

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 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 (N_2 , 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

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
	Organic Chemistry				
1	Unit - I	1	1	2	15
2	Unit - II	1	1	2	15
3	Unit - III	1	2	3	20
	General Chemistry				
4	Unit - IV	2	2	4	30
5	Unit - V	1	2	3	20
	TOTAL	6	8	14	100

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 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 KMnO_4

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

Duration: 2hrs.

Max. Marks: 50

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 N₂ 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.