (gas and liquid). Electrophoresis.

**Additional Input (Not for semester exam paper setting):** Detection as a means of further analysis (use of tags and coupling to IR and MS), Use of Electrophoresis in DNA Analysis.

**Mass spectrometry:**

**(07h)**

Making the gaseous molecule into an ion (electron **ionization**, chemical ionization), Making liquids and solids into ions (**Electro Spray Ionization (ESI)**, fast atom bombardment), Mass Analyzers – **Magnetic Sector Analyzers (MSA)**, Time of flight, Electric quadrupole. **Characteristics of Molecular Ions – The Nitrogen Rule.**

**Additional Input (Not for semester exam paper setting):** MALDI (Matrix Assisted Laser Desorption/Ionization), Resolution of Mass spectrometry, time and multiple separations, Detection and interpretation (how this is linked to excitation).

**UNIT – V**

**Elemental analysis: Atomic spectroscopy:**

**8h**

Atomic absorption, Atomic emission, and Atomic fluorescence. Excitation and getting sample into gas phase (flames, electrical discharges, plasmas), Wavelength separation and resolution (dependence on technique),

**Additional Input (Not for semester exam paper setting):** Detection of radiation (simultaneous/scanning, signal noise), Interpretation (errors due to molecular and ionic species, matrix effects, and other interferences).

**NMR spectroscopy:** Principle, Instrumentation, Factors affecting chemical shift, Spin coupling.

**Additional Input (Not for semester exam paper setting):** Applications and problem solving.

**Reference books:**

1. Skoog, D.A. Holler F.J. & Nieman, T.A. *Principles of Instrumental Analysis*, Cengage Learning India Ed.
2. Willard, H.H., Merritt, L.L., Dean, J. & Settoe, F.A. *Instrumental Methods of Analysis*, 7th Ed. Wadsworth Publishing Company Ltd., Belmont, California, USA, 1988.
3. P.W. Atkins: *Physical Chemistry*.
4. G.W. Castellan: *Physical Chemistry*.
5. C.N. Banwell: *Fundamentals of Molecular Spectroscopy*. Brian Smith: *Infrared Spectral Interpretations: A Systematic Approach*. W.J. Moore: *Physical Chemistry*

## **SYLLABUS FOR VI SEMESTER**

### **CHEMISTRY CLUSTER ELECTIVE-VIII-A-3**

#### **PAPER – VIII-A-3 : ANALYSIS OF DRUGS, FOODS , DAIRY PRODUCTS & BIO-CHEMICAL ANALYSIS**

**45 hrs (3 h / w)**

**UNIT- I**

**10 h**

Analysis of the following drugs and pharmaceuticals preparations: (Knowledge of molecular formula, structure and analysis) Analysis of analgesics and antipyretics like aspirin and paracetamol. Analysis of antimalarials like chloroquine. Analysis of drugs in the treatment of infections and infestations: Amoxicillin., chloramphenicol, penicillin, tetracycline, Anti tuberculous drug- isoniazid.

**UNIT – II**

**6 h**

Analysis of the following drugs and pharmaceuticals preparations: (Knowledge of molecular formula, structure and analysis) Analysis of antihistamine drugs and sedatives like: allegra, zyrtec(citirizine), alprazolam, diazepam.

**UNIT – III**

**10 h**

Analysis of anti epileptic and anti convulsant drugs like phenobarbital and phenacemide.

Analysis of cardiovascular drugs: atenolol,

Analysis of lipitor(atorvastatin) a drug for the prevention of production of cholesterol.

Analysis of diuretics like: furosemide (Lasix).

Analysis of prevacid(lansoprazole) a drug used for the prevention of production of acids in stomach.

**UNIT – IV**

**10 h**

Analysis of Milk and milk products: Acidity, total solids, fat, total nitrogen, proteins, lactose, phosphate activity, casein, choride. Analysis of food materials- Preservatives: Sodium carbonate, sodium benzoate sorbic acid Coloring matters, - Brilliant blue FCF, fast green FCF, sunset yellow FCF.

Flavoring agents - Vanilla , diacetyl, limonene,

Adulterants in rice and wheat, wheat flour, coconut oil, coffee powder, tea powder, milk..

**UNIT – V**

**9 h**

Clinical analysis of blood: Composition of blood, clinical analysis, trace elements in the body. Estimation of blood cholesterol, glucose.

**Additional Input (Not for semester exam paper setting):**

Analysis of trazodone, lorazepam, ambien(zolpidem) and norvasc(amlodipine), Flavoring agents isoamyl acetate, Estimation of enzymes, RBC & WBC , Blood gas analyser

**REFERENCE BOOKS :**

1.F.J.Welcher-Standard methods of analysis,

2.A.I.Vogel-A text book of quantitative Inorganic analysis-ELBS,

3.F.D.Snell & F.M.Biffen-Commercial methods of analysis-D.B.Taraporavala & sons,

4.J.J.Elving and I.M.Kolthoff- Chemical analysis - A series of monographs on

analytical chemistry and its applications -- Inter Science- Vol I to VII.,

5. Analytical Agricultural Chemistry by S.L.Chopra & J.S.Kanwar -- Kalyani Publishers
6. Quantitative analysis of drugs in pharmaceutical formulations by P.D.Sethi, CBS Publishers and Distributors, New Delhi
7. G.Ingram- Methods of organic elemental micro analysis- Chapman and Hall.,
8. H.Wincciam and Bobbles (Henry J)- Instrumental methods of analysis of food additives.,
9. H.Edward-The Chemical analysis of foods;practical treatise on the examination of food stuffs and the detection of adulterants,
10. The quantitative analysis of drugs- D.C.Garratt-Chapman & Hall.,
11. A text book of pharmaceutical analysis by K.A.Connors-Wiley-International.,
12. Comprehensive medicinal chemistry-Ed Corwin Hansch Vol 5,Pergamon Press.,

**CHEMISTRY LABORATORY COURSE – VIII-A-I**

**Practical Paper – VIII-A-1: (at the end of semester VI) 30 hrs (2 h/w)  
50 Marks**

1. Preparation of Aspirin
2. Preparation of Paracetamol
3. Preparation of Acetanilide
4. Preparation of Barbutiric Acid
5. Preparation of Phenyl Azo  $\beta$ -naphthol

**CHEMISTRY LABORATORY COURSE – VIII-A-I**

**Practical Paper – VIII-A-2: (at the end of semester VI) 30 hrs (2 h/w)  
50 Marks**

**1. Electrochemistry:**

Determination of redox potential of  $\text{Fe}^{+2}/\text{Fe}^{+3}$  by potentiometric titration of ferrous ammonium sulphate vs. potassium dichromate.

**2. pH metry:**

- i) Preparation of phosphate buffer solutions.
- ii) pH metric titration of weak acid, acetic acid with strong base NaOH and calculation of dissociation constant.

**3. Colorimetry**

- i) Verification of Beer-Lambert law for  $\text{KMnO}_4$  and determination of concentration of the given solution
- ii) Verification of Beer -Lambert law for  $\text{K}_2\text{Cr}_2\text{O}_7$  and determination of concentration of the given solution

### **List of Reference Books**

1. Green Chemistry Theory and Practice. P.T.Anatas and J.C. Warner
2. Green Chemistry V.K. Ahluwalia Narosa, New Delhi.
3. Real world cases in Green Chemistry M.C. Cann and M.E. Connelly
4. Green Chemistry: Introductory Text M.Lancaster: Royal Society of Chemistry (London)
5. Green Chemistry: Introductory Text, M.Lancaster
6. Principles and practice of heterogeneous catalysis, Thomas J.M., Thomas M.J., John Wiley
7. Green Chemistry: Environmental friendly alternatives R S Sanghli and M.M Srivastava, Narosa Publications

### **VII- A-3 Practical : Project Work**

**WEIGHTAGE TO THE COURSE CONTENT**  
**Third Year Semester - VI**  
**CLUSTER ELECTIVE PAPER – VIII-A1/A2/A3**

Sl. No.	COURSE CONTENT	ESSAY	SA
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**45 hrs (3 h / w)**

**UNIT –I**

**12h**

Review of energy sources ( renewable and non-renewable) – classification of fuels and their calorific value. Coal: Uses of Coal (fuel and non fuel) in various industries , its composition , carbonization of coal - coal gas ,producer gas and water gas – composition and uses – fractionation of coal tar – uses of coal tar based chemicals , requisites of a good metallurgical coke , coal gasification (Hydro gasification and catalytic gasification ) coal liquefaction and solvent refining.

**UNIT-II**

**6h**

Petroleum and petrol chemical industry:

Composition of crude petroleum , refining and different types of petroleum products and their applications.

**UNIT-III**

**10h**

Fractional distillation (principle and process) , cracking ( Thermal and catalytic cracking). Reforming petroleum and non petroleum fuels (LPG , CNG , LNG , biogas ) ,fuels derived from biomass , fuel from waste , synthetic fuels (gaseous and liquids) , clear fuels , petro chemicals : vinyl acetate , propylene oxide , isoprene , butadiene , toluene and its derivative xylene.

**UNIT-IV**

**10h**

Lubricants:

Classification of lubricants , lubricating oils(conducting and non conducting) , solid and semi solid lubricants , synthetic lubricants. Properties of lubricants (viscosity index , cloud point , pore point) and their determination.

**UNIT-V**

**7h**

**Batteries:**

Primary and secondary batteries, battery components and their role, Characteristics of

Battery. Working of following batteries: Pb acid, Li-Battery, Solid state electrolyte battery.

Fuel cells, Solar cell and polymer cell.

**1. LABORATORY COURSE – VIII**

**Practical Paper – VIII-B-1: (at the end of semester VI)**

**30 hrs (2 h / W)**



1. Preparation of Aspirin
2. Preparation of Paracetamol
3. Preparation of Acetanilide
4. Preparation of Barbutiric Acid
5. Preparation of Phenyl Azo  $\beta$ -naphthol

**Reference books:**1. E.Stochi : Industrial chemistry , Vol-1, Ellis Horwood Ltd.UK

2. P.C.Jain , M.Jain: Engineering chemistry, Dhanpat Rai &sons , Delhi.

3. B.K.Sharma: Industrial Chemistry , Goel Publishing house , Meerut.

**A.S.D.GOVERNMENT DEGREE COLLEGE FOR WOMEN (A), KAKINADA**

**DEPARTMENT OF CHEMISTRY**

**BOARD OF STUDIES: 2019-20**

**SEMESTER-VI**

**PAPER – VIII-B-2: INORGANIC MATERIALS OF INDUSTRIAL IMPORTANCE**

**45 hrs (3 h / w)**

**UNIT - I**

**Recapitulation of s- and p-Block Elements**

**8h**

Periodicity in *s*- and *p*-block elements with respect to electronic configuration, atomic and ionic size, ionization enthalpy, electronegativity (Pauling, Mulliken, and Alfred - Rochow scales). Allotropy in C, S, and P. Oxidation states with reference to elements in unusual and rare oxidation states like carbides and nitrides), inert pair effect, diagonal relationship and anomalous behaviour of first member of each group.

## **UNIT – II**

**15h**

### **Silicate Industries**

**Glass:** Glassy state and its properties, classification (silicate and non-silicate glasses).

Manufacture and processing of glass. Composition and properties of the following types of glasses: Soda lime glass, lead glass, armoured glass, safety glass, borosilicate glass, fluorosilicate, coloured glass, photosensitive glass.

**Ceramics:** Important clays and feldspar, ceramic, their types and manufacture. High technology ceramics and their applications, superconducting and semiconducting oxides, fullerenes carbon nanotubes and carbon fibre.

**Cements:** Classification of cement, ingredients and their role, Manufacture of cement and the setting process, quick setting cements.

## **UNIT – III**

**8h**

### **Fertilizers:**

Different types of fertilizers. Manufacture of the following fertilizers: Urea, ammonium nitrate, calcium ammonium nitrate, ammonium phosphates; polyphosphate, superphosphate, compound and mixed fertilizers, potassium chloride, potassium sulphate.

## **UNIT – IV**

**8h**

### **Surface Coatings:**

Objectives of coatings surfaces, preliminary treatment of surface, classification of surface coatings. Paints and pigments-formulation, composition and related properties. Oil paint, Vehicle, modified oils, Pigments, toners and lakes pigments, Fillers, Thinners, Enamels, emulsifying agents. Special paints (Heat retardant, Fire retardant, Eco-friendly paint, Plastic paint), Dyes, Wax polishing, Water and Oil paints, additives, Metallic coatings (electrolytic and electroless), metal spraying and anodizing.

## **UNIT – V**

**6h**

### **Alloys:**

Classification of alloys, ferrous and non-ferrous alloys, Specific properties of elements in

alloys. Manufacture of Steel (removal of silicon decarbonization, demanganization, desulphurization dephosphorisation) and surface treatment (argon treatment, heat treatment, nitriding, carburizing). Composition and properties of different types of steels.

### **Chemical explosives:**

Origin of explosive properties in organic compounds, preparation and explosive properties of lead azide, PETN, cyclonite (RDX). Introduction to rocket propellants.

## **LABORATORY COURSE – VIII** **Practical Paper – VIII-B-2: (at the end of semester VI)**

**30 hrs (2 h / W)**

### **1. Electrochemistry:**

Determination of redox potential of  $\text{Fe}^{+2}/\text{Fe}^{+3}$  by potentiometric titration of ferrous ammonium sulphate vs. potassium dichromate.

### **2. pH metry:**

- i) Preparation of phosphate buffer solutions.
- ii) pH metric titration of weak acid, acetic acid with strong base NaOH and calculation of dissociation constant.

### **3. Colorimetry**

- i) Verification of Beer-Lambert law for  $\text{KMnO}_4$  and determination of concentration of the given solution
- ii) Verification of Beer -Lambert law for  $\text{K}_2\text{Cr}_2\text{O}_7$  and determination of concentration of the given solution

### **Reference Books:**

1. E. Stocchi: *Industrial Chemistry*, Vol-I, Ellis Horwood Ltd. UK.
2. R. M. Felder, R. W. Rousseau: *Elementary Principles of Chemical Processes*, Wiley Publishers, New Delhi.
3. W. D. Kingery, H. K. Bowen, D. R. Uhlmann: *Introduction to Ceramics*, Wiley Publishers, New Delhi.
4. J. A. Kent: *Riegel's Handbook of Industrial Chemistry*, CBS Publishers, New Delhi.

5. P. C. Jain & M. Jain: *Engineering Chemistry*, Dhanpat Rai & Sons, Delhi.
6. R. Gopalan, D. Venkappayya, S. Nagarajan: *Engineering Chemistry*, Vikas Publications, New Delhi.
7. B. K. Sharma: *Engineering Chemistry*, Goel Publishing House, Meerut

**A.S.D.GOVERNMENT DEGREE COLLEGE FOR WOMEN (A), KAKINADA**

**DEPARTMENT OF CHEMISTRY**

**BOARD OF STUDIES: 2019-20**

**SEMESTER-VI**

**PAPER – VIII-B-3 : ANALYSIS OF APPLIED INDUSTRIAL PRODUCTS**

**45 hrs (3 h / w)**

***UNIT-I***

Analysis of soaps: moisture and volatile matter, combined alkali, total fatty matter, free alkali, total fatty acid, sodium silicate and chlorides.

Analysis of paints : Vehicle and pigments, Barium Sulphate, total lead, lead chromate, iron pigments, zinc chromate

***UNIT- II***

Analysis of oils: saponification value, iodine value, acid value, ester value, bromine value, acetyl value.

Analysis of industrial solvents like benzene, acetone, methanol and acetic acid.,  
Determination of methoxyl and N-methyl groups.,

***UNIT-III***

Analysis of fertilizers: Urea, NPK fertilizer, super phosphate,

Analysis of DDT, BHC, endrin, endosulfone, malathion, parathion.,

Analysis of starch, sugars, cellulose and paper,

***UNIT -IV***

Gas analysis: carbon dioxide, carbon monoxide, oxygen, hydrogen, saturated hydrocarbon, unsaturated hydrocarbons, nitrogen, octane number, cetane number

Analysis of Fuel gases like: water gas, producer gas, kerosene (oil) gas.

Ultimate analysis : carbon, hydrogen, nitrogen, oxygen, phosphorus and sulfur.,

**UNIT - V**

Analysis of Complex materials:

**Analysis of cement**- loss on ignition, insoluble residue, total silica, sesquioxides, lime, magnesia, ferric oxide, sulphuric anhydride.

**Analysis of glasses** - Determination of silica, sulphur, barium, arsenic, antimony, total  $R_2O_3$ , calcium, magnesium, total alkalis, aluminium, chloride, fluoride

5. Students empower the knowledge about fertilizers and pesticides.

6. Students can understand the chemical reactivity of the powerful pesticides like DDT, BHC used in agricultural field.

7. At the end of the Course Students can prefer to study courses like agriculture and pharmaceutical.

**SUGGESTED BOOKS:**

1. F.J. Welcher-Standard methods of analysis,

- 2.A.I.Vogel-A text book of quantitative Inorganic analysis-ELBS,
- 3.H.H.Willard and H.Deal- Advanced quantitative analysis- Van Nostrand Co,
- 4.F.D.Snell & F.M.Biffen-Commercial methods of analysis-D.B.Taraporavala & sons,
- 5.J.J.Elving and I.M.Kolthoff- Chemical analysis - A series of monographs on analytical chemistry and its applications -- Inter Science- Vol I to VII.,
- 6.G.Z.Weig - Analytical methods for pesticides,plant growth regulators and food additives - Vols I to VII,
- 7.Analytical Agricultural Chemistry by S.L.Chopra & J.S.Kanwar -- Kalyani Publishers
- 8.Manual of soil, plant, water and fertilizer analysis, R.M.Upadhyay and N.L Sharma,Kalyani Publishers

### **List of Reference Books**

1. Green Chemistry Theory and Practice. P.T.Anatas and J.C. Warner
2. Green Chemistry V.K. Ahluwalia Narosa, New Delhi.
3. Real world cases in Green Chemistry M.C. Cann and M.E. Connelly
4. Green Chemistry: Introductory Text M.Lancaster: Royal Society of Chemistry (London)
5. Green Chemistry: Introductory Text, M.Lancaster
6. Principles and practice of heterogeneous catalysis, Thomas J.M.,Thomas M.J., John Wiley
7. Green Chemistry: Environmental friendly alternatives R S Sanghli and M.M Srivastava, Narosa Publications

### **VII-A-3 Practical:- Project Work / Intern Ship**

## **PANEL OF EXTERNAL EXAMINERS:**

1. Dr. V. Sambasiva Rao, Lecturer in Chemistry, Govt. College (A), Rajahmundry.
2. Sri. P. Kiran Kumar, Lecturer in Chemistry, S.G.A.Degree College, Yellamanchali.
3. Dr. P. Suresh, Lecturer in Chemistry, M.R. College, Peddapuram.
4. Smt. N.Baby Nirmala, Lecturer in Chemistry, V.S.M. College, Ramachandrapuram.
5. Dr. D. Madhava Sarma, Lecturer in Chemistry, GDC, Tadepallegudem.
6. Sri. N. Lakshmana Rao, Lecturer in Chemistry, S.K.B.R. College, Amalapuram.
7. Dr. G. Vayu Kumar, Lecturer in Chemistry, GDC (M), Srikakulam.
8. Sri. K.A.R.S.S. Prasad, Lecturer in Chemistry, V.S.Krishna Collge (A), Visakapatnam.
9. Sri. K.Srinivas, Lecturer in Chemistry, C.R.R & S.R.R. College, Vijayavada.
10. Sri. V. Sanjeeva Kumar, Lecturer in Chemistry, GDC, Mandapeta.
11. Sri. B. Venkata rao, Lecturer in Chemistry, GDC, Tadepallegudem.
12. Smt. K.Jhansi lakshmi, Lecturer in Chemistry, Ideal Degree College (A), Kakinada.
13. Dr. V. Someswara Rao, Lecturer in Chemistry, Govt. College (A), Rajahmundry.
14. Dr. V. Ganapati Rao, Lecturer in Chemistry, MSN Degree College Kakinada.

## Cluster Elective –III

### ORGANIC

#### PAPER – VIII-C-1 : ORGANIC SPECTROSCOPIC TECHNIQUES

45 hrs (3 h / w)

#### UNIT-I

10h

##### NUCLEAR MAGNETIC RESONANCE SPECTROSCOPY

Nuclear spin, Principles of NMR-Classical and Quantum Mechanical methods, Magnetic moment and Spin angular momentum. Larmor Frequency. Instrumentation. Relaxation-spin-spin & spin lattice relaxation. Shielding constants, Chemical shifts, Shielding and Deshielding mechanism-Factors influencing Chemical shift. Spin-Spin interactions-AX, AX<sub>2</sub> and AB types. Vicinal, Geminal and Long range coupling- Factors influencing coupling constants.

#### UNIT – II

5h

Spin decoupling, Spin tickling, Deuterium exchange, Chemical shift reagents and Nuclear overhauser effect. Applications in Medical diagnostics, Reaction kinetics and Mechanically induced dynamic nuclear polarization. FT NMR and its Advantages.

#### UNIT-III

10h

##### UV & VISIBLE SPECTROSCOPY

Electronic spectra of diatomic molecules. The Born-oppenheimer approximation. Vibrational coarse structure: Bond association and Bond sequence. Intensity of Vibrational-electronic spectra: The Franck-Condon principle. Rotational fine structure of electronic vibration transitions. Electronic structure of diatomic molecules.

Types of transitions, Chromophores, Conjugated dienes, trienes and polyenes, unsaturated carbonyl compounds-Woodward – Fieser rules.

#### UNIT-IV

5h

Electronic spectra of polyatomic molecules. Chemical analysis by Electronic Spectroscopy – Beer-Lambert's Law. Deviation from Beer's law. Quantitative determination of metal ions (Mn<sup>+2</sup>, Fe<sup>+2</sup>, NO<sub>2</sub><sup>-</sup>, Pb<sup>+2</sup>). Simultaneous determination of Chromium and Manganese in a mixture.



**Electron Spin Resonance Spectroscopy**

Basic Principles, Theory of ESR, Comparison of NMR & ESR. Instrumentation, Factors affecting the 'g' value, determination of 'g' value. Isotropic and Anisotropic constants. Splitting hyper fine splitting coupling constants. Line width, Zero field splitting and Kramer degeneracy. Crystal field splitting, Crystal field effects.

Applications:- Detection of free radicals; ESR spectra of (a) Methyl radical ( $\text{CH}_3^\cdot$ ), (b) Benzene anion ( $\text{C}_6\text{H}_6^-$ ) (c) Isoquinine (d)  $[\text{Cu}(\text{H}_2\text{O})_6]^{+2}$  (e)  $[\text{Fe}(\text{CN})_5\text{NO}]^{-3}$  (f)

**REFERENCE BOOKS:**

1. Electron Spin Resonance Elementary Theory and Practical Applications- John E. Wertz and James R. Bolton, Chapman and Hall, 1986.
2. Spectroscopic Identification of organic compounds – Silverstein, Basseler and Morrill.
3. Organic Spectroscopy- William Kemp.
4. Fundamentals of Molecular Spectroscopy- C.N.Banwell and E.A. Mc cash 4<sup>th</sup> Edition, Tata Mc Graw Hill Publishing Co., Ltd. 1994.
5. Physical Methods in Inorganic Chemistry – R.S.Drago, Saunders Publications.
6. Application of Mössbauer Spectroscopy – Green Mood.
7. NMR, NQR, EPR and Mössbauer Spectroscopy in inorganic chemistry – R.V Parish, Ellis, Harwood.
8. Instrumental Methods of Chemical Analysis- H.Kaur, Pragathi Prakashan, 2003.
9. Instrumental Methods of Analysis, 7<sup>th</sup> Edition – Willard, Merrit, Dean, Settle, CBS Publications, 1986.
10. Molecular Structure and Spectroscopy – G. Aruldas, Prentice Hall of India Pvt.Ltd, New Delhi, 2001.
11. Mössbauer Spectroscopy – N.N. Green Wood and T.C. Gibb, Chapman, and Hall, Landon 1971.
12. Coordination Chemistry: Experimental Methods- K. Burger, London Butter Worths, 1973.
13. Analytical spectroscopy – Kamlesh Bansal, Campus books, 2008.
14. Structural Inorganic Chemistry Mössbauer Spectroscopy – Bhide.
15. Principle of Mössbauer Spectroscopy – T.C. Gibb, Chapman, and Hall, Landon 1976.

## Cluster Elective –III

### ORGANIC

#### PAPER – VIII-C-2 : ADVANCED ORGANIC REACTIONS

45 hrs (3 h / w)

#### UNIT – I

##### ORGANIC PHOTOCHEMISTRY

Organic photochemistry : Molecular orbitals, carbonyl chromophore–triplet states, Jablonski diagram, inter–system crossing. Energy transfer. Energies properties and reaction of singlet and triplet states of and transitions.

**Photochemical reactions** : (a) Photoreduction, mechanism, influence of temperature, solvent, nature of hydrogen donors, structure of substrates on the course of photo reduction,.

#### UNIT – II

##### ORGANIC PHOTOCHEMISTRY

Norrish cleavages, type I : Mechanism, acyclic cyclicdiones, influence of sensitizer, photo Fries rearrangement. Norrish type II cleavage : Mechanism and stereochemistry, type II reactions of esters : 1: 2 diketones, photo decarboxylation., Di -  $\pi$  methane rearrangement, Photochemistry – of conjugated dienes, Decomposition of nitrites – Barton reaction.

#### UNIT – III

##### PROTECTING GROUPS AND ORGANIC REACTIONS

Principles of (1) Protection of alcohols – ether formation including silyl ethers – ester formation, (2) Protection of diols – acetal,ketal and carbonate formation, (3) Protection of carboxylic acids – ester formation, benzyl and t–butyl esters, (4) Protection of amines – acetylation, benzylation, benzyloxy carbonyl, triphenyl methyl groups and fmoc, (5) Protection of carbonyl groups – acetal, ketal, 1,2–glycols and 1,2–dithioglycols formation.

#### UNIT – IV

Synthetic reactions : Mannich reaction – Mannich bases – Robinson annulations. The Shapiro reaction, Stork–enamine reaction. Use of dithioacetals – Umpolung, phase transfercatalysis – mechanisms and use of benzyl trialkyl ammonium halides. Wittig reaction.

## UNIT –V : NEW SYNTHETIC REACTIONS

Baylis–Hillman reaction, RCM olefin metathesis, Grubb catalyst, Mukayama aldol reaction, Mitsunobu reaction, McMurrey reaction, Julia–Lythgoe olefination, and Peterson’s stereoselective olefination, Heck reaction, Suzuki coupling, Stille coupling and Sonogishira coupling, Buchwald–Hartwig coupling. Ugi reaction, Click reaction.

### Recommended Books

1. Molecular reactions and Photochemistry by Charles Dupey and O.L. Chapman.
2. Molecular Photochemistry by Turru.
3. Importance of antibonding orbitals by Jaffe and Orchin.
4. Text Book of Organic Chemistry by Cram,. Hammand and Henrickson.
5. Some modern methods of organic synthesis by W. Carruthers.
6. Guide Book to Organic Synthesis by R.K. Meckie, D.M. Smith and R.A. Atken.
7. Organic Synthesis by O.House.
8. Organic synthesis by Michael B. Smith.
9. Organic Chemistry Claydon and others 2005.
10. Name Reactions by Jie Jack Li
11. Reagents in Organic synthesis by B.P. Mundy and others.
12. Tandem Organic Reactions by Tse–Lok Ho.

## Cluster Elective –III

### ORGANIC

#### PAPER – VIII-C-3 : PHARMACEUTICAL AND MEDICINAL CHEMISTRY

45 hrs (3 h / w)

#### UNIT-I

8h

Pharmaceutical chemistry Terminology: Pharmacy, Pharmacology, Pharmacophore, Pharmacodynamics, Pharmacokinetics (ADME, Receptors - brief treatment) Metabolites and Anti metabolites.

#### UNIT-II

##### Drugs:

8h

Nomenclature: Chemical name, Generic name and trade names with examples Classification: Classification based on structures and therapeutic activity with one example each, Administration of drugs

#### UNIT-III

##### Synthesis and therapeutic activity of the compounds:

12h

a. Chemotherapeutic Drugs

1.Sulphadruugs(Sulphamethoxazole) 2.Antibiotics -  $\beta$ -Lactam Antibiotics, Macrolide Antibiotics, 3. Anti malarial Drugs(chloroquine)

b. Psycho therapeutic Drugs:

1.Anti pyretics(Paracetamol) 2.Hypnotics, 3.Tranquilizers(Diazepam) 4.Levodopa

#### UNIT-IV

##### Pharmacodynamic Drugs:

8h

1. Antiasthma Drugs (Solbutamol) 3. Antianginals (Glycerol Trinitrate)

4. Diuretics(Frusemide)

#### UNIT-V HIV-AIDS:

9h

Immunity - CD-4cells, CD-8cells, Retro virus, Replication in human body, Investigation available, prevention of AIDS, Drugs available - examples with structures: PIS: Indivanir (crixivan), Nelfinavir(Viracept).

#### List of Reference Books:

1.Medicinal Chemistry by Dr. B.V.Ramana

2.Synthetic Drugs by O.D.Tyagi & M.Yadav

3.Medicinal Chemistry by Ashutoshkar

4.Medicinal Chemistry by P.Parimoo

5.Pharmacology& Pharmacotherapeutics R.S Satoshkar & S.D.Bhandenkar

6.Medicinal Chemistry by Kadametal P-I & P.II

7.European Pharmacopoeia.