

**PITHAPUR RAJAH'S GOVERNMENT COLLEGE  
(AUTONOMOUS)**

**KAKINADA - 533 001, EAST GODAVARI, A.P.**

**Affiliated to Adikavi Nannaya University**

**NAAC Accredited with "A" Grade (3.17 CGPA)**

**BOARD OF STUDIES OF CHEMISTRY**

**B.Sc. Chemistry Under CBCS**

**Meeting Minutes/Resolutions**



*Convened on 02 December 2021*

**DEPARTMENT OF CHEMISTRY**

**P. R. GOVT. COLLEGE (Autonomous)**

**Opp. Mc Laurin High School, Raja Ram Mohan Roy Road,  
Kakinada**

**[www.prgc.ac.in](http://www.prgc.ac.in); e-mail: [chemistry\\_dept@prgc.ac.in](mailto:chemistry_dept@prgc.ac.in)**

**P. R. Govt. College (A), Kakinada**  
**Recommended Composition and Functions of the Board of Studies of Chemistry: 2021-22**

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**I Composition**

**1. Head of the Department concerned (Chairman):**

Dr. D. Rama Rao, M.Sc., B. Ed., M. Phil., Ph.D.

**2. The entire faculty of each specialization.**

1. Dr. D. Chenna Rao
2. V. Sanjeeva Kumar
3. T. V. V. Satyanarayana
4. P. Vijay Kumar
5. V. Rambabu
6. G. Pavani
7. Dr. T. Uma Maheswara Rao
8. Dr. N. Bujji Babu
9. Dr. Ch. Praveen
10. V. Venkateswara Rao

**3. One expert in the subject from outside the college to be nominated by the Academic Council**

Sri. V. Mallikarjuna Sarma, Lecturer in Chemistry, ASD Govt. Degree College for Women (Autonomous), Kakinada.

**4. One expert to be nominated by the Vice-Chancellor from a panel of six recommended by the College Principal**

Dr. K. Jhansi Lakshmi, Lecturer in Chemistry, ASD Govt. Degree College for Women (Autonomous), Kakinada.

**5. One representative from industry/ Corporate Sector/ allied area relating to Placement.**

Dr. B. Ramesh Babu, Founder & M.D., BogaR laboratories, Peddapuram.  
Ph: 9701712028.

**6. One postgraduate meritorious alumnus to be nominated by the Principal. The chairman, Board of Studies, may with the approval of the Principal of the College, Co-opt.**

K.N.S. Swamy, M.Sc., APSET (Student Alumni Member)

**II. Term**

The term of the nominated members shall be two years.

**III. Meeting**

The Principal of the College shall draw the schedule for meeting of the Board of Studies for different Departments. The meeting may be scheduled as and when necessary but at least once in a year.

#### IV. Functions

The Board of Studies of a Department in the College shall:

- a) Prepare syllabus and various courses keeping in view the objectives of the College interest of the stakeholders and national requirement for consideration and approval of the Academic Council.
- b) Suggest methodologies for innovative teaching and evaluation techniques.
- c) Suggest panel of names to the Academic Council for appointment of examiners.
- d) Coordinate research, Teaching, Extension and other academic activities in the Department/ College.

**P.R. GOVT.COLLEGE (A) KAKINADA**  
**DEPARTMENT OF CHEMISTRY**

Meeting of Board of Studies in Chemistry is convened on 02 December 2021 through offline at P.R. Govt. College (A), Kakinada, at 3.00 PM.

**Venue:** Conference Hall, Dt: 02-12-2021, Thursday - 3.00 PM.

The Principal Dr. B.V. Tirupanyam, Chairman, Dr. D. Rama Rao, University Nominee, Dr. K. Jhansi Lakshmi, Lecturer in Chemistry, ASD Govt. Degree College for Women (Autonomous), Kakinada, Industrialist Dr. B. Ramesh Babu, Founder & M.D., BogaR laboratories, Peddapuram, Subject Expert Sri. V. Mallikarjuna Sarma, Lecturer in Chemistry, ASD Govt. Degree College for Women (Autonomous), Kakinada, all the faculty members of Chemistry Department and student alumni attended the meeting.

**Agenda:**

- To discuss the Semester System and Choice Based Credit System (CBCS) being implemented for the past 06 years, i.e., w.e.f. 2015-16.
- To discuss and approve the Continuation/Modifications of the syllabus for the Odd & Even Semesters of I, II & III Years for 2021-22.
- Grant of Extra credits for Online SWAYAM MOOCs etc.
- Syllabus, Model Question Papers and Model Blue Prints for I, II, III, IV, V and VI Semesters.
- Teaching learning methodology by 60:40 (External: Internal) ratio for the present II- and III-Year Students and 50:50 (External: Internal) ratio I Year Students w.e.f. 2021-22.
- Panel of paper setters and examiners.
- Proposals for Community Service Projects/Extension activities for the benefit of the society.
- Department action plan for 2021-22.
- To discuss and resolve the minor modifications/refinement if any, in the cluster electives CI, CII & CIII as majority of the students opting this cluster as their choice.
- Any Other Proposal with the Permission of the Chairman.

## Resolutions:

The Board of Studies meeting was convened by the Chemistry Department on 02.12.2021 at 3.00 pm under the chairmanship of Dr. D. Rama Rao, In-charge of the department. Dr. K. Jhansi Lakshmi, University Nominee., Sri. V. Mallikarjuna Sarma, Lecturer in Chemistry, ASD Degree College for Women's, Kakinada and all members of the faculty of Chemistry and student representatives attended the meeting. The following agenda items are discussed and resolutions are made.

1. It is resolved to continue choice-based credit system in the chemistry combination programmes as per the directions of the CCE, Vijayawada to the first year, second year and final year students for the academic year 2021-22.
2. Resolved to follow 50%-50% external and internal pattern of evaluation w. e. f. 2021-2022 admitted batch and it will be continued in second and third year consecutively.
3. Resolved to follow 60%-40% external and internal for 2018-2019 and 2019-2020 admitted batch and the same is continued in second and third year.
4. It is resolved to allocate 50 marks for project work for final year students of chemistry in cluster paper C - 3 practicals, w.e.f 2021-22 in accordance with APSCHE.
5. It is resolved to conduct Departmental activities such as OZONE DAY, CHEM FEST, CHEMISTRY DAY, SCIENCE DAY etc.
6. It is resolved to offer Subject Electives and clusters A, B and C in the VI Semester as per the guidelines of AKNU
7. It is resolved to implement the recommended pedagogy for the first semester 2021-22
8. Resolved to conduct practical examinations semester wise.
9. It is resolved to organize guest lectures by eminent professors.
10. Resolved to implement no pass minimum for internal assessment for CBSE pattern students as the pattern is learner oriented.
11. It is resolved to maintain status quo for question paper pattern in I, II, III years.
12. It is resolved to encourage students enroll in MOOCS Online Programmes and give extra credits for students after successful completion of the courses.
13. Resolved to submit proposals to conduct a faculty development program in instrumentation techniques/ advanced topics with the assistance of the industry representatives and university representatives.
14. Resolved to assist the orphan children of below two years age being taken by

department of women and child welfare as an extension activity with the funds contributed by the faculty members of the Department.

15. Resolved that the syllabus/ workload distribution to the individual lecturers is either as Paper wise or as Track wise.

## Signatures of the members who attended the Board of studies in Chemistry

On 02<sup>nd</sup> December 2021

### **Mode of Conduct of meeting: Offline**

1. Dr. D. Rama Rao Chairman & Lecturer in Charge
2. Dr. K. Jhansi Lakshmi, University representative  
ASD Govt. Degree College for Women (Autonomous), Kakinada..
3. Dr. B. Ramesh Babu, Founder & M.D., BogaR laboratories, Peddapuram. Ph: 9701712028.
4. Sri. V. Mallikarjuna Sarma Subject expert  
Lecturer in Chemistry,  
ASD Degree College for Women's, Kakinada
5. Dr. D. Chenna Rao Member
6. V. Sanjeeva Kumar Member
7. T. V. V. Satyanarayana Member
8. P. Vijay Kumar Member
9. V. Ram babu Member
10. G. Pavani Member
11. Dr. T. Uma Maheswara Rao Member
12. Dr. N. Bujji Babu Member
13. Dr. Ch. Praveen Member
14. V. Venkateswara Rao Member
15. K.N.S. Swamy Student Alumni Member

Signatures of the members who attended the

Board of studies in Chemistry on 02.12.2021 at 3.00pm

Mode of Conduct of meeting: Offline

NAME	SIGNATURE	CONTACT NO.
Dr. D. Rama Rao		
Dr. K. Jhansi Lakshmi	K. Jhansi Lakshmi	9441236409
Dr. B. Ramesh Babu	B. Ramesh Babu 21/12/21	9701712028
Sri. V. Mallikarjuna Sarma	V. Mallikarjuna Sarma	9676822550
Dr. D. Chenna Rao	D. Chenna Rao	9560740108
V. Sanjeeva Kumar	V. Sanjeeva Kumar	9849324966
T. V. V. Satyanarayana	T. V. V. Satyanarayana	9490876913
P. Vijay Kumar	P. Vijay Kumar	9652023082
V. Ram babu	V. Ram babu	9948485537
G. Pavani	G. Pavani	9701877823
Dr. T. Uma Maheswara Rao	T. Uma Maheswara Rao	9247714077
Dr. N. Bujji Babu	N. Bujji Babu	9441394792
Dr. Ch. Praveen	Ch. Praveen	9491185518
V. Venkateswara Rao	V. Venkateswara Rao	9885165588
K.N.S. Swamy	K.N.S. Swamy	9908900962



## ACTION PLAN BOS MEETING -CHEMISTRY HELD ON 02.12.2021.

### 1. Department activities for 2021-22 academic year.

#### Annexure- I

Month	Activity proposed	Faculty member in charge
July-21	Departmental staff meeting to review results and class work allotment	Dr. D. Rama Rao
July - 21	Preparation of curricular plans, time-tables etc.,	All Faculty Members
Aug - 21	Remedial coaching classes for II & III year supplementary exams	All Faculty Members
Sept-21	Ozone day	All Faculty Members
Nov-21	National Education Day - Outreach Program to nearby school	All Faculty Members
	Student awareness programmes on ragging & eve teasing - consequences, self-discipline, career guidance, higher education opportunities etc.,	All Faculty Members
	Bridge classes for I year students	All Faculty Members
Dec-21	World AIDS Day	All Faculty Members
	Chemistry day & Chem fest	All Faculty Members
Jan-21	10 days coaching for PG entrance examinations in chemistry Study tour / Field trips	All Faculty Members
Feb-21	NATIONAL SCIENCE DAY	All Faculty Members
March-21	Consumer awareness day	Dr. D. Rama Rao

### 2. Organizing National/ State level seminars/Workshops/ Conferences/ Training programs etc., with topics and other details. (Mandatory for each Department)

- i) Faculty Development Program
- ii) Student Training Programme in TLC/Column Chromatography
- iii) Awareness on OZONE protection
- iv) National Chemistry day
- v) National Science day 2021
- vi) Guest Lectures
- vii) National seminar in chemistry
- viii) Training in Soil analysis
- ix) Training in water analysis

**3. Change of modules in the syllabus content.**

Syllabus changed for first, second and final years as per university regulations and CBCS pattern.

**4. Plan for utilization of funds for Autonomous/CPE/other grants available for arranging guest lectures, faculty improvement programs, study tours, equipping laboratories, reference books & other necessary teaching-learning material with ICT enabled teaching.**

**I. Study visits to:** Rs, 50,000

1. Visakha Steel Plant, Visakhapatnam
2. Hetero Laboratories, Nakkapally
3. Dr. Reddy's Laboratories, Yanam.
4. National Institute of Hydrology, Kakinada.
5. SAR Chandra Environ Solutions, Kakinada.
6. ONGC mini refinery, Tatipaka.
7. Soil analysis laboratory, Samalkot.
8. IICT, HYD
9. Venky parenterals, Yanam

**II. Purchase of Equipment**

- |  |           |
|--|-----------|
| 1. Sophisticated version UV-Visible spectrophotometer- | 5.0 lakhs |
| 2. Rotavapour  | 4.0 lakhs |
| 3. Other equipment                                     | 1.0 lakhs |

**5. Plan for organizing subject oriented community outreach programs & allocation of necessary funds. (Mandatory for each Department)**

- |                                |     |        |
|--------------------------------|-----|--------|
| i) Adoption of village         | Rs. | 20,000 |
| ii) Medical Awareness programs | Rs. | 10,000 |

**6. Instituting of new medals/incentives/prizes etc., from alumni, philanthropists, parents, faculty etc., - Strategies to be recommended**

**7. Introduction of new programs -PG/UG/Diploma and certificate courses.**

**8. Any other program that enhances the learning capacity of students and their employable & knowledge skills.**

Training in the use of instruments like AAS, UV-Vis, HPLC, flame photometer, uranium analyzer, soil and water analysis projects, air quality projects.

9. Proposed panel of examiners/paper setters & other experts/nominees for BOS deliberations.

Chemistry:

1. Sri. V. Mallikarjuna Sarma, Lecturer in Chemistry, ASD Govt. Degree College for Women (Autonomous), Kakinada.
2. Dr. V. Narayana Rao, Lecturer in Chemistry, GDC, Perumallapuram.
3. Dr. T. Narasimha Murthy, Lecturer in Chemistry Govt. Arts College, Rajamahendravaram.
4. Dr. P. Siva Kumar, Lecturer in Chemistry, Govt. Arts College, Rajamahendravaram.
5. Sri. U. Sai Krishna, Lecturer in Chemistry, Govt. Arts College, Rajamahendravaram
6. Sri. K. Anand, Lecturer in Chemistry, GDC, Pithapuram.

### Structure of Chemistry Syllabus under CBCS

YEAR	SEMESTER	PAPER	TITLE	MARKS	CREDITS	
I	I	I	Inorganic and Physical Chemistry	100 (50:50)	04	
			Practical - I	50	01	
	II	II	Organic and General Chemistry	100 (50:50)	04	
			Practical - II	50	01	
II	III	III	Spectroscopy and Physical Chemistry	100 (60:40)	04	
			Practical - III	50	01	
	IV	IV	Inorganic, Organic and Physical Chemistry	100 (60:40)	04	
			Practical - IV	50	01	
	IV	V	Inorganic and Physical Chemistry	100 (60:40)	04	
			Practical - V	50	01	
III	V	V	Inorganic, Organic and Physical Chemistry	100 (60:40)	03	
			Practical - V	50	02	
		VI	Inorganic, Organic and Physical Chemistry	100 (60:40)	03	
			Practical - VI	50	02	
	* Any one Paper from VII A,B and C	VII (A)*	Elective	100	03	
			Practical - VII A	50	02	
		VII (B)*	Elective	100	03	
			Practical - VII B	50	02	
		VII (C)*	Elective	100	03	
			Practical - VII C	50	02	
	** Any one cluster from VIII, A, B and C	VIII (A)**	<b>Cluster Electives - I :</b>			
			VIII-A-1	100	03	
			VIII-A-2	100	03	
			VIII-A-3	100	03	
Practical			50	02		
Practical			50	02		
Project						
VIII (B)**			<b>Cluster Electives - II ::</b>			
			VIII-B-1	100	03	
	VIII-B-2	100	03			
	VIII-B-3	100	03			
	Practical	50	02			
	Practical	50	02			
Project	50	02				

		VIII (C)**	<b>Cluster Electives - III ::</b> VIII-C- 1 VIII- C-2 VIII-C- 3 Practical Practical Project	100 100 100 50 50 50	03 03 03 02 02 02
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**P. R. GOVERNMENT COLLEGE, KAKINADA**  
**SYLLABUS FOR SEMESTER – I (CHEMISTRY)**

**Paper I (Inorganic & Physical chemistry) 60 hrs.**  
**(4h/w)**

**Course outcomes:**

At the end of the course, the student will be able to;

1. Understand the basic concepts of p-block elements.
2. Explain the difference between solid, liquid and gases in terms of intermolecular interactions.
3. Apply the concepts of gas equations, pH and electrolytes while studying other chemistry courses.

**INORGANIC CHEMISTRY 24 h**

**UNIT –I**

**Chemistry of p-block elements** **8h**

**Group 13:** Preparation & structure of Diborane, Borazine

**Group 14:** Preparation, classification and uses of silicones

**Group 15:** Preparation & structures of Phosphonitrilic halides  $\{(\text{PNCl}_2)_n$  where  $n=3,4$

**Group 16:** Oxoacids of Sulphur (structures only)

**Group 17:** Pseudo halogens, Structures of Interhalogen compounds.

**Additional Input:** Oxides of Sulphur (structures only)

**UNIT-II**

**1. Chemistry of d-block elements:** **6h**

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

Chemistry of lanthanides - electronic structure, oxidation states, lanthanide contraction, consequences of lanthanide contraction, magnetic properties.

**Theories of bonding in metals:** **6h**

Valence bond theory and Free electron theory, explanation of thermal and electrical conductivity of metals based on these theories, Band theory- formation of bands, explanation of conductors, semiconductors and insulators.

**Additional Input:** Chemistry of actinides - electronic configuration, oxidation states, actinide contraction, comparison of lanthanides and actinides.

## PHYSICAL CHEMISTRY

36h

### UNIT-III

#### Solid state

10h

Symmetry in crystals. Law of constancy of interfacial angles. The law of rationality of indices. The law of symmetry. Miller indices, Definition of lattice point, space lattice, unit cell. Bravais lattices and crystal systems. X-ray diffraction and crystal structure. Bragg's law. Powder method.

**Additional Input:** Defects in crystals. Stoichiometric and non-stoichiometric defects.

### UNIT-IV

#### 1. Gaseous state

6h

van der Waal's equation of state. Andrew's isotherms of carbon dioxide, continuity of state. Critical phenomena. Relationship between critical constants and vander Waal's constants. Joule-Thomson effect. Inversion temperature.

#### 2. Liquid state

4h

Liquid crystals, mesomorphic state. Differences between liquid crystal and solid/liquid. Classification of liquid crystals into Smectic and Nematic. Application of liquid crystals as LCD devices.

**Additional Input:** Law of corresponding states.

### UNIT-V

#### Solutions, Ionic equilibrium & dilute solutions

#### 1. Solutions

6h

Azeotropes- HCl- H<sub>2</sub>O system and ethanol-water system. Partially miscible liquids-phenol-water system. Critical solution temperature (CST), Nernst distribution law. Calculation of the partition coefficient. Applications of distribution law.

#### 2. Ionic equilibrium

3h

Ionic product, common ion effect, solubility and solubility product. Calculations based on solubility product.

#### 3. Dilute solutions

7h

Colligative properties- RLVP, Osmotic pressure, Elevation in boiling point and depression in freezing point. Experimental method for the determination of molar mass of a non-volatile solute using osmotic pressure, abnormal colligative properties. Van't Hoff factor.

**Additional Input:** Effect of impurity on consolute temperature. Immiscible liquids and steam distillation. Experimental methods for the determination of Elevation in boiling point and depression in freezing point.

### Co-curricular activities and Assessment Methods

1. Continuous Evaluation: Monitoring the progress of students learning
2. Class Tests, Work sheet sand Quizzes
3. Presentations ,Projects and Assignments and Group Discussions:  
Enhances criticalthinking skills and personality
4. Semester- end Examination: critical indicator of student’s learning  
and teachingmethods adopted by teachers throughout the  
semester.

### List of Reference Books

1. Principles of physical chemistry by Prutton and Marron
2. Solid State Chemistry and its applications by Anthony R. West
3. Text book of physical chemistry by K L Kapoor
4. Text book of physical chemistry by S Glasstone
5. Advanced physical chemistry by Bahl and Tuli
6. Inorganic Chemistry by J.E.Huheey
7. Basic Inorganic Chemistry by Cotton and Wilkinson
8. A textbook of qualitative inorganic analysis by A.I. Vogel
9. Atkins,P.W.&Paula,J.deAtkin’sPhysicalChemistryEd.,OxfordUniversityPress 10thEd(2014).
10. Mortimer, R. G.PhysicalChemistry3rdEd. Elsevier: NOIDA,UP(2009).
11. Barrow, G.M. Physical Chemistry

**P. R. GOVERNMENT COLLEGE, KAKINADA**  
**SYLLABUS FOR SEMESTER – I (CHEMISTRY)**  
**Paper I (Inorganic & Organic Chemistry)**  
**Weightage to content**

S. No.	Course Content	Essay Questions (10M)	Short Answer Questions (5M)	Total No. Of Questions from each Unit	Total No. of Marks allotted to each Unit
	<b>Inorganic Chemistry</b>				
1	Unit - I	1	2	3	20
2	Unit - II	2	1	3	25
	<b>Physical Chemistry</b>				
3	Unit - III	1	1	2	15
4	Unit - IV	1	2	3	20
5	Unit -V	1	2	3	20
	<b>TOTAL</b>	<b>6</b>	<b>8</b>	<b>14</b>	<b>100</b>



**LABORATORY COURSE –I**

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

**Practical-I Analysis of SALT MIXTURE**

(At the end of Semester-I)

**Qualitative inorganic analysis (Minimum of Six mixtures should be analysed) 50 M**

**Course outcomes:**

At the end of the course, the student will be able to;

1. Understand the basic concepts of qualitative analysis of inorganic mixture
2. Use glassware, equipment and chemicals and follow experimental procedures in the laboratory
3. Apply the concepts of common ion effect, solubility product and concepts related to qualitative analysis

**Analysis of SALT MIXTURE**

**50 M**

Analysis of mixture salt 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, Aluminium, Zinc, Nickel, Manganese, Calcium, Strontium, Barium, Potassium and Ammonium.

**P. R. GOVERNMENT COLLEGE, KAKINADA**  
**MODEL PAPER FOR SEMESTER – I (CHEMISTRY)**  
**Paper I (Inorganic & Organic Chemistry)**

**Duration: 2hrs.**

**Max. Marks: 50**

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**PART- A**

4 X 5 = 20 Marks

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

1. Question from Unit –I
2. Question from Unit –I
3. Question from Unit –II
4. Question from Unit – III
5. Question from Unit –IV
6. Question from Unit – IV
7. Question from Unit – V
8. Question from Unit – V

**PART- B**

3 X 10 = 30 Marks

Answer any THREE questions. Each carries TEN marks

9. Question from Unit –I
10. Question from Unit –II
11. Question from Unit –II
12. Question from Unit – III
13. Question from Unit – IV
14. Question from Unit – V

**P. R. GOVERNMENT COLLEGE, KAKINADA**  
**SEMESTER-I**  
**CHEMISTRY Course-I: INORGANIC & PHYSICAL CHEMISTRY**

**Question bank**

**Unit – I**

**ESSAY QUESTIONS**

1. Explain Classification, Preparations & uses of Silicones
2. Explain Preparation and Structure of Diborane.
3. What are Pseudo halogens? Explain the Structures of  $AX_3$  &  $AX_5$  types of interhalogen compounds.

**SHORT ANSWER QUESTIONS**

1. Explain the preparation and structure of Borazine
2. Explain the structures of Phosphonitrilic compounds.
3. Write any three structures of sulphur oxy acids.

**Unit – II**

**ESSAY QUESTIONS**

1. Explain magnetic and catalytic properties of d-block elements.
2. What is Lanthanide Contraction? Explain the Consequences of Lanthanide Contraction?
3. Explain Band theory of Conductors, Semi-conductors and Insulators.

**SHORT ANSWER QUESTIONS**

1. Why do d- block elements show variable oxidation states? Explain with examples.
2. Explain free electron theory of metals.
3. Explain Valence bond theory of metals.

**Unit – III**

**ESSAY QUESTIONS**

1. Derive Bragg's Law. Explain the determination of structure of a crystal by powder method?
2. Explain symmetry elements in crystals.

**SHORT ANSWER QUESTIONS**

1. Write a short note on Law of constancy of interfacial angles, law of rationality of indices and the law of symmetry.
2. Write short note on Bravais lattices and crystal systems.
3. Define lattice point, space lattice and unit cell?

**Unit – IV**

**ESSAY QUESTIONS**

1. Derive the relationship between Critical constants & Van der Waal's constants
2. Why do real gases deviate from ideal gas behavior? Derive Vander Waal's equation of state?
3. State and explain Joule- Thomson effect.

**SHORT ANSWER QUESTIONS**

1. What are liquid Crystals? Explain.
2. Explain applications of liquid crystals as LCD devices?
3. What is Inversion Temperature? Give Examples.

## Unit - V

### **ESSAY QUESTIONS**

1. What is Osmotic Pressure? Determine the molar weight of a non-volatile solute using osmotic pressure?
2. What is Critical Solution temperature? Explain Critical solution temperature for Phenol – water system.

### **SHORT ANSWER QUESTIONS**

1. State and write the applications of Nernst distribution Law?
2. Define colligative properties. Write different types of colligative properties.
3. Explain briefly Common ion effect & Solubility product?

**P. R. GOVERNMENT COLLEGE, KAKINADA**  
**SYLLABUS FOR SEMESTER – II (CHEMISTRY)**  
**Paper II (Organic & General Chemistry) 60 hrs. (4h/w)**

**Course outcomes:**

At the end of the course, the student will be able to;

1. Understand and explain the differential behavior of organic compounds based on fundamental concepts learnt.
2. Formulate the Mechanism of organic reactions by recalling and correlating the fundamental properties of the reactants involved.
3. Learn and identify many organic reaction mechanisms including Free Radical Substitution, Electrophilic Addition and Electrophilic Aromatic Substitution.
4. Correlate and describe the stereochemical properties of organic compounds and reactions.

**ORGANIC CHEMISTRY** **36h**

**UNIT-I**

**Recapitulation of Basics of Organic Chemistry**

**Carbon-Carbon sigma bonds (Alkanes and Cycloalkanes)** **12h**

General methods of preparation of alkanes- Wurtz and Wurtz Fittig reaction, Corey House synthesis, physical and chemical properties of alkanes, Isomerism and its effect on properties, Free radical substitutions; Halogenation, concept of relative reactivity v/s selectivity. General molecular formulae of cycloalkanes and relative stability, Baeyer strain theory.

**Additional Input:** Conformational analysis of alkanes. Cyclohexane conformations with energy diagram, Conformations of monosubstituted cyclohexane.

**UNIT-II**

**Carbon-Carbon pi Bonds (Alkenes and Alkynes)** **12h**

General methods of preparation, physical and chemical properties. Mechanism of E1, E2, E1cb reactions, Saytzeff and Hoffmann eliminations, Electrophilic Additions, mechanism (Markownikoff/Antimarkownik of addition) with suitable examples, *syn* and *anti*- addition; addition of HX. hydroboration-oxidation, ozonolysis, Diels Alder reaction, 1, 2- and 1,4-addition reactions in conjugated dienes.

Reactions of alkynes; acidity, electrophilic and nucleophilic additions, hydration to form carbonyl compounds.

**Additional Input:** Oxymercuration- demercuration and hydroxylation of Alkenes, Alkylation of terminal alkynes.

### UNIT-III

#### **Benzene and its reactivity**

**12h**

Concept of aromaticity, Huckel's rule - application to Benzenoid (Benzene, Naphthalene) and Non - Benzenoid compounds (cyclopropenyl cation, cyclopentadienyl anion and tropylium cation)  
Reactions - General mechanism of electrophilic aromatic substitution, mechanism of nitration, Friedel-Craft's alkylation and acylation. Orientation of aromatic substitution - ortho, para and meta directing groups. Ring activating and deactivating groups with examples  
Orientation of  
i. Amino, methoxy and methyl groups.  
ii. Carboxy, nitro, and sulphonic acid groups.

**Additional Input:** Orientation of Nitrile, Carbonyl Groups, Halogens.

### GENERAL CHEMISTRY

**24 h**

#### UNIT-IV

#### **1. Surface chemistry and chemical bonding**

##### **a) Surface chemistry**

**6h**

**Colloids-** Coagulation of colloids- Hardy-Schulze rule. Stability of colloids, Protection of Colloids, Gold number.

**Adsorption-** Physical and chemical adsorption, Langmuir adsorption isotherm, applications of adsorption.

##### **b) Chemical Bonding**

**6h**

Valence bond theory, hybridization, 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 ( $\text{N}_2$ ,  $\text{O}_2$ , CO and NO).

**Additional Input:**

**HSAB:** Pearson's concept, HSAB principle & its importance, bonding in Hard-Hard and Soft-Soft combinations.

#### UNIT-V

#### **Stereochemistry of carbon compounds**

**10h**

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- Glyceraldehyde, Lactic acid, Alanine, Tartaric acid, 2,3-dibromopentane. D, L, R,S and E,Z- configuration with examples.

Definition of Racemic mixture – Resolution of racemic mixtures (any 3 techniques).

### **Co-curricular activities and Assessment Methods**

Continuous Evaluation: Monitoring the progress of student's learning Class Tests, Worksheets and Quizzes Presentations, Projects and Assignments and Group Discussions: Enhances critical thinking skills and personality Semester-end Examination: critical indicator of student's learning and teaching methods adopted by teachers throughout the semester.

### **List of**

#### **Reference**

#### **Books Theory:**

Morrison, R. N. & Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).

Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).

Finar, I. L. Organic Chemistry (Volume 2: Stereochemistry and the Chemistry of Natural Products), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education). Eliel, E. L. & Wilen, S. H. Stereochemistry of Organic Compounds; Wiley: London, 1994. Kalsi, P. S. Stereochemistry Conformation and Mechanism; New Age International, 2005.

#### **Practical:**

Ahluwalia, V.K. & Aggarwal, R. Comprehensive Practical Organic Chemistry: Preparation and Quantitative Analysis, University Press (2000).

Ahluwalia, V.K. & Dhingra, S. Comprehensive Practical Organic Chemistry: Qualitative Analysis, University Press (2000).

Furniss, B.S.; Hannaford, A.J.; Smith, P.W.G.; Tatchell, A.R. Practical Organic Chemistry, 5th Ed., Pearson (2012)

#### **Additional Resources:**

Solomons, T. W. G.; Fryhle, C. B. & Snyder, S. A. Organic Chemistry, 12th Edition, Wiley.

Bruice, P. Y. Organic Chemistry, Eighth Edition, Pearson.

Clayden, J.; Greeves, N. & Warren, S. Organic Chemistry, Oxford.

Nasipuri, D. Stereochemistry of Organic Compounds: Principles and Applications, Third Edition, New Age International.

Gunstone, F. D. Guidebook to Stereochemistry, Prentice Hall Press, 1975.

**P. R. GOVERNMENT COLLEGE, KAKINADA**  
**SYLLABUS FOR SEMESTER - I (CHEMISTRY)**  
**Paper II (General & Organic Chemistry)**

**Weightage to content**

<b>S. No.</b>	<b>Course Content</b>	<b>Essay Questions (10M)</b>	<b>Short Answer Questions (5M)</b>	<b>Total No. Of Questions from each Unit</b>	<b>Total No. of Marks allotted to each Unit</b>
	<b>Organic Chemistry</b>				
1	Unit - I	1	1	2	15
2	Unit - II	1	1	2	15
3	Unit - III	1	2	3	20
	<b>General Chemistry</b>				
4	Unit - IV	2	2	4	30
5	Unit - V	1	2	3	20
	<b>TOTAL</b>	<b>6</b>	<b>8</b>	<b>14</b>	<b>100</b>



**Practical-II Volumetric Analysis**

(At the end of Semester-II)

**Course outcomes:**

The end of the course, the student will be able to;

1. Use glassware, equipment and chemicals and follow experimental procedures in the laboratory
2. Understand and explain the volumetric analysis based on fundamental concepts learnt in ionic equilibria
3. Learn and identify the concepts of a standard solutions, primary and secondary standards
4. Facilitate the learner to make solutions of various molar concentrations. This may include:  
The concept of the mole; Converting moles to grams; Converting grams to moles; Defining concentration; Dilution of Solutions; Making different molar concentrations.

**Volumetric analysis****50 M**

1. Estimation of sodium carbonate and sodium hydrogen carbonate present in a mixture.
2. Determination of Fe (II) using  $\text{KMnO}_4$  with oxalic acid as primary standard.
3. 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.
4. Estimation of water of crystallization in Mohr's salt by titrating with  $\text{KMnO}_4$

**P. R. GOVERNMENT COLLEGE, KAKINADA**  
**MODEL PAPER FOR SEMESTER – II**  
**(CHEMISTRY)**  
**Paper II (Physical & General Chemistry)**

**Duration: 2hrs.**

**Max. Marks: 50**

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**PART- A**

4 X 5 = 20 Marks

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

1. Question from Unit –I
2. Question from Unit –II
3. Question from Unit –III
4. Question from Unit – III
5. Question from Unit –IV
6. Question from Unit – IV
7. Question from Unit – V
8. Question from Unit – V

**PART- B**

3X 10 = 30 Marks

Answer Any Three questions. Each carries TEN marks

9. Question from Unit –I
10. Question from Unit –II
11. Question from Unit –III
12. Question from Unit –IV
13. Question from Unit –IV
14. Question from Unit – V

**P. R. GOVERNMENT COLLEGE, KAKINADA**  
**SEMESTER-II**  
**CHEMISTRY Course-I: ORGANIC & GENERAL CHEMISTRY**  
**Question bank**

**Unit – I**

**ESSAY QUESTIONS**

1. Write any two preparation methods of alkanes and Explain Halogenation of alkanes?
2. Explain Baeyer Strain Theory?

**SHORT ANSWER QUESTIONS**

1. Explain concept of relative reactivity v/s selectivity in halogenations of alkanes?
2. Explain Free radical substitution reactions in alkanes?

**Unit – II**

**ESSAY QUESTIONS**

1. Write any two preparation methods and three chemical properties of alkenes?
2. Explain the mechanism of Markonikoff and Anti-Markonikoff addition of HBr to alkene?
3. Explain mechanism of E1 and E2 with suitable examples?

**SHORT ANSWER QUESTIONS**

1. Explain about Diel's – Alder reactions with examples?
2. Explain briefly Ozonolysis of alkenes?
3. Explain the acidity of 1-alkynes?

**Unit-III**

**ESSAY QUESTIONS**

1. Define Huckels Rule? Explain Benzenoid and Non- Benzenoid Compounds with suitable Examples?
2. Explain electrophilic aromatic substitution in benzene with example?

**SHORT ANSWER QUESTIONS**

1. Explain the mechanisms of Nitration of Benzene?
2. Explain the mechanisms of Friedel-Craft's alkylation of Benzene
3. Explain the orientation effect of Methoxy group on mono substituted benzene

**ESSAY QUESTIONS**

**Unit – IV**

1. Derive Langmuir adsorption isotherm.
2. Draw the Molecular Orbital Energy diagram of N<sub>2</sub> and CO molecules and explain their bond order and magnetic behavior?

3. Draw the Molecular Orbital Energy diagram of  $O_2$  and NO molecules and explain their bond order and magnetic behavior?

#### SHORT ANSWER QUESTIONS

1. Write the difference between Physical adsorption and Chemical adsorption.
2. Explain applications of adsorption.
3. Explain the structure of  $Ni(CO)_4$  by Valence Bond theory?
4. Explain Protection of Colloids?

### Unit – V

#### ESSAY QUESTIONS

1. Explain Cahn Ingold and Prelog rules for assigning R, S configuration to optically active molecules with examples
2. Define optical isomerism. Explain the optical isomerism in Lactic acid and tartaric acid.
3. Explain Cahn Ingold and Prelog rules for assigning E - Z configuration with examples.

#### SHORT ANSWER QUESTIONS

1. Draw Wedge and Fischer molecular representations with an example.
2. Define Optical activity and Specific rotation?
3. Explain D, L – Nomenclature with example?
4. Define Enantiomers and Diastereomers and give one example for each.

**P. R. GOVERNMENT DEGREE COLLEGE (A), KAKINADA**

**DEPARTMENT OF CHEMISTRY**

**BOARD OF STUDIES: 2021-22**

**SECOND YEAR, SEMESTER– III**

**Paper III (ORGANIC & SPECTROSCOPY) 60 h (4 h / w)**

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

**UNIT I:**

**1. Chemistry of Halogenated Hydrocarbons:**

Alkyl Halides: Methods of preparation and properties, nucleophilic substitution reactions– SN1, SN2 mechanisms with stereo chemical aspects and effect of solvent etc.; nucleophilic substitution vs. elimination, Williamson's synthesis. Aryl Halides: Preparation (including preparation from diazonium salts) and properties, nucleophilic aromatic substitution; Relative reactivity of alkyl, allyl, benzyl, vinyl and aryl halides towards nucleophilic substitution reactions. **Additional Input:** SNi mechanisms, SN Ar, Benzyne mechanism.

**2. Alcohols & Phenols**

Preparation, properties and relative reactivity of 1°, 2°, 3° alcohols, Bouveault-Blanc Reduction; Oxidation of Diols by Periodic Acid and lead Tetraacetate, Pinacol- Pinacolone Rearrangement; Phenols: Preparation and Properties; Acidity and Factors Affecting it, Ring substitution reactions, Reimer–Tiemann and Kolbe's–Schmidt Reactions.

**Additional Input:** Fries and Claisen Rearrangement with mechanism.

**UNIT II:**

**Carbonyl Compounds:**

Structure, reactivity, preparation and properties; Nucleophilic Addition, Nucleophilic Addition-elimination reactions with ammonia derivatives, Mechanisms of Aldol and Benzoin Condensation, Claisen-Schmidt, Perkin, Cannizzaro and Wittig reaction, Beckmann Haloform Reaction and Baeyer-Villiger oxidation,  $\alpha$ - substitution reactions, oxidations and reductions (Clemmensen, Wolf–Kishner, with LiAlH<sub>4</sub> & NaBH<sub>4</sub>).

**Additional Input:** Addition Reactions of  $\alpha$ ,  $\beta$  unsaturated carbonyl compounds: Michael Addition.

**UNIT III:**

**Carboxylic Acids and their Derivatives:**

General methods of preparation, physical properties and reactions of mono carboxylic acids, effect of substituent acidic strength. Typical reactions of carboxylic acids, hydroxy acids and unsaturated acids. Preparation and Reactions of Acid Chlorides, anhydrides, esters and amides; Comparative study of nucleophilic substitution at acyl group–Mechanism of acidic and alkaline hydrolysis of esters, Claisen Condensation, Degradation of carboxylic acids by Huns-Diecker reaction, decarboxylation by Schmidt reaction.

**Additional Input:** Arndt- Eistert synthesis, halogenations by Hell- Volhard- Zelensky reaction.

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

### **UNIT IV:**

**Molecular Spectroscopy:** Interaction of electromagnetic radiation with molecules and various types of spectra;

**Rotation spectroscopy:** Selection rules, intensities of spectral lines.

**Vibrational Spectroscopy:** Classical Equation of Vibration, computation of force constant, Harmonic and anharmonic oscillator, Morse Potential curve, Selection rules for vibrational transitions.

**Electronic spectroscopy:** 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. Bathochromic and hypsochromic shifts. Beer-Lambert's law and its limitations.

**Nuclear Magnetic Resonance (NMR) spectroscopy:** 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 and acetophenone.

**Additional Input:** Determination of bond lengths of diatomic and linear triatomic molecules, isotopic substitution. Fundamental Frequencies and overtones.

### **UNIT V:**

#### **Application of Spectroscopy to Simple Organic Molecules**

Application of visible, ultraviolet and infrared spectroscopy in organic molecules. Application of electronic spectroscopy and Woodward rules for calculating  $\lambda_{\max}$  of conjugated dienes and  $\alpha$ ,  $\beta$  – unsaturated compounds.

Infrared radiation and types of molecular vibrations, functional group and fingerprint region. IR Spectra of alkanes, alkenes and simple alcohols (inter and intramolecular hydrogen bonding), aldehydes, ketones and carboxylic acids.

**REFERENCE BOOKS:**

1. A TextBook of Organic Chemistry by Bahl and Arunbahl
2. A Textbook of Organic chemistry by I L FinarVol I
3. Organic chemistry by Bruice
4. Organic chemistry by Clayden
5. Spectroscopy by William Kemp
6. Spectroscopy by Pavia
7. Organic Spectroscopy by J. R. Dyer
8. Elementary organic spectroscopy by Y.R. Sharma
9. Spectroscopy by P.S.Kalsi
10. Mann, F.G. & Saunders, B.C. Practical Organic Chemistry, Pearson Education (2009)
11. Spectrometric Identification of Organic Compounds by Robert M Silverstein, Francis X Webster
12. Furniss, B.S., Hannaford, A.J., Smith, P.W.G. & Tatchell, A.R. Practical Organic Chemistry,5th Ed. Pearson (2012)
13. Ahluwalia, V.K. & Aggarwal, R. Comprehensive Practical Organic Chemistry: Preparation and Quantitative Analysis,

**Practical Paper-III (At the end of Semester-III)****Organic Preparations and IR Spectral Analysis Lab: 50 Marks****Course Outcomes**

1. How to use glassware, equipment and chemicals and follow experimental procedures in the laboratory
2. how to calculate limiting reagent, theoretical yield, and percent yield
3. how to engage in safe laboratory practices by handling laboratory glassware, equipment, and chemical reagents appropriately
4. how to dispose of chemicals in a safe and responsible manner
5. how to perform common laboratory techniques including reflux, distillation, recrystallization, vacuum filtration.
6. how to create and carry out work up and separation procedures
7. how to critically evaluate data collected to determine the identity, purity, and percent yield of products and to summarize findings in writing in a clear and concise manner

**Organic preparations: 40M**

- i. Acetylation of one of the following compounds:  
amines (aniline) and phenols ( $\beta$ -naphthol, salicylic acid) by any one method:
  - a. Using conventional method.
  - b. Using green approach
- ii. Benzoylation of amine (aniline)
  - a. Nitration of any one of the following: Acetanilide/nitrobenzene by conventional method
  - b. Salicylic acid by green approach (using ceric ammonium nitrate).

**IR Spectral Analysis: 10M**

IR Spectral Analysis of the following functional groups with examples

- a) Hydroxyl groups
- b) Carbonyl groups
- c) Amino groups
- d) Aromatic groups



**P. R. GOVERNMENT COLLEGE, KAKINADA**  
**MODEL PAPER FOR SEMESTER – III (CHEMISTRY)**  
**Paper III (ORGANIC CHEMISTRY & SPECTROSCOPY)**

**Duration: 2hrs.30 Min**

**Max. Marks: 60**

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**PART- A**

Answer any Four of the following questions. Each carries FIVE marks      4 X 5 = 20 Marks

1. Question from Unit –I
2. Question from Unit –II
3. Question from Unit –III
4. Question from Unit – III
5. Question from Unit –IV
6. Question from Unit – IV
7. Question from Unit – V
8. Question from Unit – V

**PART- B**

Answer ALL the questions. Each carries TEN marks

4 X 10 = 40 Marks

9. Question from Unit –I  
(OR)

Question from Unit –I

10. Question from Unit –II  
(OR)

Question from Unit – III

11. Question from Unit –IV  
(OR)

Question from Unit – IV

12. Question from Unit – V  
(OR)

Question from Unit – V

## WEIGHTAGE TO THE COURSE CONTENT

Second Year Semester - III

ORGANIC AND SPECTROSCOPY - III

Sl. No.	COURSE CONTENT	ESSAY	SHORTS	Total Marks
1	UNIT - I	2	1	25
2	UNIT - II	1	1	15
3	UNIT - III	1	2	20
4	UNIT - IV	2	2	30
5	UNIT - V	2	2	30
<b>Total</b>		<b>8</b>	<b>8</b>	<b>120</b>

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**P.R. GOVERNMENT DEGREE COLLEGE (A), KAKINADA  
DEPARTMENT OF CHEMISTRY BOARD OF STUDIES: 2021-22**

**SECOND YEAR, SEMESTER- III**

**Paper: III- Organic and Spectroscopy**

**Question Bank**

**Unit-I**

**Essay Questions**

1. Explain  $SN^1$  &  $SN^2$  reactions with mechanism?
2. Explain the following reaction mechanisms
  - a. Reimer –Tiemann reaction
  - b) Kolbe-Schmidt reaction
3. Explain the following reaction mechanisms
  - a. Fries rearrangement
  - b) Pinacol – Pinacolone rearrangement

**Short answer questions**

1. Explain the following terms
  - a) Walden inversion
  - b) Racemic mixture
2. Write any two preparation methods of Alcohols?
3. Write any two preparation methods of phenols?
4. Explain the identification tests of Primary, Secondary & Tertiary alcohols.

**Unit-II**

**Essay Questions**

1. Explain the following reactions with mechanism
  - a) Aldol condensation.
  - b) Cannizzaro reaction
2. Explain the following reactions with mechanism
  - a) Perkin reaction.
  - b) Benzoin condensation
3. Explain the following reactions:
  - a) Haloform reaction
  - b) Bayer - villegier oxidation

**Short answer questions**

1. Write any two preparation methods of carbonyl compounds?
2. Explain the nucleophilic addition reactions of carbonyl compounds?
3. Explain the following reactions:
  - a) Clemensen reduction.
  - b) Wolf-Kishner reduction.

### Unit-III

#### Essay Questions

1. Explain the following reactions with mechanism
  - a) Huns - diecker's reaction
  - b) Schmidt reaction
2. Write any two preparation methods of carboxylic acids and write the chemical Properties?

#### Short answer questions

1. Write any two chemical properties of carboxylic acids?
2. Explain hydrogen bonding in carboxylic acid
3. Explain Claisen condensation with mechanism?

### Unit-IV

#### Essay Questions

1. Explain Lambert's law and Lambert's – Beers law.
2. Explain the selection rules for electronic spectra.
3. What are Electronic Transitions? Explain various types of Electronic transitions.
4. What is principle of NMR spectroscopy and Write the applications of NMR spectroscopy?

#### Short answer questions

1. Explain a) Chromophore b) Auxochrome.
2. Explain various types of Spectra?
3. What are equivalent protons and Non-equivalent protons?
4. Explain spin-spin Coupling?
5. What is Chemical shift? How it is calculated?
6. What is coupling constant?

### Unit-V

#### Essay Questions

1. Explain the Various types of molecular vibrations?
2. Write Woodward rules for calculating  $\lambda_{\max}$  of conjugated dienes?
3. Write Woodward rules for calculating  $\lambda_{\max}$  of  $\alpha, \beta$  – unsaturated compounds.

#### Short answer questions

1. Explain Fingerprint region of IR Spectroscopy?
2. Write the Applications of UV-Visible Spectroscopy?
3. Discuss about the IR Spectra of alcohols?
4. Discuss about the IR Spectra of Carboxylic Acids?

**P.R. GOVERNMENT DEGREE COLLEGE (A), KAKINADA  
DEPARTMENT OF CHEMISTRY BOARD OF STUDIES: 2021-22**

**SECOND YEAR, SEMESTER- IV**

**Paper IV- INORGANIC, ORGANIC & PHYSICAL CHEMISTRY  
60 h (4 h / w)**

**Course Outcomes:**

1. To learn about the laws of absorption of light energy by molecules and subsequent photochemical reactions.
2. To understand the concept of quantum efficiency and mechanisms of photochemical reactions.

**UNIT I:**

**Organ metallic Compounds:**

Definition and classification of organometallic compounds on the basis of bond type, Concept of hapticity of organic ligands. Metal Carbonyls: 18 electron rule, electron count of mononuclear, poly nuclear and substituted metal carbonyls of 3d series. General methods of preparation of mono and binuclear carbonyls of 3d series. Pi-acceptor behavior of carbon monoxide.

**Additional Input:** Synergic effects (VB approach) - (MO diagram of CO can be referred to for synergic effect to IR frequencies).

**UNIT II:**

**Carbohydrates:**

Occurrence, classification and their biological importance, Monosaccharides: Constitution and absolute configuration glucose and fructose, epimers and anomers, mutarotation, determination of ring size of glucose and fructose, Haworth Projection and Conformational Structures; Interconversions of aldoses and ketoses; Kiliani-Fischer synthesis and Ruff degradation.

**Additional Input:** Disaccharides- Elementary Treatment of Maltose, lactose and sucrose.

**UNIT III:**

**Amino acids and proteins:**

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 and valine) by following methods: a) from halogenated carboxylic acid b) Gabriel Phthalimide 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).

### **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, - 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

**Additional Input:** Structure and nomenclature of peptides and proteins.

### **UNIT IV:**

#### **Nitrogen Containing Functional Groups:**

Preparation, properties and important reactions of nitro compounds, amines and diazonium salts.

#### **1. Nitro hydrocarbons**

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 Michael addition and reduction.

#### **2. Amines:**

Introduction, classification, chirality in amines (pyramidal inversion), importance and general methods of preparation.

Properties: Physical properties, Basicity of amines: Effect of substituent, solvent and steric effects. Distinction between Primary, secondary and tertiary amines using Hinsberg's Method and Nitrous Acid. Discussion of the following reactions with emphasis on the mechanistic pathway: Gabriel Phthalimide synthesis, Hoffmann- Bromamide Reaction, Carbylamine Reaction.

**Additional Input:** Hofmann-elimination reaction and Cope elimination.

### **UNIT V:**

#### **Photochemistry:**

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 and hydrogen- bromine reaction. Qualitative description of fluorescence, phosphorescence, Jablonski diagram. Photosensitized reactions- energy transfer processes (simple example).

**Thermodynamics:**

The first law of thermodynamics-statement, definition of internal energy and enthalpy, Heat capacities and their relationship, Joule-Thomson effect- coefficient, Calculation of work 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.

**Additional Input:** Entropy changes in spontaneous and equilibrium processes.

**REFERENCE BOOKS:**

1. Concise coordination chemistry by Gopalan and Ramalingam
2. Coordination Chemistry by Basalo and Johnson
3. Organic Chemistry by G.Mareloudan, Purdue Univ
4. 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 Arunbahl
9. A Text Book of Organic chemistry by I L FinarVol I
10. A Text Book of Organic chemistry by I L FinarVol II
11. Advanced physical chemistry by Gurudeep Raj

**LABORATORY COURSE -IV**

30hrs (2 h / w)

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

**(Paper-4) Organic Qualitative analysis Lab: 50 Marks**

**Course Outcomes:**

1. Use glassware, equipment and chemicals and follow experimental procedures in the laboratory
2. Determine melting and boiling points of organic compounds
3. Understand Application of concepts of different organic reactions studied in theory part of organic chemistry

**Organic Qualitative analysis 50 M**

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



**P. R. GOVERNMENT COLLEGE, KAKINADA**  
**MODEL PAPER FOR SEMESTER – IV (CHEMISTRY)**  
**Paper IV (INORGANIC, ORGANIC & PHYSICAL CHEMISTRY)**

**Duration: 2hrs.30 Min**

**Max. Marks: 60**

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**PART- A**

Answer any Four of the following questions. Each carries FIVE marks      4 X 5 = 20 Marks

1. Question from Unit –I
2. Question from Unit –II
3. Question from Unit –III
4. Question from Unit – III
5. Question from Unit –IV
6. Question from Unit – IV
7. Question from Unit – V
8. Question from Unit – V

**PART- B**

Answer ALL the questions. Each carries TEN marks

4 X 10 = 40 Marks

9. Question from Unit –I  
(OR)

Question from Unit –I

10. Question from Unit –II  
(OR)

Question from Unit – II

11. Question from Unit –III  
(OR)

Question from Unit – IV

12. Question from Unit – V  
(OR)

Question from Unit – V

## WEIGHTAGE TO THE COURSE CONTENT

Second Year Semester - IV

### INORGANIC, ORGANIC AND PHYSICAL CHEMISTRY - IV

Sl. No.	COURSE CONTENT	ESSAY	SHORT	Total Marks
1	UNIT - I	2	1	25
2	UNIT - II	2	1	25
3	UNIT - III	1	2	20
4	UNIT - IV	1	2	20
5	UNIT - V	2	2	30
	<b>Total</b>	<b>8</b>	<b>8</b>	<b>120</b>

**P.R. GOVERNMENT DEGREE COLLEGE (A), KAKINADA  
DEPARTMENT OF CHEMISTRY BOARD OF STUDIES: 2021-22**

**SECOND YEAR, SEMESTER- IV**

**Paper: IV- Inorganic, Organic and Physical Chemistry**

**Question Bank**

**Unit-I**

**Essay Questions**

1. What is Organ metallic Compounds? Explain the classification of organ metallic Compounds?
2. Write the preparation of mono and binuclear carbonyl Compounds?

**Short Answer Questions**

1. Define 18 electron rule. Explain with example .
2. Write the Concept of hapticity of organic ligands.

**Unit-II**

**Essay Questions**

1. Explain
  - a) Killiani fisher synthesis
  - b) Ruff degradation
2. Explain Inter-conversion of
  - a) aldohexose to ketohexose.
  - b) Ketohexose to aldohexose.
3. Write about Constitution and absolute configuration glucose?

**Short Answer Questions**

1. Explain Mutarotation.
2. Define Epimers and Anomers and give examples.

**Unit-III**

**Essay Questions**

1. Explain the classifications of Amino Acids. Preparation of amino acids.
2. Write any two methods of Preparations of pyrrole, Furan and Thiophene?

**Short Answer Questions**

1. Explain electrophilic substitution reactions in furan?
2. Write about Diels Alder reaction in furan?
3. What are Essential and Non Essential amino acids give examples?
4. Write about Zwitter ion?

## Unit-IV

### Essay Questions

1. Write the Preparation and properties of Nitroalkanes.
2. Write note on
  - a) Nef
  - b) Michael
  - c) Mannich
3. Explain Hinsberg method of separation of primary, Secondary, Tertiary Amines.
4. Write about Hoffmann bromide reaction with mechanism.

### Short Answer Questions

1. Explain Basic nature of amines.
2. Explain Tautomerism of nitroalkanes?
3. What is Carbylamines Reaction?
4. Explain Halogenation of nitrohydrocarbons?

## Unit-V

### Essay Questions

1. Explain Jablanski diagram of various processes occurring in Photo Chemistry?
2. What is Quantum yield? Explain Quantum yield of the reaction between  $H_2$  and  $Cl_2$ ?
3. State and explain first law of thermodynamics?
4. Derive Kirchhoff's equation.
5. What is Carnot cycle? Explain Efficiency of Heat Engine by Carnot cycle?

### Short Answer Questions

1. Explain Laws of photochemistry?
2. Explain Fluorescence and Phosphorescence?
3. Explain Concept of Entropy?
4. Explain Joule Thomson Effect?

**P.R. GOVERNMENT DEGREE COLLEGE (A), KAKINADA**  
**DEPARTMENT OF CHEMISTRY BOARD OF STUDIES: 2021-22**  
**SECOND YEAR, SEMESTER- IV**  
**Paper V- (INORGANIC & PHYSICAL CHEMISTRY) 60 h (4 h / w)**

## **INORGANIC CHEMISTRY**

### **UNIT I:**

#### **Coordination Chemistry:**

IUPAC nomenclature of coordination compounds, Structural and stereoisomerism in complexes with coordination numbers 4 and 6. Valence Bond Theory (VBT): Inner and outer orbital complexes. Limitations of VBT, Crystal field effect, octahedral symmetry. Crystal field stabilization energy (CFSE), Crystal field effects for weak and strong fields. Tetrahedral symmetry, Factors affecting the magnitude of crystal field splitting energy.

**Additional Input:** Comparison of CFSE for Octahedral and Tetrahedral complexes.

### **UNIT II:**

#### **1. Inorganic Reaction Mechanism:**

Introduction to inorganic reaction mechanisms. Concept of reaction pathways, transition state, intermediate and activated complex. Labile and inert complexes, ligand substitution reactions -S<sub>N</sub>1 and S<sub>N</sub>2, Substitution reactions in square planar complexes, Trans-effect, theories of trans effect and its applications

**2. Stability of metal complexes:** Thermodynamic stability and kinetic stability, factors affecting the stability of metal complexes, chelate effect, determination of composition of complex by Job's method.

#### **3. Bioinorganic Chemistry:**

Metal ions present in biological systems, classification of elements according to their action in biological system. Excess and deficiency of some trace metals. Toxicity of metal ions (Hg, Pb, Cd and As), reasons for toxicity, Use of chelating agents in medicine, Cis-platin as an anti-cancer drug. Iron and its application in bio-systems, Haemoglobin

**Additional Input:** Geochemical effect on the distribution of metals, Sodium / K – pump, Myoglobin.

## **PHYSICAL CHEMISTRY**

### **UNIT-III:**

#### **Phase rule:**

Concept of phase, components, degrees of freedom. Thermodynamic derivation of Gibbs phase rule. Phase diagram of one component system - water system, Study of Phase diagrams of Simple eutectic systems i) Pb-Ag system, desilverisation of lead ii) NaCl-Water system, freezing mixtures.

### **UNIT IV:**

#### **Electrochemistry:**

Specific conductance, equivalent conductance and molar conductance- Definition and effect of dilution. Cell constant. Strong and weak electrolytes, Kohlrausch's law and its applications, Definition of transport number, determination of transport number by Hittorf's method. Debye-Huckel-Onsager's equation for strong electrolytes (elementary treatment only), Application of conductivity measurements- conduct metric titrations. Electrochemical Cells- Single electrode potential, Types of electrodes with examples: Metal- metal ion, Glass electrode, Inert electrode, Redox electrode, Metal-metal insoluble salt- salt anion. Determination of EMF of a cell, Nernst equation.

**Additional Input:** Applications of EMF measurements - Potentiometric titrations.

### **UNIT V:**

#### **Chemical Kinetics:**

The concept of reaction rates. Effect of temperature, pressure, catalyst and other factors on reaction rates. Order and molecularity of a reaction, Derivation of integrated rate equations for zero, first and second order reactions (both for equal and unequal concentrations of reactants). Half-life of a reaction. General methods for determination of order of a reaction. Concept of activation energy and its calculation from Arrhenius equation.

**Additional Input:** Theories of Reaction Rates: Collision theory and Activated Complex theory of bimolecular reactions.

**REFERENCE BOOKS:**

1. Text book of physical chemistry by S Glasstone
2. Concise Inorganic Chemistry by J.D.Lee
3. Advanced Inorganic Chemistry Vol-I by Satyaprakash, Tuli, Basu and Madan
4. Advanced physical chemistry by Gurudeep Raj
5. Principles of physical chemistry by Prutton and Marron
6. Advanced physical chemistry by Bahl and Tuli
7. Inorganic Chemistry by J.E.Huheey
8. Basic Inorganic Chemistry by Cotton and Wilkinson
9. A textbook of qualitative inorganic analysis by A.I. Vogel
10. Atkins, P.W. & Paula, J.de Atkin's Physical Chemistry Ed., Oxford University Press  
10thEd(2014)
11. Castellan, G.W. Physical Chemistry, 4thEd .Narosa(2004)
12. Mortimer,R. G.PhysicalChemistry3rdEd. Elsevier:NOIDA,UP(2009).

**LABORATORY COURSE -IV 30hrs (2 h / w)**

**Practical Paper-V (At the end of Semester-IV)**

**(Paper-5) Conductometric and Potentiometric Titrimetry Lab : 50 Marks**

**Course Outcomes:**

1. Use glassware, equipment and chemicals and follow experimental procedures in the laboratory
2. Apply concepts of electrochemistry in experiments
3. Be familiar with electro analytical methods and techniques in analytical chemistry which study an analyte by measuring the potential ( volts) and/or current ( amperes) in an electrochemical cell containing the analyte

**Conductometric and Potentiometric Titrimetry**

**50 M**

1. **Conductometric titration**- Determination of concentration of HCl solution using standard NaOH solution.
2. **Conductometric titration**- Determination of concentration of CH<sub>3</sub>COOH Solution using standard NaOH solution.
3. **Conductometric titration**- Determination of concentration of CH<sub>3</sub>COOH and HCl in a mixture using standard NaOH solution.
4. **Potentiometric titration**- Determination of Fe (II) using standard K<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub> solution.
5. Determination of rate constant for acid catalyzed ester hydrolysis.



**P. R. GOVERNMENT COLLEGE, KAKINADA**  
**MODEL PAPER FOR SEMESTER – IV (CHEMISTRY)**  
**Paper V (INORGANIC & PHYSICAL CHEMISTRY)**

**Duration: 2hrs.30 Min**

**Max. Marks: 60**

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**PART- A**

Answer any Four of the following questions. Each carries FIVE marks      4 X 5 = 20 Marks

1. Question from Unit –I
2. Question from Unit –II
3. Question from Unit –II
4. Question from Unit – III
5. Question from Unit –IV
6. Question from Unit – IV
7. Question from Unit – V
8. Question from Unit – V

**PART- B**

Answer ALL the questions. Each carries TEN marks

4 X 10 = 40 Marks

9. Question from Unit –I  
(OR)

Question from Unit –I

10. Question from Unit –II  
(OR)

Question from Unit – II

11. Question from Unit –III  
(OR)

Question from Unit – IV

12. Question from Unit – V  
(OR)

Question from Unit – V

## WEIGHTAGE TO THE COURSE CONTENT

Second Year Semester - IV

### INORGANIC AND PHYSICAL CHEMISTRY - V

Sl. No.	COURSE CONTENT	ESSAY	SHORT	TOTAL MARKS
1	UNIT - I	2	1	25
2	UNIT - II	2	2	30
3	UNIT - III	1	1	15
4	UNIT - IV	1	2	20
5	UNIT - V	2	2	30
<b>Total</b>		<b>8</b>	<b>8</b>	<b>120</b>

**P.R. GOVERNMENT DEGREE COLLEGE (A), KAKINADA**  
**DEPARTMENT OF CHEMISTRY BOARD OF STUDIES: 2021-22**

**SECOND YEAR, SEMESTER- IV**

**Paper: V- Inorganic and Physical Chemistry**

**Question Bank**

**Unit-I**

**Essay Questions**

1. Explain the Geometry and Magnetic Properties of any two of the following  
a)  $[\text{Co}(\text{NH}_3)_6]^{+3}$       b)  $[\text{Fe}(\text{CN})_6]^{-4}$       c)  $[\text{Cr}(\text{NH}_3)_6]^{+3}$   
d)  $[\text{Ni}(\text{CO})_4]$       e)  $[\text{Cu}(\text{NH}_3)_4]^{+2}$       f)  $[\text{COF}_6]^{-3}$

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, complexes?
3. Explain Crystal Field theory in Tetrahedral and Square Planar Complexes?
4. Explain the different types of Structural isomerism exhibited by complexes with examples?

**Short Answer Questions**

1. Explain High spin and Low spin complexes with examples.
2. What is a chelating? Give two examples.
3. What is meant by CFSE? Give two examples?
4. Define Stereoisomerism? Give two examples

**Unit-II**

**Essay Questions**

1. Explain determination of composition of complex by job's method.
2. Explain the factors affecting the stability of complexes.
3. Explain the mechanism of ligand substitution reactions with examples.
4. Explain the structure and function of Hemoglobin?

**Short Answer Questions**

1. What is Trans effect? Write its applications?
2. What are labile and inert complexes? Give examples.
3. Write the toxicity of Pb and Hg?

**Unit-III**

**Essay Questions**

1. State Phase rule and explain the terms involved in phase rule?
2. Explain the phase diagram of Pb-Ag system?

**Short Answer Questions**

1. Write notes on freezing mixtures?
2. What is congruent and incongruent melting point-Give one example each?

## **Unit-IV**

### **Essay Questions**

1. Define transport number? Determine the Transport number by Hittorf's method.
2. Explain the Debye-Huckel-Onsager equation for strong electrolytes.
3. Explain about Conductometric titrations? with examples

### **Short Answer Questions**

1. State and explain Nernst equation.
2. Explain Kohlrausch's law of independent migration of ions.
3. Define Molar Conductance and specific conductance
4. Define Equivalent conductance Explain variation of equivalent conductance with dilution.

## **Unit-V**

### **Essay Questions**

1. Define First order reaction? Derive rate Constant of First order reaction. Write the units.
2. Define Second order reaction? Derive rate Constant of Second order reaction. Write the units.
3. Define order of a reaction. Explain any three methods for the determination of order of a reaction.

### **Short Answer Questions**

1. Write about Zero order reaction.
2. Write about Half-life period of first order reaction?
3. Define molecularity and order of reaction and write the differences of them.
4. Write any three factors effecting the rate of reaction

**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'.

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

**INORGANIC CHEMISTRY**

**UNIT – I**

**Coordination Chemistry:**

**8h**

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 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. Spectral and magnetic properties of metal complexes:**

**4h**

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

**ORGANIC CHEMISTRY**

**UNIT-III**

**Nitro hydrocarbons:**

**3h**

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.

**UNIT – IV**

**Nitrogen compounds:**

**10h**

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.

### **Heterocyclic Compounds:**

**8h**

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 - 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.

## **PHYSICAL CHEMISTRY**

### **UNIT- V**

#### **Thermodynamics:**

**12h**

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

**Weightage to Content**  
**Fifth semester**  
**Paper-V**

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

**P.R.COLLEGE (A), KAKINADA**  
**III YEAR BSC-(Examination at the end of V semester)**  
**MODEL PAPER**  
**(Inorganic, Organic & Physical chemistry)**  
**Paper-V**

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**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 d-orbitals in octahedral complexes.
2. Explain the Formation of  $[\text{Fe}(\text{CN})_6]^{4-}$  and  $[\text{Fe}(\text{CN})_6]^{3-}$  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.
6. 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 1<sup>st</sup> law of thermodynamics
8. Derive Kirchhoff's equation and mention its units.
9. Show that  $PV^{\gamma} = \text{Constant}$



## SECTION-IV

**Answer any Five questions**

**4x5=20M**

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.

**DEPARTMENT OF CHEMISTRY SEMESTER-V**

**PAPER-III**

**QUESTION BANK**

**ESSAY QUESTIONS:**

1. Explain the Geometry and Magnetic Properties of

- a)  $[\text{Co}(\text{NH}_3)_6]^{+3}$    b)  $[\text{Fe}(\text{CN})_6]^{+3}$    c)  $[\text{Fe}(\text{CN})_6]^{-3}$    d)  $[\text{Cr}(\text{NH}_3)_6]^{+3}$    e)  $[\text{Fe}(\text{CN})_6]^{-4}$   
f)  $[\text{Zn}(\text{NH}_3)_6]^{+2}$    g)  $[\text{Ni}(\text{CO})_4]$    h)  $[\text{Cu}(\text{NH}_3)_4]^{+2}$    i)  $[\text{Ni}(\text{CN})_4]^{-2}$    j)  $[\text{CO F}_6]^{-3}$

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  $PV^{\gamma}$  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  $[\text{Ti}(\text{H}_2\text{O})_6]^{3+}$  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.

**P.R.GOVERNMENT COLLEGE (AUTONOMOUS)-KAKINADA**  
**THIRD YEAR 2019-20**  
**SEMESTER-V**  
**Paper - VI (INORGANIC, ORGANIC & PHYSICAL CHEMISTRY)**

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**OBJECTIVES:**

1. Gains knowledge Labile and Inert complexes
2. Knowledge of Biological significance of inorganic elements.
3. Structure of Carbohydrates.
4. Synthesis of Amino acids.

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

**INORGANIC CHEMISTRY**

**UNIT-I**

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

Labile and inert complexes, ligand substitution reactions - SN1 and SN2, substitution reactions of Square planar complexes - Trans effect and applications of Trans effect.

**2. Stability of metal complexes: 4h**

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.

**3. 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, and Chlorophyll.

**ORGANIC CHEMISTRY**

**UNIT-II**

**Carbohydrates: 10h**

Mono saccharides: (+) Glucose (aldohexose) - Evidence for cyclic structure of glucose (some negative aldehydes tests and muta rotation) - Proof for the ring size (methylation, hydrolysis and oxidation reactions) - Pyranose structure (Haworth formula and chair conformational formula). (-) Fructose (ketohexose) - Evidence of 2 - ketohexose 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 Aldoexose (Arabinose to D- Glucose, D-Mannose) (Kiliani - Fischer method)

Epimers, Epimerisation - Lobry de bruyn van Ekenstein rearrangement. Aldohexose to Aldopentose (D-Glucose to D- Arabinose) by Ruff degradation. Aldohexose to Ketohexose [(+) Glucose to (-) Fructose] and Ketohexose to Aldohexose (Fructose to Glucose)

### **Amino acids and proteins**

**9h**

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.

## **PHYSICAL CHEMISTRY**

### **UNIT-III**

#### **1. Chemical kinetics**

**8h**

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

#### **2. Photochemistry**

**6h**

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, and Photosensitized reactions- energy transfer processes (simple example) – Jablonski diagram

#### **List of Reference Books**

1. Concise coordination chemistry by Gopalan and Ramalingam
2. Coordination Chemistry by Basalo and Johnson
4. Advanced Physical Chemistry by Atkins
6. Instrumentation and Techniques by Chatwal and Anand
8. A Textbook of Physical Chemistry by Puri and Sharma
9. Advanced physical chemistry by Gurudeep Raj

**Weightage to Content**  
**Fifth semester**  
**Paper -VI**

S.No	Course Content	Long Answer	Short Answer(SA)	Total marks
	<b>Inorganic Chemistry</b>			
1	Reactivity of Metal Complex	1	1	15
2	Stability of metal complexes	1	1	15
3	Bio inorganic Chemistry	1	1	15
	<b>Organic Chemistry</b>			
1	Carbohydrates	2	1	25
2	Amino Acids	1	1	15
	<b>Physical Chemistry</b>			
1	Chemical Kinetics	2	2	30
2	Photo Chemistry	1	1	15
	<b>Total</b>	<b>9</b>	<b>8</b>	<b>130</b>

**P.R.COLLEGE (A), KAKINADA**

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

**(Inorganic, Organic & Physical chemistry)**

**Paper-VI**

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**Time: 2 1/2Hrs**

**Max.Marks:60M**

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

**SECTION-I**

**4x10=40M**

1. Explain  $SN^1$  and  $SN^2$  substitution reactions in octahedral complexes.
2. Explain determination of the composition of metal complexes by job's method.
3. i). Explain the biological signification of Na, K  
ii). Explain the Structure of Chlorophyll

**SECTION-II**

4. Establish the Open chain structure of Glucose with relevant chemical equations.
5. Explain
  - i) Killiani-Fischer synthesis
  - ii) Ruff degradation
6. What are Amino Acids. Write the preparation of  $\alpha$  -amino acids from
  - i) Streckers synthesis
  - ii) Malonic ester synthesis
  - iii) Gabriel phthalamide synthesis

**SECTION-III**

7. a) Derive the rate constant for first order reaction.  
b) The rate constant for the certain first order reaction is  $1 \times 10^{-5} \text{sec}^{-1}$ . Calculate the time taken for the 20% completion of the reaction.
8. Define the terms 'order' and 'molecularity'. Explain any two methods for the determination of order of a reaction.
9. What is meant by quantum yield? State and explain laws of photochemistry.



#### SECTION-IV

Answer any **Five** questions

4x5=20M

10. Explain Chelate effect.
11. What is trans effect. Write any two applications of Trans effect.
12. Explain muta rotation of Glucose.
13. Explain the formation of Glucozone.
14. Write a note on Isoelectric point.
15. Write about the effect of temperature on rate of a reaction.
16. Discuss about Zero order reaction.
17. Explain Jablonski diagram.
18. What are labile and inert complexes? Give examples?

**PAPER-VI**  
**QUESTION BANK**  
**ESSAY QUESTIONS**

1. Explain determination of composition of complex by job's method and mole ratio method.
2. Explain the factors effecting the stability of complexes.
3. Discuss the mechanism of  $SN^1$  and  $SN^2$  reactions in coordination complexes with examples in Octahedral complexes.
4. Explain the mechanism of ligand substitution reactions of square planar complexes.
5. Explain the structure and function of Hemoglobin and chlorophyll
6. Explain open chain and ring structure of Glucose.
7. Explain 1) Killiani fisher synthesis 2) Ruff degradation 3) Glucose to Fructose  
4) Fructose to Glucose
8. Explain the classifications of Amino Acids. Preparations and properties of amino acids.
9. Derive First order equation.
10. Derive second order equation.
11. Define order of a reaction. Explain any three methods for the determination of order of a reaction.
12. Explain Jablanski diagram of various processes occurring in the excited state.
13. What is quantum yield? Explain quantum yield of the reaction between  $H_2$  and  $Cl_2$
14. What is quantum yield? Explain quantum yield of the reaction between  $H_2$  and  $Br_2$

Short Answers

1. Trans effect and its applications.
2. Chelating effect. Give example.
3. What are labile and Inert complexes. Give examples.
4. What is spectrochemical series? Explain.
5. Explain the absorption spectrum of  $[Ti(H_2O)_6]^{+3}$  Ion
6. What are essential elements and importance of Na and K in biological systems.

7. Peptide bond.
8. Isoelectric point.
9. Zwitter ion.
10. Essential Amino acids.
11. Mutarotation.
12. Epimers and Anomers.
13. Lobry de bruyn van ekenstein rearrangement.
14. Osazones.
15. Write about Zero order reaction
16. Write about Half-life period
17. Define molecularity and order of a reaction.
18. Quantum yield.
19. Photo sensitization.
20. Fluorescence, Phosphorescence, chemiluminiscence.
21. What are the metallophorphyrine.
23. Streicker synthesis.
24. Effect of temperature on rate of a reaction.

## **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.

**P.R.GOVERNMENT COLLEGE (AUTONOMOUS)-KAKINADA  
THIRD YEAR 2019-20**

**SEMESTER-VI**

**ELECTIVE PAPER – VII-(B): ENVIRONMENTAL CHEMISTRY**

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

**UNIT-I**

**Introduction**

**9h**

Concept of Environmental chemistry-Scope and importance of environment in now adays – Nomenclature of environmental chemistry – Segments of environment - Natural resources – Renewable Resources – Solar and biomass energy and Nonrenewable resources – Thermal power and atomic energy – Reactions of atmospheric oxygen and Hydrological cycle.

**UNIT-II**

**Air Pollution**

**9h**

Definition – Sources of air pollution – Classification of air pollution – Acid rain – Photochemical smog – Greenhouse 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 - biogeographically 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

**P. R. GOVERNMENT COLLEGE, KAKINADA**  
**SEMESTER – VI (CHEMISTRY)**  
**Paper –VII B: ELECTIVE – B: ENVIRONMENTAL CHEMISTRY**

#### Weightage to content

S. No.	Course Content	Essay Questions (10M)	Short Answer Questions (5M)	Total No. Of Questions from each Unit	Total No. of Marks allotted to each Unit
1	Unit -I	2	2	4	30
2	Unit -II	2	2	4	30
3	Unit -III	2	1	3	25
4	Unit -IV	1	1	2	15
5	Unit -V	2	2	4	30
	<b>TOTAL</b>	<b>9</b>	<b>8</b>	<b>17</b>	<b>130</b>

**P. R. GOVERNMENT COLLEGE, KAKINADA**  
**MODEL PAPER FOR SEMESTER – VI (CHEMISTRY)**  
**Paper –VII B: ELECTIVE – B: ENVIRONMENTAL CHEMISTRY**

**Duration: 2.30 hrs.**

**Max. Marks: 60**

Answer any **FOUR** questions choosing **AT LEAST ONE** question from each section  
**4X10=40Marks**

**Section-I**

1. Explain the segments of the environment
2. Write about renewable energy sources.
3. What are the toxic effects of cyanide on the environment?

**Section-II**

4. Discuss in detail about air pollution.
5. Describe the Greenhouse effect.
6. What are the quality parameters of water?

**Section-III**

7. Give the methods to convert permanent hard water to soft water.
8. Describe the types of ecosystem.
9. Give detailed account on biodiversity.

**Section-IV**

Answer any **FOUR** questions. Each question carries **FIVE** marks.

**4X5=20Marks**

10. Explain the importance of environment in now-a-days.
11. Write about hydrological cycle.
12. Short note on acid rains.
13. What is Bhopal gas disaster?
14. Give about the hardness of water.
15. Explain the toxicity of mercury.
16. What are the functions of eco system?
17. Discuss briefly about food chain.

**LABORATORY COURSE – VI**  
**Practical Paper – Elective VII B (at the end of semester VI)**

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

1. Determination of carbonate and bicarbonate in water samples
2. Determination of hardness of water using EDTA
  - a) Permanent hardness
  - b) Temporary hardness
3. Determination of Acidity of water samples
4. Determination of Alkalinity of water samples
5. Determination of chlorides present in water samples



**P. R. GOVERNMENT COLLEGE, KAKINADA**  
**SEMESTER – VI (CHEMISTRY)**  
**Paper –VII B: ELECTIVE – B: ENVIRONMENTAL CHEMISTRY**

**Question bank**

**Essay questions**

1. Explain different segments of environment.
2. Explain different renewable and non-renewable energy resources.
3. Write different source of air pollution and explain the effects of air pollution
4. What is acid rain how is it formed write equations ? what are its effects?
5. Explain formation and depletion of ozone layer. write the effects of ozone depletion.
6. What are the causes of temporary hardness write the methods to temporary hard water into soft water.
7. What are the causes of permanent hardness write the methods to permanent hard water into soft water.
8. Explain any four water quality parameters.
9. Explain the toxic effects of lead ,mercury and arsenic.
10. Write the types and functions of eco system.
11. Explain carbon and nitrogen cycles.
12. Explain bio diversity at regional, national and global level.

**Short answer**

1. Explain the terms with examples
  - a) Pollutant b) contaminant
2. Explain the terms with examples
  - a) Receptor
  - b) sink
3. Reaction of atmospheric oxygen
4. Explain green house effect.
5. Explain Bhopal gas disaster.
6. What is utrophication write its effects.
7. Write the toxic effect of cyanides.
8. Write bio chemical effects of pesticides.
9. Explain food chain.
10. Explain biodiversity and write different types of biodiversity.
11. Write about significance of bio diversity.
12. Explain any two control methods of air pollutions.

### Cluster Elective –III

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

45 hrs (3 h / w)

##### UNIT-I

10h

##### NUCLEAR MAGNETIC RESONANCE SPECTROSCOPY

Nuclear spin, Principles of NMR Magnetic moment and Spin angular momentum. Larmor Frequency. Instrumentation. Relaxation- spin-spin & spin lattice relaxation. 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: 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

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>). Simultaneous determination of Chromium and Manganese in a mixture

##### UNIT-V

15h

##### Electron Spin Resonance Spectroscopy

Basic Principles, Theory of ESR, Comparison of NMR & ESR. Instrumentation, Factors affecting the 'g' value, determination of 'g' value. Hyper fine splitting concept and splitting patterns, Zero field splitting and Kramer degeneracy.

Applications: - Detection of free radicals; ESR spectra of (a) Methyl radical (CH<sub>3</sub>·), (b) Benzene anion (C<sub>6</sub>H<sub>6</sub><sup>-</sup>) (c) CH<sub>2</sub>.CH<sub>3</sub> (ETHYL RADICAL)

### List of 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. NMR, NQR, EPR and Mössbauer Spectroscopy in inorganic chemistry – R.V Parish, Ellis, Harwood.
6. Instrumental Methods of Chemical Analysis- H.Kaur, Pragathi Prakashan, 2003.
7. Analytical spectroscopy – Kamlesh Bansal, Campus books, 2008.
8. Structural Inorganic Chemistry Mössbauer Spectroscopy – Bhide.
9. Principle of Mössbauer Spectroscopy – T.C. Gibb, Chapman, and Hall, Landon 1976.

**P. R. GOVERNMENT COLLEGE, KAKINADA  
SEMESTER – VI (CHEMISTRY)**

**Paper - VIII : CLUSTER-C-1: ORGANIC SPECTROSCOPIC TECHNIQUES**

### Weightage to content

S. No.	Course Content	Essay Questions (10M)	Short Answer Questions (5M)	Total No. Of Questions from each Unit	Total No. of Marks allotted to each Unit
1	Unit -I	2	1	3	25
2	Unit -II	1	1	2	15
3	Unit -III	2	2	4	30
4	Unit -IV	1	2	3	20
5	Unit -V	3	2	5	40
	<b>TOTAL</b>	<b>9</b>	<b>8</b>	<b>17</b>	<b>130</b>

**P. R. GOVERNMENT COLLEGE, KAKINADA**  
**MODEL PAPER FOR SEMESTER – VI (CHEMISTRY)**  
**Paper - VIII : CLUSTER-C-1: ORGANIC SPECTROSCOPIC TECHNIQUES**

**Duration: 2.30hrs.**

**Max. Marks: 60**

Answer any **FOUR** questions choosing **AT LEAST ONE** question from each section

**4X10=40Marks**

**Section-I**

1. i. Which type of atoms exhibit nuclear magnetic resonance?  
ii. Write the principle involved in NMR spectroscopy.
2. Define chemical shift. What are the factors influencing chemical shift?
3. Discuss in detail the Nuclear Over Hauser effect

**Section-II**

4. Write about Born-oppenheimer approximation.
5. What are the Woodward-Fieser rules of UV-Visible spectroscopy?
6. How is Beer-Lambert's law useful in quantitative determination of Mn(II) and Fe(II)?

**Section-III**

7. Explain principle and theory of esr spectroscopy
8. Explain about the experimental techniques involved in ESR studies.
9. Write notes on 'g' value and hyperfine structure.

**Section-IV**

Answer any **FOUR** questions. Each question carries **FIVE** marks.

**4X5=20Marks**

10. Describe the factors influencing the coupling constant.
11. Explain about spin decoupling.
12. Write about Franck-Condon principle.
13. What are the different types of electronic transitions?
14. State and explain Beer-Lambert law.
15. Write the quantitative determination of any metal ions.
16. How ESR studies are useful to study the structure of free radicals?
17. How ESR studies are useful to study the structure of benzene anion?

**III B.SC CHEMISTRY –PAPER VIII-C-1**  
**ORGANIC SPECTROSCOPIC TECHNIQUES.**  
**QUESTION BANK**

**ESSAY QUESTIONS: 10M**

1. What is the principle of NMR Spectroscopy?
2. Define chemical shift. What are the factors influencing chemical shift.
3. Explain 1) Spin-spin coupling 2) coupling constant-Factors
4. Discuss 1) Born-Oppenheimer approximation 2) Frank- Condon principle.
5. What are the Woodward-fieser rules of UV-Visible Spectroscopy.
6. What is Beer-lamberts law. Write its limitations. How is Beer-Lambert's law useful in quantitative determination of Mn (II) and Fe (II).
7. Give the experimental procedure of simultaneous determination of chromium and manganese in a mixture using Beer-lamberts law.
8. Explain the principle and theory involved ESR Spectroscopy.
9. Write about the experimental techniques involved in ESR Spectroscopy
9. Write about hyperfine splitting and explain the hyperfine splitting pattern of  $\text{CH}_3$  radical
- 10 Explain about the hyperfine splitting lines appear for the following species,  
a)  $\cdot\text{C}_6\text{H}_6^-$  (Benzene anion) b)  $\cdot\text{CH}_3\text{CH}_2$  (ethyl radical)
11. Write about the following, a). g – Factor b). Hyperfine splitting

**SHORT ANSWERS**

**5M**

11. Discuss about a) Shielding effect b) de-shielding
12. Write about a) spin- spin relaxation b) spin decoupling
13. Explain about a) Spin tricing b) spin hamiltoniun
14. Write about larmour frequency
15. Write short note on nuclear overhauser effect
16. What are the different types of electronic transitions?
17. What is FT nmr? What are the advantages of FT in NMR?
18. How is Beer-Lambert's law useful in quantitative determination of  $\text{No}_2^-$
19. Discuss define Chromophore
20. Write comparisons between NMR & ESR?
21. Explain Zero field splitting in ESR spectroscopy
22. Write about Kramer's degeneracy in ESR spectroscopy
23. Write the Principle involved in esr spectroscopy
- 24, Write a short note on g factor.

**Cluster Elective –III**  
**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 cyclic diones, 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, 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 and ketal, (3) Protection of carboxylic acids – ester formation, benzyl and t-butyl esters, (4) Protection of amines

– Acetylation, benzoylation, benzyloxy carbonyl, triphenyl methyl groups, (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. Phase transfer catalysis – mechanisms and use of benzyl trialkyl ammonium halides. Wittig reaction.

**UNIT –V: NEW SYNTHETIC REACTIONS**

Baylis–Hillman 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.

### List of 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.

**P. R. GOVERNMENT COLLEGE, KAKINADA**  
**SEMESTER – VI (CHEMISTRY)**

**Paper - VIII : CLUSTER-C-2: ADVANCED ORGANIC REACTIONS**

**Weightage to content**

S. No.	Course Content	Essay Questions (10M)	Short Answer Questions (5M)	Total No. Of Questions from each Unit	Total No. of Marks allotted to each Unit
1	Unit -I	2	2	4	30
2	Unit –II	2	1	3	25
3	Unit –III	2	2	4	30
4	Unit –IV	2	2	4	30
5	Unit -V	1	1	2	15
	<b>TOTAL</b>	<b>9</b>	<b>8</b>	<b>17</b>	<b>130</b>

**P. R. GOVERNMENT COLLEGE, KAKINADA**  
**MODEL PAPER FOR SEMESTER – VI (CHEMISTRY)**  
**Paper - VIII : CLUSTER-C-2: ADVANCED ORGANIC REACTIONS**

**Duration: 2.30 hrs.**

**Max. Marks: 60**

Answer any **FOUR** questions choosing **AT LEAST ONE** question from each section  
**4X10=40Marks**

**Section-I**

1. Write the mechanism of photo reduction reaction? How it is affected by temperature and solvent?
2. Explain the following:  
i) Singlet and triplet states      ii) Jablonski diagram
3. Discuss the Norrish type-I cleavage with an example.

**Section-II**

4. What do you know about the following:  
i) Di- $\pi$  methane rearrangement      ii) Barton reaction
5. Give a detailed account on the protection of carbonyl groups.
6. How amine group is protected by acylation and benzylation.

**Section-III**

7. Write note on the following:  
i) Mannich reaction      ii) Wittig reaction
8. Write a note on the following:  
i) use of benzyl trialkyl ammonium halides ii) Phase transfer catalysis
9. Illustrate the following reactions:  
Baylis-Hillman reaction      ii) Heck reaction

**Section-IV**

Answer any **FOUR** questions. Each question carries **FIVE** marks. **4X5=20Marks**

10. Write notes on inter-system crossing.
11. Explain the nature of hydrogen donors in photochemical reactions
12. Explain about Photo Fries rearrangement.
13. Give a brief account on the protection of carboxylic acids by ester formation.
14. How does carbonate formation protect diols?
15. Write about Robinson annulation.
16. What is Stork-enamine reaction?
17. Write about Buchwald–Hartwig coupling



**Cluster Elective –III**  
**PAPER – VIII-C-2 : ADVANCED ORGANIC REACTIONS**

**Question bank**

**ESSAYS**

1. Write the mechanism of photo reduction reaction explain the influence of temperature & solvent on photo reduction reaction
2. Explain intersystem crossing energy transfer process by Jablonski diagram
3. Write and Explain the mechanism of Norrish type-I and Norrish type –II reactions
4. Write and explain the mechanism of di-  $\pi$  methane rearrangement and Barton reaction
5. What are protecting groups? Write different methods of preparation of alcohols
6. What are protecting groups write different methods of preparation of amines
7. What are protecting groups? Write different methods of preparation of carbonyl groups
8. Explain the following 1) Mannich reaction 2.) Stork- enamine reaction
9. Explain the following 1) McMurrey reaction 2.) Heck reaction
10. Explain the following 1). UGI reaction 2). Click reaction

**Short answer questions**

- 1.) Write Barton reaction with mechanism
- 2.) Norrish type-2 reactions of 1, 2 - di ketones
3. Explain Photo decarboxylation reaction.
- 3.) What are protecting groups explain with one example
- 4.) Shapiro reaction
- 5.) Mitsunobu reaction
- 6.) Photo fries rearrangement
- 7.) What are phase transfer catalyst? Explain the use of benzyl tri alkyl ammonium halides as phase transfer catalyst
- 8.) Suzuki coupling reactions

**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. Sulpha drugs (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**

**Pharmacodynamics Drugs:** **8h**  
1. Antiasthma Drugs (Salbutamol) 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: Indinavir (crivivan), 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 & Pharmaco therapeutics R. S Satoshkar & S. D. Bhandenkar
- 6. Medicinal Chemistry by Kadametal P-I & P – II

**P. R. GOVERNMENT COLLEGE, KAKINADA**  
**MODEL PAPER FOR SEMESTER – VI (CHEMISTRY)**  
**Paper - VIII : CLUSTER-C-3: PHARMACEUTICAL & MEDICINAL**  
**CHEMISTRY**

**Duration: 2.30hrs.**

**Max. Marks: 60**

Answer any **FOUR** questions choosing **AT LEAST ONE** question from each section

**4X10=40Marks**

**Section-I**

1. Give a detailed account on pharmacodynamics and pharmacokinetics.
2. Explain the following terms with suitable examples.  
i). Metabolites      ii) Anti-metabolites
3. How drugs are classified according to their structure?

**Section-II**

4. Discuss the classification of drugs based on therapeutic activity.
5. Write about the synthesis of chloroquin.
6. Write about the synthesis and therapeutic activity of Paracetamol.

**Section-III**

7. Write about the synthesis of solbutamol.
8. What do you know about CD-4 and CD-8 cells?
9. What are the drugs available for prevention of AIDS? Give their structures.

**Section-IV**

Answer any **FOUR** questions. Each question carries **FIVE** marks.

**4X5=20Marks**

10. Define pharmacy and pharmacology.
11. Define pharmacophore and give two examples.
12. Write the clinical, generic and trade names of paracetamol.
13. Describe the types of administration of drugs.
14. Write about the therapeutic activity of chloroquine.
15. Write the preparation method and uses of antiuritics.
16. Define hypnotics and antipyretics.
17. Write notes on retro virus.

**Paper - VIII : CLUSTER-C-3:  
PHARMACEUTICAL & MEDICINAL CHEMISTRY**

**Questionbank**

**Essay questions(10M)**

1. Explain metabolites and antimetabolites with an example each
2. Explain ADME in pharmacokinetics.
3. Explain the classification of drugs based on structure.
4. Explain the classification of drugs based on therapeutic activity.
5. Write the synthesis and therapeutic activity of sulphamethoxazole
6. Write the synthesis and therapeutic activity of chloroquine
7. Write the synthesis and therapeutic activity of paracetamol
8. Write the synthesis and therapeutic activity of diazepam
9. Write the synthesis and therapeutic activity of salbutamol
10. Write the synthesis and the therapeutic activity of glycerol tri nitrate.
11. Write the synthesis and therapeutic activity of furosemide.
12. Explain CD-4 cells and CD-8 cells.
13. Write the synthesis and therapeutic activity of  $\beta$ - lactum

**Short answer questions(5M)**

1. Explain the terms pharmacology and pharmacology.
2. Explain Pharmacophore with two examples.
3. Explain chemical name, generic name and trade name with examples.
4. Write different types of dosage forms based on a) physical state b) route of administration
5. Write short note on antibiotics
6. Write short notes on antipyretics
7. What are hypnotics and tranquilizers give examples
8. Write about methods of prevention of AIDS.
9. Write the structures of drugs a) indinavir b) Nelfinavir.
10. Briefly explain pharmacokinetics
11. Write short note on administration of drugs
12. Write the investigations available for HIV-AIDS
13. Write the prevention methods available for HIV-AIDS

**P. R. GOVERNMENT COLLEGE, KAKINADA**  
**SEMESTER – VI (CHEMISTRY)**  
**Paper - VIII : CLUSTER-C-3: PHARMACEUTICAL & MEDICINAL**  
**CHEMISTRY**

**Weightage to content**

<b>S. No.</b>	<b>Course Content</b>	<b>Essay Questions (10M)</b>	<b>Short Answer Questions (5M)</b>	<b>Total No. Of Questions from each Unit</b>	<b>Total No. of Marks allotted to each Unit</b>
<b>1</b>	<b>Unit -I</b>	<b>2</b>	<b>2</b>	<b>4</b>	<b>30</b>
<b>2</b>	<b>Unit –II</b>	<b>2</b>	<b>2</b>	<b>4</b>	<b>30</b>
<b>3</b>	<b>Unit –III</b>	<b>2</b>	<b>2</b>	<b>4</b>	<b>30</b>
<b>4</b>	<b>Unit –IV</b>	<b>1</b>	<b>1</b>	<b>2</b>	<b>15</b>
<b>5</b>	<b>Unit -V</b>	<b>2</b>	<b>1</b>	<b>4</b>	<b>25</b>
	<b>TOTAL</b>	<b>9</b>	<b>8</b>	<b>17</b>	<b>130</b>

**I. LABORATORY COURSE – VIII**  
**Practical Paper – VIII-A-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

**II. LABORATORY COURSE – VIII Practical Paper –**  
**VIII-A-2 (at the end of semester VI)**

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

Green procedure for organic qualitative analysis: Detection of N, S and halogens  
2. Acetylation of 1<sup>o</sup> amine by green method: Preparation of acetanilide

3. Rearrangement reaction in green conditions: Benzil-Benzilic acid rearrangement
4. Electrophilic aromatic substitution reaction: Nitration of phenol
5. Radical coupling reaction: Preparation of 1,1-bis -2-naphthol
6. Green oxidation reaction: Synthesis of adipic acid
7. Green procedure for Diels Alder reaction between furan and maleic anhydride

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