

I SEMESTER SYLLABUS

FOR CHEMISTRY(H),

ORGANIC

CHEMISTRY(H),

ANALYTICAL

CHEMISTRY(H)

	Government College (Autonomous) Rajahmundry	Program & Semester I B.Sc. CHEMISTRY			
Course Code C1	Title of the Course C1: GENERAL CHEMISTRY	(SEMESTER – I) 2025-26			
Teaching	Hours Allocated: 45 (Theory) (3 hrs. / Wk.)	L	T	P	C
Pre-requisites	Basic knowledge of inorganic chemistry	3	-	-	3

Course Objectives:

1. To understand the structure of the atom and its relation to periodic properties.
2. To explain different types of chemical bonding-ionic, covalent, metallic, hydrogen bonding.
3. To apply bonding theories to predict molecular structure and bonding nature.
4. To correlate periodic trends with physical and chemical properties of elements.
5. To evaluate practical applications of nuclear chemistry in science and industry

Course Outcomes:

On Completion of the course, the students will be able to		Cognitive Domain
CLO1	Describe the electronic configuration of elements and periodic trends	Knowledge
CLO2	Analyze the formation and properties of ionic and covalent compounds.	Understanding
CLO3	Apply VSEPR, hybridization, and MOT to predict molecular geometry and bonding.	Applying
CLO4	Explain metallic bonding, hydrogen bonding, and intermolecular forces and relate them to physical properties..1.	Evaluating
CLO5	E Explain types of radioactivity, nuclear reactions, and real-life applications.	Analysing

Course with focus on employability / entrepreneurship / Skill Development modules

Skill Development		Employability		Entrepreneurship	

Syllabus

UNIT-1: ATOMIC STRUCTURE AND PERIODIC TABLE

(9 h)

Electronic configuration-Aufbau principle, Hund's rule and Pauli's exclusion principle. Periodic law and arrangement of elements in the periodic table, horizontal, vertical, and diagonal relationships in the periodic table. Definition and periodic trends of atomic radii, ionic radii, covalent radii, ionization potential, electron affinity, and electronegativity, Pauling scale.

UNIT-2: IONIC BOND

(9 h)

Properties of ionic compounds, factors favouring the formation of ionic compounds, Lattice energy: definition, factors affecting lattice energy, Born-Haber cycle - enthalpy of formation of ionic compound and stability, Covalent character in ionic compounds - polarization and Fajan's rules.

UNIT- 3: COVALENT BOND

(9 h)

Valence Bond theory: Hybridization of atomic orbitals and geometry of molecules - BeCl_2 , BF_3 , CH_4 , PCl_5 , and SF_6

VSEPR model: Effect of bonding and nonbonding electrons on the structure of molecules - NH_3 , H_2O , SF_4 , ICl_4^- and XeF_4

Molecular orbital theory: LCAO method, construction of M.O. diagrams for homo nuclear and hetero nuclear diatomic molecules (N_2 , CO)

UNIT - 4: METALLIC AND HYDROGEN BONDS

(9 h)

Metallic bond: Metallic properties, free electron theory, band theory of metals. Explanation of conductors, semiconductors and insulators.

Hydrogen bonding: Intra and Inter-molecular hydrogen bonding, influence on the physical properties of molecules, Van der waals forces, dipole-dipole interactions.

UNIT-5: NUCLEAR CHEMISTRY

(9 h)

Definition, Isotopes, n/p ratio, binding energy, types of radioactivity, Soddy-Fajan's displacement law, Law of Radioactivity, Radioactive decay series, Nuclear Reactions- Fission and Fusion, Applications of radioactivity in agriculture and medicine.

References:

1. 1. J.D. Lee, Concise Inorganic Chemistry, 5th ed., Blackwell Science, London, 1996.2.
B. R. Puri, L.R. Sharma, K.C. Kalia, Principles of Inorganic Chemistry, Shoban Lal Nagin Chand and Co.,1996.
2. 3. D.F. Shriver and P.W. Atkins, Inorganic Chemistry, 3rd ed., W. H. Freeman and Co, London,
3. 4. James E. Huheey, Inorganic Chemistry: Principles of Structure and Reactivity, 4thed., 2017.
4. 5. W.U. Malik, G.D Tuli, R.D Madan, Selected Topics in Inorganic Chemistry, S. Chand Publishing, 1998.
5. 6. H.J. Arnikaar, Essentials of Nuclear Chemistry, New Age International Publishers, 2015..

CLO-PLO Mapping:

(1: Slight[Low]; 2: Moderate[Medium]; 3: Substantial [High], '-': No Correlation)

	CLO \ PL O	PL O1	PL O2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7	PLO 8	PLO 9	PLO 10
Inorga nic Chemi stry	CLO1	3	2	2	1	1	0	0	0	3	0
	CLO2	3	1	2	1	1	0	0	0	3	0
	CLO3	3	3	3	1	1	0	0	0	3	0
	CLO4	3	3	3	2	2	0	0	0	3	0
	CLO5	3	3	3	2	2	0	0	0	3	0
	Avg.	3	2.4	2.6	1.4	1.4	0	0	0	3	0

I B.Sc., General chemistry CHEMISTRY-SEMESTER-I
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C1 -GENERAL CHEMISTRY

Sl. No	Chapter	Essay questions (7M) Knowledge/Understanding/ skill /Application	Short questions (3M) Knowledge/Understanding/ skill /Application
1	Unit-I	02	02
2	Unit-II	02	01
3	Unit-III	02	01
4	Unit-IV	02	02
5	Unit-V	02	02
Total number of questions		10	08

GOVERNMENT COLLEGE (A), RAJAMAHENDRAVARAM
DEPARTMENT OF CHEMISTRY
I B.Sc., CHEMISTRY I-SEMESTER
General chemistry C1
MODEL QUESTION PAPER

Time: 2½hrs

Answer **ALL** Questions.

Max.Marks:50 M

5X7=35M

Part-A

1. (a) Explain the Aufbau principle, Hund's rule, and Pauli's exclusion principle with suitable examples.
OR
(b) Discuss the periodic trends in ionization energy and electronegativity across a period and down a group.
2. (a) Define lattice energy. Explain the factors affecting lattice energy and illustrate the **Born-Habercycle** with an example.
OR
(b) What is covalent character in ionic compounds? Explain **Fajan's rules** with examples.
3. (a) Discuss the hybridization and geometry of **BeCl₂, BF₃, CH₄, PCl₅, and SF₆**.
OR
(b) Apply the **VSEPR theory** to predict the structures of **NH₃, H₂O, SF₄, ICl₂⁻, and XeF₄**.
4. (a) Explain **band theory of metals** and how it accounts for conductors, semiconductors, and insulators.
OR
(b) Describe **intermolecular and intramolecular hydrogen bonding** with examples. How does hydrogen bonding affect physical properties?
5. (a) Explain the concepts of isotopes, binding energy, and the neutron-proton ratio in nuclear chemistry.
OR
(b) Write short notes on **nuclear fission and nuclear fusion**. Discuss their applications in energy production.

PART – B

Short Answer Questions (Answer any **Five**, each question carries **3 marks**)

(5 × 3 = 15 Marks)

1. What is the diagonal relationship? Give two examples.
2. Define electron affinity. How does it vary across the periodic table?
3. Write the Born-Haber cycle steps for the formation of NaCl.
4. What are the limitations of Valence Bond Theory?
5. Draw the MO diagram of O₂ and comment on its magnetic property.
6. Differentiate between metallic bond and ionic bond.
7. Give two examples each for intra- and intermolecular hydrogen bonding.
8. State Soddy-Fajan's displacement law.

QUESTION BANK

UNIT – 1: ATOMIC STRUCTURE AND PERIODIC TABLE

Long Answer Questions (7 Marks)

1. Explain Aufbau principle, Hund's rule and Pauli's exclusion principle with suitable orbital diagrams.
2. Discuss the modern periodic law and the arrangement of elements in the periodic table.
3. Write a note on horizontal, vertical and diagonal relationships in the periodic table with examples.
4. Explain periodic trends of atomic radii, ionic radii, and covalent radii across a period and down a group.
5. Discuss the variations of ionization potential, electron affinity and electronegativity in the periodic table.
6. Explain the Pauling scale of electronegativity.

Short Answer Questions (3 Marks)

1. Define Pauli's exclusion principle with one example.
2. What is Hund's rule of maximum multiplicity?
3. Write the electronic configuration of Cr and Cu.
4. Define diagonal relationship. Give one example.
5. How does atomic radius vary in a period and a group?
6. Define ionization potential.
7. What is electron affinity?
8. Write a short note on Pauling's scale of electronegativity.

UNIT – 2: IONIC BOND

Long Answer Questions (7 Marks)

1. Write the general properties of ionic compounds.
2. Discuss the factors favouring the formation of ionic compounds.
3. Define lattice energy. Explain the factors affecting lattice energy.
4. Explain the Born-Haber cycle for the formation of NaCl.
5. Discuss polarization of ions and Fajan's rules with examples.
6. Explain covalent character in ionic compounds.

Short Answer Questions (3 Marks)

1. Define lattice energy.
2. Mention any two factors affecting lattice energy.
3. Write any two properties of ionic compounds.

4. What is polarization?
5. Define Fajan's rules.
6. Give one example for ionic compound with covalent character.
7. Distinguish between ionic and covalent bond.
8. What is enthalpy of formation?

UNIT – 3: COVALENT BOND

Long Answer Questions (7 Marks)

1. Discuss Valence Bond Theory and its applications.
2. Explain the concept of hybridization and geometry of BeCl_2 , BF_3 , CH_4 , PCl_5 , and SF_6 .
3. Explain the VSEPR theory and predict the shapes of NH_3 , H_2O , SF_4 , ICl_2^- , and XeF_4 .
4. Discuss the Molecular Orbital Theory and explain the LCAO method.
5. Draw and explain the MO diagrams of N_2 and O_2 . Comment on their bond order and magnetic nature.
6. Construct the MO diagram of CO and discuss its bonding nature.

Short Answer Questions (3 Marks)

1. Define hybridization.
2. Write the geometry of BF_3 .
3. What is the bond angle in CH_4 ?
4. Explain the shape of NH_3 by VSEPR theory.
5. What is bond order?
6. Draw the MO diagram of N_2 .
7. Why is O_2 paramagnetic?
8. State one limitation of VBT.

UNIT – 4: METALLIC AND HYDROGEN BOND

Long Answer Questions (7 Marks)

1. Explain the metallic bond using the free electron theory.
2. Discuss the band theory of metals. How does it explain conductors, semiconductors, and insulators?
3. Write a note on the properties of metals based on metallic bonding.
4. Explain intra- and inter-molecular hydrogen bonding with examples.
5. Discuss the influence of hydrogen bonding on physical properties of molecules.
6. Explain van der Waals forces and dipole–dipole interactions.

Short Answer Questions (3 Marks)

1. What is a metallic bond?
2. Define free electron theory.
3. Differentiate between conductors and insulators.
4. What is hydrogen bonding?
5. Give one example for intermolecular hydrogen bonding.
6. Give one example for intramolecular hydrogen bonding.
7. Define van der Waals forces.
8. State any two physical properties affected by hydrogen bonding.

UNIT – 5: NUCLEAR CHEMISTRY

Long Answer Questions (7 Marks)

1. Define isotopes. Explain the n/p ratio and its significance.
2. Discuss binding energy and stability of nucleus.
3. Explain different types of radioactivity with examples.
4. State Soddy–Fajan’s displacement law and explain with example.
5. Explain the law of radioactivity.
6. Write a note on nuclear fission and nuclear fusion.
7. Discuss the applications of radioactivity in agriculture and medicine.

Short Answer Questions (3 Marks)

1. Define isotope with one example.
2. What is binding energy?
3. Define radioactivity.
4. Write the equation for α -decay.
5. Write Soddy–Fajan’s displacement law.
6. Mention two differences between nuclear fission and nuclear fusion.
7. Name any two radioactive isotopes used in medicine.
8. State one application of radioactivity in agriculture.

	Government College (Autonomous) Rajahmundry	Program & Semester I B.Sc.			
Course Code	Title of the Course SALT ANALYSIS	CHEMISTRY (SEMESTER – I) 2025-26			
Teaching	Hours Allocated: 30 (Practical) (2 hrs. / Wk.)	L	T	P	C
Pre-requisites	Basic knowledge of Inorganic chemistry	-	-	-	1

Course Objectives:

1. To understand the theoretical principles behind classical qualitative analysis of cations and anions.
2. To develop the ability to identify common cations and anions in inorganic salts
3. To practice laboratory safety and correct handling of reagents
4. To record and interpret observations accurately in systematic salt analysis.

Course Outcomes:

On Completion of the course, the students will be able to		Cognitive Domain
CL O1	Proper use of glassware, equipment and chemicals in the laborator	Understanding
CL O2	Apply systematic procedures to identify one cation and one anion in a given inorganic salt.	Understanding
CL O3	Analyze reactions based on solubility, color changes, and precipitate formation	Applying
CL O4	Interpret results to draw conclusions and confirm the identity of ions	Evaluating

Course with focus on employability / entrepreneurship / Skill Development modules

Skill Development		Employability		Entrepreneurship	

SYLLABUS

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

Anions: Carbonate, sulphate, chloride, bromide, acetate, nitrate, borate, phosphate.

Cations: Lead, copper, iron, aluminium, zinc, nickel, manganese, calcium, strontium, barium, ammonium.

REFERENCES

1. G. Svehla, Vogel's Textbook of Qualitative Inorganic Analysis, Pearson Education, 2008.
2. K. Nagaraj, S. Kamalesu, S. Lokhandwala, N.M. Parekh, Textbook of Semi-micro Inorganic Qualitative Analysis, Notion Press, 2023.
3. G. Pass, H. Sutcliff, Practical Inorganic Chemistry. 2nd edition, John-Wiley & Sons, 2020.

CLO-PLO Mapping:

(1: Slight[Low]; 2: Moderate[Medium]; 3: Substantial [High], '-': No Correlation)

	C L O	P L	PL O2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7	PLO 8	PLO 9	PLO 10
	\										
	PL O	O 1									
An aly sis of sim ple salt	CL O1	3	2	2	1	1	0	0	0	3	0
	CL O2	3	1	2	1	1	0	0	0	3	0
	CL O3	3	3	3	1	1	0	0	0	3	0
	CL O4	3	3	3	2	2	0	0	0	3	0
	Av g.	3	2.4	2.6	1.4	1.4	0	0	0	3	0

	Government College (Autonomous) Rajahmundry	Program & Semester I B.Sc. CHEMISTRY (SEMESTER – I) 2025-26			
Course Code c2	Title of the Course C2: INORGANIC CHEMISTRY				
Teaching	Hours Allocated: 45 (Theory) (3 hrs. / Wk.)	L	T	P	C
Pre-requisites	Basic knowledge of inorganic chemistry	3	-	-	3

Course Objectives:

1. To explain preparation and uses of selected p-block compounds.
2. To understand the structural and chemical properties of selected p-block compounds.
3. To classify and analyse the characteristics of d- and f-block elements.
4. To compare the properties of lanthanides and actinides.
5. To understand the processes involved in the extraction of metals from their ores.

Course Outcomes:

On Completion of the course, the students will be able to		Cognitive Domain
CL O1	Explain the structure, bonding, and preparation methods of compounds of some p-block elements	Understand, Apply
CL O2	Classify various types of oxides, oxoacids, and halogen derivatives and analyze their properties, reactivity, and industrial relevance.	Analyze, Evaluate
CL O3	Describe the general characteristics of d-block elements and their applications (Understand, Analyze)	Understand, Analyze
CL O4	Compare the chemistry of lanthanides and actinides and their importance	Understand, Analyze, Evaluate
CL O5	Explain the occurrence of metals, extraction, and refining of ores and assess modern methods of metal recovery.	Understand, Apply, Evaluate

Course with focus on employability / entrepreneurship / Skill Development modules

Skill Development		Employability		Entrepreneurship	

UNIT-1: CHEMISTRY OF p-BLOCK ELEMENTS – I (9 h)

Group 13: Preparation and structure of Diborane, Borazine and (BN)_x.

Group 14: Preparation, classification and uses of silicones.

Group 15: Preparation and structure of Phosphonitrilic Chloride P₃N₃Cl₆.

UNIT-2: CHEMISTRY OF p-BLOCK ELEMENTS – II (9 h)

Group 16: Classification of oxides, structures of oxides and oxoacids of sulphur.

Group 17: Preparation and structures of Interhalogen compounds, Pseudo halogens.

UNIT-3: CHEMISTRY OF d-BLOCK ELEMENTS (9 h)

Characteristics of d-block elements with special reference to electronic configuration, variable valency, colour, magnetic properties, catalytic properties and ability to form complexes. Stability of various oxidation states of 3d-series.

UNIT-4: CHEMISTRY OF f-BLOCK ELEMENTS (9 h)

Chemistry of Lanthanides: Electronic configuration, oxidation states, colour, magnetic properties, lanthanide contraction, consequences of lanthanide contraction.

Chemistry of Actinides: Electronic configuration, oxidation states, actinide contraction, comparison of lanthanides and actinides.

UNIT-5: GENERAL PRINCIPLES OF METALLURGY (9 h)

Occurrence of metals, minerals and ores, Concentration of ores – levitation, magnetic separation, froth flotation, leaching, Conversion of concentrated ores to oxide - calcination and roasting, reduction of oxide to the metal, Refining of crude metal - distillation, liquation, poling, electrolysis, zone refining and vapour phase refining, Corrosion and Alloys.

References:

1. J. D. Lee, Concise Inorganic Chemistry, 5th ed., Blackwell Science, London, 1996.
2. B.R. Puri, L.R. Sharma, K.C. Kalia, Principles of Inorganic Chemistry, Shoban Lal Nagin Chand and Co., 1996.
3. D.F. Shriver, P.W. Atkins, Inorganic Chemistry, W. H. Freeman and Co, London, 1999.
4. J.E. Huheey, Inorganic Chemistry: Principles of Structure and Reactivity, 4th ed., 2017.
5. A.K. Das, Fundamentals of Metallurgy. Tata McGraw Hill Education, 2011.

CLO-PLO Mapping:

(1: Slight[Low]; 2: Moderate[Medium]; 3: Substantial [High], '-': No Correlation)

	CLO\ PLO	P L O 1	P L O 2	PL O3	PLO4	P L O 5	PL O6	PLO7	P L O 8	P L O 9	PL O 10
Inorganic Chemistry	CL O1	3	1	1	1	1	-	1	1	2	1
	CL O2	3	3	2	2	1	-	1	1	2	1
	CL O3	3	2	1	1	1	-	1	1	2	1
	CL O4	3	2	3	2	2	-	2	1	2	2
	CL O5	3	3	2	3	2	2	2	2	3	2
	Avg .	3	2.2	1.8	1.8	1.4	0.4	1.4	1.2	2.2	1.4

GOVERNMENT COLLEGE (A),
RAJAMAHENDRAVARAM

I B.Sc. Chemistry (Hons.) SEMESTER-I

2025-26

INORGANIC CHEMISTRY QUESTION PAPER BLUE

PRINT

TIME: 2¹/₂ hrs. Max. Marks: 50

PART – A

Answer **ALL** the following questions.

5x7 = 35 M

1a Question from UNIT-I

OR

1b Question from UNIT-I

2a Question from UNIT-II

OR

2b Question from UNIT-II

3a Question from UNIT-III

OR

3b Questions from UNIT-III

4a Question from UNIT-IV

OR

4b Question from UNIT-IV

5a Question from UNIT-V

OR

5b Question from UNIT-V

PART – B

Answer any **FIVE** of the following questions.

5x3 = 15 M

6 Questions from UNIT-I

7 Questions from UNIT-I

8 Questions from UNIT-II

9 Questions from UNIT-II

10 Questions from UNIT-III

11 Questions from UNIT-III

12 Questions from UNIT-IV

13 Questions from UNIT-V

INORGANIC CHEMISTRY

MODEL QUESTION PAPER

Time: 2½ hrs.

Max. Marks: 50

PART – A

Answer **ALL** the following questions.

5x7 = 35 M

		M ar ks	BL	C L O	PLO
1	Explain the preparation and structure of Diborane. OR	7	2, 3	1	1, 4
2	What are Silicones? Explain the classification, preparation and applications of Silicones.	7	2, 3	1	1, 4
3	What are oxides? Explain the classification of oxides based on oxygen content. OR	7	4, 5	2	1, 2, 3
4	Explain the preparation and structures of AX ₃ and AX ₅ type Inter halogen compounds.	7	4, 5	2	1, 2, 3
5	Why d-block elements exhibit variable oxidation states? Illustrate the various oxidation states of d-block elements. OR	7	2, 4	3	1, 2, 3
6	Explain the following characteristic properties of d-block elements. a) Complex forming ability b) Magnetic properties	7	2, 4	3	1, 2, 3
7	What is Lanthanide contraction? Explain the consequences of Lanthanide contraction. OR	7	2, 4, 5	4	1, 2, 3
8	How can you separate Lanthanides by ion exchange method?	7	2, 4, 5	4	1, 2, 3
9	Explain the methods of concentration of ores. OR	7	2, 3, 5	5	1, 2, 3, 4
10	Describe the refining of crude metals.	7	2, 3, 5	5	1, 2, 3, 4

PART – B

Answer any **FIVE** of the following questions.

5x3 = 15 M

		M ar ks	B L	C L O	PLO
11	Why Borazole is known as Inorganic Benzene? Explain.	3	2	1	1, 4
12	Describe the structure of $P_3N_3Cl_6$.	3	2	1	1, 4
13	Write a short note on pseudo halogens.	3	2	1	1, 4
14	Explain the classification of oxides based on chemical behaviour.	3	4 , 5	2	1, 2, 3
15	Why Cr and Cu exhibit abnormal electronic configurations?	3	2 , 4	3	1, 2, 3
16	Why particularly d- block elements act as catalysts? Explain with suitable examples.	3	2 , 4	3	1, 2, 3
17	Write the differences between Lanthanides and Actinides.	3	2 , 4 , 5	4	1, 2, 3
18	Differentiate between calcination and roasting.	3	2 , 4	5	1, 2, 3, 4

QUESTION BANK

Essay type questions. Each question carries 7 marks.				
Unit-1	Marks	BL	C L O	PL O
1. Describe the structure of Diborane.	7	2	1	1, 4
2. Give the preparation and applications of Silicones.	7	2, 3	1	1, 4
3. What are Silicones? Explain the classification and applications of Silicones.	7	2, 3	1	1, 4
Unit-2	Marks	BL	C L O	PL O
1. What are oxides? Discuss the classification of oxides based on oxygen content.	7	4, 5	2	1, 2, 3
2. Discuss the structures of oxyacids of sulphur.	7	4, 5	2	1, 2, 3
3. Explain the preparation and structures of AX_3 and AX_5 type Inter halogen compounds.	7	4, 5	2	1, 2, 3
Unit-3	Marks	BL	C L O	PL O
1. Why d-block elements exhibit variable oxidation states? Illustrate various oxidation states of d-block elements.	7	2, 4	3	1, 2, 3
2. Explain the following characteristic properties of d-block elements. a) Complex forming ability b) Magnetic properties	7	2, 4	3	1, 2, 3
3. Explain the following characteristic properties of d-block elements. a) Catalytic properties b) Colour	7	2, 4	3	1, 2, 3

Unit-4	Marks	BL	C L O	PL O
1. What is Lanthanide contraction? Explain the consequences of Lanthanide contraction.	7	2, 4, 5	4	1, 2, 3
2. How can you separate Lanthanides by ion exchange method?	7	2, 4, 5	4	1, 2, 3
3. Distinguish between Lanthanides and Actinides.	7	2, 4, 5	4	1, 2, 3
Unit-5	Marks	BL	C L O	PL O
1. Explain the methods of concentration of ores.	7	2, 3, 5	5	1, 2, 3, 4
2. Describe the refining of crude metals.	7	2, 3, 5	5	1, 2, 3, 4

3. Discuss about alloys.	7	2, 3	5	1, 4

Short answer questions. Each question carries 3 marks.

Unit-1	Marks	BL	C L O	PL O
1. Why Borazole is known as Inorganic Benzene? Explain.	3	2	1	1, 4
2. Describe the structure of $P_3N_3Cl_6$.	3	2	1	1, 4
3. Discuss the structure of $(BN)_3$.	3	2	1	1, 4
Unit-2	Marks	BL	C L O	PL O
1. Write a short note on pseudo halogens.	3	4, 5	1	1, 4
2. Explain the classification of oxides based on chemical behaviour.	3	4, 5	2	1, 2, 3
3. Explain the structures of oxides of sulphur.	3	2, 4	2	1, 2, 3
Unit-3	Marks	BL	C L O	PL O

1. Why Chromium and Copper exhibit abnormal electronic configurations?	3	2, 4	3	1, 2, 3
2. Why particularly d-block elements act as catalysts? Explain with suitable examples.	3	2, 4	3	1, 2, 3
3. Explain the reason for variable valency of d-block elements.	3	2, 4	3	1, 2, 3
Unit-4	Marks	BL	C L O	PL O
1. Write any 3 differences between Lanthanides and Actinides.	3	2, 4	4	1, 2, 3
2. Write about Lanthanide contraction.	3	2, 4	4	1, 2, 3
Unit-5	Marks	BL	C L O	PL O
1. Differentiate between calcination and roasting.	3	2, 4	5	1, 2, 3, 4
2. Exemplify about corrosion.	3	2	5	1, 2, 3, 4

	Government College (Autonomous) Rajahmundry	Program & Semester I B.Sc. CHEMISTRY (SEMESTER – I) 2025-26			
Course Code : C2 PRACTICAL	Title of the Course INORGANIC PREPARATIONS				
Teaching	Hours Allocated: 30 (Practical) (2 hrs. / Wk.)	L	T	P	C
Pre-requisites	Basic knowledge of Inorganic chemistry	-	-	-	1

Course Objectives:

1. To understand and apply stoichiometry and principles of inorganic salt preparation.
2. To learn techniques such as crystallization, filtration and drying.
3. To calculate percentage yields.
4. To handle reagents and lab apparatus safely and precisely.

Course Outcomes:

On Completion of the course, the students will be able to		Cognitive Domain
CL O1	Demonstrate safe use of laboratory equipment and chemicals handling	Understand
CL O2	Analyse the theoretical background for the preparation of inorganic salts.	Analyse
CL O3	Perform synthesis of potash alum, ferrous salts and cuprous chloride following proper procedures.	Apply
CL O4	Analyze colour changes, crystal formation and yields to evaluate reaction completion.	Evaluate

Course with focus on employability / entrepreneurship / Skill Development modules

Skill Development		Employability		Entrepreneurship	

SYLLABUS:

1. Preparation of Potash alum.
2. Preparation of Ferrous oxalate.
3. Preparation of Ferrous ammonium sulphate.
4. Preparation of Cuprous chloride.
5. Preparation of Chrome alum.

REFERENCES:

1. G. Svehla, Vogel's Textbook of Qualitative Inorganic Analysis, Pearson Education, 2008.
2. G.H. Jeffery, J. Bassett, J. Mendham, R.C. Denney, Vogel's Textbook of Quantitative Chemical Analysis, John Wiley and Sons, 1989.

CLO-PLO Mapping:

(1: Slight[Low]; 2: Moderate[Medium]; 3: Substantial [High], '-': No Correlation)

	CLO\ PLO	P L O 1	P L O 2	PL O3	P L O 4	PL O5	PL O6	PL O7	P L O 8	PLO9	PLO10
Inorganic Preparations	CL O1	3	2	2	3	2	2	2	3	2	3
	CL O2	3	3	3	2	2	2	2	2	2	2
	CL O3	3	2	2	3	3	2	2	3	2	3
	CL O4	3	3	3	2	2	2	2	2	2	3
	Avg .	3	2 . 5	2.5	2.5	2.2 5	2	2	2.5	2	2. 7 5

II SEMESTER SYLLABUS

FOR CHEMISTRY (H),

ORGANIC CHEMISTRY(H),

ANALYTICAL CHEMISTRY

(H)

	Government College (Autonomous) Rajahmundry	Program & Semester I B.Sc. CHEMISTRY (SEMESTER – II) 2025-26
Course Code C3	Title of the Course C3: ORGANIC CHEMISTRY	

Teaching	Hours Allocated: 45 (Theory) (3 hrs. / Wk.)	L	T	P	C
Pre-requisites	Basic knowledge of inorganic chemistry	3	-	-	3

Course Objectives:

1. To understand the structural theory behind reactivity in organic chemistry.
2. To identify and classify hydrocarbons, their reactions, and stability.
3. To explain organic reaction mechanisms and orientation in aromatic substitution.
4. To apply concepts like resonance, inductive effects, hyperconjugation, and aromaticity.
5. To analyze stereochemistry through molecular representations and optical activity.

Course Outcomes:

	On Completion of the course, the students will be able to	Cognitive Domain
CLO1	Study Inductive effect, Mesomeric effect, Hyperconjugation and its applications.	Knowledge
CLO2	Explain the preparation and chemical properties of alkanes, alkenes, alkynes and benzene.	Understanding
CLO3	Analyze and apply Huckel's rule to benzenoid and non-benzenoid aromatic compounds.	Analysing
CLO4	Differentiate between Markownikoff and Anti-markownikoff addition, Ring activating and deactivating groups	Evaluating
CLO5	Interpret stereochemical representations and identify chiral molecules	Applying

Course with focus on employability / entrepreneurship / Skill Development modules

Skill Development		Employability		Entrepreneurship	

Syllabus

UNIT-1: STRUCTURAL THEORY IN ORGANIC CHEMISTRY (9 h)

Functional groups in organic chemistry, Types of bond fission, Electrophiles, Nucleophiles, Reactive intermediates-carbocations, carbanions & free radicals. Inductive effect and its application: (a) Basicity of amines and (b) Acidity of carboxylic acids, Resonance or Mesomeric effect and its application: (a) Acidity of phenol, and (b) Acidity of carboxylic acids. Hyper conjugation and its application to the stability of carbonium ions.

UNIT-2: SATURATED HYDROCARBONS (ALKANES & CYCLOALKANES) (9 h)

Types of organic reactions: Addition, Elimination, Substitution and Rearrangement reactions.

Alkanes: Preparation of alkanes by Corey House synthesis, Substitution reactions of alkanes.

Cycloalkanes: Cycloalkanes and their relative stability, Baeyer strain theory, Cyclohexane conformations with energy diagram.

UNIT-3: UNSATURATED HYDROCARBONS (ALKENES & ALKYNES) (9 h)

Alkenes: Preparation of alkenes by dehydration of alcohols, Saytzeff and Hofmann eliminations, Electrophilic Additions of X_2 , H_2O , HX to alkene, Markownikoff and Anti-markownikoff addition, Ozonolysis, Diels-Alder reaction, 1,2- and 1,4-addition reactions in conjugated dienes.

Alkynes: Additions of X_2 , H_2O , HX to alkynes, acidity and alkylation of terminal alkynes.

UNIT-4: AROMATICITY, BENZENE AND ITS REACTIVITY (9 h)

Aromaticity: Concept of aromaticity, Huckel's rule - application to Benzenoid (Benzene, Naphthalene) and Non-Benzenoid compounds (cyclopropenylcation, cyclopentadienyl anion and tropylium cation). Electrophilic aromatic substitution benzene- Halogenation, Nitration, Friedel-Craft's alkylation and Friedel- Craft's acylation.

Orientation of aromatic substitution: Ortho, para and meta directing groups with examples, Ring activating and deactivating groups with examples.

UNIT- 5: STEREOCHEMISTRY OF CARBON COMPOUNDS (9 h)

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

Optical isomerism: Optical activity, optical rotation and specific rotation. Chiral molecules-Symmetry elements-enantiomers and diastereomers, Explanation of optical isomerism with examples- Glyceraldehyde, Lactic acid, and Tartaric acid. Relative configuration (D, L-notation), CIP rules, Absolute configuration (R, S-Configuration)

IV. REFERENCES:

1. R.N. Morrison, R.N. Boyd, Organic Chemistry, Pearson Education, 7th edition, 2010.
2. Peter Sykes, Guidebook to Mechanism in Organic Chemistry, 6th edition, 1985.
3. S.P. Singh, O. Prakash, Reaction mechanism in organic chemistry, Laxmi Publications, 2017.
4. P.Y. Bruice, Organic Chemistry, 8th Edition, Pearson, 2017.
5. V.K. Ahluwalia, P. Bhagat, R. Aggarwal, R. Chandra, Intermediate for Organic Synthesis, I.K. International. 2005.
6. T.W.G. Solomons, C.B. Fryhle, S.A. Snyder, Organic Chemistry, 12th Edition, Wiley, 2016.
7. P.S. Kalsi, Stereochemistry, New Age International, 2015.
8. D. Nasipuri, Stereochemistry of organic compounds, New Age International, 2020.

CLO-PLO Mapping:

(1: Slight[Low]; 2: Moderate[Medium]; 3: Substantial [High], '-': No Correlation)

	C L O \ P L O	PL O1	PL O2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7	PLO 8	PLO 9	PLO 10
Inorgan ic Chemis try	CL O1	3	2	2	1	1	0	0	0	3	0
	CL O2	3	1	2	1	1	0	0	0	3	0
	CL O3	3	3	3	1	1	0	0	0	3	0
	CL O4	3	3	3	2	2	0	0	0	3	0
	CL O5	3	3	3	2	2	0	0	0	3	0
	Av g.	3	2.4	2.6	1.4	1.4	0	0	0	3	0

I B.Sc., General chemistry CHEMISTRY-SEMESTER-I
BLUE PRINT

C1 -GENERAL CHEMISTRY

Sl. No	Chapter	Essay questions (7M) Knowledge/Understanding/ skill /Application	Short questions (3M) Knowledge/Understanding/ skill /Application
1	Unit-I	02	02
2	Unit-II	02	01
3	Unit-III	02	01
4	Unit-IV	02	02
5	Unit-V	02	02
Total number of questions		10	08

GOVERNMENT COLLEGE (A), RAJAMAHENDRAVARAM

DEPARTMENT OF CHEMISTRY

I.B.Sc., CHEMISTRY I-SEMESTER

Organic chemistry C3

MODEL QUESTION PAPER

Time: 2½hrs

Answer **ALL** Questions.

Max.Marks:50 M

5X7=35M

Section – A (5 × 10 = 50 Marks)

Answer any FIVE questions, choosing either (a) or (b).

Q1.

a) Explain inductive effect with examples. Discuss its applications in (i) basicity of amines and (ii) acidity of carboxylic acids.

OR

b) Explain resonance effect. Discuss its applications in (i) acidity of phenol and (ii) acidity of carboxylic acids.

Q2.

a) Describe Baeyer's strain theory. Explain the conformations of cyclohexane with energy diagram.

OR

b) Explain the preparation of alkanes by Corey-House synthesis. Write notes on substitution reactions of alkanes.

Q3.

a) Explain Markownikoff's and Anti-Markownikoff's addition with suitable examples.

OR

b) Discuss the mechanism of Diels–Alder reaction and 1,2- & 1,4-addition in conjugated dienes.

Q4.

a) Explain Huckel's rule of aromaticity and apply it to benzene, naphthalene, cyclopropenyl cation, cyclopentadienyl anion, and tropylium cation.

OR

b) Discuss electrophilic substitution reactions of benzene with mechanism: (i) Halogenation, (ii) Nitration, (iii) Friedel-Craft's alkylation.

Q5.

a) What is optical isomerism? Explain with examples of glyceraldehyde, lactic acid, and tartaric acid.

OR

b) Explain R and S configuration of chiral molecules using CIP rules.

Section – B ($5 \times 3 = 15$ Marks)

Answer any EIGHT questions (3 Marks each).

1. Define carbocation and carbanion with examples.
 2. Write a note on hyperconjugation.
 3. Distinguish between electrophiles and nucleophiles with one example each.
 4. Write the conformational structures of cyclohexane (chair and boat).
 5. What is Saytzeff's rule? Give an example.
 6. Write any two reactions showing addition of HX to alkenes.
 7. Define aromaticity. State Huckel's rule.
 8. Write the orientation of electrophilic substitution for $-\text{OH}$ and $-\text{NO}_2$ groups in benzene.
 9. Define chiral center. Give one example.
 10. What is specific rotation? Write the formula.
-

QUESTION BANK

UNIT – 1: STRUCTURAL THEORY IN ORGANIC CHEMISTRY

Long

Answer Questions:

1. Explain inductive effect and its applications.
2. Discuss resonance effect and its applications.
3. Explain hyperconjugation and its role in stability of carbocations.
4. Write notes on reactive intermediates: (a) carbocations, (b) carbanions, and (c) free radicals. **Short Answer**

Questions:

1. Define electrophiles and nucleophiles with examples.
2. Explain bond fission: homolytic and heterolytic.
3. Write any two applications of inductive effect.
4. What is resonance? Give one example.

UNIT – 2: SATURATED HYDROCARBONS

Long Answer Questions:

1. Explain Corey-House synthesis of alkanes.
2. Discuss substitution reactions of alkanes.
3. Explain Baeyer's strain theory.
4. Draw and explain conformations of cyclohexane with energy diagram. **Short Answer**

Questions:

1. Define elimination and rearrangement reactions.
 2. Give one method of preparation of alkanes.
 3. Write the conformations of cyclopropane and cyclobutane.
 4. Why is cyclohexane more stable than cyclopropane?
-

UNIT – 3: UNSATURATED HYDROCARBONS

Long Answer

Questions:

1. Explain Saytzeff and Hofmann elimination with examples.
2. Describe the mechanism of addition of HX to alkenes (Markownikoff's & Peroxide effect).
3. Explain ozonolysis of alkenes with mechanism.
4. Discuss 1,2- and 1,4-addition reactions of conjugated dienes.
5. Write notes on acidity and alkylation of terminal alkynes.

Short

Answer Questions:

1. Write the equation for dehydration of alcohol to alkene.
 2. What is peroxide effect? Give example.
 3. Write an equation for Diels-Alder reaction.
 4. Define acidity of alkynes.
-

UNIT – 4: AROMATICITY, BENZENE AND ITS REACTIVITY

Long Answer

Questions:

1. Explain Huckel's rule with examples of aromatic and non-aromatic compounds.
2. Discuss halogenation, nitration, and Friedel-Crafts alkylation of benzene.
3. Write notes on orientation in electrophilic substitution – activating and deactivating groups.
4. Explain with examples ortho, para, and meta directing groups.

Short Answer

Questions:

1. Define aromaticity with one example.
2. Give one example each of activating and deactivating groups.
3. What is nitration of benzene? Write the equation.
4. Write the structure of tropylium cation.

UNIT – 5:

STEREOCHEMISTRY OF CARBON COMPOUNDS

Long Answer

Questions:

1. Explain molecular representations – Wedge, Fischer, Newman and Sawhorse formulae.
2. Explain optical isomerism with reference to glyceraldehyde, lactic acid, and tartaric acid.
3. Explain enantiomers and diastereomers with suitable examples.
4. Explain CIP rules and assign R & S configuration to given compounds.
5. Write notes on relative configuration (D and L).

Short Answer

Questions:

1. Define chiral molecules with an example.
2. What is the difference between enantiomers and diastereomers?
3. Write a note on specific rotation.
4. Write the D and L configuration of glyceraldehyde.

	Government College (Autonomous) Rajahmundry	Program & Semester I B.Sc. CHEMISTRY (SEMESTER –II) 2025-26			
Course Code:c 3	Title of the Course ORGANIC PREPARATIONS				
Teach ing	Hours Allocated: 30 (Practical) (2 hrs. / Wk.)				
Pre- requisites	Basic knowledge of Organic chemistry	-	-	-	1

Objectives: Course

1. Understand mechanisms and conditions for common organic synthesis reactions (nitration, bromination, esterification, acetylation).
2. Perform organic synthesis using appropriate techniques such as heating, reflux, crystallization, and filtration.
3. Develop safe laboratory practices and chemical handling procedures.

Course Outcomes:

On Completion of the course, the students will be able to		Cognitive Domain
C L O 1	Describe the theoretical background and reaction mechanisms of organic preparations.	Understanding
C L O 2	Synthesize organic compounds using standard laboratory procedures.	Understanding
C L O 3	Analyze reaction steps and evaluate the melting point, and yield of synthesized products.	Applying
C L O 4	Relate synthesis methods to pharmaceutical and industrial applications	Evaluating

Course with focus on employability / entrepreneurship / Skill Development modules

Skill Developm ent		Employab ility		Entreprene urship	

SYLLABUS:

1. Preparation of tribromo aniline
2. Preparation of p-nitroacetanilide
3. Preparation of nerolin
4. Preparation of aspirin (Acetylsalicylic acid)
5. Preparation of paracetamol (Acetaminophen)

REFERENCES:

1. B.S. Furniss, A.J. Hannaford, P.W.G. Smith, A.R. Tatchell, Vogel's Textbook of Practical Organic Chemistry, Pearson, 2012.
2. V.K. Ahluwalia, R. Agarwal, Comprehensive Practical Organic Chemistry, University Press, 2010.

CLO-PLO Mapping:

(1: Slight[Low]; 2: Moderate[Medium]; 3: Substantial [High], '-' : No Correlation)

	CLO\ PLO	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10
	CL O1	3	2	2	1	1	0	0	0	3	0
	CL O2	3	1	2	1	1	0	0	0	3	0
	CL O3	3	3	3	1	1	0	0	0	3	0
	CL O4	3	3	3	2	2	0	0	0	3	0
	Av g.	3	2.4	2.6	1.4	1.4	0	0	0	3	0

	Government College (Autonomous) Rajahmundry	Program & Semester I B.Sc. CHEMISTRY (HONOURS) (SEMESTER – II)			
Course Code CH-4	TITLE OF THE COURSE Course -4: PHYSICAL CHEMISTRY-I States of matter, Phase rule & Surface Chemistry				
Teaching	Hours Allocated: 45 (Theory) (3 hrs. / Wk.)	L	T	P	C
Pre-requisite	Basic knowledge about material and energy balances	3	-	-	3

Course Objectives:

1. To understand the theoretical principles governing gases, liquids, solids, and colloidal systems.
2. To apply gas laws and interpret the behavior of real and ideal gases.
3. To describe physical properties of matter in various states and relate them to structural features.
4. To interpret phase diagrams and apply Gibbs' phase rule to one- and two-component systems.

Course Outcomes:

On Completion of the course, the students will be able to-		Cognitive Domain
CLO 1	To understand the theoretical principles governing gases, liquids, solids, and colloidal systems.	Understand
CLO 2	To apply gas laws and interpret the behavior of real and ideal gases.	Apply, Analyze
CLO 3	To describe physical properties of matter in various states and relate them to structural features.	Remember, Understand
CLO 4	To interpret phase diagrams and apply Gibbs' phase rule to one- and two-component systems.	Analyze, Apply

Course with focus on employability / entrepreneurship / Skill Development modules

Skill Development		Employability		Entrepreneurship	

SYLLABUS:

UNIT-1: GASEOUS STATE

(9 h)

Gas laws, Ideal Gas equation, Vander Waal's equation of state, Andrew's isotherms of carbon dioxide, Critical phenomena, Relationship between critical constants and van der Waal's constants, Law of corresponding states, Joule-Thomson effect, Inversion temperature.

UNIT-2: LIQUID STATE

(9 h)

Physical properties of liquids: Definition of vapour pressure, boiling point, surface tension and coefficient of viscosity, Effect of temperature and addition of solutes on surface tension and viscosity.

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.

UNIT-3: SOLID STATE

(9h)

Law of constancy of interfacial angles, The law of rationality of indices-Miller indices, Symmetry in crystals, definition of lattice point, space lattice, unit cell, Bravais lattices and crystal systems, X-ray diffraction and crystal structure, Bragg's law and its derivation, Defects in crystals: Stoichiometric and Non-stoichiometric defects.

UNIT-4: PHASE RULE

(9 h)

The concept of phase, components, degrees of freedom, Gibbs phase rule, Phase diagram of one component system – water system, Definition and examples for systems having congruent and incongruent melting point, Study of Phase diagrams of Simple eutectic systems (i) Pb-Ag system, desilverisation of lead (ii) NaCl-Water system, freezing mixtures

UNIT-5: SURFACE CHEMISTRY

(9 h)

Colloids: Definition and classification of Colloids, Coagulation of colloids, Hardy-Schulze rule, Stability of colloids, Protection of Colloids-Gold number.

Adsorption: Physical and chemical adsorption, Freundlich and Langmuir adsorption isotherm, applications of adsorption.

REFERENCES:

1. P.W. Atkins, J.de., Paula, Atkin's Physical Chemistry, 10th Edition, Oxford University Press, 2014.
2. D.W. Ball, Physical Chemistry, 2nd Edition, Cengage Learning, 2017.
3. G.W. Castellan, Physical Chemistry, 4th Edition, Narosa, 2014.
4. K.L. Kapoor, A Textbook of Physical Chemistry, 6th Edition, McGraw-Hill Education, 2015.

PROPOSED ACTIVITIES:

1. Model building: Bravais lattices and symmetry in crystals
2. Chart preparation of phase diagrams (Water, Pb-Ag, NaCl-H₂O)
3. PPT: Adsorption isotherms or colloidal behavior.
4. List out applications of Liquid crystals in different display devices.
5. Peer Teaching: Phase rule and eutectic systems

CO-CURRICULAR ACTIVITIES AND ASSESSMENT METHODS:

1. Continuous Internal Evaluation (CIA): Monitoring the progress of student's learning
2. Class Tests, Worksheets, Quizzes, Industrial/Field visits, Student seminars, Poster and PPT presentations, Peer learning, Project-based learning, Assignments, Debates, Group Discussions: Enhances critical thinking skills.
3. Semester End Examination (SEE): Critical indicator of student's learning and teaching methods adopted by teachers throughout the semester.

CO-PO Mapping:

(1: Slight[Low]; 2: Moderate[Medium]; 3: Substantial[High], '-': No Correlation)

	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10
CLO1	3	2	2	0	0	0	0	0	1	0
CLO2	3	3	3	2	2	0	0	0	2	0
CLO3	3	2	2	2	0	0	0	0	1	0
CLO4	3	3	3	2	2	1	1	0	2	1
Avg.	3	2.5	2.5	1.5	1	0.25	0.25	0	1.5	0.25

GOVERNMENT COLLEGE (A), RAJAHMUNDRY
I B.Sc. CHEMISTRY

(Honours) Course -4:

PHYSICAL CHEMISTRY-I

States of matter, Phase rule & Surface Chemistry
SEMESTER-II MODEL PAPER (From 2025-26)

Time: 2½ hrs.

Maximum Marks: 50

PART- A

ALL the questions. Each carries SEVEN marks

5 x 7 = 35 M

1. Derive the relationship between Critical

& Vanderwaal's constants. (or)

2. Derive the Vander Waal's equation of state.

3. Differentiate between liquid crystals & liquids.
(or)

4. Discuss any three applications of Liquid crystals.

5. Explain Crystal defects.

(or)

6. What is Bragg's Law. Derive Braggs equation.

7. Explain the phase diagram of

Pb-Ag
system. (or)

8. Explain the phase diagram of NaCl-Water system.

9. Explain the Hardy-Schulze rule and

stability of colloids.

(or)

10. Define adsorption. Discuss the
Freundlich adsorption isotherm.

M a r k s	B L	CL O	PLO	P I
7	3	3	1,2	
7	3	3	1,2	
7	2	2	1,3	
7	2	2	1,4	
7	2	2	1,3	
7	3	3	1,2	
7	4	4	1,2,3	
7	4	4	1,2,3	
7	2	2	1,2	

PART- B

Answer any FIVE of the following questions.

5 x 3 = 15 M

	Marks	B L	CLO	PLO	PI
11. Explain the Joule-Thomson effect.	3	2	1	1,2	
12. Discuss Andrew's isotherm of CO ₂ .	3	2	1	1,2,3	
13. Explain the effect of temperature on surface tension and viscosity.	3	2	2	1,2	
14. What are Smectic & Nematic liquid Crystals? Explain	3	2	2	1,4	
15. Write about stoichiometric and non-stoichiometric defects in crystals.	3	2	3	1,3	
	3	2	3	1,2	
	3	2	4	1,2,3	
	3	1	1	1	
16. Explain miller indices.					
17. Write Gibbs phase rule and explain terms in it.					
18. Define Gold number in colloids.					

I B.Sc. CHEMISTRY (Honours)
Course -4: PHYSICAL CHEMISTRY-I
States of matter, Phase rule & Surface Chemistry
SEMESTER-II (From 2025-26)
QUESTION BANK

UNIT-1: Gaseous State

7 marks:

1. Explain the van der Waals equation of state and discuss its significance.
2. Describe Andrew's isotherms of CO₂ and explain critical phenomena.
3. Derive the relationship between critical constants and van der Waals constants.

3 marks:

1. Write the Ideal Gas Equation and explain each term.
2. Define van der Waals constants (a and b).
3. What are Andrew's isotherms of CO₂?
4. Define critical temperature and critical pressure.
5. What is Joule-Thomson effect?
6. Define inversion temperature.

UNIT-2: Liquid State

7 marks:

1. Explain the effect of temperature and solutes on surface tension and viscosity.
2. Discuss any three applications of Liquid crystals.
3. Discuss liquid crystals, classification into smectic and nematic, and their applications.
4. Compare liquids and Liquid crystals based on physical properties.

3 marks:

1. Define vapour pressure and boiling point.
2. What is surface tension? Give its unit.
3. Define coefficient of viscosity. 4.
- What are liquid crystals?

UNIT-3: Solid State

7 marks:

1. Discuss Bravais lattices and crystal systems.
2. Derive Bragg's Law and explain X-ray diffraction.
3. Discuss stoichiometric and non-stoichiometric defects in crystals. 3

marks:

1. Define unit cell and lattice point.
2. Explain miller indices.
3. What are **stoichiometric defects**?

UNIT-4: Phase Rule

7 marks:

1. Derive the Gibbs Phase Rule and explain its terms.
2. Explain the Phase Diagram of Water System.
3. Discuss the Pb-Ag system and explain desilverisation of lead.

4. Explain the NaCl–Water system with freezing mixtures.

3 marks:

1. State the Gibbs Phase Rule.
2. Define eutectic point with an example.

UNIT–5: Surface Chemistry

7 marks:

1. Explain the **coagulation of colloids** and discuss the Hardy–Schulze rule.
2. Describe the **stability of colloids** and explain protection of colloids with the concept of Gold number.
3. Derive the **Freundlich adsorption isotherm** and discuss its limitations.
4. Derive the **Langmuir adsorption isotherm** and explain its assumptions.

3 marks:

1. What is meant by stability of colloids?
2. Define Gold number.
3. Differentiate between lyophilic and lyophobic sols.
4. What is adsorption?

	Government College (Autonomous) Rajahmundry	Program & Semester I B.Sc. CHEMISTRY (Honours) (II Semester)			
Course Code C4P	TITLE OF THE COURSE Course -4: PHYSICAL CHEMISTRY-I PRACTICAL				
Teaching	Hours Allocated: 30 (Practical)	L	T	P	C
Pre-requisites	Use glassware, equipment and follow experimental procedures in the laboratory.	-	-	2	1

Course Objectives:

1. To understand the concepts of surface tension and viscosity of liquids.
2. To familiarize students with using different lab equipment and glassware for the determination of the coefficient of viscosity and surface tension.
3. To gain hands-on experience in preparing colloidal solutions.

Course Outcomes:

On Completion of the course, the students will be able to-		Cognitive Domain
C O 1	Use glassware, equipment and follow experimental procedures in the laboratory.	Apply
C O 2	Determine surface tension and viscosity using standard experimental techniques.	Apply, Analyze
C O 3	Prepare colloidal solutions and study their stability.	Apply, Analyze
C O 4	Conduct adsorption experiments and verify Freundlich isotherm	Apply, Analyze, Evaluate

Course with focus on employability / entrepreneurship / Skill Development modules

Skill Development		Employability		Entrepreneurship	-

Practical Syllabus: 50M

1. Determination of surface tension of liquid by drop count method.
2. Determination of surface tension of liquid by drop weight method.
3. Determination of coefficient of viscosity of an organic liquid.
4. Preparation of sols: $\text{Al}(\text{OH})_3$, $\text{Fe}(\text{OH})_3$ and starch.
5. Adsorption of acetic acid on animal charcoal, verification of Freundlich isotherm.

REFERENCES:

1. B.D. Khosla, V.C. Garg, A. Gulati, Senior Practical Physical Chemistry, R. Chand & Co, New Delhi, 2015.
2. K.L. Kapoor, A Textbook of Physical Chemistry, McGraw-Hill Education, 2019.
3. C.W. Garland, J.W. Nibler, D.P. Shoemaker, Experiments in Physical Chemistry, 8th Edition, McGraw-Hill, New York, 2003.

CO-CURRICULAR ACTIVITIES AND ASSESSMENT METHODS:

1. Internal Practical Assessment
2. Lab Record Evaluation
3. Final Practical Examination

CO-PO Mapping:

4. Oral/Viva Voce **Slight [Low]; 2: Moderate [Medium]; 3: Substantial [High], 4: (No Correlation)**

	PO1	PO 2	P O3	P O 4	P O 5	P O 6	P O 7	P O 8	P O 9	PO 10
C O 1	3	0	0	2	3	2	1	1	2	1
C O 2	3	3	0	2	3	0	2	1	1	2
C O 3	3	2	2	2	0	0	1	1	2	2
C O 4	3	3	2	2	3	0	2	2	3	3
A v g .	3	2	1	2	3	0 · 5	1 · 5	1 · 2 5	2	2

**III SMESTER
SYLLABUS FOR
CHEMISTRY (H)**

	Government College (Autonomous) Rajahmundry	Program & Semester CHEMISTRY(H) (III Semester)			
Course Code C5	TITLE OF THE COURSE Organic Chemistry – 1 (Fundamentals in Organic chemistry)				
Teaching	Hours Allocated: 45 (Theory)	L	T	P	C
Pre-requisites	Exposure to basic concepts of organic chemistry, such as types of bonds, hybridization, isomerism, and functional groups	3	-	-	3

Course Objectives:

To understand the fundamental concepts of structural theory, resonance, aromaticity, and electronic effects in organic chemistry.

To study the structure, preparation, properties, and reactivity of alkenes, alkynes, and cycloalkanes.

To analyze the structure, stability, and characteristic reactions of benzene and its derivatives.

To develop problem-solving skills in predicting reactivity, mechanisms, and applications of hydrocarbons in organic synthesis.

Course Outcomes:

On Completion of the course, the students will be able to		Cognitive Domain
CO1	Understand the fundamental principles of structural theory in organic chemistry, including hybridization, resonance, aromaticity, and electronic effects.	Knowledge
CO2	Explain the preparation methods, properties, and mechanisms of reactions of alkenes and alkynes	Understanding
CO3	Analyze the stability, conformational aspects, and strain effects in cycloalkanes	Analysis
CO4	Evaluate the structure, resonance stabilization, and electrophilic substitution reactions of benzene and its derivatives to predict orientation and reactivity.	Application

Course with focus on employability / entrepreneurship / Skill Development modules

Skill Development		Employability		Entrepreneurship	

SYLLABUS

UNIT-I: STRUCTURAL THEORY IN ORGANIC CHEMISTRY

9hrs.

Types of bond fission – Homolytic and Heterolytic fissions, organic reagents - Electrophiles, Nucleophiles with examples Inductive effect. Application of inductive effect (a) Basicity of amines (b) Acidity of carboxylic acids (c) Stability of carbonium ions. Resonance or Mesomeric effect, application to acidity of phenol, and (b) acidity of carboxylic acids. Hyper conjugation and its application to stability of carbonium ions, Free radicals and alkenes, carbanions. Types of Organic reactions: Addition - electrophilic, nucleophilic and free radical. Substitution - electrophilic, nucleophilic and free radical. Elimination- Examples.

UNIT-II: ACYCLIC HYDROCARBONS

9 Hrs.

Alkenes - Preparation of alkenes. Properties: Addition of hydrogen - heat of hydrogenation and stability of alkenes. Addition of halogen and its mechanism. Addition of HX, Markonikov's rule, addition of H₂O, HOX, H₂SO₄ with mechanism and addition of HBr in the presence of peroxide (anti - Markonikov's addition). Dienes - Types of dienes, reactions of conjugated dienes - 1,2 and 1,4 addition of HBr to 1,3 - butadiene and Diels - Alder reaction

UNIT-III:

9 Hrs.

Alkynes - Preparation by dehydrohalogenation of dihalides, dehalogenation of tetrahalides, Properties; Acidity of acetylenic hydrogen (formation of Metal acetylides). Reduction and Polymerization reaction of acetylene. Preparation of higher acetylenes, Metal ammonia reductions, Chemical reactivity - electrophilic addition of X₂, HX, H₂O (Tautomerism), Oxidation with KMnO₄, OsO₄,

UNIT-IV: ALICYCLIC HYDROCARBONS (CYCLOALKANES)

9 Hrs.

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

UNIT – V: BENZENE AND ITS REACTIVITY

9 Hrs.

Concept of aromaticity - aromaticity (definition), Huckel's rule - application to Benzenoid (Benzene, Naphthalene) and Non - Benzenoid compounds (cyclopropenyl cation, cyclopentadienyl anion and tropylium cation) Reactions - General mechanism of electrophilic substitution, mechanism of nitration, Friedel Craft's alkylation and acylation. Orientation of aromatic substitution - Definition of ortho, para and meta directing groups. Ring activating and deactivating groups with examples (Electronic interpretation of various groups like NO₂ and Phenolic). Orientation of (i) Amino, methoxy and methyl groups (ii) Carboxy, nitro, nitrile, (iii) Halogens

Text books:

Reference Books

1. **Morrison, R. T. & Boyd, R. N.** – *Organic Chemistry*, 6th Edition, Pearson.
2. **Solomons, T. W. G., Fryhle, C. B. & Snyder, S. A.** – *Organic Chemistry*, 12th Edition, Wiley.
3. **Peter Sykes** – *A Guidebook to Mechanism in Organic Chemistry*, 6th Edition, Pearson.
4. **I. L. Finar** – *Organic Chemistry Volume 1: The Fundamental Principles*, 6th Edition, Pearson.
5. **Paula Yurkanis Bruice** – *Organic Chemistry*, 8th Edition, Pearson.
6. **K. S. Tewari & N. K. Vishnoi** – *A Textbook of Organic Chemistry*, Vikas Publishing.
7. **Bahl, A. & Bahl, B. S.** – *Advanced Organic Chemistry*, S. Chand Publishing.

Open Educational Resources (OERs)

1. **NCERT Chemistry Textbooks (Class XI & XII)** – Clear explanations of hydrocarbons, resonance, aromaticity, etc.
NCERT e-Books

CO-PO Mapping:

(1: Slight [Low]; 2: Moderate [Medium]; 3:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	2	3	2	2	2	3	3	2	2	3	3	3
CO2	2	3	3	3	3	2	2	2	2	3	2	2	3
CO3	3	3	3	2	2	1	1	2	3	1	2	3	3
CO4	2	3	2	1	3	2	3	1	2	3	3	2	2
Avg.	2.5	2.75	2.75	2	2.5	1.75	2.25	2	2.25	2.25	2.5	2.5	2.75

Substantial [High], '-' : No Correlation)

Proposed activities:

Skill Development:

1. Molecular visualization, drawing resonance structures, predicting electronic effects.
2. Application of Markovnikov's and anti-Markovnikov's rules.
3. Designing synthetic routes, applying acidity and substitution reactions, understanding industrial applications

Employability:

1. Structural Theory in Organic Chemistry: Skills in molecular structure and reactivity analysis are essential for **chemical, pharmaceutical, and R&D industries**.
2. Alkenes & Alkynes: Useful in **petrochemical, plastics, and polymer industries** (e.g., polyethylene, polypropylene production), Relevant for **industrial organic synthesis, agrochemicals, and medicinal chemistry** sectors.

Entrepreneurship:

1. Alkenes & Alkynes: Small-scale production of **polymers, plastics, and synthetic rubbers**. Acetylene applications in **welding, fuel gases, and specialty chemicals**.
2. Benzene & its reactivity: Production of **aromatic derivatives** used in **dyes, pharmaceuticals, and polymers**.

GOVERNMENT COLLEGE (A),
RAJAMAHENDRAVARAM
II B.Sc. Chemistry (Hons.)
SEMESTER -III

Chemistry Course -5: ORGANIC CHEMISTRY – 1
BLUE PRINT

TIME: 2½ hr.

MARKS: 50 M

SECTION - A

Answer ALL the questions

(5 X 7 = 35 M)

1. Question from Unit -I
(OR)
2. Question from Unit -I
3. Question from Unit -II
(OR)
4. Question from Unit -II
5. Question from Unit -III
(OR)
6. Question from Unit -III
7. Question from Unit -IV
(OR)
8. Question from Unit -IV
9. Question from Unit -V
(OR)
10. Question from Unit -V

SECTION-B

Answer any Five of the following

(5 X 3 = 15 M)

11. Question from Unit –I
12. Question from Unit –II
13. Question from Unit –III
14. Question from Unit –IV
15. Question from Unit –V
16. Question from Unit –I
17. Question from Unit –II
18. Question from Unit –V

GOVERNMENT COLLEGE (A),
RAJAMAHENDRAVARAM

II B.Sc. CHEMISTRY(HONS)
SEMESTER -III

C5: ORGANIC CHEMISTRY -1

BLUE PRINT

S. No.	Course Content	Essay Questionns (7M)	Short Answer Questionns (4M)	Total No. Of Questions from each Unit
1	Unit –I	2	2	4
2	Unit –II	2	2	4
3	Unit –III	2	1	3
4	Unit –IV	2	1	3
5	Unit –V	2	2	4
	TOTAL	10	8	18

GOVERNMENT COLLEGE (A),
RAJAMAHENDRAVARAM
II B.Sc. Chemistry (Hons.)

SEMESTER -III

Chemistry Course -5: ORGANIC CHEMISTRY – 1

MODEL PAPER

TIME: 2½ hr.

MARKS: 50 M

SECTION - A

Answer ALL the questions

(5 X 7 = 35 M)

1. Explain the Inductive effect with examples and write its applications BT3
(OR)
2. Discuss the types of organic reactions with suitable examples BT2
3. Write any two preparation methods of Alkenes and explain its chemical reactions BT2
(OR)
4. Explain 1,2 – and 1,4 – addition reactions in 1,3 – Butadiene BT4
5. Describe the preparation methods and chemical properties of alkynes BT2
(OR)
6. How higher alkynes are prepared? explain their chemical reactions BT3
7. How Bayer strain theory used for explaining the stability of cycloalkanes? BT4
(OR)
8. Discuss the conformational isomers of cyclohexane by using Sack – Mohr theory
9. Discuss the electrophilic substitution reactions in Benzene BT3
(OR)
10. Write about the concept of aromaticity based on Huckels rule BT2

SECTION-B

Answer any Five of the following

(5 X 3 = 15 M)

11. Explain the acidity of phenol based on Mesomeric effect BT4
12. Write a short note on Markovnikov's rule? BT3
13. Discuss briefly about the acidity of acetylene? BT2
14. What are Cycloalkanes? Give examples BT1
15. What is the difference between Benzenoid and non – benzenoid aromatic compounds? BT2
16. What is ring activating groups? Give examples BT2
17. Write briefly about Homolytic and Heterolytic fissions? BT3
18. What is Diels – Alder reaction? Give example BT2

GOVERNMENT COLLEGE (A), RAJAMAHENDRAVARAM

II B.Sc. Chemistry (Hons.)

SEMESTER -III

Chemistry Course -5: ORGANIC CHEMISTRY – 1

QUESTION BANK

ESSAY QUESTIONS: 07 Marks

1. Discuss Inductive effect and write its applications
2. Explain about the types of organic reactions with suitable examples
3. Write any two preparation methods of alkenes and write its chemical properties
4. Explain the 1,2 – and 1,4 - addition reactions of 1,3 – butadiene
5. Write any two preparation methods of alkynes and write its chemical properties
6. How higher alkynes are prepared? write its chemical reactions
7. Explain the stability of cycloalkanes by using Baeyer strain theory
8. Discuss the conformational isomers of cyclohexane by using Sachse – Mohr theory
9. Explain the aromatic electrophilic substitution reactions in Benzene
10. Discuss the benzenoid and non – benzenoid aromatic compounds with examples
11. Write the Nitration and Friedel craft alkylation reactions in benzene with mechanism

SHORT QUESTIONS: 03 Marks

1. Write a short note on the acidity of phenol based on Mesomeric effect
2. Write briefly about Homolytic and Heterolytic bond fissions
3. Define electrophile and nucleophile with example
4. What is Markonikovs rule? Give example
5. Write a note on types of dienes
6. What is Diel's alder reaction? Give example
7. Discuss briefly about the acidity of acetylene
8. What are alkynes and higher alkynes? Give examples
9. What are cycloalkanes? Give examples
10. Write the preparation methods of cycloalkanes
11. Write the concept of Aromaticity based on Huckels rule
12. What is ring activating groups? Give examples
13. What are ring deactivating groups? give example

	Government College (Autonomous) Rajahmundry	Program & Semester			
Course Code C5P	TITLE OF THE COURSE Course -5: Organic Functional group analysis	II B.Sc. Chemistry (Hons.) (III Semester)			
Teaching	Hours Allocated: 30 (Practical)	L	T	P	C
Pre-requisites	Basic concept of systematic organic qualitative analysis.	-	-	2	2

Course Objectives:

- To understand the fundamental principles and systematic approach for identifying organic functional groups.
- To develop practical skills in performing preliminary, group-specific, and confirmatory tests for organic compounds.
- To apply functional group analysis in interpreting chemical behavior and relating structure with reactivity.

Course Outcomes:

On Completion of the course, the students will be able to	
CO1	Identify physical properties and solubility behavior of organic compounds as a preliminary step in functional group analysis.
CO2	Perform systematic chemical tests to detect functional groups in organic compounds.
CO3	Analyze experimental results to confirm the presence of specific functional groups using multiple tests.
CO4	Relate functional group identification with chemical reactivity and practical applications in organic chemistry.

Course with focus on employability / entrepreneurship / Skill Development modules

Skill Development		Employability		Entrepreneurship	

II B.Sc. CHEMISTRY (H)

SEMESTER -III

C5- ORGANIC FUNCTIONAL GROUP ANALYSIS

PRACTICAL SYLLABUS

30 Hrs. (02 Hrs. / Wk.)

Organic functional group analysis:

Reactions of the following functional groups present in the organic compound.

Alcohols, Phenols, Aldehydes, Ketones, Carboxylic acids, Amines, Carbohydrates

Textbooks:

1. Vogel, A. I. – Vogel's Textbook of Practical Organic Chemistry, 5th Edition, Pearson.
2. Furniss, B. S., Hannaford, A. J., Smith, P. W. G., & Tatchell, A. R. – Vogel's Textbook of Practical Organic Chemistry, ELBS.
3. J. N. Gurtu & R. Kapoor – Advanced Experimental Chemistry: Organic, S. Chand Publishing.

Reference Books

1. O. P. Agarwal – Practical Organic Chemistry, Krishna Prakashan Media.
2. Raj K. Bansal – Laboratory Manual of Organic Chemistry, New Age International.
3. Ahluwalia, V. K. & Aggarwal, R. – Comprehensive Practical Organic Chemistry: Qualitative Analysis, Universities Press.
4. Bahl, B. S. & Arun Bahl – Advanced Organic Chemistry, S. Chand Publishing (for functional group theory & background).

CO-PO Mapping:

Slight [Low];

Moderate [Medium]; 3: Substantial [High], '-' : No Correlation)

(1:
2:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	2	3	2	2	2	3	3	2	2	3	3	3
CO2	2	3	3	3	3	2	2	2	2	3	2	2	3
CO3	3	3	3	2	2	1	1	2	3	1	2	3	3
CO4	2	3	2	1	3	2	3	1	2	3	3	2	2
Avg.	2.5	2.75	2.75	2	2.5	1.75	2.25	2	2.25	2.25	2.5	2.5	2.75

GOVERNMENT COLLEGE (A),RAJAMAHENDRAVARAM

II B.Sc. CHEMISTRY (HON.)

SEMESTER -IV

C5- ORGANIC CHEMISTRY -1

(Organic functional group analysis)

AT THE END OF SEMESTER –III

SCHEME OF VALUATION

Time: 03 Hrs.

Max. Marks: 50 M

1. Record	-----	10 Marks
2. Practical	-----	35 Marks
3. Viva - voce	-----	05 Marks

Splitting of Practical Marks : (35M)

Preliminary examination in
10 minutes : 05 M

Confirmation tests : 10 M

Derivative preparation : 10 M

Reporting : 10 M

	Government College (Autonomous) Rajahmundry	Program & Semester II B.Sc. ORGANIC CHEMISTRY (H) (SEMESTER – III)			
Course Code 6	TITLE OF THE COURSE Course - 6: ORGANIC CHEMISTRY (Halogen And Oxygen Containing Organic Compounds)				
Teaching	Hours Allocated: 45 (Theory) (3 hrs. / Wk.)	L	T	P	C
Prerequisites:	Basic knowledge on structure and reactivity of organic compounds	3	-	-	3

Course Objectives:

1. To provide knowledge on reactivity of Halogen and Oxygen containing organic compounds.
2. To provide basic awareness on preparatory methods of Halogen and Oxygen containing organic compounds.
3. To understand classification of carbohydrates and structural elucidation of glucose & fructose.

Course Outcomes:

On Completion of the course, the students will be able to-		Cognitive Domain
CO1	Understand the concept of SN1 and SN2 mechanisms	Understanding
CO2	Describe the reactivity of alkyl halides, alcohols and phenols.	Application
CO3	Achieve the skills required to propose various mechanisms	Skill
CO4	Apply the concepts for synthesising various Halogen & Oxygen containing organic compounds	Application

Course with focus on employability / entrepreneurship / Skill Development modules

Skill Development		Employability		Entrepreneurship	

Syllabus:

Unit – I Halogen compounds (9 h)

Alkyl halides: Preparation of alkyl halides from i) alkanes, ii) alkenes and iii) alcohols. Properties - nucleophilic substitution reactions–SN1 and SN2 mechanisms with energy profile diagrams and stereo chemical aspects. Williamson's synthesis.

Aryl halides: Preparation i) from phenols ii) Sandmeyer's reaction, nucleophilic aromatic substitution (Benzyne mechanism); relative reactivity of alkyl, allyl, vinyl and benzyl, aryl halides towards nucleophilic substitution reactions.

Unit - II Alcohols and Phenols (9 h)

Alcohols: Nomenclature, classification, Preparation of 1^o, 2^o, 3^o alcohols from Grignard's reagent, Bouveault–Blanc Reduction; Chemical properties –A) Reactions involving only the hydrogen atom of -OH group B) Reactions involving -OH group as a whole. Distinction between 1^o, 2^o, 3^o alcohols with Lucas reagent. Pinacol – Pinacolone rearrangement with mechanism.

Phenols: Preparation from diazonium salt and Cumene. Reactions and mechanism–Reimer–Tiemann, Kolbe–Schmitt Reactions, Fries and Claisen rearrangements

Unit - III Carbonyl Compounds (9 h)

Preparation from- Acid chlorides, 1,3-dithiane and nitriles; Structure and reactivity of carbonyl group, Nucleophilic addition reactions with HCN, NaHSO₃ and alcohols. Addition - elimination reactions with hydroxylamine, hydrazine, phenyl hydrazine, 2,4DNP, semi-carbazide. Oxidations and reductions (Baeyer -Villiger oxidation, KMnO₄, Clemmensen's, Wolf–Kishner's, with LiAlH₄ & NaBH₄).

Reaction & Mechanism- Aldol condensation, Cannizzaro reaction, Perkin reaction, Benzoin condensation, Claisen-Schmidt reaction, Haloform reaction.

Unit-IV Carboxylic acid (9h)

Carboxylic Acids: Preparation from Grignard reagent and hydrolysis of nitriles, Reactions of monocarboxylic acids- Reactions involving -H, -OH and -COOH groups, formation of salts, esters, acid chlorides, amides and anhydrides. Degradation of carboxylic acids by Huns - Diecker's reaction, decarboxylation by Schmidt reaction, Arndt-Eistert synthesis, halogenation by Hell- Volhard- Zelinsky reaction. Mechanisms of acidic and alkaline hydrolysis of esters, Reformatsky reactions, Curtius rearrangement.

Unit - V: Active Methylene Compounds (9h)

Active methylene compounds: Keto-enol tautomerism, preparation of Acetic Aceto Ester (AAE) by Claisen condensation with mechanism, synthetic applications of AAE in the preparation of mono carboxylic acids, di carboxylic acids, α,β -unsaturated acids and heterocyclic compounds.

List of Reference Books

1. Morrison, R. N. & Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
2. Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
3. Guide book to Mechanism in Organic Chemistry by Peter Sykes 6th edition, 1985.

CO-PO Mapping: 1: Slight [Low]; 2: Moderate [Medium];

3: Substantial [High], '-': No Correlation

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	2	2	3	2	2	2	3	3	2	2	3	3	3
CO2	2	3	3	3	3	2	1	2	2	3	2	2	3
CO3	3	3	3	2	2	1	1	2	3	1	2	3	3
CO4	2	1	1	1	3	2	3	1	2	3	2	3	2
Avg.	2.25	2.25	2.5	2.0	2.5	1.75	2.0	2.0	2.25	2.25	2.25	2.75	2.75

Government College (A), Rajamahendravaram II B.Sc.
Organic Chemistry(H) Semester – 3 Course -6: Organic
Chemistry

(Halogen and Oxygen containing organic compounds)

Weightage to Content & Blue Print

S.No.	Course Content	Long Answer Questions	Short Answer Questions	Total Marks
1.	UNIT - I	2	1	17
2.	UNIT – II	2	2	20
3.	UNIT – III	2	2	20
4.	UNIT – IV	2	2	20
5.	UNIT - V	2	1	17
	TOTAL	10	8	94

Government College (A), Rajahmundry
II B.Sc. Organic Chemistry (H) Semester-3
Course - 6: ORGANIC CHEMISTRY
(Halogen and Oxygen containing organic compounds)

Model Paper

Time: 2 1/2 hrs.

Maximum Marks: 50

PART - A

Answer **ALL** the questions. Each carry SEVEN marks 5 x 7 = 35 M

1. Discuss the mechanism and stereochemistry of SN1 and SN2 reactions taking suitable examples. BT2 CO1

(OR)

2. Write a short note on the following BT1 CO3

a) Sandmeyer reaction

b) Benzyne mechanism

3. a) Write the preparation of alcohols using Grignard reagent and Bouveault - Blanc reduction BT1 CO4

b) Explain Lucas method for identification of 1°, 2°, 3° alcohols. BT3 CO2

(OR)

4. Explain the mechanism of Reimer-Tiemann and Kolbe - Schmidt reaction. BT1 CO3

5. How does Acetone react with the following reagents BT3 CO3

i) HCN ii) NaSHO₃ iii) NH₂OH iv) NH₂NH₂

(OR)

6. Discuss Aldol condensation and Cannizzaro reaction with mechanism. BT1 CO2

7. Write any two preparation methods of carboxylic acids and explain Esterification reaction with mechanism. BT3 CO3

(OR)

8. Explain the acidic and alkaline hydrolysis of esters with mechanism. BT2 CO2

9. Write the preparation and any two synthetic applications of Aceto Acetic Ester. BT2 CO1

(OR)

10. What is active methylene compound? Explain Claisen condensation with mechanism. BT2 CO4

PART- B

Answer **any FIVE** of the following questions. Each carry THREE marks 5 x 3 = 15 M

11. Compare the reactivity of alkyl halides with vinyl halides BT4 CO2

12. Write the mechanism for Pinacol-Pinacolone rearrangement. BT2 CO1

13. Write a short note on Fries rearrangement. BT1 CO3

14. Give any two reduction reactions of carbonyl compounds. BT1 CO4
15. Explain the mechanism of Perkin reaction BT2 CO1
16. Explain Arndt-Eistert reaction. BT2 CO4
17. Write a note on Hunsdiecker's reaction BT2 CO3
18. Write a note on Keto-enol tautomerism. BT2 CO2

YouTube video sources:

https://youtube.com/watch?v=Bi_01qiVr0I&feature=share8

<https://youtube.com/watch?v=SJr2JTn7W7M&feature=share8>

https://youtube.com/watch?v=YNG_iSNA9vk&feature=share8

<https://youtube.com/watch?v=Wk-dH4V4AOQ&feature=share8>

<https://youtube.com/watch?v=YVWGG0sxboQ&feature=share8>

<https://youtube.com/watch?v=EWBhJw-6DIQ&feature=share8>

<https://youtube.com/watch?v=mPUiMh4hnok&feature=share8>

<https://youtube.com/watch?v=DMFi7DhrKUA&feature=share8>

II B.Sc., Semester-3 Course - 6: Organic Chemistry (Halogen And Oxygen Containing Organic Compounds)
Question Bank

Unit -1

1. Discuss the mechanism and stereochemistry of SN1 reaction taking suitable examples. (7 marks)
2. Discuss the mechanism and stereochemistry of SN2 reactions taking suitable examples. (7 marks)
3. Write a short note on the following. (7 marks) a) Sandmeyer reaction b) Benzyne mechanism
4. Williamson's synthesis (3 marks)
5. Sandmeyer reaction (3 marks)

Unit – 2

1. Write any two methods of preparation and any two properties of phenol. (7 marks)
2. Explain Reimer-Tiemann reaction with mechanism. (7 marks)
3. Write notes on (a) pinacol – pinacolone rearrangement and (b) Lucas method for identification of 10, 20, 30 alcohols. (7 marks).
4. Write the preparation of alcohols using Grignard reagent and Bouveault (3 marks)
5. Explain Kolbe - Schmidt reaction. (3 marks)
6. How does Acetone react with the following reagents? (3 marks) i) HCN ii) NaSHO₃ iii) NH₂OH
7. Explain Fries rearrangement. (3 marks).

Unit – 3

1. Discuss Aldol condensation and Cannizzaro reaction with mechanism. (7 marks)
2. Explain the mechanism of Perkin reaction and Benzoin condensation. (7 marks)
3. Write any two methods of synthesis of aldehydes and ketones each. (7 marks)
4. Write notes on Clemmensen reduction and Wolf-Kishner reduction (3 marks)
5. Explain Haloform reaction (3 marks).
6. Explain how carbonyl compounds respond to Tollens and Fehling's reagents. (3 marks).
7. Give any two reduction reactions of carbonyl compounds. (3 marks)

Unit - 4

1. Write any two preparation methods of carboxylic acids and explain HVZ reaction. (7 marks)
2. Explain esterification reaction with mechanism. (7 marks)
3. Write a note on a) Hunsdiecker's reaction and b) Ester hydrolysis reaction. (7 marks)
4. Explain Arndt-Eistert reaction. (3 marks).
5. Write a note on Schmidt reaction. (3 marks).
6. Write a note on halogenation by Hell- Volhard- Zelinsky reaction. (3 marks).
7. How ester is formed from carboxylic acid? Give example. (3 marks).

Unit - 5

1. Write the preparation and any two synthetic applications of Aceto Acetic Ester. (7 marks)
2. What is active methylene compound? Explain Claisen condensation. (7 marks)
3. Write with equations how a) acetic acid, b) succinic acid, c) 4-methyl uracil can be prepared from aceto acetic ester. (7 marks).
4. Write a note on keto-enol tautomerism. (3 marks).
5. Explain the reaction between acetoacetic ester and urea (3 marks).

	Government College (Autonomous) Rajahmundry	Program & Semester II B.Sc., CHEMISTRY(H) (III Semester)			
Course Code C6 -P	TITLE OF THE COURSE Course -6: ORGANIC PREPARATIONS (Halogen and Oxygen containing organic compounds)				
Teaching	Hours Allocated: 30 (Practical)	L	T	P	C
Pre-requisites	Basic knowledge on handling of glassware and chemicals	-	-	2	1

Course Objectives:

1. To provide basic knowledge about the handling of laboratory apparatus
2. To provide knowledge on calculating limiting reagent, theoretical yield, and percent yield.
3. To provide hands on training on laboratory techniques including reflux, distillation, recrystallization, vacuum filtration, MP & BP determinations.

Course Outcomes:

On Completion of the course, the students will be able to	
CO 1	How to use glassware, equipment and chemicals and follow experimental procedures in the laboratory.
CO 2	How to calculate limiting reagent, theoretical yield, and percent yield.
CO 3	How to perform common laboratory techniques including reflux, distillation, recrystallization, vacuum filtration.
CO 4	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.

Course with focus on employability / entrepreneurship / Skill Development modules

Skill Development		Employability		Entrepreneurship	-

Syllabus - Organic preparations (50M)

1. Acetylation of β -naphthol, vanillin and salicylic acid by:

a) Using conventional method. b) Using green approach

2. Preparation of Nerolin

Reference books:

1. Vogel A.I. Practical Organic Chemistry, Longman Group Ltd.

2. Bansal R.K. Laboratory Manual of Organic Chemistry, Wiley-Eastern.

3. Ahluwalia V. K. and Agarwal R. Comprehensive Practical Organic Chemistry, University press.

CO-PO Mapping:

1. Slight [Low]; 2. Moderate [Medium];

3. Substantial [High], 4. (No Correlation)

	P O 1	P O 2	P O 3	P O 4	P O 5	P O 6	P O 7	P O 8	P O 9	P O 10	PS O1	PS O2	PS O3
C O 1	2	3	3	2	3	2	2	2	3	2	2	3	3
C O 2	3	3	3	2	3	2	2	3	2	3	3	3	3
C O 3	3	2	3	2	3	1	2	2	2	2	2	3	2
C O 4	3	3	2	1	3	2	2	1	2	3	3	3	3
A vg .	2. 7 5	2. 7 5	2 .7 5	2	3	2	2	2	2. 2 5	2. 5	2.5	3	2.7 5

	Government College (Autonomous) Rajahmundry	Program & Semester II B.Sc. Chemistry (H) III Semester Course 7			
Course Code 7	TITLE OF THE COURSE PHYSICAL CHEMISTRY				
Teaching	Hours Allocated: (Theory) 45	L	T	P	C
Pre-requisites:	Basic Knowledge about Solids, Liquids, Gases and Solutions	3		-	3

Course Objectives:

The objective of this course is to provide students with a comprehensive understanding of the essential concepts and applications of Solids, liquids, gases, solutions and ionic equilibria. The course aims to develop students' critical thinking, problem-solving, and analytical skills in these areas, enabling them to apply scientific principles to real-world situations.

On Completion of the course, the students will be able to-		Cognitive Domain
CLO1	Gain Knowledge about the concepts of Solutions, solids, Liquids, gases and ionic equilibrium	Knowledge
CLO2	At the end of the course, the students will be able to Understand the basic concepts of Solids, Liquids, Gases, Solutions and ionic equilibria	Understanding
CLO3	application of Distribution law to various systems, application of liquid crystals to LCD devices	Application
CLO4	compare and conclude theoretical concepts and applications to day to situations	Evaluation
CLO5	Analyze and calculate the mathematical problems on different concepts	Analysis

Course with focus on employability / entrepreneurship / Skill Development modules

Skill Development		Employability		Entrepreneurship	

Syllabus:

PHYSICAL CHEMISTRY

2 hrs/week

UNIT-I

9h

SOLID STATE: Symmetry in crystals. Law of constancy of interfacial angles. The law of rationality of indices. The law of symmetry. Definition of lattice point, space lattice, unit cell.

X-ray diffraction and crystal structure. Bragg's law. Defects in crystals. Stoichiometric and non-stoichiometric defects.

UNIT-II

9h

GASEOUS STATE Introduction and derivation of Ideal Gas Equation. Vander Waal's equation of state. P-V Isotherms of real gases, Andrew's isotherms of carbon dioxide. Critical phenomena. The vanderwaal's equation and the critical state. Law of corresponding states. Relationship between critical constants and vander Waal's constants. Joule Thomson effect.

UNIT-III:

9h

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

UNIT-IV

9h

SOLUTIONS Liquid-liquid - ideal solutions, Raoult's law. Ideally dilute solutions, Henry's law. Non-ideal solutions. Azeotropes-HCl-H₂O, ethanol-water systems and fractional distillation. Partially miscible liquids-phenol-water. Effect of impurity on consolute temperature. Immiscible liquids and steam distillation. Nernst distribution law. Calculation of the partition coefficient. Applications of distribution law.

UNIT-V

9h

IONIC EQUILIBRIUM AND HSAB Ionic Product, common ion effect, solubility and solubility product. Definition of acid and base with examples, Pearson concept, HSAB Principle & its importance definition of buffer solution. Henderson –Hassel batch Equation

List of Reference Books

- 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

Web Links:

<https://youtu.be/IPN0WWWfwts?list=PLHhlnNg2PQWVHNecGWt3YAxFcKTW44nJX>

<https://youtu.be/cmnmqmdTZU80>

CLO-PLO Mapping:

(1: Slight[Low]; 2: Moderate[Medium]; 3: Substantial[High], '-': No Correlation)

Proposed Activities:

Skill Development: 1.

Employability

	PL O1	PL O2	PL O3	PL O4	PL O5	PL O6	PL O7	PL O8	PL O9	P L O 10
CLO1	3	2	2	1	1	0	0	0	3	0
CLO2	3	1	2	1	1	0	0	0	3	0
CLO3	3	3	3	1	1	0	0	0	3	0
CLO4	3	3	3	2	2	0	0	0	3	0
CLO5	3	3	3	2	2	0	0	0	3	0
Avg.	3	2.4	2.6	1 .4	1 .4	0	0	0	3	0

GOVERNMENT COLLEGE (A), RAJAMAHENDRAVARAM
II B.Sc. CHEMISTRY (H) SEMESTER-III (2025-26)

CHEMISTRY COURSE-7: PHYSICAL CHEMISTRY
QUESTION PAPER BLUE PRINT

TIME: 2½ Hrs.

MAX. MARKS: 50 PART – A

Answer **ALL** the following questions.

5x7 = 35 M

1a	Question from UNIT-I	OR
1b	Question from UNIT-I	
2a	Question from UNIT-II	OR
2b	Question from UNIT-II	
3a	Question from UNIT-III	OR
3b	Questions from UNIT-III	
4a	Question from UNIT-IV	OR
4b	Question from UNIT-IV	
5a	Question from UNIT-V	OR
5b	Question from UNIT-V	

PART – B

Answer any

FIVE of the following questions.

5x3 = 15 M

6	Question from UNIT-I
7	Question from UNIT-II
8	Question from UNIT-III
9	Question from UNIT-IV
10	Question from UNIT- V
11	Question from UNIT-I
12	Question from UNIT-II
13	Question from UNIT- IV

GOVERNMENT COLLEGE (A), RAJAHMUNDRY

II B.Sc. CHEMISTRY (H)

SEMESTER-III

MODEL PAPER (From 2025-26)

Course - 7: PHYSICAL CHEMISTRY

Time: 2½ Hrs

Max.Marks:50

PART- A

Answer ALL the questions. Each question carries SEVEN marks

5 x 7 = 35 M

1a Derive Bragg's equation.

OR

1b What are crystal defects? Explain stoichiometric crystal defects with suitable examples.

2a What are critical constants? Derive the relationships between critical constants and Vander Waal's constants.

OR

2b Derive Vander Waal's gas equation.

3a What are liquid crystals? Explain the classification and properties of liquid crystals.

OR

3b Write the structural differences between solids, liquids and gases.

4a What are azeotropes? Explain maximum boiling azeotropes and minimum boiling azeotropes with suitable examples.

OR

4b What are partially miscible liquid mixtures? Explain Phenol -Water system.

5a Discuss the HSAB principle and its applications.

OR

5b Describe the common ion effect with suitable example.

Marks	BL	CLO	PLO	PI
7	6	1	1	
7	1	1	2	
7	6	2	2	
7	6	2	2	
7	2	3	7	
7	1	3	5	
7	2	4	3	
7	2	4	2	
7	2	5	5	
7	2	5	4	

PART – B

Answer any **FIVE** of the following questions.

5x3 = 15 M

	Marks	BL	CLO	PLO	PI
6	3	1	1	1	
7	3	1	2	2	
8	3	3	3	3	
9	3	4	4	5	
10	3	6	5	7	
11	3	2	1	2	
12	3	4	2	3	
13	3	2	4	3	

GOVERNMENT COLLEGE (A) RAJAMAHENDRAVARAM
II B.Sc. CHEMISTRY
SEMESTER – III
PAPER –C-7 : PHYSICAL CHEMISTRY

QUESTION BANK

Essay type questions. Each question carries 7 marks.				
Unit-1	Marks	BL	CLO	PLO
1. Derive Bragg's equation.	7	6	1	1, 4
2. What are crystal defects? Explain stoichiometric crystal defects with suitable examples.	7	2	1	1, 4
3. Explain the law of symmetry.	7	2	1	1, 4
Unit-II	Marks	BL	CLO	PLO
1. Derive Vander Waal's gas equation.	7	6	2	1, 2, 3
2. What are critical constants? Derive the relationships between critical constants and Vander Waal's constants.	7	6	2	1, 2, 3
3. Explain the law of corresponding states.	7	2	2	1, 2, 3
Unit-III	Marks	BL	CLO	PLO
1. What are liquid crystals? Explain the classification and properties of liquid crystals.	7	2	3	1, 2, 3
2. Explain Nematic and Smectic liquid crystals with suitable examples.	7	2	3	1, 2, 3
Unit-IV	Marks	BL	CLO	PLO
1. What are azeotropes? Explain maximum boiling azeotropes and minimum boiling azeotropes with suitable examples.	7	2	4	1, 2, 3
2. Explain Nernst distribution law and its applications.	7	2, 4.	4	1, 2, 3
3. What are partially miscible liquid mixtures? Explain Phenol -Water system.	7	2	4	1, 2, 3
Unit-V	Marks	BL	CLO	PLO
1. Discuss the HSAB principle and its applications.	7	2,4.	5	1, 2, 3, 4
2. Explain common ion effect with suitable examples.	7	2	5	1, 2, 3, 4

Short answer questions. Each question carries 3 marks.

Unit-1	Marks	BL	CLO	PLO
1. Define the terms unit cell, lattice point and space lattice.	3	1	1	1, 4
2. Write a short note on the law of constancy of interfacial angles	3	2	1	1, 4
3. Explain the law of rational indices.	3	2	1	1, 4
Unit-II	Marks	BL	CLO	PLO
1. Explain Joule -Thomson effect.	3	2	2	1, 4
2. Write a short note on Vander Waal's constants a & b.	3	2	2	1, 2, 3
3. Derive reduced equation of state.	3	6	2	1
Unit-III	Marks	BL	CLO	PLO
1. Write the structural differences between solids, liquids and gases.	3	4	3	1, 2, 3
2. Discuss the applications of liquid crystals.	3	2,4.	3	1, 4
Unit-IV	Marks	BL	CLO	PLO
1. Write the differences between Ideal and Non-Ideal solutions.	3	4	4	1
2. Discuss Raoult's law.	3	2,6.	4	1, 2, 3
3. Explain Henry's law.	3	4	4	1, 4
4. What is critical solution temperature and explain the effect of impurities on critical solution temperature.	3	2	4	1, 4
Unit-V	Marks	BL	CLO	PLO
1. Derive the relationship between solubility and solubility product.	3	6	5	1, 2, 3, 4
2. Explain the Henderson – Hassel batch equation of buffers.	3	2,6.	5	1, 2, 3

	Government College (Autonomous) Rajahmundry	Program & Semester			
Course Code Major 7 practical	TITLE OF THE COURSE Course -7: Physical chemistry practical	II B.Sc.CH EMISTR Y (H)			
Teaching	Hours Allocated: 30 (Practical)	L	T	P	
Pre-requisites	Theoretical Knowledge about liquid properties like surface tension and viscosity, Knowledge about partition coefficient	-	-	2	

Course Objectives:

1. Measurement of liquid property like Surface tension, Viscosity
2. Measurement of partition coefficient of substance between two liquids
3. Correct Usage of different lab equipment

Course Outcomes:

On Completion of the course, the students will be able to	
C O1	Understand the basic concepts surface tension. viscosity and partition coefficient
C O2	Usage of glassware, equipment used for surface tension, viscosity and Partition coefficient measurement
C O3	Acquire knowledge of measurement of surface tension. viscosity of different liquids and distribution coefficient of substance between two liquids procedure.
C O4	Acquire knowledge of accurate measurement . tabulation of readings and calculation of results

Course with focus on employability / entrepreneurship / Skill Development modules

Skill Development		Employability		Entrepreneurship	-

SYLLABUS

Credits: 1 (2 hrs/week)

1. Determination of molecular status and partition coefficient of benzoic acid in Benzene and water.
2. Determination of Surface tension of liquid 1
3. Determination of Surface tension of liquid 2
4. Determination of Viscosity of liquid.1
5. Determination of Viscosity of liquid.2

List of Reference Books

1. O.P. Pandey, D.N. Bajpai & S. Giri, Practical Chemistry, S. Chand & Company Ltd.
2. B. D. Khosla, V. C. Garg & A. Gulati, Senior Practical Physical Chemistry, S. Chand & Co.: New Delhi (2011).
3. C. W. Garland, J.W. Nibler, & D.P. Shoemaker, Experiments in Physical Chemistry 8th Ed.; McGrawHill: New York (2003).
4. R.C. Das and B. Behra, Experiments in Physical Chemistry,; Tata McGraw Hill.

Web Links:

<https://youtu.be/xGlXcpcPgYs>

CLO-PLO

Mapping:

1: Slight [Low]; 2: Moderate [Medium]; 3: Substantial [High], 4: (No Correlation)

	PL O1	PL O2	PL O3	PL O4	PL O5	PL O6	PL O7	PL O8	PL O9	P L O 10
CLO1	3	2	2	3	2	1	0	0	3	0
CLO2	3	2	2	3	2	1	0	0	3	0
CLO3	3	3	3	3	2	1	0	0	3	0
CLO4	3	3	3	3	2	1	0	0	3	0
A v g .	3	2.5	2.5	3	2	1	0	0	3	0

	Government College (Autonomous) Rajahmundry	Program & Semester II B.Sc. CHEMISTRY (H) SEMESTER-III			
Course Code Major-8	TITLE OF THE COURSE COURSE CODE 8: INORGANIC AND PHYSICAL CHEMISTRY				
Teaching	Hours Allocated: 45 (Theory) (3 hrs. / Wk.)		T	P	C
Pre-requisites:	Basic knowledge about inorganic chemistry and elements		-	-	3

Course Objectives:

1. Understand IUPAC nomenclature, theories, Structure, crystal field splitting and Isomerism of Coordination compounds.
2. To Understand the Stability of coordination compounds and factors affecting, Trans effect and its applications.
3. To predict stability of metal carbonyl by application of 18 electron rule and π acceptor behaviour of CO.
4. To understand the basic concepts in Thermodynamics, First Law of Thermodynamics, Joule-Thomson effect and Kirchhoff's equation.
5. To understand the applications of second law of thermodynamics, Carnot cycle, entropy changes and Third Law of thermodynamics.

Course Outcomes:

On Completion of the course, the students will be able to-		Cognitive Domain
CO 1	Understand the basic concepts of Coordination compounds and Thermodynamics	Remember, Understand, Analyze
CO 2	Interpret geometries, splitting of d-orbitals and stability of compounds	Understand, Apply, Evaluate
CO 3	Explain Reaction paths and stereo chemistry of coordination compounds	Analyze, Evaluate
CO 4	Predict feasibility of physical and Chemical processes	Understand, Analyze, Evaluate
CO 5	Compare the theoretical and practical results regarding the properties of compounds.	Evaluate

Course with focus on Employability / Entrepreneurship / Skill Development modules

Skill Development		Employability		Entrepreneurship	

Syllabus:

Unit I Coordination Chemistry-I

(10 h)

IUPAC nomenclature of Coordination compounds, structural and stereo isomerism in complexes with coordination numbers 4 and 6. Valence Bond Theory (VBT): Postulates- magnetic properties- Inner and outer orbital complexes. Limitations of VBT, CFT- Postulates- Splitting in Octahedral, tetrahedral, tetragonal and square planar fields. Crystal field stabilization energy(CFSE), Crystal field effects for weak and strong fields. Factors affecting the magnitude of crystal field splitting energy, Spectro chemical series,

UNIT-II Coordination Chemistry II

(9 h)

1. Inorganic molecular Reaction Mechanism: (6 h)

Introduction to inorganic reaction mechanisms. Labile and inert complexes, ligand substitution reactions – SN^1 and SN^2 , Substitution reactions in square planar complexes, Trans-effect and its applications

2. Stability of metal complexes: (3 h)

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

Unit III Metal carbonyls:

(7 h)

Metal carbonyls: Definition, stable metal carbonyls for first row transition metals, General methods of preparation of mono and binuclear carbonyls of 3d series, 18electron rule, electron count of mononuclear, poly nuclear and substituted metal carbonyls of 3d series. π -acceptor behaviour of CO

Unit IV Thermodynamics- I

(10 h)

Concept of heat(q), work(w), internal energy(U), State function and Path function- statement of first law; enthalpy(H), relation between heat capacities, calculations of q, w, U and H for reversible, irreversible processes, Joule-Thomson effect- coefficient,

Calculation of work for the expansion of perfect gas under isothermal and adiabatic conditions for reversible processes. Temperature dependence of enthalpy of formation- Kirchoff's equation.

Unit V Thermodynamics II

(9 h)

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. Third law of thermodynamics.

List of Reference Books:

1. J. D. Lee, Concise Inorganic Chemistry, 5th ed., Blackwell Science, London, 1996.
2. R Gopalan, V Ramalingam, Concise Coordination Chemistry.
3. B. R. Puri, L. R. Sharma, K. C. Kalia, Principles of Inorganic Chemistry, Shoban Lal Nagin Chand and Co., 1996.
4. D. F. Shriver and P. W. Atkins, Inorganic Chemistry, 3 rd ed., W.H. Freeman and Co, London,

CO-PO Mapping:

1: Slight [Low]; 2: Moderate [Medium]; 3: Substantial [High]; '-': No Correlation);

	CL O\ P L O	PLO	P L O 2	PLO 3	PLO4	PLO5	PLO6	PL O7	P L O 8	PL O9	PL O10
Inorganic & Physical Chemistry	CL O1	3	2	2	1	0	0	0	0	2	0
	CL O2	3	3	2	2	0	0	0	0	2	0
	CL O3	3	3	3	2	1	0	0	0	2	0
	CL O4	3	3	3	2	0	0	0	0	2	1
	CL O5	3	3	3	2	1	0	2	0	3	1
	Av g.	3	2.8	2.6	1.8	0.4	0	0.4	0	2.2	0.4

GOVERNMENT COLLEGE (A), RAJAMAHENDRAVARAM
II B.Sc. CHEMISTRY (H)

SEMESTER – III

QUESTION BANK

Course -8: INORGANIC AND PHYSICAL CHEMISTRY

UNIT-I	Marks	BL	CLO	PLO	PI
1. Summarize different types of structural isomerism with suitable examples	7	2	1	1,2,7	
2. Describe Crystal field splitting in octahedral complexes.	7	2	2	1,2,3	
3. Discuss Crystal field splitting in square planar complexes.	7	4	2	1,2,3	
4. Explain the factors affecting the magnitude of crystal field splitting energy.	7	4	2	1,2,3	
5. How would you predict the magnetic properties of a complexes using Valence Bond Theory (VBT)?	3	3	2,4	1,2,3,4	
6. Outline Spectrochemical series.	3	1,2	1	1,2	
7. What is Crystal field stabilization energy and illustrate with examples.	3	3	2	1,2,3	
8. Summarize and justify the major limitations of Valence Bond Theory in explaining coordination compounds.	3	2	1	1,2,7,9	
UNIT-II					
1. Explain SN ² substitution reactions in square planar complexes	7	2	3	1,2,3	
2. Assess the importance of Trans effect in Synthetic Inorganic Chemistry	7	5	3,4	1,2,3,4	
3. Explain how Job's method helps determine composition of complexes	7	3	4	1,2,3,4	
4. Analyze the various factors influencing the stability of metal complexes.	7	4	2,4	1,2,3	
5. Differentiate between labile and inert complexes with suitable examples.	3	2	2,3	1,2	
6. Compare and explain thermodynamic and kinetic stability of metal complexes with examples.	3	4	4,5	1,2,3,9	
7. Explain the chelate effect and justify how it enhances the stability of metal complexes.	3	5	2,4	1,2,3,9	
UNIT-III					
1. Explain metal carbonyls with suitable examples and list the stable metal carbonyls of first-row transition metals.	7	2	1	1,2,7	
2. Explain the general methods of preparation of mono and binuclear carbonyls with examples	7	2	1,3	1,2,3	
3. Illustrate 18electron rule with one example for each mononuclear, poly nuclear and substituted metal carbonyls?	7	3	2	1,2,3	
4. Justify CO as π -acceptor ligand.	3	4	2	1,2,3	
5. What is back bonding and give example?	3	1	1	1,2	
UNIT-IV					
1. Calculate the work done for the reversible isothermal and adiabatic expansion of a perfect gas.	7	3	4	1,2,3,4	
2. Discuss Joule-Thomson effect and its coefficient.	7	2	1	1,2,3	
3. Derive Kirchoff's equation and indicate some of its applications	7	4	4	1,2,3,4	

4. State and Explain first Law of Thermodynamics	3	1,2	1	1,2	
5. Explain relation between heat capacities.	3	2,3	1,4	1,2,3,4	
6. What are State and Path functions	3	1	1	1,2	
UNIT-V					
1. Describe Carnot cycle and Justfy the work efficiency of a heat engine in a cyclic processes maximum.	7	4	4	1,2,3	
2. Explain the entropy changes in reversible and irrversible processes.	7	2	1	1,2	
3. Discuss entropy changes in spontaneous and equilibrium processes.	7	4	4	1,2,3	
4. Define different statements of second law of thermodynamics	3	1	1	1	
5. Discuss Carnot theorem	3	4	4	1,2,3	
6. State the Third Law of Thermodynamics.	3	2	1	1,2,9	

GOVERNMENT COLLEGE (A), RAJAMAHENDRAVARAM
II B.Sc. CHEMISTRY (H)

SEMESTER – III

QUESTION PAPER BLUE PRINT

Course -8: INORGANIC AND PHYSICAL CHEMISTRY

TIME: 2½ Hrs.

MARKS: 50 M

PART-A

Answer ALL the Questions

5 x 7 = 35 M

1. 2 Questions from UNIT- I
2. 2 Questions from UNIT- II
3. 2 Questions from UNIT-III
4. 2 Questions from UNIT IV
5. 2 Questions from UNIT-V

Answer any FIVE Questions

PART-B

5 x 3 = 15 M

1. 1 Question from UNIT- I
2. 2 Questions from UNIT- II
3. 1 Question from UNIT- III
4. 2 Questions from
UNIT- IV
5. 2 Questions from
UNIT- V

GOVERNMENT COLLEGE (A), RAJAHMUNDRY
II B.Sc. CHEMISTRY HONS. SEMESTER-III
MODEL PAPER

MODEL PAPER (From 2024-25)

Course -8: INORGANIC AND PHYSICAL CHEMISTRY

Time: 2½ Hrs.

Maximum Marks: 50

PART- A

Answer ALL the questions. Each question carries SEVEN marks.

5 x 7M = 35 M

	Ma rks	BL	CLO	PLO	PI
1a. Summarize the structural isomerism of coordination compounds.	7	2	1,3	1,2	
OR					
1b. Explain the splitting of d- orbitals in octahedral complexes.	7	2	2	1,2	
2a. Apply JOB's Method for the determination of composition of a complex.	7	3	3,5	1,2,3	
OR					
2b. Describe SN ² reactions of square planar complexes with mechanism	7	2,4	3	1,2,3	
3a. Explain the general methods of preparation of mono and binuclear carbonyls with examples	7	2	1	1,9	
OR					
3b. Illustrate 18electron rule with one example for each mononuclear, poly nuclear and substituted metal carbonyls?	7	3	2,5	1,2,3	
4a. Discuss Joule-Thomson effect and its coefficient.	7	4	1,4	1,2,3	
OR					
4b. Derive Kirchoff's equation and indicate some of its applications	7	3,4	1,4	1,2,3	
5a. Describe Carnot cycle and Justfy the work efficiency of a heat engine in a cyclic processes maximum.	7	4,5	1,4,5	1,2,3,10	
OR					
5b. Explain the entropy changes in reversible and irrversible processes.	7	2,4	1,4	1,2,3,10	

PART – B

Answer any **FIVE** of the following questions.

5x3 = 15 M

	Marks	BL	CLO	PLO	PI
6. Outline Spectrochemical series.	3	1,2	1	1,2	
7. Illustrate Labile and Inert complexes with examples	3	2,3	2	1,2,3	
8. Explain chelate effect.	3	2,4	1,3	1,2,3	
9. Justify CO as π -acceptor ligand.	3	4,5	2,3,5	1,2,3	
10. State and Explain first Law of Thermodynamics.	3	1,2	1	1,2	
11. Explain relation between heat capacities.	3	2,4	1,4	1,2,3	
12. Define different statements of second law of thermodynamics.	3	1,2	1,4	1,2	
13. Discuss Carnot theorem	3	4,5	4,5	1,2,3,10	

	Government College (Autonomous) Rajahmundry	Program & Semester			
Course Code Major-8 practical	TITLE OF THE COURSE Course -8: ANALYSIS OF INORGANIC MIXTURE	II B.Sc. CHEMISTRY(H) (III Semester)			
Teaching	Hours Allocated: 30 (Practical)	L	T	P	
Pre-requisites	Qualitative analysis of inorganic simple anions and cations	-	-	2	

Course Objectives:

- Identification of inorganic simple anions
- Identification of inorganic simple cations
- Usage of different lab equipment and reagents for simple salt analysis.
- Chemical reactions involving in the identification of acidic and basic radicals.

Course Outcomes:

On Completion of the course, the students will be able to-		Cognitive Domain
CO 1	Understand the basic concepts of qualitative analysis of inorganic salts	Understand
CO 2	Usage of glassware, equipment and chemicals involved in salt analysis	Apply
CO 3	Apply the concepts of common ion effect, solubility product and concepts related to qualitative analysis	Apply, Analyze
CO 4	Acquire knowledge of micro scale salt analysis procedure.	Understand, Apply
CO 5	Practice Laboratory safety and proper handling of reagents and glassware during qualitative analysis.	Apply
CO 6	Correlate theoretical knowledge of inorganic Chemistry with practical analysis and strengthen problem-solving skills in salt analysis.	Analyze, Evaluate

Course with focus on employability / entrepreneurship / Skill Development modules

Skill Development		Employability		Entrepreneurship	-

Syllabus

Analysis of Inorganic Mixture

50 M

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

Anions: Carbonate, Sulphate, Chloride, Bromide, Acetate, Nitrate, Borate and Phosphate

Cations: Lead, Copper, Iron, Aluminium, Zinc, Nickel, Manganese, Calcium, Strontium, Barium, Magnesium and Ammonium

References:

1. A Text Book of Quantitative Inorganic Analysis - Vogel, A. I.
2. A Textbook of Elementary Qualitative Analysis. Third edition (Engelder, Carl J.)
3. Systematic Qualitative Analysis. K L Kapoor.

1. <https://youtu.be/adA8doZhqWs>

CO-PO Mapping: 1: Slight [Low];

2:

Moderate [Medium]; 3: Substantial [High]; 4: (No Correlation);

	CL O\ PL O	PL O1	P L O 2	PLO 3	PLO4	PL O5	PL O 6	PLO7	PL O8	PLO9	PL O10
Analysis of simple salt Analysis	CLO1	3	2	2	0	0	0	0	0	2	0
	CLO2	3	0	1	3	0	0	0	2	2	0
	CLO3	3	3	3	0	0	0	0	0	2	0
	CLO4	3	2	2	3	0	0	0	0	2	0
	CLO5	2	0	0	3	2	0	0	3	0	3
	CLO6	3	3	3	2	2	2	2	2	3	0
	Avg.	2.83	1.6	1.83	3	0.6	0.3	0.3	1.16	1.83	0.5

GOVERNMENT COLLEGE (A),
RAJAMAHENDRAVARAM III SEMESTER
END EXAMINATIONS

LABORATORY Course -8: ANALYSIS OF INORGANIC MIXTURE - - PRACTICAL

Scheme of Valuation

Time: 3 Hours

Max. Marks: 50

1. Record	10 Marks
2. Practical	35 Marks
3. Viva - voce	5 Marks

III SEMESTER
ORGANIC
CHEMISTRY (H)

	Government College (Autonomous) Rajahmundry	Program & Semester II B.Sc. Organic Chemistry (Hons.) III Semester			
Course Code CHE-5	Title of the course INORGANIC CHEMISTRY				
Teaching	Hours Allocated: 45 (Theory)	L	T	P	C
Pre-requisites:	Conductivity, properties of d-block elements, hybridization, magnetism, electromagnetic radiation	3	-	-	3

Course Objectives:

1. The basic concepts of metals, conductors and insulators.
2. Theories of complex compounds, physical, chemical properties and stability of complex compounds.

Course Outcomes

On Completion of the course, the students will be able to		Cognitive Domain
CL O1	Know the theories of bonding in metals and compounds.	Knowledge
CL O2	Understand the nature of bonding in complex compounds.	Understanding
CL O3	Apply the knowledge of hybridization in predicting the structures of molecules.	Applying
CL O4	Compare the theoretical and practical results regarding the properties of compounds.	Evaluating
CL O5	Analyze the stability of metals and metal compounds.	Analysing

Course with focus on employability / entrepreneurship / Skill Development modules

Skill Development		Employability		Entrepreneurship	

Syllabus:

INORGANIC CHEMISTRY

UNIT-I

6 h

THEORIES OF BONDING IN METALS:

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

UNIT-II

8 h

METAL CARBONYLS:

Introduction 18 electron rule, EAN rule, classification of metal carbonyls, structures and shapes of metal carbonyls of V, Cr, Mn, Fe, Co and Ni.

UNIT-III

18 h

COORDINATION CHEMISTRY:

IUPAC nomenclature - bonding theories - Review of Werner's theory and Sidgwick's concept of coordination - Valence bond theory - geometries of coordination numbers 4 - tetrahedral and square planar and 6-octahedral and its limitations, crystal field theory - splitting of d- orbitals in octahedral, 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-IV

5 h

SPECTRAL AND MAGNETIC PROPERTIES OF METAL COMPLEXES:

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

UNIT-V

8 h

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 and mole ratio method.

List of Reference Books

1. Concise coordination chemistry by Gopalan and Ramalingam
2. Coordination Chemistry by Basalo and Johnson
3. Concise Inorganic Chemistry by J. D. Lee
4. Advanced Inorganic Chemistry Vol-I by Satyaprakash, Tuli, Basu and Madan

CLO-PLO Mapping:

(1: Slight[Low]; 2: Moderate[Medium]; 3: Substantial[High], '-': No Correlation)

	CLO\ PLO	PL O1	PL O2	P L O 3	PL O4	PL O5	PLO6	PL O7	PLO8	PL O9	PLO10
Inorganic Chemistry	C L O 1	3	2	2	1	1	0	0	0	3	0
	C L O 2	3	1	2	1	1	0	0	0	3	0
	C L O 3	3	3	3	1	1	0	0	0	3	0
	C L O 4	3	3	3	2	2	0	0	0	3	0
	C L O 5	3	3	3	2	2	0	0	0	3	0
	A vg .	3	2.4	2. 6	1.4	1.4	0	0	0	3	0

CHEMISTRY COURSE-5: INORGANIC CHEMISTRY

QUESTION PAPER BLUE PRINT

TIME: 2½ hrs.

MAX. MARKS: 50

PART – A

Answer **ALL** the following questions.

5x7 = 35 M

1a Question from UNIT-I

OR

1b Question from UNIT-I

2a Question from UNIT-II

OR

2b Question from UNIT-II

3a Question from UNIT-

III OR

3b Questions from UNIT-III

4a Question from UNIT-IV

OR

4b Question from UNIT-IV

5a Question from UNIT-V

OR

5b Question from UNIT-V

PART – B

Answer any **FIVE** of the following questions.

5x3 = 15 M

6 Questions from UNIT-I

7 Questions from UNIT-II

8 Questions from UNIT-III

9 Questions from UNIT-III

10 Questions from UNIT-III

11 Questions from UNIT-III

12 Questions from UNIT-IV

13 Questions from UNIT-V

COURSE-5: INORGANIC CHEMISTRY

MODEL QUESTION PAPER

TIME: 2½ hrs.

MAX. MARKS: 50

PART – AAnswer **ALL** the following questions.**5x7 = 35 M**

1a Outline the band theory of metals.

OR

1b Compare the properties of conductors, semi-conductors and insulators.

2a Classify the metal carbonyls. Write about EAN rule.

OR

2b Explain the structures of $V(CO)_5$ and $Ni(CO)_4$.

3a Explain the Crystal field theory of complex compounds.

OR

3b Exemplify the optical isomerism exhibited by the complex compounds with coordination number 4

4a Categorize the types of magnetic behavior.

OR

4b Describe the Gouy balance method.

5a Discuss the factors affecting the stability of metal complexes.

OR

5b Describe the experimentation of Job's method.

PART – BAnswer any **FIVE** of the following questions.

6 List some metal properties.

7 Illustrate the 18 electron rule.

8 Interpret the Sidgwick's concept of coordination.

9 Draw the structures of any three complex compounds.

10 Explain about linkage isomerism.

11 Summarize the merits and demerits of crystal field theory.

12. How is magnetic moment calculated by using spin-only formula?

13. Explain the thermodynamic stability of metal complexes.

Marks	B L	CLO	P L O	P I
7	2	1	1	
7	2	2	2	
7	2	1	2	
7	2	3	2	
7	5	1	9	
7	2	2	5	
7	4	1	3	
5x3 = 15 M				
7	3	4	2	
Marks	B L	CLO	P L O	P I
7	6	5	5	
3	1	1	1	
7	3	4	4	
3	2	2	2	
3	2	1	3	
3	3	3	5	
3	5	3	9	
	2	5	2	
3	5	5	4	
3	4	4	3	

QUESTION BANK

(7 Marks and 3 Marks Questions)

7 MARKS QUESTIONS

UNIT – I: Theories of Bonding in Metals

1. Explain Valence Bond Theory of metallic bonding. Mention its limitations.
2. Describe Free Electron Theory of metals and explain electrical conductivity.
3. Explain Band Theory and formation of energy bands in solids.
4. Distinguish between conductors, semiconductors and insulators based on band theory.
5. Explain thermal conductivity of metals using Free Electron Theory.

UNIT – II: Metal Carbonyls

6. Explain the 18-electron rule and EAN rule with suitable examples.
7. Classify metal carbonyls with examples.
8. Describe the structure and bonding in carbonyls of chromium and iron.
9. Discuss the structures and shapes of carbonyls of V, Mn and Co.
10. Explain the structure and geometry of nickel carbonyl and its bonding.

UNIT – III: Coordination Chemistry

11. Explain Werner's theory and Sidgwick's concept of coordination.
12. Describe Valence Bond Theory for coordination compounds with geometries of coordination number 4 and 6.
13. Explain crystal field splitting in octahedral complexes.
14. Discuss factors affecting crystal field splitting energy (Δ_o).
15. Explain structural isomerism in coordination compounds with examples.
16. Discuss stereoisomerism in coordination compounds of coordination number 4 and 6.
17. Write a note on merits and demerits of Crystal Field Theory.

UNIT – IV: Spectral and Magnetic Properties

18. Explain different types of magnetic behaviour in metal complexes.
19. Derive spin-only formula and explain calculation of magnetic moment.
20. Explain Gouy method for determination of magnetic susceptibility.

UNIT – V: Stability of Metal Complexes

21. Differentiate between thermodynamic and kinetic stability.
22. Discuss factors affecting stability of metal complexes.
23. Explain chelate effect with suitable examples.
24. Describe Job's method for determination of composition of complex.
25. Explain mole ratio method for determination of composition of complex.

3 MARKS QUESTIONS

UNIT – I

1. Define metallic bonding.
2. What are metallic properties?
3. State limitations of Free Electron Theory.
4. What are energy bands?
5. Define conductor and semiconductor.

UNIT – II

6. State 18-electron rule.
7. Define EAN rule.
8. What are metal carbonyls?
9. Give classification of metal carbonyls.
10. Write structure of $\text{Ni}(\text{CO})_4$.

UNIT – III

11. Define coordination number.
12. What is meant by ligand?
13. State Werner's postulates.
14. Define crystal field splitting energy.
15. What is tetrahedral geometry?
16. What is square planar geometry?
17. Define structural isomerism.
18. Define stereoisomerism.

UNIT – IV

19. Define paramagnetism and diamagnetism.
20. Write spin-only formula.
21. Define magnetic susceptibility.

UNIT – V

22. Define thermodynamic stability.
23. What is kinetic stability?
24. Define chelate effect.
25. What is Job's method?
26. What is mole ratio method.

	Government College (Autonomous) Rajahmundry	Program & Semester II B.Sc. ORGANIC CHEMISTRY (H) (SEMESTER – III)			
Course Code 6	TITLE OF THE COURSE Course - 6: ORGANIC CHEMISTRY (Halogen And Oxygen Containing Organic Compounds)				
Teaching	Hours Allocated: 45 (Theory) (3 hrs. / Wk.)	L	T	P	C
Prerequisites:	Basic knowledge on structure and reactivity of organic compounds	3	-	-	3

Course Objectives:

- To provide knowledge on reactivity of Halogen and Oxygen containing organic compounds.
- To provide basic awareness on preparatory methods of Halogen and Oxygen containing organic compounds.
- To understand classification of carbohydrates and structural elucidation of glucose & fructose.

Course Outcomes:

On Completion of the course, the students will be able to-		Cognitive Domain
CO1	Understand the concept of SN1 and SN2 mechanisms	Understanding
CO2	Describe the reactivity of alkyl halides, alcohols and phenols.	Application
CO3	Achieve the skills required to propose various mechanisms	Skill
CO4	Apply the concepts for synthesising various Halogen & Oxygen containing organic compounds	Application

Course with focus on employability / entrepreneurship / Skill Development modules

Skill Development		Employability		Entrepreneurship	

Syllabus:

Unit – I Halogen compounds (9 h)

Alkyl halides: Preparation of alkyl halides from i) alkanes, ii) alkenes and iii) alcohols. Properties - **nucleophilic substitution reactions–SN1 and SN2 mechanisms** with energy profile diagrams and stereo chemical aspects. Williamson's synthesis.

Aryl halides: Preparation i) from phenols ii) **Sandmeyer's reaction, nucleophilic aromatic substitution (Benzyne mechanism)**; relative reactivity of alkyl, allyl, vinyl and benzyl, aryl halides towards nucleophilic substitution reactions.

Unit - II Alcohols and Phenols (9 h)

Alcohols: Nomenclature, classification, Preparation of 1^o, 2^o, 3^o alcohols from Grignard's reagent, Bouveault–Blanc Reduction; Chemical properties –A) Reactions involving only the hydrogen atom of -OH group B) Reactions involving -OH group as a whole. Distinction between 1^o, 2^o, 3^o alcohols with Lucas reagent. Pinacol – Pinacolone rearrangement with mechanism.

Phenols: Preparation from **diazonium salt and Cumene**. Reactions and mechanism–**Reimer–Tiemann, Kolbe–Schmitt Reactions, Fries and Claisen rearrangements**

Unit - III Carbonyl Compounds (9 h)

Preparation from- Acid chlorides, 1,3-dithiane and nitriles; Structure and reactivity of carbonyl group, Nucleophilic addition reactions with HCN, NaHSO₃ and alcohols. Addition - elimination reactions with hydroxylamine, hydrazine, phenyl hydrazine, 2,4DNP, semi-carbazide. Oxidations and reductions (Baeyer -Villiger oxidation, KMnO₄, Clemmensen's, Wolf–Kishner's, with LiAlH₄ & NaBH₄).

Reaction & Mechanism- Aldol condensation, Cannizzaro reaction, Perkin reaction, Benzoin condensation, Claisen-Schmidt reaction, Haloform reaction.

Unit-IV Carboxylic acid (9h)

Carboxylic Acids: **Preparation from Grignard reagent and hydrolysis of nitriles**, Reactions of monocarboxylic acids- Reactions involving -H, -OH and -COOH groups, formation of salts, esters, acid chlorides, amides and anhydrides. Degradation of carboxylic acids by Huns - Diecker's reaction, decarboxylation by Schmidt reaction, Arndt-Eistert synthesis, halogenation by Hell- Volhard- Zelinsky reaction. **Mechanisms of acidic and alkaline hydrolysis of esters, Reformatsky reactions, Curtius rearrangement.**

Unit - V: Active Methylene Compounds (9h)

Active methylene compounds: Keto-enol tautomerism, preparation of Acetic Aceto Ester (AAE) by Claisen condensation with mechanism, **synthetic applications of AAE in the preparation of mono carboxylic acids, di carboxylic acids, α,β -unsaturated acids and heterocyclic compounds.**

List of Reference Books

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

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

6. Guide book to Mechanism in Organic Chemistry by Peter Sykes 6th edition, 1985.

CO-PO Mapping: 1: Slight [Low]; 2: Moderate [Medium];

3: Substantial [High], '-': No Correlation

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	2	2	3	2	2	2	3	3	2	2	3	3	3
CO2	2	3	3	3	3	2	1	2	2	3	2	2	3
CO3	3	3	3	2	2	1	1	2	3	1	2	3	3
CO4	2	1	1	1	3	2	3	1	2	3	2	3	2
Avg.	2.25	2.25	2.5	2.0	2.5	1.75	2.0	2.0	2.25	2.25	2.25	2.75	2.75

Government College (A), Rajamahendravaram II B.Sc.
Organic Chemistry(H) Semester – 3 Course -6: Organic
Chemistry

(Halogen and Oxygen containing organic compounds)

Weightage to Content & Blue Print

S.No.	Course Content	Long Answer Questions	Short Answer Questions	Total Marks
1.	UNIT - I	2	1	17
2.	UNIT – II	2	2	20
3.	UNIT – III	2	2	20
4.	UNIT – IV	2	2	20
5.	UNIT - V	2	1	17
	TOTAL	10	8	94

Government College (A), Rajahmundry
II B.Sc. Organic Chemistry (H) Semester-3
Course - 6: ORGANIC CHEMISTRY
(Halogen and Oxygen containing organic compounds)

Model Paper

Time: 21/2 hrs.

Maximum Marks: 50

PART - A

Answer **ALL** the questions. Each carry SEVEN marks 5 x 7 = 35 M

1. Discuss the mechanism and stereochemistry of SN1 and SN2 reactions taking suitable examples. BT2 CO1

(OR)

2. Write a short note on the following BT1 CO3

a. Sandmeyer reaction

b) Benzyne mechanism

3. a) Write the preparation of alcohols using Grignard reagent and Bouveault - Blanc reduction BT1 CO4

b) Explain Lucas method for identification of 1°, 2°, 3° alcohols. BT3 CO2

(OR)

4. Explain the mechanism of Reimer-Tiemann and Kolbe - Schmidt reaction. BT1 CO3

5. How does Acetone react with the following reagents BT3 CO3

i) HCN ii) NaSHO₃ iii) NH₂OH iv) NH₂NH₂

(OR)

6. Discuss Aldol condensation and Cannizzaro reaction with mechanism. BT1 CO2

7. Write any two preparation methods of carboxylic acids and explain Esterification reaction with mechanism. BT3 CO3

(OR)

8. Explain the acidic and alkaline hydrolysis of esters with mechanism. BT2 CO2

9. Write the preparation and any two synthetic applications of Aceto Acetic Ester. BT2 CO1

(OR)

10. What is active methylene compound? Explain Claisen condensation with mechanism. BT2 CO4

PART- B

Answer **any FIVE** of the following questions. Each carry THREE marks 5 x 3 = 15 M

11. Compare the reactivity of alkyl halides with vinyl halides BT4 CO2

12. Write the mechanism for Pinacol-Pinacolone rearrangement. BT2 CO1

13. Write a short note on Fries rearrangement. BT1 CO3

14. Give any two reduction reactions of carbonyl compounds. BT1 CO4
15. Explain the mechanism of Perkin reaction BT2 CO1
16. Explain Arndt-Eistert reaction. BT2 CO4
17. Write a note on Hunsdiecker's reaction BT2 CO3
18. Write a note on Keto-enol tautomerism. BT2 CO2

YouTube video sources:

https://youtube.com/watch?v=Bi_01qiVr0I&feature=share8

<https://youtube.com/watch?v=SJr2JTn7W7M&feature=share8>

https://youtube.com/watch?v=YNG_iSNA9vk&feature=share8

<https://youtube.com/watch?v=Wk-dH4V4AOQ&feature=share8>

<https://youtube.com/watch?v=YVWGG0sxboQ&feature=share8>

<https://youtube.com/watch?v=EWBhJw-6DIQ&feature=share8>

<https://youtube.com/watch?v=mPUiMh4hnok&feature=share8>

<https://youtube.com/watch?v=DMFi7DhrKUA&feature=share8>

II B.Sc., Semester-3 Course - 6: Organic Chemistry (Halogen And Oxygen Containing Organic Compounds)
Question Bank

Unit -1

1. Discuss the mechanism and stereochemistry of SN1 reaction taking suitable examples. (7 marks)
2. Discuss the mechanism and stereochemistry of SN2 reactions taking suitable examples. (7 marks)
3. Write a short note on the following. (7 marks) a) Sandmeyer reaction b) Benzyne mechanism
4. Williamson's synthesis (3 marks)
5. Sandmeyer reaction (3 marks)

Unit – 2

1. Write any two methods of preparation and any two properties of phenol. (7 marks)
2. Explain Reimer-Tiemann reaction with mechanism. (7 marks)
3. Write notes on (a) pinacol – pinacolone rearrangement and (b) Lucas method for identification of 10, 20, 30 alcohols. (7 marks).
4. Write the preparation of alcohols using Grignard reagent and Bouveault (3 marks)
5. Explain Kolbe - Schmidt reaction. (3 marks)
6. How does Acetone react with the following reagents? (3 marks) i) HCN ii) NaSHO₃ iii) NH₂OH
7. Explain Fries rearrangement. (3 marks).

Unit – 3

1. Discuss Aldol condensation and Cannizzaro reaction with mechanism. (7 marks)
2. Explain the mechanism of Perkin reaction and Benzoin condensation. (7 marks)
3. Write any two methods of synthesis of aldehydes and ketones each. (7 marks)
4. Write notes on Clemmensen reduction and Wolf-Kishner reduction (3 marks)
5. Explain Haloform reaction (3 marks).
6. Explain how carbonyl compounds respond to Tollens and Fehling's reagents. (3 marks).
7. Give any two reduction reactions of carbonyl compounds. (3 marks)

Unit - 4

1. Write any two preparation methods of carboxylic acids and explain HVZ reaction. (7 marks)
2. Explain esterification reaction with mechanism. (7 marks)
3. Write a note on a) Hunsdiecker's reaction and b) Ester hydrolysis reaction. (7 marks)
4. Explain Arndt-Eistert reaction. (3 marks).
5. Write a note on Schmidt reaction. (3 marks).
6. Write a note on halogenation by Hell- Volhard- Zelinsky reaction. (3 marks).
7. How ester is formed from carboxylic acid? Give example. (3 marks).

Unit - 5

1. Write the preparation and any two synthetic applications of Aceto Acetic Ester. (7 marks)
2. What is active methylene compound? Explain Claisen condensation. (7 marks) 3. Write with equations how a) acetic acid, b) succinic acid, c) 4-methyl uracil can be prepared from aceto acetic ester. (7 marks).
4. Write a note on keto-enol tautomerism. (3 marks).
5. Explain the reaction between acetoacetic ester and urea (3 marks).

	Government College (Autonomous) Rajahmundry	Program & Semester II B.Sc., ORGANIC CHEMISTRY(H) (III Semester)			
Course Code C6 -P	TITLE OF THE COURSE Course -6: ORGANIC PREPARATIONS (Halogen and Oxygen containing organic compounds)				
Teaching	Hours Allocated: 30 (Practical)	L	T	P	C
Pre-requisites	Basic knowledge on handling of glassware and chemicals	-	-	2	1

Course Objectives:

- To provide basic knowledge about the handling of laboratory apparatus
- To provide knowledge on calculating limiting reagent, theoretical yield, and percent yield.
- To provide hands on training on laboratory techniques including reflux, distillation, recrystallization, vacuum filtration, MP & BP determinations.

Course Outcomes:

On Completion of the course, the students will be able to	
CO 1	How to use glassware, equipment and chemicals and follow experimental procedures in the laboratory.
CO 2	How to calculate limiting reagent, theoretical yield, and percent yield.
CO 3	How to perform common laboratory techniques including reflux, distillation, recrystallization, vacuum filtration.
CO 4	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.

Course with focus on employability / entrepreneurship / Skill Development modules

Skill Development		Employability		Entrepreneurship	-

Syllabus - Organic preparations (50M)

3. Acetylation of β -naphthol, vanillin and salicylic acid by:

a) Using conventional method. b) Using green approach

4. Preparation of Nerolin

Reference books:

4. Vogel A.I. Practical Organic Chemistry, Longman Group Ltd.

5. Bansal R.K. Laboratory Manual of Organic Chemistry, Wiley-Eastern.

6. Ahluwalia V. K. and Agarwal R. Comprehensive Practical Organic Chemistry, University press.

CO-PO Mapping:

1. Slight [Low]; 2. Moderate [Medium];
3. Substantial [High], 4. (No Correlation)

	P O 1	P O 2	P O 3	P O 4	P O 5	P O 6	P O 7	P O 8	P O 9	P O 10	PS O1	PS O2	PS O3
CO 1	2	3	3	2	3	2	2	2	3	2	2	3	3
CO 2	3	3	3	2	3	2	2	3	2	3	3	3	3
CO 3	3	2	3	2	3	1	2	2	2	2	2	3	2
CO 4	3	3	2	1	3	2	2	1	2	3	3	3	3
Avg.	2.75	2.75	2.75	2	3	2	2	2	2.25	2.5	2.5	3	2.75

	Government College (Autonomous) Rajahmundry	rogram & Semester II B.Sc. ORGANIC, INDUSTRIAL, ANALYTICAL Chemistry (H) III Semester Course 7			
Course Code 7	TITLE OF THE COURSE PHYSICAL CHEMISTRY				
Teaching	Hours Allocated: (Theory) 45	L	T	P	C
Pre-requisites:	Basic Knowledge about Solids, Liquids, Gases and Solutions	3		-	3

Course Objectives:

The objective of this course is to provide students with a comprehensive understanding of the essential concepts and applications of Solids, liquids, gases, solutions and ionic equilibria. The course aims to develop students' critical thinking, problem-solving, and analytical skills in these areas, enabling them to apply scientific principles to real-world situations.

On Completion of the course, the students will be able to-		Cognitive Domain
CLO1	Gain Knowledge about the concepts of Solutions . solids. Liquids .gases and ionic equilibrium	Knowledge
CLO2	At the end of the course , the students will be able to Understand the basic concepts of Solids, Liquids, Gases. Solutions and ionic equilibria	Understanding
CLO3	application of Distribution law to various systems, application of liquid crystals to LCD devices	Application
CLO4	compare and conclude theoretical concepts and applications to day to situations	Evaluation
CLO5	Analyze and calculate the mathematical problems on different concepts	Analysis

Course with focus on employability / entrepreneurship / Skill Development modules

Skill Development		Employability		Entrepreneurship	
t					

Syllabus:

PHYSICAL CHEMISTRY

3 hrs/week

UNIT-I

9h

SOLID STATE: Symmetry in crystals. Law of constancy of interfacial angles. The law of rationality of indices. The law of symmetry. Definition of lattice point, space lattice, unit cell.

X-ray diffraction and crystal structure. Bragg's law. Defects in crystals. Stoichiometric and non-stoichiometric defects.

UNIT-II

9h

GASEOUS STATE Introduction and derivation of Ideal Gas Equation. Vander Waal's equation of state. P-V Isotherms of real gases, Andrew's isotherms of carbon dioxide. Critical phenomena. The vanderwaal's equation and the critical state. Law of corresponding states. Relationship between critical constants and vander Waal's constants. Joule Thomson effect.

UNIT-III:

9h

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

UNIT-IV

9h

SOLUTIONS Liquid-liquid - ideal solutions, Raoult's law. Ideally dilute solutions, Henry's law. Non-ideal solutions. Azeotropes-HCl-H₂O, ethanol-water systems and fractional distillation. Partially miscible liquids-phenol-water. Effect of impurity on consolute temperature. Immiscible liquids and steam distillation. Nernst distribution law. Calculation of the partition coefficient. Applications of distribution law.

UNIT-V

9h

IONIC EQUILIBRIUM AND HSAB Ionic Product, common ion effect, solubility and solubility product. Definition of acid and base with examples, Pearson concept, HSAB Principle & its importance definition of buffer solution. Henderson –Hassel batch Equation

List of Reference Books

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

Web Links:

<https://youtu.be/IPN0WWWfwts?list=PLHhInNg2PQWVHNecGWt3YAxFcKTW44nJX>

<https://youtu.be/cmnmqmdTZU80>

CLO-PLO Mapping:

(1: Slight[Low]; 2: Moderate[Medium]; 3: Substantial[High], '-': No Correlation)

Proposed Activities:

Skill Development: 1.

Employability

	PL O1	PL O2	PL O3	PL O4	PL O5	PL O6	PL O7	PL O8	PL O9	P L O 10
CLO1	3	2	2	1	1	0	0	0	3	0
CLO2	3	1	2	1	1	0	0	0	3	0
CLO3	3	3	3	1	1	0	0	0	3	0
CLO4	3	3	3	2	2	0	0	0	3	0
CLO5	3	3	3	2	2	0	0	0	3	0
Avg.	3	2.4	2.6	1 .4	1 .4	0	0	0	3	0

GOVERNMENT COLLEGE (A), RAJAMAHENDRAVARAM
II B.Sc. ORGANIC CHEMISTRY (H) SEMESTER-III (2025-26)

CHEMISTRY COURSE-7: PHYSICAL CHEMISTRY
QUESTION PAPER BLUE PRINT

TIME: 2½ Hrs.

MAX. MARKS: 50 PART – A

Answer **ALL** the following questions.

5x7 = 35 M

1a	Question from UNIT-I	OR
1b	Question from UNIT-I	
2a	Question from UNIT-II	OR
2b	Question from UNIT-II	
3a	Question from UNIT-III	OR
3b	Questions from UNIT-III	
4a	Question from UNIT-IV	OR
4b	Question from UNIT-IV	
5a	Question from UNIT-V	OR
5b	Question from UNIT-V	

PART – B

Answer any

FIVE of the following questions.

5x3 = 15 M

6	Question from UNIT-I
7	Question from UNIT-II
8	Question from UNIT-III
9	Question from UNIT-IV
10	Question from UNIT- V
11	Question from UNIT-I
12	Question from UNIT-II
13	Question from UNIT- IV

GOVERNMENT COLLEGE (A), RAJAHMUNDRY

II B.Sc. ORGANIC CHEMISTRY (H)

SEMESTER-III

MODEL PAPER (From 2025-26)

Course - 7: PHYSICAL CHEMISTRY

Time: 2½ Hrs

Max.Marks:50

PART- A

Answer ALL the questions. Each question carries SEVEN marks

5 x 7 = 35 M

		Marks	BL	CLO	PLO	PI
1a	Derive Bragg's equation. OR	7	6	1	1	
1b	What are crystal defects? Explain stoichiometric crystal defects with suitable examples.	7	1	1	2	
2a	What are critical constants? Derive the relationships between critical constants and Vander Waal's constants. OR	7	6	2	2	
2b	Derive Vander Waal's gas equation.	7	6	2	2	
3a	What are liquid crystals? Explain the classification and properties of liquid crystals. OR	7	2	3	7	
3b	Write the structural differences between solids, liquids and gases.	7	1	3	5	
4a	What are azeotropes? Explain maximum boiling azeotropes and minimum boiling azeotropes with suitable examples. OR	7	2	4	3	
4b	What are partially miscible liquid mixtures? Explain Phenol -Water system.	7	2	4	2	
5a	Discuss the HSAB principle and its applications. OR	7	2	5	5	
5b	Describe the common ion effect with suitable example.	7	2	5	4	

PART – B

Answer any **FIVE** of the following questions.

5x3 = 15 M

	Marks	BL	CLO	PLO	PI
6	3	1	1	1	
7	3	1	2	2	
8	3	3	3	3	
9	3	4	4	5	
10	3	6	5	7	
11	3	2	1	2	
12	3	4	2	3	
13	3	2	4	3	

GOVERNMENT COLLEGE (A) RAJAMAHENDRAVARAM
II B.Sc. ORGANIC CHEMISTRY
SEMESTER – III
PAPER –C-7 : PHYSICAL CHEMISTRY

QUESTION BANK

Essay type questions. Each question carries 7 marks.				
Unit-1	Marks	BL	CLO	PLO
1. Derive Bragg's equation.	7	6	1	1, 4
2. What are crystal defects? Explain stoichiometric crystal defects with suitable examples.	7	2	1	1, 4
3. Explain the law of symmetry.	7	2	1	1, 4
Unit-II	Marks	BL	CLO	PLO
1. Derive Vander Waal's gas equation.	7	6	2	1, 2, 3
2. What are critical constants? Derive the relationships between critical constants and Vander Waal's constants.	7	6	2	1, 2, 3
3. Explain the law of corresponding states.	7	2	2	1, 2, 3
Unit-III	Marks	BL	CLO	PLO
1. What are liquid crystals? Explain the classification and properties of liquid crystals.	7	2	3	1, 2, 3
2. Explain Nematic and Smectic liquid crystals with suitable examples.	7	2	3	1, 2, 3
Unit-IV	Marks	BL	CLO	PLO
1. What are azeotropes? Explain maximum boiling azeotropes and minimum boiling azeotropes with suitable examples.	7	2	4	1, 2, 3
2. Explain Nernst distribution law and its applications.	7	2, 4.	4	1, 2, 3
3. What are partially miscible liquid mixtures? Explain Phenol -Water system.	7	2	4	1, 2, 3
Unit-V	Marks	BL	CLO	PLO
1. Discuss the HSAB principle and its applications.	7	2,4.	5	1, 2, 3, 4
2. Explain common ion effect with suitable examples.	7	2	5	1, 2, 3, 4

Short answer questions. Each question carries 3 marks.

[illegible]

	Government College (Autonomous) Rajahmundry	Program & Semester			
Course Code Major 7 practical	TITLE OF THE COURSE Course -7: Physical chemistry practical	II B.Sc.CH EMISTR Y (H)			
Teaching	Hours Allocated: 30 (Practical)	L	T	P	
Pre-requisites	Theoretical Knowledge about liquid properties like surface tension and viscosity, Knowledge about partition coefficient	-	-	2	

Course Objectives:

- Measurement of liquid property like Surface tension, Viscosity
- Measurement of partition coefficient of substance between two liquids
- Correct Usage of different lab equipment

Course Outcomes:

On Completion of the course, the students will be able to	
C O1	Understand the basic concepts surface tension. viscosity and partition coefficient
C O2	Usage of glassware, equipment used for surface tension, viscosity and Partition coefficient measurement
C O3	Acquire knowledge of measurement of surface tension. viscosity of different liquids and distribution coefficient of substance between two liquids procedure.
C O4	Acquire knowledge of accurate measurement . tabulation of readings and calculation of results

Course with focus on employability / entrepreneurship / Skill Development modules

Skill Development		Employability		Entrepreneurship	-

SYLLABUS

Credits: 1 (2 hrs/week)

4. Determination of molecular status and partition coefficient of benzoic acid in Benzene and water.
5. Determination of Surface tension of liquid 1
6. Determination of Surface tension of liquid 2
9. Determination of Viscosity of liquid.1
10. Determination of Viscosity of liquid.2

List of Reference Books

1. O.P. Pandey, D.N. Bajpai & S. Giri, Practical Chemistry, S. Chand & Company Ltd.
2. B. D. Khosla, V. C. Garg & A. Gulati, Senior Practical Physical Chemistry, S. Chand & Co.: New Delhi (2011).
3. C. W. Garland, J.W. Nibler, & D.P. Shoemaker, Experiments in Physical Chemistry 8th Ed.; McGrawHill: New York (2003).
4. R.C. Das and B. Behra, Experiments in Physical Chemistry,, Tata McGraw Hill.

Web Links:

<https://youtu.be/xGlXcpcPgYs>

CLO-PLO Mapping:

1: Slight [Low]; 2: Moderate [Medium]; 3: Substantial [High], 4: (No Correlation)

	Government College(Autonomous) Rajamahendravaram	Program & Semester II B.Sc. Organic Chemistry (H) (Semester - III)			
Course Code C8	TITLE OF THE COURSE Course -08: GENERAL CHEMISTRY				
Teaching	Hours Allocated: 45 (Theory)	L	T	P	C
Pre-requisites	Basics in surface chemistry, chemical bonding, stereo isomerism	3		-	3

Course Objectives:

1. To learn the concepts of colloids and adsorption.
2. To provide the knowledge about different types of chemical bonds and VBT.
3. To provide the basic knowledge on stereo isomerism.
4. To learn applying optical isomerism to some simple organic molecules.

Course Outcomes:

On Completion of the course, the students will be able to	
CO1	Understand the basic concepts of Colloids, emulsions, and Gels.
CO2	Understand the concept of VBT and LCAO Method.
CO3	Comprehend the characteristic aspects of optical isomerism.
CO4	Apply the concept of optical isomerism to specific examples.

Course with focus on Employability / Entrepreneurship / Skill Development modules

Skill Developm ent		Employabili ty		Entrepreneurs hip	

COLLOIDS: Syllabus

UNIT-I 9 h

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

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

Liquids in solids (gels) preparation, uses.

UNIT-II

9 h

ADSORPTION:

Physical adsorption, chemisorption. Freundlich, Langmuir adsorption isotherms. Applications of adsorption, difference between physical adsorption and chemical adsorption

UNIT-III

9 h

CHEMICAL BONDING:

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).

UNIT-IV

9

STEREOCHEMISTRY OF CARBON COMPOUNDS-I:

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

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

UNIT-V 9

STEREOCHEMISTRY OF CARBON COMPOUNDS-II

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

List of Reference Books:

1. Text book of physical chemistry by K L Kapoor
2. Text book of physical chemistry by S Glasstone
3. Stereochemistry of Organic compounds by E L Eliel
4. Advanced Organic Chemistry by F A Carey and R J Sundberg
5. Stereochemistry by P.S.Kalsi
6. Stereochemistry of Organic compounds by D. Nasipuri
7. Advanced physical chemistry by Bahl and Tuli

1: Slight [Low]; 2: Moderate [Medium]; 3: Substantial [High]; '-': No Correlation);

	P O 1	P O 2	P O 3	P O 4	P O 5	P O 6	P O 7	P O 8	P O 9	P O 10	PS O 1	PS O 2	PS O 3
C O 1	3	2	3	2	2	2	3	3	2	2	3	3	3

C O 2	2	3	3	3	3	2	1	2	2	3	2	2	3
C O 3	3	3	3	2	2	1	1	2	3	1	2	3	3
C O 4	2	1	2	1	3	2	3	1	2	3	2	3	2
A vg .	2 .5	2.25	2.75	2. 0	2.5	1.75	2.0	2.0	2.25	2.25	2.25	2.75	2.75

GOVERNMENT COLLEGE (A), RAJAMAHENDRAVARAM II B.Sc.
CHEMISTRY (H) SEMESTER – III QUESTION PAPER BLUE PRINT
Course -8: GENERAL CHEMISTRY

TIME: 2¹/₂ Hrs.

MARKS: 50 M

PART-A

Answer ALL the Questions

5 x 7 = 35 M

1. 2 Questions from UNIT- I
2. 2 Questions from UNIT- II
3. 2 Questions from UNIT-III
4. 2 Questions from UNIT IV
5. 2 Questions from UNIT-V

PART-B

Answer any FIVE Questions

5 x 3 = 15 M

1. 2 Question from UNIT- I
2. 2 Questions from UNIT- II
3. 2 Question from UNIT- III
4. 1 Questions from UNIT- IV
5. 1 Questions from UNIT- V

GOVERNMENT COLLEGE (A), RAJAHMUNDRY II B.Sc.
CHEMISTRY Hons. (SEMESTER-III) MODEL PAPER
Course - 8: GENERAL CHEMISTRY

Time: 2¹/₂ Hrs.

Maximum Marks: 50

PART- A

Answer ALL the questions. Each question carries SEVEN marks.

5 x 7M = 35 M

1. Explain three preparation methods of colloids. [BT2, CO1]

(OR)

2. Explain Tindal effect and Brownian movement. [BT3, CO1]

3. Write a note on Langmuir adsorption isotherm.

[BT2, CO2]

[BT2, CO2]

(OR)

4. Differentiate between physical adsorption and chemical adsorption.

5. Explain the structures of ClF_3 & $\text{Ni}(\text{CO})_4$ based on VBT. [BT4, CO3]

(OR)

6. Write MO diagrams of N_2 and CO and explain their bond order and magnetic properties. [BT2, CO3]

7. What is meant by optical activity? Which type of organic molecules exhibit this activity? [BT2, CO3]

(OR)

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

[BT4, CO3]

9. Write about enantiomers and diastereomers with suitable examples. [BT3, CO4]

(OR)

10. Explain of optical isomerism in Tartaric acid and 2,3- dibromo pentane. [BT2, CO3]

PART- B

Answer any FIVE of the following questions. Each question carries THREE marks

5 x 3M = 15M

11. Explain Hardy Schulz rule. [BT4, CO1]

12. Write about emulsions and their uses. [BT2, CO1]

13. Write a note on Freundlich adsorption isotherm. [BT1, CO2]

14. Write any three applications of adsorption. [BT2, CO2]

15. What is LCAO method? [BT4, CO3]

16. Write Molecular Orbital diagram of NO . [BT4, CO3]

17. What is specific rotation? [BT1, CO3]

18. What is meant by chirality? [BT2, CO4]

QUESTION BANK

UNIT – I : COLLOIDS

Easy Questions

1. Define colloids. Explain the preparation and properties of sols (solids in liquids).
2. Explain the kinetic, optical and electrical properties of colloids.
3. Discuss the stability of colloids. Explain Hardy–Schulze law and protective colloids.
4. Explain emulsions: preparation, properties and uses.

Short Questions

1. What are colloids? Give two examples.
2. Define Tyndall effect.
3. State Hardy–Schulze law.
4. What are gels? Give one use.

UNIT – II : ADSORPTION

Easy Questions

1. Explain physical adsorption and chemical adsorption with suitable examples.
2. Derive and explain Freundlich adsorption isotherm.
3. Explain Langmuir adsorption isotherm and its limitations.
4. Discuss the applications of adsorption.

Short Questions

1. Define adsorption.
2. Give two differences between physisorption and chemisorption.
3. What is adsorption isotherm?
4. Mention two applications of adsorption.

UNIT – III: CHEMICAL BONDING

Easy Questions

1. Explain Valence Bond Theory and its limitations.
2. Describe hybridization with examples.
3. Apply VB theory to explain the structure of ClF_3 and $\text{Ni}(\text{CO})_4$.
4. Explain Molecular Orbital Theory using LCAO method. Construct MO diagrams for N_2 and O_2 .

Short Questions

1. What is hybridization?
2. Define LCAO method.
3. Why is O_2 paramagnetic?
4. Write the bond order formula.

UNIT – IV: STEREOCHEMISTRY OF CARBON COMPOUNDS – I

Easy Questions

1. Explain different molecular representations: Wedge, Fischer, Newman and Saw-horse formulae.
2. Explain optical activity based on wave nature of light.
3. Describe plane polarised light and optical rotation.
4. Define specific rotation and explain its significance.

Short Questions

1. What is plane polarised light?
2. Define optical rotation.
3. Write the formula for specific rotation.
4. What is a Newman projection?

UNIT – V: STEREOCHEMISTRY OF CARBON COMPOUNDS – II

Easy Questions

1. Define chiral molecules and explain the criteria for chirality.
2. Explain enantiomers and diastereomers with examples.
3. Explain optical isomerism using glyceraldehyde and lactic acid.
4. Explain D,L and R,S configuration methods with examples.

Short Questions

1. Define chirality.
2. What are enantiomers?
3. What is E,Z configuration?
4. Give one example of a meso compound.

		Government College (Autonomous) Rajamahendravaram		Program & Semester II B.Sc. ORGANIC CHEMISTRY(H) (Semester - III)			
Course Code 08P		TITLE OF THE COURSE Course -8: General Chemistry Lab					
Teaching		Hours Allocated: 30 (Practical)		L	T	P	C
Pre-requisites		Basic Physical Chemistry concepts		-	-	2	1

Course Objectives:

1. To learn the determination of surface chemistry of a liquid.
2. To learn the determination of viscosity of a liquid.
3. To learn the laboratory techniques involved in the Determination of molecular status and partition coefficient of benzoic acid in benzene and water
4. To understand the chemical reactions involved in the Adsorption of acetic acid on animal charcoal, verification of Freundlich isotherm

Course Outcomes:

On Completion of the course, the students will be able to

CO1	Understand the basic concepts of surface chemistry of a liquid.
CO2	To learn the basic concepts of viscosity of a liquid.
CO3	Apply the concepts of partition coefficient
CO4	Acquire knowledge and application of Freundlich adsorption isotherm.

Course with focus on employability / entrepreneurship / Skill Development modules

Skill Development		Employability		Entrepreneurship	-

Syllabus

Practical- General Chemistry Lab

- (i) Determination of surface tension of liquid
- (ii) Determination of viscosity of liquid
- (iii) Determination of molecular status and partition coefficient of benzoic acid in benzene and water
- (iv) Adsorption of acetic acid on animal charcoal , verification of Freundlich isotherm

References:

1. Unified Chemistry, OP Agarwal, Jaiprakash Nath Publications

Web Links:

1. <https://youtu.be/adA8doZhqWs>

CO-PO Mapping:

1: Slight [Low]; 2: Moderate [Medium]; 3: Substantial [High]; 4: (No Correlation);

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO 2	PSO 3
C O 1	3	3	3	2	3	2	2	2	3	2	2	3	3
C O 2	3	3	3	2	3	2	2	3	2	3	3	3	3
C O 3	3	2	3	2	3	1	2	2	2	2	2	3	2
C O 4	3	3	2	1	3	2	2	1	3	3	3	3	3
Avg.	3	2. 75	2 .7 5	2	3	2	2	2	2.5	2.5	2.5	3	2.75

III SEMESTER SYLLABUS FOR ANALYTICAL CHEMISTRY (H)



**Government College (Autonomous)
Rajahmundry**

Program & Semester

Course Code C5	TITLE OF THE COURSE Organic Chemistry – 1 (Fundamentals in Organic chemistry)	ANALYTICAL CHEMISTRY (III Semester)			
Teaching	Hours Allocated: 45 (Theory)	L	T	P	C
Pre-requisites	Exposure to basic concepts of organic chemistry, such as types of bonds, hybridization, isomerism, and functional groups	3	-	-	3

Course Objectives:

To understand the fundamental concepts of structural theory, resonance, aromaticity, and electronic effects in organic chemistry.

To study the structure, preparation, properties, and reactivity of alkenes, alkynes, and cycloalkanes.

To analyze the structure, stability, and characteristic reactions of benzene and its derivatives.

To develop problem-solving skills in predicting reactivity, mechanisms, and applications of hydrocarbons in organic synthesis.

Course Outcomes:

On Completion of the course, the students will be able to		Cognitive Domain
CO1	Understand the fundamental principles of structural theory in organic chemistry, including hybridization, resonance, aromaticity, and electronic effects.	Knowledge
CO2	Explain the preparation methods, properties, and mechanisms of reactions of alkenes and alkynes	Understanding
CO3	Analyze the stability, conformational aspects, and strain effects in cycloalkanes	Analysis
CO4	Evaluate the structure, resonance stabilization, and electrophilic substitution reactions of benzene and its derivatives to predict orientation and reactivity.	Application

Course with focus on employability / entrepreneurship / Skill Development modules

Skill Development		Employability		Entrepreneurship	

SYLLABUS

Types of bond fission – Homolytic and Heterolytic fissions, organic reagents - Electrophiles, Nucleophiles with examples Inductive effect. Application of inductive effect (a) Basicity of amines (b) Acidity of carboxylic acids (c) Stability of carbonium ions. Resonance or Mesomeric effect, application to acidity of phenol, and (b) acidity of carboxylic acids. Hyper conjugation and its application to stability of carbonium ions, Free radicals and alkenes, carbanions. Types of Organic reactions: Addition - electrophilic, nucleophilic and free radical. Substitution - electrophilic, nucleophilic and free radical. Elimination- Examples.

UNIT-II: ACYCLIC HYDROCARBONS

9 Hrs.

Alkenes - Preparation of alkenes. Properties: Addition of hydrogen - heat of hydrogenation and stability of alkenes. Addition of halogen and its mechanism. Addition of HX, Markonikov's rule, addition of H₂O, HOX, H₂SO₄ with mechanism and addition of HBr in the presence of peroxide (anti - Markonikov's addition). Dienes - Types of dienes, reactions of conjugated dienes - 1,2 and 1,4 addition of HBr to 1,3 - butadiene and Diels - Alder reaction

UNIT-III:

9 Hrs.

Alkynes - Preparation by dehydrohalogenation of dihalides, dehalogenation of tetrahalides, Properties; Acidity of acetylenic hydrogen (formation of Metal acetylides). Reduction and Polymerization reaction of acetylene. Preparation of higher acetylenes, Metal ammonia reductions, Chemical reactivity - electrophilic addition of X₂, HX, H₂O (Tautomerism), Oxidation with KMnO₄, OsO₄,

UNIT-IV: ALICYCLIC HYDROCARBONS (CYCLOALKANES)

9 Hrs.

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

UNIT – V: BENZENE AND ITS REACTIVITY

9 Hrs.

Concept of aromaticity - aromaticity (definition), Huckel's rule - application to Benzenoid (Benzene, Naphthalene) and Non - Benzenoid compounds (cyclopropenyl cation, cyclopentadienyl anion and tropylium cation) Reactions - General mechanism of electrophilic substitution, mechanism of nitration, Friedel Craft's alkylation and acylation. Orientation of aromatic substitution - Definition of ortho, para and meta directing groups. Ring activating and deactivating groups with examples (Electronic interpretation of various groups like NO₂ and Phenolic). Orientation of (i) Amino, methoxy and methyl groups (ii) Carboxy, nitro, nitrile, (iii) Halogens

Text books:

Reference Books

8. **Morrison, R. T. & Boyd, R. N.** – *Organic Chemistry*, 6th Edition, Pearson.
9. **Solomons, T. W. G., Fryhle, C. B. & Snyder, S. A.** – *Organic Chemistry*, 12th Edition, Wiley.
10. **Peter Sykes** – *A Guidebook to Mechanism in Organic Chemistry*, 6th Edition, Pearson.
11. **I. L. Finar** – *Organic Chemistry Volume 1: The Fundamental Principles*, 6th Edition, Pearson.
12. **Paula Yurkanis Bruice** – *Organic Chemistry*, 8th Edition, Pearson.
13. **K. S. Tewari & N. K. Vishnoi** – *A Textbook of Organic Chemistry*, Vikas Publishing.
14. **Bahl, A. & Bahl, B. S.** – *Advanced Organic Chemistry*, S. Chand Publishing.

Open Educational Resources (OERs)

2. **NCERT Chemistry Textbooks (Class XI & XII)** – Clear explanations of hydrocarbons, resonance, aromaticity, etc.
NCERT e-Books

CO-PO Mapping:

(1: Slight [Low]; 2: Moderate [Medium]; 3:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	2	3	2	2	2	3	3	2	2	3	3	3
CO2	2	3	3	3	3	2	2	2	2	3	2	2	3
CO3	3	3	3	2	2	1	1	2	3	1	2	3	3
CO4	2	3	2	1	3	2	3	1	2	3	3	2	2
Avg.	2.5	2.75	2.75	2	2.5	1.75	2.25	2	2.25	2.25	2.5	2.5	2.75

Substantial [High], '-' : No Correlation)

Proposed activities:

Skill Development:

4. Molecular visualization, drawing resonance structures, predicting electronic effects.
5. Application of Markovnikov's and anti-Markovnikov's rules.
6. Designing synthetic routes, applying acidity and substitution reactions, understanding industrial applications

Employability:

3. Structural Theory in Organic Chemistry: Skills in molecular structure and reactivity analysis are essential for **chemical, pharmaceutical, and R&D industries**.
4. Alkenes & Alkynes: Useful in **petrochemical, plastics, and polymer industries** (e.g., polyethylene, polypropylene production), Relevant for **industrial organic synthesis, agrochemicals, and medicinal chemistry** sectors.

Entrepreneurship:

3. Alkenes & Alkynes: Small-scale production of **polymers, plastics, and synthetic rubbers**. Acetylene applications in **welding, fuel gases, and specialty chemicals**.
4. Benzene & its reactivity: Production of **aromatic derivatives** used in **dyes, pharmaceuticals, and polymers**.

GOVERNMENT COLLEGE (A),
RAJAMAHENDRAVARAM
II B.Sc. Chemistry (Hons.)
SEMESTER -III

Chemistry Course -5: ORGANIC CHEMISTRY – 1
BLUE PRINT

TIME: 2½ hr.

MARKS: 50 M

SECTION - A

Answer ALL the questions

(5 X 7 = 35 M)

19. Question from Unit -I
(OR)
20. Question from Unit -I
21. Question from Unit -II
(OR)
22. Question from Unit -II
23. Question from Unit -III
(OR)
24. Question from Unit -III
25. Question from Unit -IV
(OR)
26. Question from Unit -IV
27. Question from Unit -V
(OR)
28. Question from Unit -V

SECTION-B

Answer any Five of the following

(5 X 3 = 15 M)

29. Question from Unit –I
30. Question from Unit –II
31. Question from Unit –III
32. Question from Unit –IV
33. Question from Unit –V
34. Question from Unit –I
35. Question from Unit –II
36. Question from Unit –V

GOVERNMENT COLLEGE (A),
RAJAMAHENDRAVARAM

II B.Sc. CHEMISTRY(HONS)
SEMESTER -III

C5: ORGANIC CHEMISTRY -1

BLUE PRINT

S. No.	Course Content	Essay Questionns (7M)	Short Answer Questionns (4M)	Total No. Of Questions from each Unit
1	Unit –I	2	2	4
2	Unit –II	2	2	4
3	Unit –III	2	1	3
4	Unit –IV	2	1	3
5	Unit –V	2	2	4
	TOTAL	10	8	18

MODEL PAPER

TIME: 2½ hr.

MARKS: 50 M

SECTION - A

Answer ALL the questions

(5 X 7 = 35 M)

- a. Explain the Inductive effect with examples and write its applications BT3

i. (OR)

- b. Discuss the types of organic reactions with suitable examples BT2

2. Write any two preparation methods of Alkenes and explain its chemical reactions BT2

i. (OR)

3. Explain 1,2 – and 1,4 – addition reactions in 1,3 – Butadiene BT4

4. Describe the preparation methods and chemical properties of alkynes BT2

i. (OR)

5. How higher alkynes are prepared? explain their chemical reactions BT3

6. How Bayer strain theory used for explaining the stability of cycloalkanes? BT4

i. (OR)

7. Discuss the conformational isomers of cyclohexane by using Sack – Mohr theory

8. Discuss the electrophilic substitution reactions in Benzene BT3

i. (OR)

9. Write about the concept of aromaticity based on Huckels rule BT2

10. SECTION-B

i. Answer any Five of the following

(5 X 3 = 15 M)

11. Explain the acidity of phenol based on Mesomeric effect BT4

12. Write a short note on Markovnikov's rule? BT3

13. Discuss briefly about the acidity of acetylene? BT2

14. What are Cycloalkanes? Give examples BT1

15. What is the difference between Benzenoid and non – benzenoid aromatic compounds? BT2

16. What is ring activating groups? Give examples BT2

17. Write briefly about Homolytic and Heterolytic fissions? BT3

18. What is Diels – Alder reaction? Give example BT2

GOVERNMENT COLLEGE (A), RAJAMAHENDRAVARAM

II B.Sc. Chemistry (Hons.)

SEMESTER -III

Chemistry Course -5: ORGANIC CHEMISTRY – 1

QUESTION BANK

ESSAY QUESTIONS: 07 Marks

1. Discuss Inductive effect and write its applications
2. Explain about the types of organic reactions with suitable examples
3. Write any two preparation methods of alkenes and write its chemical properties
4. Explain the 1,2 – and 1,4 - addition reactions of 1,3 – butadiene
5. Write any two preparation methods of alkynes and write its chemical properties
6. How higher alkynes are prepared? write its chemical reactions
7. Explain the stability of cycloalkanes by using Baeyer strain theory
8. Discuss the conformational isomers of cyclohexane by using Sachse – Mohr theory
9. Explain the aromatic electrophilic substitution reactions in Benzene
10. Discuss the benzenoid and non – benzenoid aromatic compounds with examples
11. Write the Nitration and Friedel craft alkylation reactions in benzene with mechanism

SHORT QUESTIONS: 03 Marks

14. Write a short note on the acidity of phenol based on Mesomeric effect
15. Write briefly about Homolytic and Heterolytic bond fissions
16. Define electrophile and nucleophile with example
17. What is Markonikovs rule? Give example
18. Write a note on types of dienes
19. What is Diel's alder reaction? Give example
20. Discuss briefly about the acidity of acetylene
21. What are alkynes and higher alkynes? Give examples
22. What are cycloalkanes? Give examples
23. Write the preparation methods of cycloalkanes
24. Write the concept of Aromaticity based on Huckels rule
25. What is ring activating groups? Give examples
26. What are ring deactivating groups? give example

	Government College (Autonomous) Rajahmundry	Program & Semester			
Course Code C5P	TITLE OF THE COURSE Course -5: Organic Functional group analysis	II B.Sc. Chemistry (Hons.) (III Semester)			
Teaching	Hours Allocated: 30 (Practical)	L	T	P	C
Pre-requisites	Basic concept of systematic organic qualitative analysis.	-	-	2	2

Course Objectives:

- To understand the fundamental principles and systematic approach for identifying organic functional groups.
- To develop practical skills in performing preliminary, group-specific, and confirmatory tests for organic compounds.
- To apply functional group analysis in interpreting chemical behavior and relating structure with reactivity.

Course Outcomes:

On Completion of the course, the students will be able to	
CO1	Identify physical properties and solubility behavior of organic compounds as a preliminary step in functional group analysis.
CO2	Perform systematic chemical tests to detect functional groups in organic compounds.
CO3	Analyze experimental results to confirm the presence of specific functional groups using multiple tests.
CO4	Relate functional group identification with chemical reactivity and practical applications in organic chemistry.

Course with focus on employability / entrepreneurship / Skill Development modules

Skill Development		Employability		Entrepreneurship	

II B.Sc. CHEMISTRY (H)

SEMESTER -III

C5- ORGANIC FUNCTIONAL GROUP ANALYSIS

PRACTICAL SYLLABUS

30 Hrs. (02 Hrs. / Wk.)

Organic functional group analysis:

Reactions of the following functional groups present in the organic compound.

Alcohols, Phenols, Aldehydes, Ketones, Carboxylic acids, Amines, Carbohydrates

Textbooks:

4. Vogel, A. I. – Vogel's Textbook of Practical Organic Chemistry, 5th Edition, Pearson.
5. Furniss, B. S., Hannaford, A. J., Smith, P. W. G., & Tatchell, A. R. – Vogel's Textbook of Practical Organic Chemistry, ELBS.
6. J. N. Gurtu & R. Kapoor – Advanced Experimental Chemistry: Organic, S. Chand Publishing.

Reference Books

5. O. P. Agarwal – Practical Organic Chemistry, Krishna Prakashan Media.
6. Raj K. Bansal – Laboratory Manual of Organic Chemistry, New Age International.
7. Ahluwalia, V. K. & Aggarwal, R. – Comprehensive Practical Organic Chemistry: Qualitative Analysis, Universities Press.
8. Bahl, B. S. & Arun Bahl – Advanced Organic Chemistry, S. Chand Publishing (for functional group theory & background).

CO-PO Mapping:

Slight [Low];

Moderate [Medium]; 3: Substantial [High], '-' : No Correlation)

(1:
2:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	2	3	2	2	2	3	3	2	2	3	3	3
CO2	2	3	3	3	3	2	2	2	2	3	2	2	3
CO3	3	3	3	2	2	1	1	2	3	1	2	3	3
CO4	2	3	2	1	3	2	3	1	2	3	3	2	2
Avg.	2.5	2.75	2.75	2	2.5	1.75	2.25	2	2.25	2.25	2.5	2.5	2.75

GOVERNMENT COLLEGE (A),RAJAMAHENDRAVARAM

II B.Sc. CHEMISTRY (HON.)

SEMESTER -IV

C5- ORGANIC CHEMISTRY -1

(Organic functional group analysis)

AT THE END OF SEMESTER –III

SCHEME OF VALUATION

Time: 03 Hrs.

Max. Marks: 50 M

4. Record	-----	10 Marks
5. Practical	-----	35 Marks
6. Viva - voce	-----	05 Marks

Splitting of Practical Marks : (35M)

Preliminary examination in
10 minutes : 05 M

Confirmation tests : 10 M

Derivative preparation : 10 M

Reporting : 10 M

	Government College (Autonomous) Rajahmundry	Program & Semester II B.Sc. ANALYTICAL CHEMISTRY (H) (SEMESTER – III)			
Course Code 6	TITLE OF THE COURSE Course - 6: ORGANIC CHEMISTRY (Halogen And Oxygen Containing Organic Compounds)				
Teaching	Hours Allocated: 45 (Theory) (3 hrs. / Wk.)	L	T	P	C
Prerequisites:	Basic knowledge on structure and reactivity of organic compounds	3	-	-	3

Course Objectives:

11. To provide knowledge on reactivity of Halogen and Oxygen containing organic compounds.
12. To provide basic awareness on preparatory methods of Halogen and Oxygen containing organic compounds.
13. To understand classification of carbohydrates and structural elucidation of glucose & fructose.

Course Outcomes:

On Completion of the course, the students will be able to-		Cognitive Domain
CO1	Understand the concept of SN1 and SN2 mechanisms	Understanding
CO2	Describe the reactivity of alkyl halides, alcohols and phenols.	Application
CO3	Achieve the skills required to propose various mechanisms	Skill
CO4	Apply the concepts for synthesising various Halogen & Oxygen containing organic compounds	Application

Course with focus on employability / entrepreneurship / Skill Development modules

Skill Development		Employability		Entrepreneurship	

Syllabus:

Unit – I Halogen compounds (9 h)

Alkyl halides: Preparation of alkyl halides from i) alkanes, ii) alkenes and iii) alcohols. Properties - nucleophilic substitution reactions–SN1 and SN2 mechanisms with energy profile diagrams and stereo chemical aspects. Williamson's synthesis.

Aryl halides: Preparation i) from phenols ii) Sandmeyer's reaction, nucleophilic aromatic substitution (Benzyne mechanism); relative reactivity of alkyl, allyl, vinyl and benzyl, aryl halides towards nucleophilic substitution reactions.

Unit - II Alcohols and Phenols (9 h)

Alcohols: Nomenclature, classification, Preparation of 1^o, 2^o, 3^o alcohols from Grignard's reagent, Bouveault–Blanc Reduction; Chemical properties –A) Reactions involving only the hydrogen atom of -OH group B) Reactions involving -OH group as a whole. Distinction between 1^o, 2^o, 3^o alcohols with Lucas reagent. Pinacol – Pinacolone rearrangement with mechanism.

Phenols: Preparation from diazonium salt and Cumene. Reactions and mechanism–Reimer–Tiemann, Kolbe–Schmitt Reactions, Fries and Claisen rearrangements

Unit - III Carbonyl Compounds (9 h)

Preparation from- Acid chlorides, 1,3-dithiane and nitriles; Structure and reactivity of carbonyl group, Nucleophilic addition reactions with HCN, NaHSO₃ and alcohols. Addition - elimination reactions with hydroxylamine, hydrazine, phenyl hydrazine, 2,4DNP, semi-carbazide. Oxidations and reductions (Baeyer -Villiger oxidation, KMnO₄, Clemmensen's, Wolf–Kishner's, with LiAlH₄ & NaBH₄).

Reaction & Mechanism- Aldol condensation, Cannizzaro reaction, Perkin reaction, Benzoin condensation, Claisen-Schmidt reaction, Haloform reaction.

Unit-IV Carboxylic acid (9h)

Carboxylic Acids: Preparation from Grignard reagent and hydrolysis of nitriles, Reactions of monocarboxylic acids- Reactions involving -H, -OH and -COOH groups, formation of salts, esters, acid chlorides, amides and anhydrides. Degradation of carboxylic acids by Huns - Diecker's reaction, decarboxylation by Schmidt reaction, Arndt-Eistert synthesis, halogenation by Hell- Volhard- Zelinsky reaction. Mechanisms of acidic and alkaline hydrolysis of esters, Reformatsky reactions, Curtius rearrangement.

Unit - V: Active Methylene Compounds (9h)

Active methylene compounds: Keto-enol tautomerism, preparation of Acetic Aceto Ester (AAE) by Claisen condensation with mechanism, synthetic applications of AAE in the preparation of mono carboxylic acids, di carboxylic acids, α,β -unsaturated acids and heterocyclic compounds.

List of Reference Books

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

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

9. Guide book to Mechanism in Organic Chemistry by Peter Sykes 6th edition, 1985.

CO-PO Mapping: 1: Slight [Low]; 2: Moderate [Medium];

3: Substantial [High], -: No Correlation

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	2	2	3	2	2	2	3	3	2	2	3	3	3
CO2	2	3	3	3	3	2	1	2	2	3	2	2	3
CO3	3	3	3	2	2	1	1	2	3	1	2	3	3
CO4	2	1	1	1	3	2	3	1	2	3	2	3	2
Avg.	2.25	2.25	2.5	2.0	2.5	1.75	2.0	2.0	2.25	2.25	2.25	2.75	2.75

Government College (A), Rajamahendravaram II B.Sc.
Organic Chemistry(H) Semester – 3 Course -6: Organic
Chemistry

(Halogen and Oxygen containing organic compounds)

Weightage to Content & Blue Print

S.No.	Course Content	Long Answer Questions	Short Answer Questions	Total Marks
1.	UNIT - I	2	1	17
2.	UNIT – II	2	2	20
3.	UNIT – III	2	2	20
4.	UNIT – IV	2	2	20
5.	UNIT - V	2	1	17
	TOTAL	10	8	94

Government College (A), Rajahmundry
II B.Sc. Organic Chemistry (H) Semester-3
Course - 6: ORGANIC CHEMISTRY
(Halogen and Oxygen containing organic compounds)

Model Paper

Time: 21/2 hrs.

Maximum Marks: 50

PART - A

Answer **ALL** the questions. Each carry SEVEN marks 5 x 7 = 35 M

1. Discuss the mechanism and stereochemistry of SN1 and SN2 reactions taking suitable examples. BT2 CO1

(OR)

2. Write a short note on the following BT1 CO3

a. Sandmeyer reaction b) Benzyne mechanism

3. a) Write the preparation of alcohols using Grignard reagent and Bouveault - Blanc reduction BT1 CO4

(or)

4. b) Explain Lucas method for identification of 1^o, 2^o, 3^o alcohols. BT3 CO2

5. Explain the mechanism of Reimer-Tiemann and Kolbe - Schmidt reaction. BT1 CO3

(OR)

6. How does Acetone react with the following reagents BT3 CO3

a. i)HCN ii) NaSHO₃ iii) NH₂OH iv) NH₂NH₂

7. Discuss Aldol condensation and Cannizaro reaction with mechanism. BT1 CO2

(or)

8. Write any two preparation methods of carboxylic acids and explain Esterification reaction with mechanism. BT3 CO3

9. Explain the acidic and alkaline hydrolysis of esters with mechanism. BT2 CO2

(OR)

10. Write the preparation and any two synthetic applications of Aceto Acetic Ester. BT2 CO1

PART- B

11. Answer **any FIVE** of the following questions. Each carry THREE marks 5 x 3 = 15 M

12. Compare the reactivity of alkyl halides with vinyl halides BT4 CO2

13. Write the mechanism for Pinacol-Pinacolone rearrangement. BT2 CO1

14. Write a short note on Fries rearrangement. BT1 CO3

15. Give any two reduction reactions of carbonyl compounds. BT1 CO4
16. Explain the mechanism of Perkin reaction BT2 CO1
17. Explain Arndt-Eistert reaction. BT2 CO4
18. Write a note on Hunsdiecker's reaction BT2 CO3
19. Write a note on Keto-enol tautomerism. BT2 CO2

YouTube video sources:

https://youtube.com/watch?v=Bi_01qiVr0I&feature=share8

<https://youtube.com/watch?v=SJr2JTn7W7M&feature=share8>

https://youtube.com/watch?v=YNG_iSNA9vk&feature=share8

<https://youtube.com/watch?v=Wk-dH4V4AOQ&feature=share8>

<https://youtube.com/watch?v=YVWGGOsxboQ&feature=share8>

<https://youtube.com/watch?v=EWBhJw-6DIQ&feature=share8>

<https://youtube.com/watch?v=mPUiMh4hnok&feature=share8>

<https://youtube.com/watch?v=DMFi7DhrKUA&feature=share8>

II B.Sc., Semester-3 Course - 6: Organic Chemistry (Halogen And Oxygen Containing Organic Compounds)
Question Bank

Unit -1

1. Discuss the mechanism and stereochemistry of SN1 reaction taking suitable examples. (7 marks)
2. Discuss the mechanism and stereochemistry of SN2 reactions taking suitable examples. (7 marks)
3. Write a short note on the following. (7 marks) a) Sandmeyer reaction b) Benzyne mechanism
4. Williamson's synthesis (3 marks)
5. Sandmeyer reaction (3 marks)

Unit – 2

1. Write any two methods of preparation and any two properties of phenol. (7 marks)
2. Explain Reimer-Tiemann reaction with mechanism. (7 marks)
3. Write notes on (a) pinacol – pinacolone rearrangement and (b) Lucas method for identification of 10, 20, 30 alcohols. (7 marks).
4. Write the preparation of alcohols using Grignard reagent and Bouveault (3 marks)
5. Explain Kolbe - Schmidt reaction. (3 marks)
6. How does Acetone react with the following reagents? (3 marks) i) HCN ii) NaSHO₃ iii) NH₂OH
7. Explain Fries rearrangement. (3 marks).

Unit – 3

1. Discuss Aldol condensation and Cannizzaro reaction with mechanism. (7 marks)
2. Explain the mechanism of Perkin reaction and Benzoin condensation. (7 marks)
3. Write any two methods of synthesis of aldehydes and ketones each. (7 marks)
4. Write notes on Clemmensen reduction and Wolf-Kishner reduction (3 marks)
5. Explain Haloform reaction (3 marks).
6. Explain how carbonyl compounds respond to Tollens and Fehling's reagents. (3 marks).
7. Give any two reduction reactions of carbonyl compounds. (3 marks)

Unit - 4

1. Write any two preparation methods of carboxylic acids and explain HVZ reaction. (7 marks)
2. Explain esterification reaction with mechanism. (7 marks)
3. Write a note on a) Hunsdiecker's reaction and b) Ester hydrolysis reaction. (7 marks)
4. Explain Arndt-Eistert reaction. (3 marks).
5. Write a note on Schmidt reaction. (3 marks).
6. Write a note on halogenation by Hell- Volhard- Zelinsky reaction. (3 marks).
7. How ester is formed from carboxylic acid? Give example. (3 marks).

Unit - 5

1. Write the preparation and any two synthetic applications of Aceto Acetic Ester. (7 marks)
2. What is active methylene compound? Explain Claisen condensation. (7 marks)
3. Write with equations how a) acetic acid, b) succinic acid, c) 4-methyl uracil can be prepared from aceto acetic ester. (7 marks).
4. Write a note on keto-enol tautomerism. (3 marks).
5. Explain the reaction between acetoacetic ester and urea (3 marks).

	Government College (Autonomous) Rajahmundry	Program & Semester II B.Sc., ORGANIC CHEMISTRY(H) (III Semester)			
Course Code C6 -P	TITLE OF THE COURSE Course -6: ORGANIC PREPARATIONS (Halogen and Oxygen containing organic compounds)				
Teaching	Hours Allocated: 30 (Practical)	L	T	P	C
Pre-requisites	Basic knowledge on handling of glassware and chemicals	-	-	2	1

Course Objectives:

- 7.To provide basic knowledge about the handling of laboratory apparatus
- 8.To provide knowledge on calculating limiting reagent, theoretical yield, and percent yield.
- 9.To provide hands on training on laboratory techniques including reflux, distillation, recrystallization, vacuum filtration, MP & BP determinations.

Course Outcomes:

On Completion of the course, the students will be able to	
CO 1	How to use glassware, equipment and chemicals and follow experimental procedures in the laboratory.
CO 2	How to calculate limiting reagent, theoretical yield, and percent yield.
CO 3	How to perform common laboratory techniques including reflux, distillation, recrystallization, vacuum filtration.
CO 4	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.

Course with focus on employability / entrepreneurship / Skill Development modules

Skill Development		Employability		Entrepreneurship	-

Syllabus - Organic preparations (50M)

5. Acetylation of β -naphthol, vanillin and salicylic acid by:

a) Using conventional method. b) Using green approach

6. Preparation of Nerolin

Reference books:

7. Vogel A.I. Practical Organic Chemistry, Longman Group Ltd.

8. Bansal R.K. Laboratory Manual of Organic Chemistry, Wiley-Eastern.

9. Ahluwalia V. K. and Agarwal R. Comprehensive Practical Organic Chemistry, University press.

CO-PO Mapping:

1. Slight [Low]; 2. Moderate [Medium];
3. Substantial [High], 4. (No Correlation)

	P O 1	P O 2	P O 3	P O 4	P O 5	P O 6	P O 7	P O 8	P O 9	P O 10	PS O1	PS O2	PS O3
CO 1	2	3	3	2	3	2	2	2	3	2	2	3	3
CO 2	3	3	3	2	3	2	2	3	2	3	3	3	3
CO 3	3	2	3	2	3	1	2	2	2	2	2	3	2
CO 4	3	3	2	1	3	2	2	1	2	3	3	3	3
Avg.	2.75	2.75	2.75	2	3	2	2	2	2.25	2.5	2.5	3	2.75

	Government College (Autonomous) Rajahmundry	Program & Semester II B.Sc. ANALYTICAL Chemistry (H) III Semester Course 7			
Course Code 7	TITLE OF THE COURSE PHYSICAL CHEMISTRY				
Teaching	Hours Allocated: (Theory) 45	L	T	P	C
Pre-requisites:	Basic Knowledge about Solids, Liquids, Gases and Solutions	3		-	3

Course Objectives:

The objective of this course is to provide students with a comprehensive understanding of the essential concepts and applications of Solids, liquids, gases, solutions and ionic equilibria. The course aims to develop students' critical thinking, problem-solving, and analytical skills in these areas, enabling them to apply scientific principles to real-world situations.

On Completion of the course, the students will be able to-		Cognitive Domain
CLO1	Gain Knowledge about the concepts of Solutions . solids. Liquids .gases and ionic equilibrium	Knowledge
CLO2	At the end of the course , the students will be able to Understand the basic concepts of Solids, Liquids, Gases. Solutions and ionic equilibria	Understanding
CLO3	application of Distribution law to various systems, application of liquid crystals to LCD devices	Application
CLO4	compare and conclude theoretical concepts and applications to day to situations	Evaluation
CLO5	Analyze and calculate the mathematical problems on different concepts	Analysis

Course with focus on employability / entrepreneurship / Skill Development modules

Skill Development		Employability		Entrepreneurship	

Syllabus:

PHYSICAL CHEMISTRY

3 hrs/week

UNIT-I

9h

SOLID STATE: Symmetry in crystals. Law of constancy of interfacial angles. The law of rationality of indices. The law of symmetry. Definition of lattice point, space lattice, unit cell.

X-ray diffraction and crystal structure. Bragg's law. Defects in crystals. Stoichiometric and non-stoichiometric defects.

UNIT-II

9h

GASEOUS STATE Introduction and derivation of Ideal Gas Equation. Vander Waal's equation of state. P-V Isotherms of real gases, Andrew's isotherms of carbon dioxide. Critical phenomena. The vanderwaal's equation and the critical state. Law of corresponding states. Relationship between critical constants and vander Waal's constants. Joule Thomson effect.

UNIT-III:

9h

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

UNIT-IV

9h

SOLUTIONS Liquid-liquid - ideal solutions, Raoult's law. Ideally dilute solutions, Henry's law. Non-ideal solutions. Azeotropes-HCl-H₂O, ethanol-water systems and fractional distillation. Partially miscible liquids-phenol-water. Effect of impurity on consolute temperature. Immiscible liquids and steam distillation. Nernst distribution law. Calculation of the partition coefficient. Applications of distribution law.

UNIT-V

9h

IONIC EQUILIBRIUM AND HSAB Ionic Product, common ion effect, solubility and solubility product. Definition of acid and base with examples, Pearson concept, HSAB Principle & its importance definition of buffer solution. Henderson –Hassel batch Equation

List of Reference Books

- 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

Web Links:

<https://youtu.be/IPN0WWWfwts?list=PLHhInNg2PQWVHNecGWt3YAxFcKTW44nJX>

<https://youtu.be/cmnmqmdTZU80>

CLO-PLO Mapping:

(1: Slight[Low]; 2: Moderate[Medium]; 3: Substantial[High], '-': No Correlation)

Proposed Activities:

Skill Development: 1.

Employability

	PL O1	PL O2	PL O3	PL O4	PL O5	PL O6	PL O7	PL O8	PL O9	P L O 10
CLO1	3	2	2	1	1	0	0	0	3	0
CLO2	3	1	2	1	1	0	0	0	3	0
CLO3	3	3	3	1	1	0	0	0	3	0
CLO4	3	3	3	2	2	0	0	0	3	0
CLO5	3	3	3	2	2	0	0	0	3	0
Avg.	3	2.4	2.6	1.4	1.4	0	0	0	3	0

GOVERNMENT COLLEGE (A), RAJAMAHENDRAVARAM
II B.Sc. CHEMISTRY (H) SEMESTER-III (2025-26)

CHEMISTRY COURSE-7: PHYSICAL CHEMISTRY
QUESTION PAPER BLUE PRINT

TIME: 2½ Hrs.

MAX. MARKS: 50 PART – A

Answer **ALL** the following questions.

5x7 = 35 M

1a	Question from UNIT-I	OR
1b	Question from UNIT-I	
2a	Question from UNIT-II	OR
2b	Question from UNIT-II	
3a	Question from UNIT-III	OR
3b	Questions from UNIT-III	
4a	Question from UNIT-IV	OR
4b	Question from UNIT-IV	
5a	Question from UNIT-V	OR
5b	Question from UNIT-V	

PART – B

Answer any

FIVE of the following questions.

5x3 = 15 M

6	Question from UNIT-I
7	Question from UNIT-II
8	Question from UNIT-III
9	Question from UNIT-IV
10	Question from UNIT- V
11	Question from UNIT-I
12	Question from UNIT-II
13	Question from UNIT- IV

GOVERNMENT COLLEGE (A), RAJAHMUNDRY

II B.Sc. CHEMISTRY (H)

SEMESTER-III

MODEL PAPER (From 2025-26)

Course - 7: PHYSICAL CHEMISTRY

Time: 2½ Hrs

Max. Marks: 50

PART- A

Answer ALL the questions. Each question carries SEVEN marks

5 x 7 = 35 M

		Marks	BL	CLO	PLO	PI
1a	Derive Bragg's equation. OR	7	6	1	1	
1b	What are crystal defects? Explain stoichiometric crystal defects with suitable examples.	7	1	1	2	
2a	What are critical constants? Derive the relationships between critical constants and Vander Waal's constants. OR	7	6	2	2	
2b	Derive Vander Waal's gas equation.	7	6	2	2	
3a	What are liquid crystals? Explain the classification and properties of liquid crystals. OR	7	2	3	7	
3b	Write the structural differences between solids, liquids and gases.	7	1	3	5	
4a	What are azeotropes? Explain maximum boiling azeotropes and minimum boiling azeotropes with suitable examples. OR	7	2	4	3	
4b	What are partially miscible liquid mixtures? Explain Phenol -Water system.	7	2	4	2	
5a	Discuss the HSAB principle and its applications. OR	7	2	5	5	
5b	Describe the common ion effect with suitable example.	7	2	5	4	

PART – B

Answer any **FIVE** of the following questions.

5x3 = 15 M

- 6 Define the terms unit cell, lattice point and space lattice.
- 7 Write a short note on Joule-Thomson's effect.
- 8 Write the applications of liquid crystals.
- 9 What are differences between Ideal and Non-Ideal solutions?
- 10 Define the terms solubility and solubility product and derive the relationship between them.
- 11 Explain the law of rational indices.
- 12 Explain law of corresponding states.
- 13 Discuss Nernst distribution law.

Marks	BL	CLO	PLO	PI
3	1	1	1	
3	1	2	2	
3	3	3	3	
3	4	4	5	
3	6	5	7	
3	2	1	2	
3	4	2	3	
3	2	4	3	

GOVERNMENT COLLEGE (A) RAJAMAHENDRAVARAM
II B.Sc. CHEMISTRY
SEMESTER – III
PAPER –C-7 : PHYSICAL CHEMISTRY

QUESTION BANK

Essay type questions. Each question carries 7 marks.				
Unit-1	Marks	BL	CLO	PLO
1. Derive Bragg's equation.	7	6	1	1, 4
2. What are crystal defects? Explain stoichiometric crystal defects with suitable examples.	7	2	1	1, 4
3. Explain the law of symmetry.	7	2	1	1, 4
Unit-II	Marks	BL	CLO	PLO
1. Derive Vander Waal's gas equation.	7	6	2	1, 2, 3
2. What are critical constants? Derive the relationships between critical constants and Vander Waal's constants.	7	6	2	1, 2, 3
3. Explain the law of corresponding states.	7	2	2	1, 2, 3
Unit-III	Marks	BL	CLO	PLO
1. What are liquid crystals? Explain the classification and properties of liquid crystals.	7	2	3	1, 2, 3
2. Explain Nematic and Smectic liquid crystals with suitable examples.	7	2	3	1, 2, 3
Unit-IV	Marks	BL	CLO	PLO
1. What are azeotropes? Explain maximum boiling azeotropes and minimum boiling azeotropes with suitable examples.	7	2	4	1, 2, 3
2. Explain Nernst distribution law and its applications.	7	2, 4.	4	1, 2, 3
3. What are partially miscible liquid mixtures? Explain Phenol -Water system.	7	2	4	1, 2, 3
Unit-V	Marks	BL	CLO	PLO
1. Discuss the HSAB principle and its applications.	7	2,4.	5	1, 2, 3, 4
2. Explain common ion effect with suitable examples.	7	2	5	1, 2, 3, 4

Short answer questions. Each question carries 3 marks.

Unit-1	Marks	BL	CLO	PLO
1. Define the terms unit cell, lattice point and space lattice.	3	1	1	1, 4
2. Write a short note on the law of constancy of interfacial angles	3	2	1	1, 4
3. Explain the law of rational indices.	3	2	1	1, 4
Unit-II	Marks	BL	CLO	PLO
1. Explain Joule -Thomson effect.	3	2	2	1, 4
2. Write a short note on Vander Waal's constants a & b.	3	2	2	1, 2, 3
3. Derive reduced equation of state.	3	6	2	1
Unit-III	Marks	BL	CLO	PLO
1. Write the structural differences between solids, liquids and gases.	3	4	3	1, 2, 3
2. Discuss the applications of liquid crystals.	3	2,4.	3	1, 4
Unit-IV	Marks	BL	CLO	PLO
1. Write the differences between Ideal and Non-Ideal solutions.	3	4	4	1
2. Discuss Raoult's law.	3	2,6.	4	1, 2, 3
3. Explain Henry's law.	3	4	4	1, 4
4. What is critical solution temperature and explain the effect of impurities on critical solution temperature.	3	2	4	1, 4
Unit-V	Marks	BL	CLO	PLO
1. Derive the relationship between solubility and solubility product.	3	6	5	1, 2, 3, 4
2. Explain the Henderson – Hassel batch equation of buffers.	3	2,6.	5	1, 2, 3

	Government College (Autonomous) Rajahmundry	Program & Semester			
Course Code Major 7 practical	TITLE OF THE COURSE Course -7: Physical chemistry practical	II B.Sc.CH EMISTR Y (H)			
Teaching	Hours Allocated: 30 (Practical)	L	T	P	
Pre-requisites	Theoretical Knowledge about liquid properties like surface tension and viscosity, Knowledge about partition coefficient	-	-	2	

Course Objectives:

- Measurement of liquid property like Surface tension, Viscosity
- Measurement of partition coefficient of substance between two liquids
- Correct Usage of different lab equipment

Course Outcomes:

On Completion of the course, the students will be able to	
C O1	Understand the basic concepts surface tension. viscosity and partition coefficient
C O2	Usage of glassware, equipment used for surface tension, viscosity and Partition coefficient measurement
C O3	Acquire knowledge of measurement of surface tension. viscosity of different liquids and distribution coefficient of substance between two liquids procedure.
C O4	Acquire knowledge of accurate measurement . tabulation of readings and calculation of results

Course with focus on employability / entrepreneurship / Skill Development modules

Skill Development		Employability		Entrepreneurship	-

SYLLABUS

Credits: 1 (2 hrs/week)

7. Determination of molecular status and partition coefficient of benzoic acid in Benzene and water.
8. Determination of Surface tension of liquid 1
9. Determination of Surface tension of liquid 2
14. Determination of Viscosity of liquid.1
15. Determination of Viscosity of liquid.2

List of Reference Books

1. O.P. Pandey, D.N. Bajpai & S. Giri, Practical Chemistry, S. Chand & Company Ltd.
2. B. D. Khosla, V. C. Garg & A. Gulati, Senior Practical Physical Chemistry, S. Chand & Co.: New Delhi (2011).
3. C. W. Garland, J.W. Nibler, & D.P. Shoemaker, Experiments in Physical Chemistry 8th Ed.; McGrawHill: New York (2003).
4. R.C. Das and B. Behra, Experiments in Physical Chemistry,, Tata McGraw Hill.

Web Links:

<https://youtu.be/xGlXcpcPgYs>

CLO-PLO Mapping:

1: Slight [Low]; 2: Moderate [Medium]; 3: Substantial [High], 4: (No Correlation)

	PL O1	PL O2	PL O3	PL O4	PL O5	PL O6	PL O7	PL O8	PL O9	P L O 10
CLO1	3	2	2	3	2	1	0	0	3	0
CLO2	3	2	2	3	2	1	0	0	3	0
CLO3	3	3	3	3	2	1	0	0	3	0
CLO4	3	3	3	3	2	1	0	0	3	0
A v g .	3	2.5	2.5	3	2	1	0	0	3	0

	Government College (Autonomous) Rajahmundry	Program & Semester II B.Sc. Analytical Chemistry (Hons.) (III Semester)			
Course Code C8	TITLE OF THE COURSE C8 QUANTITATIVE METHODS OF ANALYSIS				
Teaching	Hours Allocated: 45 (Theory)	L	T	P	C
Pre-requisites	Introduction to chemical analysis and basic analytical methods	3	1	-	3

Course Objectives:

1. To gain knowledge and get awareness on gravimetric analysis
2. To give basic information about types of gravimetric methods
3. To give knowledge and practical experience on volumetric analysis
4. To give knowledge and practical experience on volumetric analysis
5. To provide knowledge and awareness on thermal methods of analysis

Course Outcomes:

On Completion of the course, the students will be able to		Cognitive Domain
C O 1	Get awareness and understanding of Gravimetric analysis and precipitation methods	Understanding
C O 2	Get Separate and Determine some of the solutes quantitatively by using gravimetric methods	Skill
C O 3	Get practical skill and determine some of the analytes quantitatively by using volumetric titration methods	Application
C O 5	Get practical skill and determine some of the analytes quantitatively by using volumetric titration methods	Application
C O 4	Get awareness and understand the principles of Thermal methods of analysis	Understanding

Course with focus on employability / entrepreneurship / Skill Development modules

Skill Development		Employab ility		Entrepreneur ship	

II B.Sc. Analytical Chemistry (Hons.) SEMESTER -III

SYLLABUS QUANTITATIVE METHODS OF ANALYSIS

45 Hrs. (03Hrs. /Wk.)

UNIT – I

9 Hours

GRAVIMETRY -I

Introduction, Types of gravimetric methods

Precipitation Gravimetry: Principle and theory of Precipitation gravimetry Various Steps involved in precipitation gravimetry Applications of precipitation methods

Volatilization Gravimetry: Principle and theory of Volatilization methods Various steps involved in volatilization methods Applications of volatilization methods:

Determination of the Sodium Hydrogen Carbonates content of ant acid tablets.

UNIT – II

9hours

GRAVIMETRY – II

Properties of Precipitates and Precipitating Reagents: Particle size, Filterability of Precipitates, Factors that determine particle size, formation of precipitates (Mechanism of precipitates and Relative super saturation value)

Precipitation reagents: Dimethyl glyoxime for Nickel, 8 – Hydroxy quinoline for Aluminium,

Colloidal Precipitates (coagulation of colloids, peptization of colloids)

Co-precipitation (surface adsorption, mixed-crystal formation, occlusion, and mechanical entrapment, co precipitation errors)

UNIT – III

9 Hours

TITRIMETRIC ANALYSIS -I

Acid-base titrations, Neutralization curves, Neutralization of a strong acid with a strong base, Choice of indicators, Preparation of a standard acid (constant boiling point mixture)

Redox titrations: Change of the electrode potential during the titration of a reductant with an oxidant, formal potentials, Detection of the end point in oxidation-reduction titrations, Oxidations with potassium permanganate, potassium dichromate

UNIT – IV

9 Hours

TITRIMETRIC ANALYSIS -II Complexometric titrations: types of EDTA titrations, Direct titration, Back- titration, Replacement or substitution titration; Metal ion indicators, Determination of copper: (direct titration), Determination of calcium and magnesium

Precipitation titrations: Precipitation reactions, Determination of end points in precipitation reactions, Mohr titration, Volhard's method

UNIT – V

9 Hours

THERMAL METHODS OF ANALYSIS

Thermal methods of analysis: Introduction Types of Thermal methods

Thermogravimetry (TG): Principle, Instrumentation Applications of Thermogravimetry – (CuSO₄.5H₂O) and (CaC₂O₄.H₂O)

Differential thermal analysis (DTA): Principle, Instrumentation, Applications of DTA- (CH₃COO)₂ Ca. H₂O.

TEXT BOOKS:

1. Douglas A. Skoog and Donald M. West: Fundamentals of Analytical Chemistry.
2. Quantitative chemical analysis by Vogel's 6th and 7th editions

Reference books:

1. Analytical Chemistry-Methods of Separation (R.V. Dils).
2. Laboratory Handbook of Chromatographic Methods (O. Mikes, R.A. Chalmers).
3. F.W. Fifiel and D. Kealy: Analytical Chemistry.
4. Vogel's textbook of quantitative chemical analysis, 6th edition.
5. Vogel's textbook of quantitative chemical analysis, 7th edition.
6. Keith Wilson and John Walker: Practical Biochemistry.

CO PO Mapping

(1: Slight [Low];

2: Moderate [Medium]; 3: Substantial [High], '-' : No

Correlation)

	C L O P L O	PLO 1	PLO 2	PLO3	P L O 4	P L O 5	P L O 6	P L O 7	P L O 8	P L O 9	PLO1 0
CL O P L O	CLO 1	3	2	2	1	1	0	0	0	3	0

	CLO 2	3	1	2	1	1	0	0	0	3	0
	CLO 3	3	3	3	1	1	0	0	0	3	0

	CLO 4	3	3	3	2	2	0	0	0	3	0
	CLO 5	3	3	3	2	2	0	0	0	3	0
	A v g .	3	2. 4	2.6	1.4	1.4	0	0	0	3	0

Proposed activities:

Skill Development:

1. Preparation of Buffer solutions
2. Applications of Volumetric titrations

Employability:

1. Principles of Gravimetric methods
2. Applications of Precipitation methods

Entrepreneurship:

1. Thermogravimetry and Differential thermal analysis

GOVERNMENT COLLEGE (A),
II B.Sc. ANALYTICAL CHEMISTRY

SEMESTER -III

C8: QUANTITATIVE METHODS OF ANALYSIS
MODEL QUESTION PAPER

Time: 2¹/₂ hrs.

Max. Marks: 50 M

SECTION - A

Answer ALL the questions

(5 X 7 = 35 M)

1. Any One Question from Unit -I
(OR)
2. Any One Question from Unit -I
3. Any One Question from Unit -II
(OR)
4. Any One Question from Unit -II
5. Any One Question from Unit -III
(OR)
6. Any One Question from Unit -III
7. Any One Question from Unit -IV
(OR)
8. Any One Question from Unit -IV
9. Any One Question from Unit -V (OR)
10. Any One Question from Unit -V

SECTION-B

Answer any FIVE of the following

(5 X 3 = 15 M)

11. Any Question from Unit -I
12. Any Question from Unit -I
13. Any Question from Unit -II
14. Any Question from Unit -II
15. Any Question from Unit -III
16. Any Question from Unit -III
17. Any Question from Unit -IV
18. Any Question from Unit -V

GOVERNMENT COLLEGE (A),

II B.Sc. ANALYTICAL CHEMISTRY

SEMESTER -III

PAPER – II: QUANTITATIVE METHODS OF ANALYSIS

BLUE PRINT

S. No	Course Content	Essay Questions (7M)	Short Answer Questions (3M)	Total No. Of Questions from each Unit
1	Unit –I	2	2	4
2	Unit –II	2	2	4
3	Unit –III	2	2	4
4	Unit –IV	2	1	3
5	Unit –V	2	1	3
	TOTAL	10	8	18

GOVERNMENT COLLEGE (A), RAJAMAHENDRAVARAM

DEPARTMENT OF CHEMISTRY

II B.Sc. ANALYTICAL CHEMISTRY

SEMESTER -III

PAPER – C8: QUANTITATIVE METHODS OF ANALYSIS

MODEL QUESTION PAPER

Time: 2¹/₂ hrs.

Max. Marks: 50 M

SECTION - A

Answer ALL the questions

(5 X 7 = 35 M)

			Marks	BL PLO	CLO PI
1a	What are Precipitation methods? Explain about the various steps involved in precipitation gravimetry	7	2	1	1
	OR				
1b	Explain the principles of Volatilization method. How do you determine the Sodium Bicarbonate (NaHCO ₃) content of Antacid tablets by using volatilization method?	7	2	2	2
2a	What is Co-precipitation? Explain the different types of Co-precipitation methods.	OR 7	2	1	2
2b	Explain precipitating agents DMG and 8-Hydroxy Quinoline	7	2	3	2
3a	Write about the neutralization of strong acid by strong base	7	5	1	9
	OR				

3	Explain briefly about Redox titrations with example	7	6	5	5
b		7	2	2	5
4	Describe Mohr method	7	4	1	3
a					

OR

4b Explain briefly Complexometric titrations with examples

7 3 4 2
5a Explain the Principle, Experimental set up and application of TGA

OR

5b Explain the principle, Experimental set up and application of DTA

7 3 4 4

SECTION-B

Answer any FIVE of the following

(5 X 3 = 15 M)

		Marks	B L	C L O	PLO	P I
6	What are Gravimetric methods and explain briefly?	3	1	1	1	
7	Write briefly about Drying and ignition of precipitates			1		
8	Explain about Colloidal precipitates	3	2	2	2	
9	Explain the factors that determine the particle size	3	2	1	3	
10	Explain about choice of indicators in acid base titrations	3	6	3	5	
11	What is formal potential					
12	Define back titration	3	5	3	9	
13	Explain the types of thermal methods	3	2	5	2	
		3	1	1	3	

II B.Sc. ANALYTICAL CHEMISTRY

SEMESTER -III

QUANTITATIVE METHODS OF ANALYSIS -QUESTION BANK

ESSAY QUESTIONS: 07 M

1. Explain the principles of Volatilization method. How do you determine the Sodium Bi-carbonate (NaHCO_3) content of Antacid tablets by using volatilization method?
2. What are Precipitation methods? Explain about the various steps involved in precipitation gravimetry.
3. What are gravimetric methods? Write briefly about different types of gravimetric methods
4. Explain the properties of precipitates and precipitating reagents.
5. What is Co-precipitation? Explain the different types of Co-precipitation methods.
6. How do you determine Nickel and Calcium by using Precipitation gravimetric methods
7. Explain precipitating agents DMG and 8-Hydroxy Quinoline
8. Explain briefly about Redox titrations with example
9. Explain briefly Complexometric titrations with examples.
10. Write about the neutralization of strong acid by strong base
11. Describe Mohr method
12. Explain the Volhard method
13. Explain the Principle, Experimental set up and application of TGA
14. Explain the principle, Experimental set up and application of DTA

QUESTION BANK

SHORT ANSWER QUESTIONS –03 Marks

1. What are Gravimetric methods and explain briefly?
2. How do you determine NaHCO_3 content in antacid tablet by using volatilization gravimetry?
3. Explain about Colloidal precipitates
4. What is Co-precipitation? Explain Co-precipitation errors
5. Explain the direct and back titration
6. What is Indicator? Write the different types of indicators used in precipitation titrations.
7. What is formal potential.
8. Explain briefly about the various types of thermal methods used in chemical analysis
9. What are thermal methods? write the applications of thermal methods

	Government College (Autonomous) Rajahmundry	Program & Semester II B.Sc.AC (III Semester)			
Course Code ACH C8P	TITLE OF THE COURSE QUANTITATIVE METHODS OF ANALYSIS (PRACTICAL –II)				
Teaching	Hours Allocated: 30 (Practical)	L	T	P	C
Pre-requisites	Introduction to chemical analysis and basic laboratory apparatus	-	-	3	2

Course Objectives:

1. To provide basic practical knowledge about precipitation methods
2. To give practical experience on volumetric titration methods
3. To provide practical knowledge about quantitative determination of different solutes based on titrimetric analysis
4. To provide practical knowledge about quantitative determination of different solutes based on complexometric titration method

Course Outcomes:

On Completion of the course, the students will be able to	
C O1	Determine Ni (II) quantitatively by using precipitation gravimetry
C O2	Perform redox titration for quantitative determination of Fe (II)
C O3	Determine Ca, Mg and Ni ions quantitatively by using complexometric titration method
C O4	Perform acid – base titrations for determination of acidity and alkalinity of samples

Course with focus on employability / entrepreneurship / Skill Development modules

Skill Development		Employability		Entrepreneurship	

PRACTICAL SYLLABUS:

1. Determination of Iron (II) by titrating with standard Potassium dichromate solution.
2. Estimation of strength of magnesium sulphate solution by using EDTA solution
3. Determination of amount of Calcium and Magnesium in the given mixture by using EDTA.
4. Determination of amount of Carbonate and Bicarbonate in water by titrating with Hydrochloric acid.

Text books:

1. Douglas A. Skoog and Donald M. West: Fundamentals of Analytical Chemistry.
2. Quantitative chemical analysis by Vogel's 6th and 7th editions

Reference books:

1. Douglas A. Skoog and Donald M. West: Fundamentals of Analytical Chemistry.
2. Adion A. Gordus: Schaum's Outline of Analytical Chemistry, Tata McGraw- Hill.
3. Gary D. Christian: Analytical Chemistry.
4. Freifelder and Kealy: Analytical Chemistry.
5. Quantitative chemical analysis by Vogel's 6th and 7th editions

II B.Sc. ANALYTICAL CHEMISTRY

SEMESTER -III

QUANTITATIVE METHODS OF ANALYSIS (PRACTICAL –II) AT

THE END OF SEMESTER –III SCHEME OF

VALUATION

Time: 03 arks: 50 M

1. Record	-----	10 Marks
2. Practical	-----	35 Marks
3. Viva - voce	-----	05 Mark s

Splitting of Practical Marks: (35M)

A. Procedure in 10 minutes:	5M	
B. Formula with units:	5M	
C. Neat tabulation:	5M	
	5M	
i. Correct calculation:	5M	error < 1 % :15 M
ii. Error up to 5 %		:10 M
iii. Error > 5%		:5 M

IV SEMESTER SYLLABUS

FOR

CHEMISTRY (H) &

ORGANIC CHEMISTRY

	Government College (Autonomous) Rajahmundry	Program & Semester II B.Sc. ORGANIC CHEMISTRY (SEMESTER – IV)			
Course Code 9	TITLE OF THE COURSE Course -9: SPECTROSCOPY				
Teaching	Hours Allocated: 45 (Theory) (3 hrs. / Wk.)	L	T	P	C
Pre-requisites:	Basic knowledge about spectrum and its classification	3	-	-	3

Course Objectives:

1. To inculcate basic knowledge on basic concepts like Beer-Lambert's law
2. To understand the concept of Spectroscopy
3. To illustrate the classification of spectroscopies
4. To provide knowledge and applications on various spectroscopies

Course Outcomes:

On Completion of the course, the students will be able to-		Cognitive Domain
C O1	Understand the basic governing law of spectroscopy – Beer lamberts law and interaction of electromagnetic radiation with matter	Knowledge
C O2	Learn Principles of Electronic, IR and NMR spectroscopies	Understand
C O3	Understand Applications of Electronic, IR and NMR spectroscopies	Application
C O4	Applying principles of various spectroscopies to various organic compounds	Application

Skill Development			Employability		Entrepreneurship	

Syllabus:

UNIT-I

GENERAL FEATURES OF ABSORPTION

Beer-Lambert's law and its limitations, transmittance, Absorbance, and molar absorptivity. Single and double beam spectrophotometers. Application of Beer-Lambert's law for quantitative analysis of 1. Chromium in K₂Cr₂O₇ 2. Manganese in Manganous sulphate

UNIT-II

ELECTRONIC SPECTROSCOPY:

Interaction of electromagnetic radiation with molecules and types of molecular spectra. Energy levels of molecular orbitals (σ , π , n). Selection rules for electronic spectra. Types of electronic transitions in molecules. Concept of chromophore and auxochrome. Bathochromic shift, Hypsochromic shift, hyper chromic shift, hypochromic shift. Effect of conjugation on $\lambda_{\max}$.

UNIT-III

INFRA RED SPECTROSCOPY:

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

UNIT-IV

PROTON MAGNETIC RESONANCE SPECTROSCOPY ($^1\text{H-NMR}$)

Principles of nuclear magnetic resonance, equivalent and non-equivalent protons, position of signals. Chemical shift, NMR splitting of signals - spin-spin coupling, coupling constants.

UNIT-V APPLICATIONS

Application of electronic spectroscopy-Woodward-Fieser rules for calculating $\lambda_{\max}$ of conjugated dienes and α,β - unsaturated carbonyl compounds. Applications of IR Spectroscopy NMR Spectra of Ethyl bromide, Ethanol, Acetaldehyde, 1,1,2-Tribromo ethane, Ethyl acetate, Toluene and Acetophenone

List of Reference Books:

1. Spectroscopy by William Kemp
 2. Spectroscopy by Pavia
 3. Organic Spectroscopy by J. R. Dyer
 4. Elementary organic spectroscopy by Y.R. Sharma
 5. Spectroscopy by P.S. Kalsi
 6. Organic spectroscopy by Jagmohan
- CLO-PLO Mapping:
7. light [Low]; 2: Moderate [Medium]; 3: Substantial [High], '-': No Correlation)

	C L O	PL O1	PL O2	PL O3	PL O4	PL O5	PL O6	PL O7	PL O8	PLO 9	PLO1 0	CLO\ PLO	PLO1	
	CLO1	3	2	3	2	2	2	3	3	2	2	3	3	3
	CLO2	2	3	3	3	3	2	1	2	2	3	2	2	3
	CLO3	3	3	3	2	2	1	1	2	3	1	2	3	3
	CLO4	2	1	2	1	3	2	3	1	2	3	2	3	2
	CL O5	2. 5	2. 2 5	2. 7 5	2 .0	2 .5	1. 7 5	2 .0	2 .0	2. 2 5	2. 25	2.2 5	2.7 5	2.7 5

CHEMISTRY COURSE-9: SPECTROSCOPY

QUESTION PAPER BLUE PRINT

TIME: 2½ Hrs.

MAX. MARKS: 50 PART – A

5x7 = 35 M

Answer **ALL** the following questions.

1a Question from UNIT-I

OR

1b Question from UNIT-I

2a Question from UNIT-II

OR

2b Question from UNIT-II

3a Question from UNIT-III

OR

3b Questions from UNIT-III

4a Question from UNIT-IV

OR

4b Question from UNIT-IV

5a Question from UNIT-V

OR

5b Question from UNIT-V

PART – B

Answer any **FIVE** of the following questions.

5x3 = 15 M

6 Question from UNIT-I

7 Question from UNIT-II

8 Question from UNIT-III

9 Question from UNIT-IV

10 Question from UNIT- V

11 Question from UNIT-II

12 Question from UNIT-III

13 Question from UNIT- V

GOVERNMENT COLLEGE (A), RAJAHMUNDRY
II B.Sc. CHEMISTRY(H) SEMESTER-IV
MODEL PAPER (From 2024-25) Course - 9:
SPECTROSCOPY

Time: 2½ hrs

Max.Marks: 50

PART- A

Answer ALL the questions. Each carry SEVEN marks

5 x 7 = 35 M

1a State and explain Beer-Lambert's law.

Marks	B L	CLO	P L O	P I
7	2	2	1	

OR

1b Give the experimental procedure for determination of Chromium in Potassium dichromate using Beer-Lambert's law.

2a What are electronic transitions? Explain different types of electronic transitions with suitable examples.

7	2	1	2	
7	2	3	2	
7	5	1	7	
7	2	2	5	
7	4	1	3	
7	3	4	2	
7	6	5	5	
7	3	3	4	

OR

2b Explain different types of Absorption-Intensity shifts in Electronic Spectroscopy.

3a Explain the significance of functional group region and fingerprint region with suitable examples.

OR

3b Discuss different modes of vibrations in IR spectroscopy.

4a What is chemical shift? Write the factors effecting chemical shift.

OR

4b What is spin-spin coupling? Describe different types of coupling constants.

5a How many different NMR signals you will observe in the following organic compounds?
 (i) Ethanol (ii) Ethyl bromide (iii) Toluene

OR

5b Describe the Woodward-Fieser rules for calculating $\lambda_{\max}$ of α, β – unsaturated carbonyl compounds.

PART – B

Answer any **FIVE** of the following questions.

5x3 = 15 M

6	Define Absorbance, transmittance and molar absorptivity.	Ma rks	B L	C L O	PL O	P I
7	Write a short note on Chromophores.	3	1	1	1	
8	Write the characteristic absorption bands of various organic functional groups.	3	2	1	2	
9	What are equivalent and non-equivalent protons?	3	2	1	3	
10	Write any two applications of UV- Vis spectroscopy with suitable examples.	3	6	3	5	
11	Explain Auxochromes with suitable examples..	3	5	3	7	
12	Mention the important IR vibrational frequencies of Carbonyl compounds and Amines.	3	2	5	2	
13	Describe the NMR spectrum of Acetaldehyde.	3	4	4	3	
		3	5	4	3	

GOVERNMENT COLLEGE (A), RAJAMAHENDRAVARAM II
B.Sc. ORGANIC CHEMISTRY, SEMESTER-IV 2024-25
CHEMISTRY COURSE-9: SPECTROSCOPY

QUESTION BANK

Essay Questions

1. Define Absorbance, transmittance, and molar absorptivity. State and explain Beer-Lambert law
2. Give the experimental procedure of simultaneous determination of chromium in potassium dichromate and manganese in Manganous Sulphate using Beer-Lambert's law.
3. Explain types of molecular spectra and selection rules for the formation of spectra.
4. Write about different energy levels of Electronic spectroscopy.
5. Define Chromophore and auxochrome. How does the conjugation, affect the λ_{max} .
6. Write about characteristic absorption bands of various functional groups.
7. Explain the Fingerprint region. Explain its significance with an example. Write IR spectral data for any one alcohol, aldehyde and ketone.
8. Explain Functional group and finger print regions.
9. Discuss different modes of vibrations in IR spectroscopy.
10. Give a detailed explanation on the principle of NMR spectroscopy. What is a chemical shift equivalence?
11. Describe the role of equivalent and non-equivalent protons in NMR spectroscopy.
12. Explain the position of signals.
13. How many different NMR signals you will see in the following molecules? Ethanol, Ethyl Acetate, toluene and Acetophenone.
14. Explain the applications of UV – Vis and IR spectroscopies in structure determination of organic compounds.
15. Application of NMR to ethyl bromide, ethanol, acetaldehyde, 1,1,2-tribromo ethane, ethylacetate, toluene and acetophenone.

Short Answer Questions

1. Discuss single and double-beam spectrophotometers.
2. Write briefly about different shifts in UV – Vis Spectroscopy.
3. Explain types of electronic transitions in UV – Vis Spectroscopy.
4. Write a short note on different regions in IR.
5. Write IR stretching frequencies of alkanes and amines.
6. Explain about spin-spin coupling in NMR.
7. Define principle of NMR.
8. Define coupling constant with examples.
9. Write any two applications of UV- Vis spectroscopy with examples.

**OVERNMENT COLLEGE (A) –
RAJAMAHENDRAVARAM II B.Sc. CHEMISTRY
SEMESTER – IV- PAPER –C-9: SPECTROSCOPY
QUESTION BANK**

Essay type questions. Each question carries 7 marks.				
Unit-1	Marks	BL	CLO	PLO
1.How can you determine the amount of Chromium present in the given Potassium dichromate solution by applying Beer-Lambert's law?	7	4	1	4
2. State and explain Beer-Lambert's law.	7	2	1	1, 2
3. Give the experimental procedure for determination of Manganese in Manganese Sulphate using Beer-Lambert's law.	7	4	1	1, 4
Unit-II	Marks	BL	CLO	PLO
1. What are electronic transitions? Explain various types of electronic transitions with suitable examples.	7	2	2	2, 3
2. Explain different types of Absorption-Intensity shifts in Electronic Spectroscopy.	7	2	2	1
3. Explain Chromophores and Auxochromes with suitable examples.	7	2	3	2
Unit-III	Marks	BL	CLO	PLO
1. What are fundamental vibrations? Illustrate various types of fundamental vibrations.	7	3	3	1, 2, 3
2. Explain the significance of functional group region and fingerprint region with suitable examples.	7	2	4	1, 3
3. Discuss different modes of vibrations in IR spectroscopy.	7	2	3	1, 2, 3
Unit-IV	Marks	BL	CLO	PLO
1.What is chemical shift? Discuss the factors effecting chemical shift.	7	2	3	1, 2, 3

2. What is spin-spin coupling? Explain various types of spin-spin couplings in NMR spectroscopy.	7	2, 4.	4	1, 2
3. Explain the concept of splitting of NMR signals.	7	2	3	1, 2, 3
Unit-V	Marks	BL	CLO	PLO
1.Explain the Woodward-Fieser rules for calculating $\lambda_{\max}$ of α , β – unsaturated carbonyl compounds with suitable examples.	7	2,4	4	4
2.Demonstrate the NMR spectra of the following compounds. (i) Ethyl alcohol (ii) Ethyl bromide	7	3	4	1, 3, 4
3.Explain the Woodward-Fieser rules for calculating $\lambda_{\max}$ of conjugated dienes with suitable examples.	7	2,4	4	3, 4

Short answer questions. Each question carries 3 marks.

Unit-1	Marks	BL	CLO	PLO
1.Define the terms absorbance, transmittance and molar absorptivity.	3	1	1	1, 4
2. Explain single beam spectrophotometer briefly.	3	2	1	1, 4
Unit-II	Marks	BL	CLO	PLO
1. Write a short note on chromophores.	3	2	2	1, 4
2. Explain auxochromes with suitable examples.	3	2	2	1, 2
3. Write the selection rules of electronic spectroscopy.	3	4	3	1
Unit-III	Marks	BL	CLO	PLO
1. Write the characteristic absorption bands of various organic functional groups.	3	2	3	1, 2, 3
2. Mention the important IR vibrational frequencies of Carbonyl compounds and Amines.	3	2,4.	3	1, 4

3.Explain the significance of fingerprint region in IR spectroscopy.	3	2	3	1, 2, 3
Unit-IV	Marks	BL	CLO	PLO
1.Explain equivalent and non-equivalent protons with suitable examples.	3	2	3	1
2. Write the basic principle of NMR	3	2	3	1, 2, 3
Unit-V	Marks	BL	CLO	PLO
1. Describe the NMR spectrum of Toluene.	3	2	4	1, 2, 3, 4
2. Write the applications of IR spectroscopy	3	4	3	1, 2, 3
3. Describe the NMR spectrum of Acetaldehyde.	3	2	4	1, 2, 3

	Government College (Autonomous) Rajahmundry	Program & Semester II B.Sc. ORGANIC CHEMISTRY (SEMESTER – IV)			
Course Code 9	TITLE OF THE COURSE Course 9: SPECTROSCOPY				
Teaching	Hours Allocated: 30 (Practical)	L	T	P	C
Pre-requisites	Preparation of standard solutions and handling of laboratory apparatus and instruments	-	-	2	1

Course Objectives:

1. To demonstrate basic knowledge about the handling of laboratory apparatus
2. To illustrate knowledge about the preparation of standard solutions
3. To provide hands-on training for the determination of different organic compounds

Course Outcomes:

On Completion of the course, the students will be able to	
CO 1	Learn to Handle and calibrate the common laboratory glass apparatus and instruments
CO 2	Get practical skill to the preparation of different standard solutions used for quantitative analysis
CO 3	Identify and confirm the structure of a given organic compounds
CO 4	Principles and applications of different molecular spectra

Course with focus on employability / entrepreneurship / Skill Development modules

Skill Development			Employability		Entrepreneurship	-

IR spectral analysis of the following functional groups with examples

(a) Hydroxyl Groups

(b) Carbonyl Groups

(c) Amino Groups

(d) Aromatic Groups

CLO-PLO Mapping:

1: Slight [Low]; 2: Moderate [Medium]; 3: Substantial [High], 4: (No Correlation)

	C L	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7	PLO 8	PLO 9	PLO1 0	CLO\ PLO	P L O 1
	O\P LO												
CL O1	3	3	3	2	3	2	2	2	3	2	2	3	3
CL O2	3	3	3	2	3	2	2	3	2	3	3	3	3
CL O3	3	2	3	2	3	1	2	2	2	2	2	3	2
CL O4	3	3	2	1	3	2	2	1	2	3	3	3	3
CL O5	3	2 . 7 5	2 . 7 5	2	3	2	2	2	2 . 2 5	2 . 5	2. 5	3	2. 75

	Government College (Autonomous) Rajahmundry	Program & Semester II B.Sc. CHEMISTRY (H),

Course Code	TITLE OF THE COURSE Course -10: PHYSICAL CHEMISTRY-II	CHEMISTRY(H) (SEMESTER – IV)			
Teaching	Hours Allocated: 45 (Theory) (3 hrs. / Wk.)	L	T	P	C
Pre-requisites:	Basic knowledge about material and energy balances	3	-	-	3

Course Objectives:

1. To provide basic knowledge on Colligative Properties
2. To provide basic awareness on concepts of electrochemistry
3. To understand the basic concepts of Electrodes and their usage
4. To provide knowledge and understand ability on phase systems
5. To Provide the knowledge on photochemistry

Course Outcomes:

On Completion of the course, the students will be able to-		Cognitive Domain
CO 1	Understand the concept of Colligative Properties.	Knowledge and Application
CO 2	Understand the basic concepts of electrochemistry	Knowledge
CO 3	Understand the basic concepts of Electrodes and their usage	Understand and application
CO 4	To understand basic concepts of phase rule	Application
CO 5	Understand the laws of photochemistry and learn how to calculate the quantum yields of different photo physical processes	Knowledge

Development		Employability		Entrepreneurship	

SYLLABUS

UNIT-I DILUTE SOLUTIONS

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

UNIT-II ELECTROCHEMISTRY-I

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

UNIT-III ELECTROCHEMISTRY-II

Single electrode potential, sign convention, Reversible and irreversible cells Nernst Equation- Reference electrode, Standard Hydrogen electrode, calomel electrode, Indicator electrode, metal – metal ion electrode, Inert electrode, Determination of EMF of cell, Applications of EMF measurements

- Potentiometric titrations.

UNIT-IV PHASE RULE

Concept of phase, components, degrees of freedom. Thermodynamic Derivation of Gibbs phase rule. Phase equilibrium of one component system - water system. Phase equilibrium of two- component system, solid-liquid equilibrium. Simple eutectic diagram of Pb-Ag system, simple eutectic diagram, desilverisation of lead., NaCl-Water system, Freezing mixtures.

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, hydrogen- bromine reaction. Qualitative description of fluorescence, phosphorescence, Photosensitized

LIST OF REFERENCE BOOKS

1. Modern Electrochemistry by J.O. M. Bockris and A.K.N.Reddy
2. Advanced Physical Chemistry by Atkins

3. Introduction to Electrochemistry by S. Glasstone

CO-PO Mapping:

(1: Slight [Low]; 2: Moderate [Medium]; 3: Substantial [High], '-': No Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	2	3	2	2	2	3	3	2	2	3	3	3
CO2	2	3	3	3	3	2	1	2	2	3	2	2	3
CO3	3	3	3	2	2	1	1	2	3	1	2	3	3
CO4	2	1	2	1	3	2	3	1	2	3	2	3	2
Avg.	2.5	2.25	2.75	2.0	2.5	1.75	2.0	2.0	2.25	2.25	2.25	2.75	2.75

GOVERNMENT COLLEGE (A), RAJAMAHENDRAVARAM

II B.Sc. CHEMISTRY (H),

SEMESTER – IV

Course -4: PHYSICAL CHEMISTRY-II WEIGHTAGE
TO CONTENT & BLUE PRINT

S.NO.	COURSE CONTENT	LONG ANSWER QUESTIONS	SHORT ANSWER QUESTIONS	TOTAL MARKS	AS PER BLOOMS TAXONOMY
1.	UNIT - I	2	1	17	Understanding, Application
2.	UNIT – II	2	2	20	Remembering, Understanding
3.	UNIT – III	2	2	20	Analyzing, Creation
4.	UNIT – IV	2	2	20	Evaluation, Understanding
5.	UNIT - V	2	1	17	Understanding, Application
	TOTAL	10	8	94	

GOVERNMENT COLLEGE (A), RAJAHMUNDRY
II B.Sc. CHEMISTRY (H), ORG CHEMISTRY, ANALYTICAL CHEMISTRY
PHYSICAL CHEMISTRY SEMESTER -IV
MODEL PAPER

Course -10: PHYSICAL CHEMISTRY-II

Time: 2 ½ Hr.

Max Marks. 50 Marks

PART- A

Answer ALL the questions. Each carry SEVEN marks

5 x 7 = 35 M

1. What is elevation in boiling point and derive the relation between molecular weight of solute and elevation in boiling point? BT2 CO1 PO1
- (OR)
2. Define osmotic pressure and explain their experimental determination? BT2 CO1 PO1
3. Describe Kohlrausch's law and its applications BT2 CO2 PO2
- (OR)
4. Define the transport number and determine the transport number by Hittorf's method BT1 CO2 PO2
5. State the Nernst equation and write its applications BT2 CO3 PO3
- (OR)
6. Describe Reversible electrodes and its types BT2 CO3 PO3
7. What is phase rule? Explain the phase diagram of one component system BT1 CO4 PO4
- (OR)
8. Explain phase diagram of Pb-Ag System BT3 CO4 PO4
9. Describe the laws of photo chemistry BT2 CO5 PO5
- (OR)
10. Explain the photochemical reaction of $H_2 - Cl_2$ with mechanism. BT3 CO5 PO5

PART- B

Answer any FIVE of the following questions. Each carry THREE marks 5 x 3 = 15 M

11. What are colligative properties? Give examples BT1 P
CO1 O
1
12. State and explain Raoult's law BT2 P
CO2 O
2
13. Define specific conductance and equivalent conductance BT2 P
CO2 O
2
14. Write a short note on Ostwald's dilution law BT3 P
CO3 O
3

15. Write briefly about Calomel electrode?	BT1	P
	CO3	O
		3
16. Define the terms Phase, Component and Degrees of freedom	BT3	P
	CO4	O
		4
17. Write the differences between photochemical and thermochemical reactions	BT2	P
	CO4	O
		5
18. Define fluorescence and phosphorescence?	BT1	P
	CO5	O
		5

Question Bank:

Essay Questions: 07 Marks

1. What is elevation in boiling point and derive the relation between molecular weight of solute and elevation in boiling point?
2. Define osmotic pressure and explain their experimental determination?
3. Derive Raoult's law equation for relative lowering of vapour pressure and determine molecular weight from lowering of vapour pressure
4. Describe the relation between depression in freezing point and molecular weight of non-volatile solute
5. Describe Kohlrausch's law and its applications
6. Define the transport number and determine the transport number by Hittorf's method
7. Discuss in detail about conductometric titrations with suitable examples
8. State the main postulates of Debye – Huckel theory of strong electrolytes
9. State the Nernst equation and write its applications
10. Describe Irreversible electrodes and its types
11. What is phase rule? Explain the phase diagram of one component system
12. Explain phase diagram of Pb-Ag System
13. Draw and explain the phase diagram of NaCl – Water system
14. Describe the laws of photo chemistry
15. Explain the photochemical reaction of $\text{H}_2 - \text{Cl}_2$ with mechanism.
16. Explain the photochemical reaction of $\text{H}_2 - \text{Br}_2$ with mechanism.

Short Answer Questions: 03 Marks

1. What are colligative properties? Give examples
2. State and explain Raoult's law
3. What is Vant Hoff's factor?
4. What is mean by depression in freezing point
5. Explain why there is elevation in boiling point and depression freezing point when a non-volatile solute is dissolved in water?
6. Define specific conductance and equivalent conductance
7. Write a short note on Ostwald's dilution law
8. What is the effect of dilution on Specific and equivalent conductivities?
9. Define the term Transport number
10. Arrhenius theory of electrolytic dissociation
11. Write briefly about Calomel electrode?
12. Difference between Electrochemical cells and Electrolytic cells
13. What is standard hydrogen electrode?
14. Define the terms Phase, Component and Degrees of freedom
15. What is Phase rule?
16. Write a short note on Freezing mixtures?
17. Write the differences between photochemical and thermochemical reactions
18. Define fluorescence and phosphorescence?
19. Short note on the Jablonski diagram
20. Explain the concept of photosensitization

	Government College (Autonomous) Rajahmundry	Program & Semester			
Course Code	TITLE OF THE COURSE Course -10: PHYSICAL CHEMISTRY LAB	II B.Sc. CHEMISTRY (H),			
Teaching	Hours Allocated: 30 (Practical)	L	T	P	C
Pre-requisites	Preparation of standard solutions and handling of laboratory apparatus	-	-	2	1

Course Objectives:

1. To provide hands-on experience in determining the CST of the phenol-water system through laboratory experiments.
2. To guide students in designing and conducting experiments to study the effect of NaCl on the CST and analyze the resultant data.
3. To train students in performing conductometric titrations using standard NaOH solutions for the accurate determination of HCl concentration.
4. To equip students with the skills necessary to conduct conductometric titrations to determine the concentration of CH₃COOH using standard NaOH solutions.

Course Outcomes:

On Completion of the course, the students will be able to	
CO 1	Analyze the phase behavior of the phenol-water system at different temperatures and concentrations.
CO 2	Predict and explain the shifts in CST due to the addition of NaCl to the phenol-water system.
CO 3	Develop the skills to perform conductometric titrations using standard NaOH solutions.
CO 4	Interpret conductometric titration curves and derive accurate concentrations of CH ₃ COOH from experimental data

Course with focus on employability / entrepreneurship / Skill Development modules

Skill Development		Employability		Entrepreneurship	-

Practical Syllabus:

50 M

1. Critical solution temperature of phenol-water system
2. Effect of NaCl on CST (phenol water system)
3. Determination of concentration of HCl conductometrically using standard NaOH Solutions
4. Determination of concentration of CH₃COOH conductometrically using standard NaOH Solutions

CO-PO Mapping:

1: Slight [Low];
Correlation)

2: Moderate [Medium]; 3: Substantial [High], 4: (No

	P O 1	P O 2	P O 3	P O 4	P O 5	P O 6	P O 7	P O 8	P O 9	P O 10	PSO1	P S O 2	P S O 3
CO1	3	3	3	2	3	2	2	2	3	2	2	3	3
CO2	3	3	3	2	3	2	2	3	2	3	3	3	3
CO3	3	2	3	2	3	1	2	2	2	2	2	3	2
CO4	3	3	2	1	3	2	2	1	2	3	3	3	3
Avg.	3	2 .75	2 .75	2	3	2	2	2	2 .25	2 .5	2.5	3	2.75

	Government College (Autonomous) Rajahmundry	Program & Semester			
Course Code	TITLE OF THE COURSE Course 11: ORGANIC CHEMISTRY	II B.Sc. CHEMISTRY (H) (SEMESTER – IV)			
Teaching	Hours Allocated: 60 (Theory)	L	T	P	C
Pre-requisites	Basic knowledge on structure and reactivity of organic compounds	3	1	-	3

Course Objectives:

1. To provide knowledge on reactivity of Nitro hydrocarbons and Nitrogen compounds.
2. To provide basic awareness on preparatory methods and chemical properties of Carbohydrates and Amino acids.
3. To understand classification of Aromatic and aliphatic Nitrogen compounds

Course Outcomes:

On Completion of the course, the students will be able to		Cognitive Domain
CO1	Understand the chemical properties of nitrogen compounds and carbohydrates.	Understanding
CO2	Describe the basicity of different types of amines.	Skill
CO3	Achieve the skills required to propose various mechanisms	Skill
CO4	Apply the concepts for synthesis of various nitrogen containing organic compounds	Understanding

Course with focus on employability / entrepreneurship / Skill Development modules

Skill Development		Employability		Entrepreneurship	

SYLLABUS

UNIT – I: NITRO HYDROCARBONS

7hrs

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

UNIT – II: NITROGEN COMPOUNDS

7hrs

ALIPHATIC AMINES: 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.

UNIT – III: AROMATIC AMINES:

15hrs

Introduction 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.

UNIT – IV: CARBOHYDRATES

15hrs

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

(-) Fructose (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 Aldohexose (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)

UNIT – IV: AMINO ACIDS

15hrs

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).

Reference books:

1. Organic Chemistry by G. Marchand, Purdue Univ
2. A Text Book of Organic Chemistry by Bahl and Arun bahl
3. A Text Book of Organic chemistry by I L Finar Vol

CO-PO Mapping:

(1: Slight [Low]; 2: Moderate [Medium]; 3: Substantial [High], '-' : No

Correlation)

	P O 1	P O 2	P O 3	P O 4	P O 5	PO6	P O 7	P O 8	P O 9	P O 10	PS O 1	PS O 2	P S O 3
CO1	3	2	3	2	2	2	3	3	2	2	3	3	3
CO2	2	3	3	2	3	2	2	2	2	3	2	2	3
CO3	3	3	3	2	2	1	1	2	3	1	2	3	3
CO4	2	3	2	1	3	2	3	1	2	3	3	2	2
Avg.	2.5	2.75	2.75	1.75	2.5	1.75	2.25	2	2.25	2.25	2.5	2.5	2.75

GOVERNMENT COLLEGE (A), RAJAMAHENDRAVARAM II B.Sc.

CHEMISTRY(H) SEMESTER – IV

Course -11 : ORGANIC CHEMISTRY

WEIGHTAGE TO CONTENT & BLUE PRINT

S.NO.	COURSE CONTENT	LONG ANSWER QUESTIONS	SHORT ANSWER QUESTIONS	TOTAL MARKS
1.	UNIT - I	2	1	17
2.	UNIT – II	2	2	20
3.	UNIT – III	2	2	20
4.	UNIT – IV	2	2	20
5.	UNIT - V	2	1	17
	TOTAL	10	8	94

GOVERNMENT COLLEGE (A), RAJAHMUNDRY

**II B.Sc. CHEMISTRY(H)
SEMESTER-IV MODEL
PAPER**

Course - 11: ORGANIC CHEMISTRY

Time: 2¹/₂ hrs.

Maximum Marks: 50

PART-A

Answer ALL the questions. Each question carries SEVEN marks

5 x 7 = 35 M

- Describe about the following reactions (i) Nef reaction (ii) Mannich reaction. BT2 CO1
(OR)
- What are nitro hydrocarbons? Write any three preparations of Nitroalkanes? Describe about tautomerism of nitroalkanes. BT1 CO3
- Describe about the following reactions (i) Gabriel synthesis (ii) Hoffman's bromamide reaction. BT3 CO2
(OR)
- How do you separate 1°, 2°, 3° – amines by using Heinsberg's method?. BT1 CO3
- Give brief explanation about Chemical properties of Aromatic amines a) Alkylation b) Acylation c) Carbylamine reaction.
(OR)
- Describe steric effect and substitution effects to explain the comparative basic strength of aniline, N-methyl aniline and N,N-dimethylaniline. BT1 CO2
- Describe the constitution, configuration of Glucose. Write cyclic structure of glucose (α and β Glucopyranose) in Haworth representation. BT2 CO2
(OR)
- Describe the constitution, configuration of Fructose. Write cyclic structure of glucose (α and β Fructopyranose) in Haworth representation. BT2 CO1
- What are amino acids? Write any three general methods of preparation of α- amino acids. BT3 CO3
(OR)
- Define amino acids. Give the classification of amino acids. BT2 CO4

PART- B

Answer any FIVE of the following questions. Each question carries THREE marks 5 x 3 = 15 M

11. Write chemical reactivity of Nitro hydrocarbon with HONO, BT4 CO2
12. Explain the classification of aliphatic amines with a suitable example. BT2 CO1
13. Describe the basic strength of Ammonia, Methyl amine, dimethyl amine and Trimethyl amine. BT1 CO3
14. Write the chemical reactivity of Aliphatic and Aromatic amines with HONO. BT1 CO4
15. Write a note on Carbylamine reaction. BT2 CO1
16. What are Epimers and explain about Epimerisation with Example. BT1 CO4
17. Write a short note on Killiani – Fischer method. BT2 CO3
18. Write physical properties of Amino acids.? BT2 CO2

QUESTION BANK

UNIT-I: NITROHYDROCARBONS- Easy Questions

1. What are nitro hydrocarbons? Write any three preparations of Nitroalkanes? Describe about tautomerism of nitroalkanes.
2. Describe the preparation of nitroalkanes by any three methods.
3. Explain the tautomerism of nitroalkanes leading to aci and keto forms.
4. Describe about the following reactions (i) Nef reaction (ii) Mannich reaction.

Short Questions

1. Write a note on halogenation of nitroalkanes.
2. Explain the reaction of nitro hydrocarbons with nitrous acid (HONO).
3. What is Mannich reaction? How does it lead to Michael addition?
4. Write a short note on reduction of nitro compounds.

UNIT-II: ALIPHATIC AMINES- Easy Questions

1. How do you separate 1°, 2°, 3°-amines by using Heinsberg's method?
2. Describe the following reactions:
(i) Gabriel synthesis (ii) Hoffmann's bromamide reaction.
3. Explain the ammonolysis of alkyl halides for the preparation of amines.
4. Describe the reduction of amides and Schmidt reaction.

Short Questions

1. What are quaternary ammonium compounds? Give an example.
2. Write a short note on physical properties of aliphatic amines.
3. Explain the basic strength of ammonia, methyl amine, dimethyl amine and trimethyl amine.
4. Write the mechanism of Hoffmann's bromamide reaction (brief).

UNIT-III: AROMATIC AMINES- Easy Questions

1. Explain the comparative basic strength of aniline, N-methylaniline and N,N-dimethylaniline.
2. Describe the chemical properties of aromatic amines:
a) Alkylation b) Acylation c) Carbylamine reaction.
3. Explain Hinsberg's method for the separation of 1°, 2° and 3° amines.
4. Describe steric effect and substitution effects to explain the comparative basic strength of aniline, N-methyl aniline and N, N-dimethylaniline.

Short Questions

1. Write a short note on diazotization.
2. Explain bromination of aniline.
3. Write a note on nitration of aromatic amines.
4. Explain the reaction of nitrous acid with 1°, 2° and 3° amines.

UNIT-IV: CARBOHYDRATES-Easy Questions

1. Describe the constitution and configuration of glucose.
2. Describe the constitution, configuration of Glucose. Write cyclic structure of glucose (α and β Glucopyranose) in Haworth representation.
3. Describe the constitution and configuration of fructose.
4. Describe the constitution, configuration of Fructose. Write cyclic structure of glucose (α and β Fructopyranose) in Haworth representation.

Short Questions

1. What is mutarotation?
2. Define anomers with examples.
3. Explain osazone formation of glucose and fructose.
4. Write a short note on Kiliani-Fischer synthesis.

UNIT-V: AMINO ACIDS-Easy Questions

1. Define amino acids and classify them into α , β and γ amino acids.
2. Explain the general methods of preparation of α -amino acids.
3. Describe Strecker's synthesis of amino acids.
4. Explain zwitter ion structure and isoelectric point.

Short Questions

1. What are essential amino acids? Give examples.
2. Write a short note on amphoteric nature of amino acids.
3. Explain peptide bond formation.
4. Write a note on lactam formation from γ and δ amino acids.

	Government College (Autonomous) Rajahmundry	Program & Semester			
Course Code	TITLE OF THE COURSE Course -11: ORGANIC CHEMISTRY	II B.SC CHEMISTRY(H) (IV Semester)			
Teaching	Hours Allocated: 30 (Practical)	L	T	P	C
Pre-requisites	Knowledge on calculating limiting reagent, theoretical yield, and percent yield	-	-	2	2

Course Objectives:

1. To provide basic knowledge about the handling of laboratory apparatus
2. To provide knowledge on calculating limiting reagent, theoretical yield, and percent yield.
3. To provide hands on training on laboratory techniques including reflux, distillation, recrystallization, vacuum filtration.

Course Outcomes:

On Completion of the course, the students will be able to	
CO 1	How to use glassware, equipment and chemicals and follow experimental procedures in the laboratory.
CO 2	How to calculate limiting reagent, theoretical yield, and percent yield.
CO 3	How to perform common laboratory techniques including reflux, distillation, recrystallization, sublimation and distillation..
CO 4	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.

Course with focus on employability / entrepreneurship / Skill Development modules

Skill Developm ent			Employabili ty			Entrepreneurs hip	

Syllabus - Organic preparations (50M)

(C) Give a brief introduction on

(a) Re-crystallisation (b) sublimation (c) distillation (d) M.P & B.P

(D) Single step preparations

(a) Preparation of P-Nitro acetanilide (b) Preparation of Aspirin

Text books:

1. Vogel A.I .Practical Organic Chemistry, Longman Group Ltd.
2. Bansal R.K. Laboratory Manual of Organic Chemistry, Wiley-Eastern.
3. Ahluwalia V. K. and Agarwal R. Comprehensive Practical Organic Chemistry, University press

CO-PO Mapping:

(1: Slight [Low]; 2: Moderate [Medium]; 3: Substantial [High], '-' : No Correlation)

	P O 1	P O 2	P O 3	P O 4	P O 5	PO6	P O 7	P O 8	P O 9	P O 10	PS O 1	PS O 2	PS O 3
CO 1	3	2	3	2	2	2	2	3	2	2	3	3	3
CO 2	2	3	3	3	3	2	2	2	2	3	2	2	3
CO 3	3	3	3	2	2	1	1	2	3	1	2	3	3
CO 4	2	3	2	1	3	2	3	1	2	3	3	2	2
Avg.	2 .5	2 .75	2 .75	2	2.5	1.75	2	2	2 .25	2.25	2.5	2.5	2.75

GOVERNMENT COLLEGE (A), RAJAMAHENDRAVARAM

II B.Sc. CHEMISTRY(H)

SEMESTER -IV

C11- Organic Chemistry (PRACTICAL –III) AT THE

END OF SEMESTER –IV

SCHEME OF VALUATION

Time: 03 Hrs.

Max. Marks: 50 M

4. Record	-----	10 Marks
5. Practical	-----	35 Marks
6. Viva - voce	-----	05 Marks

Splitting of Practical Marks : (35M)

Procedure in 10 minutes : 10 M

Principle : 05 M

Experimental set up : 05 M

Effective separation : 15 M

IV SEMESTER SYLLABUS FOR ANALYTICAL CHEMISTRY



**Government College (Autonomous)
Rajahmundry**

Program & Semester
II B.Sc.
ORGANIC
CHEMISTRY

Course Code 9	TITLE OF THE COURSE Course -9: SPECTROSCOPY	(SEMESTER – IV)			
Teaching	Hours Allocated: 45 (Theory) (3 hrs. / Wk.)	L	T	P	C
Pre-requisites:	Basic knowledge about spectrum and its classification	3	-	-	3

Course Objectives:

1. To inculcate basic knowledge on basic concepts like Beer-Lambert's law
2. To understand the concept of Spectroscopy
3. To illustrate the classification of spectroscopies
4. To provide knowledge and applications on various spectroscopies

On Completion of the course, the students will be able to-		Cognitive Domain
C O1	Understand the basic governing law of spectroscopy – Beer lamberts law and interaction of electromagnetic radiation with matter	Knowledge
C O2	Learn Principles of Electronic, IR and NMR spectroscopies	Understand
C O3	Understand Applications of Electronic, IR and NMR spectroscopies	Application
C O4	Applying principles of various spectroscopies to various organic compounds	Application

Course with focus on employability / entrepreneurship / Skill Development modules

Skill Development		Employability		Entrepreneurship	

Syllabus:

UNIT-I

GENERAL FEATURES OF ABSORPTION

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

UNIT-II

ELECTRONIC SPECTROSCOPY:

Interaction of electromagnetic radiation with molecules and types of molecular spectra. Energy levels of molecular orbitals (σ , π , n). Selection rules for electronic spectra. Types of electronic transitions in molecules. Concept of chromophore and auxochrome. Bathochromic shift, Hypsochromic shift, hyper chromic shift, hypochromic shift. Effect of conjugation on λ_{max} .

UNIT-III

INFRA RED SPECTROSCOPY:

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

UNIT-IV

PROTON MAGNETIC RESONANCE SPECTROSCOPY (^1H -NMR)

Principles of nuclear magnetic resonance, equivalent and non-equivalent protons, position of signals. Chemical shift, NMR splitting of signals - spin-spin coupling, coupling constants.

UNIT-V

APPLICATIONS

Application of electronic spectroscopy-Woodward-Fieser rules for calculating λ_{max} of conjugated dienes and α,β - unsaturated carbonyl compounds. Applications of IR Spectroscopy NMR Spectra of Ethyl bromide, Ethanol, Acetaldehyde, 1,1,2-Tribromo ethane, Ethyl acetate, Toluene and Acetophenone.

List of Reference Books:

1. Spectroscopy by William Kemp
2. Spectroscopy by Pavia
3. Organic Spectroscopy by J. R. Dyer
4. Elementary organic spectroscopy by Y.R. Sharma
5. Spectroscopy by P.S. Kalsi
6. Organic spectroscopy by Jagmohan

(1: Slight [Low]; 2: Moderate [Medium]; 3: Substantial [High], '-': No Correlation)

	C L O	PL O1	PL O2	PL O3	PL O4	PL O5	PL O6	PL O7	PL O8	PL O9	PLO1 0	CLO\ PLO	PLO1
CLO 1	3	2	3	2	2	2	3	3	2	2	3	3	3
CLO 2	2	3	3	3	3	2	1	2	2	3	2	2	3

CLO 3	3	3	3	2	2	1	1	2	3	1	2	3	3
CLO 4	2	1	2	1	3	2	3	1	2	3	2	3	2
CLO 5	2.5	2.25	2.75	2.0	2.5	1.75	2.0	2.0	2.25	2.25	2.25	2.75	2.75

GOVERNMENT COLLEGE (A), RAJAMAHENDRAVARAM
II B.Sc. ORGANIC CHEMISTRY (Hons.) SEMESTER-IV 2024-25
CHEMISTRY COURSE-9: SPECTROSCOPY

QUESTION PAPER BLUE PRINT

TIME: 2½ Hrs.

MAX. MARKS: 50 PART – A

Answer **ALL** the following questions.

5x7 = 35 M

1a Question from UNIT-I

OR

1b Question from UNIT-I

2a Question from UNIT-

OR

2b Question from UNIT-II

3a Question from UNIT-III

OR

3b Questions from UNIT-III

4a Question from UNIT-IV

OR

4b Question from UNIT-IV

5a Question from UNIT-V

OR

5b Question from UNIT-V

PART – B

Answer any **FIVE** of the following questions.

5x3 = 15 M

6 Question from UNIT-I

7 Question from UNIT-II

8 Question from UNIT-III

9 Question from UNIT-IV

10 Question from UNIT- V

11 Question from UNIT-II

12 Question from UNIT-III

13 Question from UNIT- V

GOVERNMENT COLLEGE (A), RAJAHMUNDRY
II B.Sc. ORGANIC CHEMISTRY
SEMESTER-IV MODEL PAPER (From
2024-25) Course - 9: SPECTROSCOPY

Time: 2½ hrs

Max.Marks:50

PART- A

Answer ALL the questions. Each carry SEVEN marks

5 x 7 = 35 M

1a State and explain Beer-Lambert's law.

OR

1b Give the experimental procedure for determination of Chromium in Potassium dichromate using Beer-Lambert's law.

2a What are electronic transitions? Explain different types of electronic transitions with suitable examples.

OR

2b Explain different types of Absorption-Intensity shifts in Electronic Spectroscopy.

3a Explain the significance of functional group region and fingerprint region with suitable examples.

OR

3b Discuss different modes of vibrations in IR spectroscopy.

4a What is chemical shift? Write the factors effecting chemical shift.

OR

4b What is spin-spin coupling? Describe different types of coupling constants.

5a How many different NMR signals you will observe in the following organic compounds?
 (i) Ethanol (ii) Ethyl bromide (iii) Toluene

OR

5b Describe the Woodward-Fieser rules for calculating $\lambda_{\max}$ of α, β – unsaturated carbonyl compounds.

Marks	B L	CLO	P L O	P I
7	2	2	1	
7	2	2	2	
7	2	1	2	
7	2	3	2	
7	5	1	7	

7	4	1	3	
7	3	4	2	
7	6	5	5	
7	3	3	4	

PART – B

Answer any **FIVE** of the following questions.

5x3 = 15 M

6	Define Absorbance, transmittance and molar absorptivity.	Ma rks	B L	C L O	PL O	P I
7	Write a short note on Chromophores.	3	1	1	1	
8	Write the characteristic absorption bands of various organic functional groups.	3	2	1	2	
9	What are equivalent and non-equivalent protons?	3	2	1	3	
10	Write any two applications of UV- Vis spectroscopy with suitable examples.	3	6	3	5	
11	Explain Auxochromes with suitable examples..	3	5	3	7	
12	Mention the important IR vibrational frequencies of Carbonyl compounds and Amines.	3	2	5	2	
13	Describe the NMR spectrum of Acetaldehyde.	3	4	4	3	
		3	5	4	3	

CHEMISTRY COURSE-9: SPECTROSCOPY

QUESTION BANK

Essay Questions

1. Define Absorbance, transmittance, and molar absorptivity. State and explain Beer-Lambert law
2. Give the experimental procedure of simultaneous determination of chromium in potassium dichromate and manganese in Manganous Sulphate using Beer-Lambert's law.
3. Explain types of molecular spectra and selection rules for the formation of spectra.
4. Write about different energy levels of Electronic spectroscopy.
5. Define Chromophore and auxochrome. How does the conjugation, affect the λ_{max} .
6. Write about characteristic absorption bands of various functional groups.
7. Explain the Fingerprint region. Explain its significance with an example. Write IR spectral data for any one alcohol, aldehyde and ketone.
8. Explain Functional group and finger print regions.
9. Discuss different modes of vibrations in IR spectroscopy.
10. Give a detailed explanation on the principle of NMR spectroscopy. What is a chemical shift equivalence?
11. Describe the role of equivalent and non-equivalent protons in NMR spectroscopy.
12. Explain the position of signals.
13. How many different NMR signals you will see in the following molecules? Ethanol, Ethyl Acetate, toluene and Acetophenone.
14. Explain the applications of UV – Vis and IR spectroscopies in structure determination of organic compounds.
15. Application of NMR to ethyl bromide, ethanol, acetaldehyde, 1,1,2-tribromo ethane, ethylacetate, toluene and acetophenone.

Short Answer Questions

1. Discuss single and double-beam spectrophotometers.
2. Write briefly about different shifts in UV – Vis Spectroscopy.
3. Explain types of electronic transitions in UV – Vis Spectroscopy. Write a short note on different regions in IR.
4. Write IR stretching frequencies of alkanes and amines.
5. Explain about spin-spin coupling in NMR.
6. Define principle of NMR.
7. Define coupling constant with examples.
8. Write any two applications of UV- Vis spectroscopy with examples.

**OVERNMENT COLLEGE (A) –
RAJAMAHENDRAVARAM II B.Sc. CHEMISTRY
SEMESTER – IV- PAPER –C-9: SPECTROSCOPY
QUESTION BANK**

Essay type questions. Each question carries 7 marks.				
Unit-1	Marks	BL	CLO	PLO
1.How can you determine the amount of Chromium present in the given Potassium dichromate solution by applying Beer-Lambert's law?	7	4	1	4
2. State and explain Beer-Lambert's law.	7	2	1	1, 2
3. Give the experimental procedure for determination of Manganese in Manganese Sulphate using Beer-Lambert's law.	7	4	1	1, 4
Unit-II	Marks	BL	CLO	PLO
1. What are electronic transitions? Explain various types of electronic transitions with suitable examples.	7	2	2	2, 3
2. Explain different types of Absorption-Intensity shifts in Electronic Spectroscopy.	7	2	2	1
3. Explain Chromophores and Auxochromes with suitable examples.	7	2	3	2
Unit-III	Marks	BL	CLO	PLO
1. What are fundamental vibrations? Illustrate various types of fundamental vibrations.	7	3	3	1, 2, 3
2. Explain the significance of functional group region and fingerprint region with suitable examples.	7	2	4	1, 3
3. Discuss different modes of vibrations in IR spectroscopy.	7	2	3	1, 2, 3
Unit-IV	Marks	BL	CLO	PLO
1.What is chemical shift? Discuss the factors effecting chemical shift.	7	2	3	1, 2, 3

2. What is spin-spin coupling? Explain various types of spin-spin couplings in NMR spectroscopy.	7	2, 4.	4	1, 2
3. Explain the concept of splitting of NMR signals.	7	2	3	1, 2, 3
Unit-V	Marks	BL	CLO	PLO
1.Explain the Woodward-Fieser rules for calculating $\lambda_{\max}$ of α , β – unsaturated carbonyl compounds with suitable examples.	7	2,4	4	4
2.Demonstrate the NMR spectra of the following compounds. (i) Ethyl alcohol (ii) Ethyl bromide	7	3	4	1, 3, 4
3.Explain the Woodward-Fieser rules for calculating $\lambda_{\max}$ of conjugated dienes with suitable examples.	7	2,4	4	3, 4

Short answer questions. Each question carries 3 marks.

Unit-1	Marks	BL	CLO	PLO
1.Define the terms absorbance, transmittance and molar absorptivity.	3	1	1	1, 4
2. Explain single beam spectrophotometer briefly.	3	2	1	1, 4
Unit-II	Marks	BL	CLO	PLO
1. Write a short note on chromophores.	3	2	2	1, 4
2. Explain auxochromes with suitable examples.	3	2	2	1, 2
3. Write the selection rules of electronic spectroscopy.	3	4	3	1
Unit-III	Marks	BL	CLO	PLO
1. Write the characteristic absorption bands of various organic functional groups.	3	2	3	1, 2, 3
2. Mention the important IR vibrational frequencies of Carbonyl compounds and Amines.	3	2,4.	3	1, 4

3.Explain the significance of fingerprint region in IR spectroscopy.	3	2	3	1, 2, 3
Unit-IV	Marks	BL	CLO	PLO
1.Explain equivalent and non-equivalent protons with suitable examples.	3	2	3	1
2. Write the basic principle of NMR	3	2	3	1, 2, 3
Unit-V	Marks	BL	CLO	PLO
1. Describe the NMR spectrum of Toluene.	3	2	4	1, 2, 3, 4
2. Write the applications of IR spectroscopy	3	4	3	1, 2, 3
3. Describe the NMR spectrum of Acetaldehyde.	3	2	4	1, 2, 3

	Government College (Autonomous) Rajahmundry	Program & Semester II B.Sc. ORGANIC CHEMISTRY (SEMESTER – IV)			
Course Code 9	TITLE OF THE COURSE Course 9: SPECTROSCOPY				
Teaching	Hours Allocated: 30 (Practical)	L	T	P	C
Pre-requisites	Preparation of standard solutions and handling of laboratory apparatus and instruments	-	-	2	1

Course Objectives:

1. To demonstrate basic knowledge about the handling of laboratory apparatus
2. To illustrate knowledge about the preparation of standard solutions
3. To provide hands-on training for the determination of different organic compounds

Course Outcomes:

On Completion of the course, the students will be able to	
CO 1	Learn to Handle and calibrate the common laboratory glass apparatus and instruments
CO 2	Get practical skill to the preparation of different standard solutions used for quantitative analysis
CO 3	Identify and confirm the structure of a given organic compounds
CO 4	Principles and applications of different molecular spectra

Course with focus on employability / entrepreneurship / Skill Development modules

Skill Development			Employability		Entrepreneurship	-

IR spectral analysis of the following functional groups with examples

(i) Hydroxyl Groups

(j) Carbonyl Groups

(k) Amino Groups

(l) Aromatic Groups

CLO-PLO Mapping:

1: Slight [Low]; 2: Moderate [Medium]; 3: Substantial [High], 4: (No Correlation)

	C L	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7	PLO 8	PLO 9	PLO1 0	CLO\ PLO	P L O 1
	O\P LO												
CL O1	3	3	3	2	3	2	2	2	3	2	2	3	3
CL O2	3	3	3	2	3	2	2	3	2	3	3	3	3
CL O3	3	2	3	2	3	1	2	2	2	2	2	3	2
CL O4	3	3	2	1	3	2	2	1	2	3	3	3	3
CL O5	3	2 . 7 5	2 . 7 5	2	3	2	2	2	2 . 2 5	2 . 5	2. 5	3	2. 75

	Government College (Autonomous) Rajahmundry	Program & Semester II B.Sc. CHEMISTRY (H), ORG CHEMISTRY,

Course Code	TITLE OF THE COURSE Course -10: PHYSICAL CHEMISTRY-II	ANALYTICAL CHEMISTRY & INDUSTRIAL CHEMISTRY (SEMESTER – IV)			
Teaching	Hours Allocated: 45 (Theory) (3 hrs. / Wk.)	L	T	P	C
Pre-requisites:	Basic knowledge about material and energy balances	3	-	-	3

Course Objectives:

1. To provide basic knowledge on Colligative Properties
2. To provide basic awareness on concepts of electrochemistry
3. To understand the basic concepts of Electrodes and their usage
4. To provide knowledge and understand ability on phase systems
5. To Provide the knowledge on photochemistry

Course Outcomes:

On Completion of the course, the students will be able to-		Cognitive Domain
CO 1	Understand the concept of Colligative Properties.	Knowledge and Application
CO 2	Understand the basic concepts of electrochemistry	Knowledge
CO 3	Understand the basic concepts of Electrodes and their usage	Understand and application
CO 4	To understand basic concepts of phase rule	Application
CO 5	Understand the laws of photochemistry and learn how to calculate the quantum yields of different photo physical processes	Knowledge

Development		Employability		Entrepreneurship	

SYLLABUS

UNIT-I DILUTE SOLUTIONS

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

UNIT-II ELECTROCHEMISTRY-I

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

UNIT-III ELECTROCHEMISTRY-II

Single electrode potential, sign convention, Reversible and irreversible cells Nernst Equation- Reference electrode, Standard Hydrogen electrode, calomel electrode, Indicator electrode, metal – metal ion electrode, Inert electrode, Determination of EMF of cell, Applications of EMF measurements

- Potentiometric titrations.

UNIT-IV PHASE RULE

Concept of phase, components, degrees of freedom. Thermodynamic Derivation of Gibbs phase rule. Phase equilibrium of one component system - water system. Phase equilibrium of two- component system, solid-liquid equilibrium. Simple eutectic diagram of Pb-Ag system, simple eutectic diagram, desilverisation of lead., NaCl-Water system, Freezing mixtures.

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, hydrogen- bromine reaction. Qualitative description offluorescence, phosphorescence, Photosensitized

LIST OF REFERENCE BOOKS

4. Modern Electrochemistry by J.O. M. Bockris and A.K.N.Reddy
5. Advanced Physical Chemistry by Atkins
6. Introduction to Electrochemistry by S. Glasstone

CO-PO Mapping:

(1: Slight [Low]; 2: Moderate [Medium]; 3: Substantial [High], '-': No Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	2	3	2	2	2	3	3	2	2	3	3	3
CO2	2	3	3	3	3	2	1	2	2	3	2	2	3
CO3	3	3	3	2	2	1	1	2	3	1	2	3	3
CO4	2	1	2	1	3	2	3	1	2	3	2	3	2
Avg.	2.5	2.25	2.75	2.0	2.5	1.75	2.0	2.0	2.25	2.25	2.25	2.75	2.75

GOVERNMENT COLLEGE (A), RAJAMAHENDRAVARAM

**II B.Sc. CHEMISTRY (H), ORG CHEMISTRY, ANALYTICAL
CHEMISTRY & INDUSTRIAL**

CHEMISTRY

SEMESTER – IV

**Course -4: PHYSICAL CHEMISTRY-II WEIGHTAGE
TO CONTENT & BLUE PRINT**

S.NO.	COURSE CONTENT	LONG ANSWER QUESTIONS	SHORT ANSWER QUESTIONS	TOTAL MARKS	AS PER BLOOMS TAXONOMY
1.	UNIT - I	2	1	17	Understanding, Application
2.	UNIT – II	2	2	20	Remembering, Understanding
3.	UNIT – III	2	2	20	Analyzing, Creation
4.	UNIT – IV	2	2	20	Evaluation, Understanding
5.	UNIT - V	2	1	17	Understanding, Application
	TOTAL	10	8	94	

GOVERNMENT COLLEGE (A), RAJAHMUNDRY
II B.Sc. CHEMISTRY (H), ORG CHEMISTRY, ANALYTICAL CHEMISTRY
PHYSICAL CHEMISTRY SEMESTER -IV
MODEL PAPER
Course -10: PHYSICAL CHEMISTRY-II

Time: 2 ½ Hr.
Marks

Max Marks. 50

PART- A

Answer ALL the questions. Each carry SEVEN marks

5 x 7 = 35 M

1. What is elevation in boiling point and derive the relation between molecular weight of solute and elevation in boiling point? BT2 CO1 PO1
(OR)
2. Define osmotic pressure and explain their experimental determination? BT2 CO1 PO1
3. Describe Kohlrausch's law and its applications BT2 CO2 PO2
(OR)
4. Define the transport number and determine the transport number by Hittorf's method BT1 CO2 PO2
5. State the Nernst equation and write its applications BT2 CO3 PO3
(OR)
6. Describe Reversible electrodes and its types BT2 CO3 PO3
7. What is phase rule? Explain the phase diagram of one component system BT1 CO4 PO4
(OR)
8. Explain phase diagram of Pb-Ag System BT3 CO4 PO4
9. Describe the laws of photo chemistry BT2 CO5 PO5
(OR)
10. Explain the photochemical reaction of $H_2 - Cl_2$ with mechanism. BT3 CO5 PO5

PART- B

Answer any FIVE of the following questions. Each carry THREE marks 5 x 3 = 15 M

11. What are colligative properties? Give examples BT1 P
CO1 O
1
12. State and explain Raoult's law BT2 P
CO2 O
2

13. Define specific conductance and equivalent conductance	BT2	P
	CO2	O
		2
14. Write a short note on Ostwald's dilution law	BT3	P
	CO3	O
		3
15. Write briefly about Calomel electrode?	BT1	P
	CO3	O
		3
16. Define the terms Phase, Component and Degrees of freedom	BT3	P
	CO4	O
		4
17. Write the differences between photochemical and thermochemical reactions	BT2	P
	CO4	O
		5
18. Define fluorescence and phosphorescence?	BT1	P
	CO5	O
		5

Question Bank:

Essay Questions: 07 Marks

17. What is elevation in boiling point and derive the relation between molecular weight of solute and elevation in boiling point?
18. Define osmotic pressure and explain their experimental determination?
19. Derive Raoult's law equation for relative lowering of vapour pressure and determine molecular weight from lowering of vapour pressure
20. Describe the relation between depression in freezing point and molecular weight of non-volatile solute
21. Describe Kohlrausch's law and its applications
22. Define the transport number and determine the transport number by Hittorf's method
23. Discuss in detail about conductometric titrations with suitable examples
24. State the main postulates of Debye – Huckel theory of strong electrolytes
25. State the Nernst equation and write its applications
26. Describe Irreversible electrodes and its types
27. What is phase rule? Explain the phase diagram of one component system
28. Explain phase diagram of Pb-Ag System
29. Draw and explain the phase diagram of NaCl – Water system
30. Describe the laws of photo chemistry
31. Explain the photochemical reaction of $\text{H}_2 - \text{Cl}_2$ with mechanism.
32. Explain the photochemical reaction of $\text{H}_2 - \text{Br}_2$ with mechanism.

Short Answer Questions: 03 Marks

21. What are colligative properties? Give examples
22. State and explain Raoult's law
23. What is Vant Hoff's factor?
24. What is mean by depression in freezing point
25. Explain why there is elevation in boiling point and depression freezing point when a non-volatile solute is dissolved in water?
26. Define specific conductance and equivalent conductance
27. Write a short note on Ostwald's dilution law
28. What is the effect of dilution on Specific and equivalent conductivities?
29. Define the term Transport number
30. Arrhenius theory of electrolytic dissociation
31. Write briefly about Calomel electrode?
32. Difference between Electrochemical cells and Electrolytic cells
33. What is standard hydrogen electrode?
34. Define the terms Phase, Component and Degrees of freedom
35. What is Phase rule?
36. Write a short note on Freezing mixtures?
37. Write the differences between photochemical and thermochemical reactions
38. Define fluorescence and phosphorescence?
39. Short note on the Jablonski diagram
40. Explain the concept of photosensitization

	Government College (Autonomous) Rajahmundry	Program & Semester			
Course Code	TITLE OF THE COURSE Course -10: PHYSICAL CHEMISTRY LAB				
Teaching	Hours Allocated: 30 (Practical)	L	T	P	C
Pre-requisites	Preparation of standard solutions and handling of laboratory apparatus	-	-	2	1

Course Objectives:

- To provide hands-on experience in determining the CST of the phenol-water system through laboratory experiments.
- To guide students in designing and conducting experiments to study the effect of NaCl on the CST and analyze the resultant data.
- To train students in performing conductometric titrations using standard NaOH solutions for the accurate determination of HCl concentration.
- To equip students with the skills necessary to conduct conductometric titrations to determine the concentration of CH₃COOH using standard NaOH solutions.

Course Outcomes:

On Completion of the course, the students will be able to	
CO 1	Analyze the phase behavior of the phenol-water system at different temperatures and concentrations.
CO 2	Predict and explain the shifts in CST due to the addition of NaCl to the phenol-water system.
CO 3	Develop the skills to perform conductometric titrations using standard NaOH solutions.
CO 4	Interpret conductometric titration curves and derive accurate concentrations of CH ₃ COOH from experimental data

Course with focus on employability / entrepreneurship / Skill Development modules

Skill Development			Employability		Entrepreneurship	-

Practical Syllabus:

50 M

1. Critical solution temperature of phenol-water system
2. Effect of NaCl on CST (phenol water system)
3. Determination of concentration of HCl conductometrically using standard NaOH Solutions
4. Determination of concentration of CH₃COOH conductometrically using standard NaOH Solutions

CO-PO
Mapping:

1: Slight [Low]; 2: Moderate [Medium]; 3: Substantial [High], 4: (No Correlation)

	P O 1	P O 2	P O 3	P O 4	P O 5	P O 6	P O 7	P O 8	P O 9	P O 10	PS O 1	P S O 2	P S O 3
CO1	3	3	3	2	3	2	2	2	3	2	2	3	3
CO2	3	3	3	2	3	2	2	3	2	3	3	3	3
CO3	3	2	3	2	3	1	2	2	2	2	2	3	2
CO4	3	3	2	1	3	2	2	1	2	3	3	3	3
Avg.	3	2 . 7 5	2 . 7 5	2	3	2	2	2	2 . 2 5	2 . 5	2 . 5	3	2. 75

	Government College (Autonomous) Rajahmundry	Program & Semester			
Course Code C11	TITLE OF THE COURSE SEPARATION METHODS - I	ANALYTICAL CHEMISTRY (IV Semester)			
Teaching	Hours Allocated: 60 (Theory)	L	T	P	C
Pre-requisites	Introduction to separation methods and fractional distillation	3	1	-	3

Course Objectives:

1. To provide basic knowledge about separation techniques
2. To give knowledge and awareness on chromatographic techniques
3. To provide knowledge and experimental techniques of column chromatography
4. To provide knowledge and importance of HPLC technique.

Course Outcomes:

On Completion of the course, the students will be able to		Cognitive Domain
CO1	Get awareness and understand the principles of chromatography	Understanding
CO2	Get experimental skill and hands on experience about Paper and Thin layer chromatography	Skill
CO3	Get practical skill and separate some of the analytes by using column chromatography	Application
CO4	Get awareness and understanding about the HPLC technique	Understanding

Course with focus on employability / entrepreneurship / Skill Development modules

Skill Development		Employability		Entrepreneurship	

SYLLABUS

UNIT – I: Chromatography:

15hrs

Introduction to chromatography, Classification of chromatographic methods: Based on principle of separation (Adsorption & Partition), The Stationary and Mobile phases, Principle of chromatographic separation: Differential migration, Theory of chromatography: Distribution coefficients, Methods of developments in chromatographic process: Frontal analysis, Displacement development and Elution development, Efficiency of a chromatographic column, Retention time and retention volume, Capacity factor and Resolution.

UNIT – II:

15hrs

A) Paper Chromatography:

Principle and theory of paper chromatography, Experimental set up of paper chromatography, Various modes of developments used in paper chromatography: Ascending mode, Descending mode, Radial or circular mode and Two dimensional mode, The nature of the papers, Paper supports and Stationary phases used in paper chromatography, The solvent systems and the Mobile phases used in paper chromatography, Detection of spots and retardation factor, Applications of paper chromatography

Thin layer chromatography:

Principle and theory of thin layer chromatography, The techniques of thin layer chromatography: Preparation of plate, Stationary phases, Adsorbents, Sample application, Mobile phases, development of plate, measurement and identification of solutes (R_f – value) quantitative evaluation. Advantages of Thin layer chromatography, Quantitative analysis and applications of Thin layer chromatography

UNIT – III:

15hrs

Adsorption Chromatography:

Principle of Adsorption chromatography, The nature of forces between adsorbate and adsorbent: Vander waals forces, Polar forces, Ionic forces and Chemisorption, Adsorbents materials and Stationary phases used in adsorption chromatography, Solvents & Mobile phases used in adsorption chromatography and Eluotropic series, Types of adsorption chromatography: Thin layer chromatography and Column chromatography, Applications of adsorption chromatography.

UNIT – IV:

15hrs

A) Column Chromatography:

Theory and Principle of Column chromatography, Types of Columns used in column chromatography and column packing, Stationary phases and Mobile phases used in column chromatography, Column development and sample elution, Applications of column chromatography

B) Liquid-Liquid Partition Chromatography:

Principle of Liquid – liquid chromatography, Normal phase liquid chromatography, Reverse-phase liquid chromatography, The column and the support materials, Experimental set up and detectors, Applications.

UNIT – V:

15hrs

High Performance Liquid Chromatography:

Principle and theory of HPLC, Advantages of HPLC technique, Instrumentation of HPLC, Column, column matrices and Column packing, Stationary phases and mobile phases used in HPLC, Solvent delivery systems and Pumps used in HPLC, Detectors used in HPLC: Bulk property detectors: Refractive index and Conductivity detectors, Solute property detectors: UV –detectors and Fluorescence detectors, Applications of HPLC.

Text books:

1. Separation methods by M.N. Sastri
2. Douglas A. Skoog and Donald M. West: Fundamentals of Analytical Chemistry.
3. Quantitative chemical analysis by Vogel's 6th and 7th editions

Reference books:

1. F.W. Fifiield and D. Kealy: Analytical Chemistry.
2. Daniel C Harris: Exploring chemical analysis.
3. Daniel C Harris: Quantitative chemical analysis.
4. R.V. Dilts Analytical Chemistry- Methods of Separation.
5. O. Mikes, R.A. Chalmers: Laboratory Handbook of Chromatographic Methods
6. Chemical separation methods by John A. Dean

CO-PO Mapping:

(1: Slight [Low]; 2: Moderate [Medium]; 3: Substantial [High], '-' : No Correlation)

Proposed activities:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	2	3	2	2	2	3	3	2	2	3	3	3
CO2	2	3	3	3	3	2	2	2	2	3	2	2	3
CO3	3	3	3	2	2	1	1	2	3	1	2	3	3
CO4	2	3	2	1	3	2	3	1	2	3	3	2	2

A v g.	2 . 5	2 . 7 5	2.75	2	2 . 5	1 . 7 5	2 . 2 5	2	2 . 2 5	2 . 2 5	2.5	2.5	2 . 7 5

Skill Development:

1. Preparation of TLC plates
2. Separation of compounds by using TLC

Employability:

1. Principles of Chromatography
2. Applications of different chromatography techniques

Entrepreneurship:

1. High performance liquid chromatography technique

GOVERNMENT COLLEGE (A), RAJAMAHENDRAVARAM

ANALYTICAL CHEMISTRY, SEM IV

SEPARATION METHODS - I

MODEL PAPER

TIME: 2¹/₂ hr.

MARKS: 50 M

SECTION - A

Answer ALL the questions

(5 X 7 = 35 M)

1. Any One Question from Unit -I

(OR)

2. Any One Question from Unit -I
3. Any One Question from Unit -II

(OR)

4. Any One Question from Unit -II
5. Any One Question from Unit -III

(OR)

6. Any One Question from Unit -III
7. Any One Question from Unit -IV

(OR)

8. Any One Question from Unit -IV
9. Any One Question from Unit -IV

(OR)

10. Any One Question from Unit -IV

SECTION-B

Answer any Five of the following

(5 X 3 = 15 M)

11. Any One Question from Unit -I

12. Any Question from Unit -I

13. Any Question from Unit -II

14. Any Question from Unit -II

15. Any Question from Unit -III

16. Any Question from Unit -IV

17. Any Question from Unit -IV

18. Any Question from Unit -V

**GOVERNMENT COLLEGE (A),
RAJAMAHENDRAVARAM**

II B.Sc. ANALYTICAL CHEMISTRY

SEMESTER -IV

PAPER – II: SEPARATION METHODS -I

BLUE PRINT

S. No.	Cours e Conte nt	Ess ay Ques tio ns (7M)	Short Answer Question s (4M)	Total No. Of Questions from each Unit
1	Unit –I	2	2	4
2	Unit –II	2	2	4
3	Unit –III	2	1	3
4	Unit –IV	2	2	4
5	Unit –V	2	1	3
	TOTAL	10	8	18

**GOVERNMENT COLLEGE (A),
RAJAMAHENDRAVARAM**

**II B.Sc. ANALYTICAL CHEMISTRY
SEMESTER -IV**

C11- SEPARATION METHODS - I

QUESTION BANK

ESSAY QUESTIONS: 07M

1. Write about the classification of Chromatographic methods
2. Explain about the various development methods in chromatographic process.
3. Write about the following,
 - i. Theory involved in Chromatographic methods
 - ii. Efficiency of a chromatographic column
4. Write about various modes of developments in Paper chromatographic technique.
5. Explain about the principle, experimental set up and applications of Paper chromatography.
6. Explain about principle, experimental set up and applications of TLC.
7. Explain about the principle and applications of Adsorption chromatography
8. Explain about the principle and application of Column chromatography.
9. Write about the Column packing and column developments in Column chromatography.
10. Explain about the Experimental set up and detectors used in Liquid – liquid partition chromatography
11. Explain in detail about the instrumentation of HPLC
12. Write about the various Detectors used in HPLC
13. Explain briefly about HPLC technique with applications
14. Explain about Normal phase and Reverse- phase chromatographic techniques.

QUESTION BANK SHORT

ANSWER QUESTIONS –03 MARKS:

1. Explain about the principle of differential migration.
2. Write about the efficiency of a chromatographic column.
3. What are distribution coefficients? Explain briefly
4. Explain briefly about Resolution and capacity factor.
5. Write about nature of paper, detection of spots in paper chromatography.
6. Write about Quantitative analysis of TLC.
7. Explain about Sample application and plate preparation in TLC.
8. Define R_f value and write its significance.
9. Explain briefly about the nature of forces between adsorbate and adsorbent in adsorption chromatography.
10. Write about the adsorbent materials used in adsorption chromatography
11. Explain briefly about the sample elution in column chromatography
12. Explain the principle and advantages of HPLC technique.
13. Write about Stationary phases and Mobile phases used in HPLC.
14. What are the differences between NPC and RPC?
15. Explain the principle of Partition chromatography.

	Government College (Autonomous) Rajahmundry	Program & Semester			
Course Code C11P	TITLE OF THE COURSE SEPARATION METHODS –I PRACTICAL –III)	II B.Sc Analytical Chemistry (IV Semester)			
Teaching	Hours Allocated: 30 (Practical)	L	T	P	C
Pre-requisites	Introduction to separation methods and chromatography	-	-	2	2

Course Objectives:

1. To provide basic knowledge about separation techniques
2. To give knowledge and awareness on chromatographic techniques
3. To provide knowledge and practical skill on column chromatography

Course Outcomes:

On Completion of the course, the students will be able to	
CO 1	Get overall knowledge on separation methods
CO 2	Get knowledge and practical skill on Thin layer chromatography
CO 3	Get knowledge and hands on experience on column chromatography
CO 4	Separate different analyte species based on separation techniques

Course with focus on employability / entrepreneurship / Skill Development modules

Skill Development		Employability		Entrepreneurship	

II B.Sc. ANALYTICAL CHEMISTRY
SEMESTER -IV

C11- SEPARATION METHODS

PRACTICAL SYLLABUS

30 Hrs. (02 Hrs. / Wk.)

1. Determination of R_f value of amino acids using paper chromatography.
2. Separation and identification of monosaccharide present in a given mixture
by Paper Chromatography
3. Preparation of TLC plates
4. Separation of 2, 4 –DNP derivatives of acetone and 2 – butanone by TLC.
Separation of mixture of O –Nitro aniline and P –Nitro aniline by using
Column chromatography

Text books:

1. Separation methods by M.N. Sastri
2. Douglas A. Skoog and Donald M. West: Fundamentals of Analytical Chemistry.
3. Quantitative chemical analysis by Vogel's 6th and 7th editions

Reference books:

1. F.W. Fifeild and D. Kealy: Analytical Chemistry.
2. Daniel C Harris: Exploring chemical analysis.
3. Daniel C Harris: Quantitative chemical analysis.
4. R.V. Dils Analytical Chemistry- Methods of Separation.
5. O. Mikes, R.A. Chalmers: Laboratory Handbook of Chromatographic Methods

CO-PO Mapping:

(1: Slight [Low]; 2: Moderate [Medium]; 3: Substantial [High], '-' : No Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	2	3	2	2	2	3	3	2	2	3	3	3
CO2	2	3	3	3	3	2	2	2	2	3	2	2	3
CO3	3	3	3	2	2	1	1	2	3	1	2	3	3
CO4	2	3	2	1	3	2	3	1	2	3	3	2	2
Avg.	2.5	2.75	2.75	2	2.5	1.75	2.5	2	2.25	2.25	2.5	2.5	2.75

GOVERNMENT COLLEGE (A),RAJAMAHENDRAVARAM

II B.Sc. ANALYTICAL CHEMISTRY SEMESTER -IV

C11- SEPARATION METHODS -I(PRACTICAL –III)

AT THE END OF SEMESTER –III

SCHEME OF VALUATION Time: 03 Hrs. Max. Marks: 50 M

1. Record	-----	10 Marks
2. Practical	-----	35 Marks
3. Viva - voce	-----	05 Marks

Splitting of Practical Marks : (35M)

i	Procedure in 10 minutes	: 10 M
.		
ii.	Principle	: 05 M
ii.	Experimental set up	: 05 M

V/VI SEMESTER

COURSE- 12,13,14,15 SYLLABUS

(Green Chemistry, Environmental chemistry,
Analysis of Organic Chemistry are common for four
courses and course 15: synthetic organic chemistry for
Chemistry (H), Organic chemistry(H),Course 15:
Advanced analytical chemistry paper for Analytical
Chemistry (H) and Polymer chemistry for Industrial
chemistry (H)

CHEMISTRY(H),
ORGANIC
CHEMISTRY(H),
ANALYTICAL
CHEMISTRY(H)

		Program & Semester			
Course Code CHE-114C	TITLE OF THE COURSE VIC-ENVIRONMENTAL CHEMISTRY	III B.Sc. (V/VI Semester)			
Teaching	Hours Allocated: 60 (Theory)	L	T	P	C
Pre-requisites	Atmosphere, air pollution, water pollution, chemical toxicology, bio-diversity	3	1	-	3

Course Objectives

6. Segments of atmosphere and control of air pollution
7. Conversion of hard water into soft water and purification of sewage waste water.
8. Types of bio-diversity and classification of bio geo graphicals

Course Outcomes:

On Completion of the course, the students will be able to		
CO1	Understand the environment functions and how it is affected by human activities. Engage in simple and advanced analytical tools used to measure the different types of pollution	Understanding
CO2	Explain the energy crisis and different aspects of sustainability. Learn how to convert hard water into soft water and purification of sewage waste water.	Analysing
CO3	Acquire chemical knowledge to ensure sustainable use of the world's resources and ecosystems services.	Applying
CO4	Analyse key ethical challenges concerning biodiversity and understand the moral principles, goals and virtues important for guiding decisions that affect Earth's plant and animal life. .	Analysing

Course with focus on employability / entrepreneurship / Skill Development modules

Skill Development		Employability		Entrepreneurship	

Syllabus:

UNIT-I

Introduction

12 h

Environment Definition – Concept of Environmental chemistry- Scope and importance of environment in now-a-days – Nomenclature of environmental chemistry – Segments of environment - Natural resources - Renewable Resources - Solar and biomass energy and Non-renewable resources - Thermal power and atomic energy – Reactions of atmospheric oxygen and Hydrological cycle

UNIT-II

Air Pollution

12 h

Definition – Sources of air pollution – Classification of air pollution – Ambient air quality standards -- Global warming -- Acid rain – Photochemical smog – Greenhouse effect – Formation and depletion of ozone – Bhopal gas disaster - Instrumental techniques to monitor pollution - Controlling methods of air pollution.

UNIT-III

Water pollution

12 h

Unique physical and chemical properties of water – Water quality standards and parameters – Turbidity- pH Dissolved oxygen – BOD, COD, Suspended solids, total dissolved solids alkalinity- Hardness of water – Methods to convert temporary hard water in to soft water Methods to convert permanent hard water into soft water – eutrophication and its effects – Industrial waste water treatment. UNIT-IV

Chemical Toxicology

8 h

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 - Solid waste management.

UNIT-V

Ecosystem and biodiversity

8 h

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 (nitrogen, carbon and phosphorous)

Biodiversity

8 h

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

Additional Inputs: Nicotine - Biological effects - Awareness on World Tobacco Day on May 31st - Radioactive pollution - Radiation effect due to cell towers - cell phones.

Text books:

9. III B.Sc. Unified Environmental Chemistry by R.K.Agarwal- Jai prakash nath publications
 10. Environmental Chemistry by BK Sharma & H Kaur, Goel publishing house
- Reference books**
- Fundamentals of ecology by M.C.Dash
 - A Text book of Environmental chemistry by W. Moore and F.A. Moore
 - Environmental Chemistry by Samir k.Banerji
 - Water pollution, Lalude, MC Graw Hill
 - Environmental Chemistry, Anil Kumar De, Wiley Eastern ltd.
 - Environmental analysis, SM Khopkar (IIT Bombay)

Web Links:

<https://youtu.be/zph2PxDNH8g>, <https://youtu.be/IX4cT6sSa3s>

CO-PO Mapping:

(1: Slight [Low]; 2: Moderate [Medium]; 3: Substantial [High]; 4 : No Correlation)

	P O 1	P O 2	P O 3	P O 4	P O 5	PO6	P O 7	P O 8	PO9	P O 10	P S O 1	PSO 2	PS O3
CO1	3	2	3	2	2	2	3	3	2	2	3	3	3
CO2	2	3	3	3	3	2	2	2	2	3	2	2	3
CO3	3	3	3	2	2	1	1	2	3	1	2	3	3
CO4	2	3	2	1	3	2	3	1	2	3	3	2	2
Avg.	2.5	2.75	2.75	2	2.5	1.75	2.25	2	2.25	2.25	2.5	2.5	2.75

Proposed activities :

Skill Development : Estimation of chlorine , acidity and alkanity in water samples

Employability: Water sample analysers & for determine the drinking water parameters

ASSIGNMENT QUESTIONS :

UNIT – I

1. Explain the segments of environments ?
2. What are the Renewable and Non-Renewable energy resources ? Explain the following
 - a. Solar energy
 - ii) Atomic energy
3. Write the concept of scope and importance of Environmental chemistry ?
4. Explain the Hydrological cycle ?
5. What are the Renewable and Non-Renewable energy resources ? Explain the following
 - a. Thermal power
 - ii) Bio mass energy

UNIT- II

1. Discuss the green house effect and write the consequence of it ?
2. Explain the following .
 1. Write the formation and effects of Acid rain .
 2. Photo chemical smog
3. Explain the formation and depletion of ozone layer ?
4. What are controlling methods of air pollution?
5. Explain the following .
 1. Global warming and consequences of it.
 2. Bhopal gas disaster.

UNIT- III

1. Explain any two methods to convert permanent hard water into soft water .
2. Explain the classification of water pollutants ?
3. Give the principle of wastewater treatment and industrial wastewater treatment ?
4. Define BOD & COD .
5. What is Eutrophication and give its effects ?

UNIT-IV

1. What are cyanide pesticides ? give its toxic effects ?
2. Define chemical toxicology ? Explain toxic effects of arsenic and mercury?
3. What are pesticides ? give biochemical effects of pesticides?
4. Explain the biochemical effects of Lead and Cadmium?
5. Explain short note on solid waste management ?

UNIT-V

1. What is Eco- system ? Describe the types of Eco- system ?
2. Give the functions of eco-system?
3. Explain bio-geochemical cycle of Nitrogen .
4. Explain Carbon cycle in the environment.
5. Explain food chain and food web ?
6. Explain the energy flow and energy dynamics of eco-system?
7. What is Biodiversity? Explain the types of biodiversity ?
8. Write bio-geographical classification of India ?

GOVERNMENT COLLEGE (A)
RAJAMAHENDRAVARAM III B.Sc.
CHEMISTRY SEMESTER - V/VI

QUESTION PAPER BLUE PRINT

Paper-VIC – ENVIRONMENTAL CHEMISTRY

TIME : 2¹/₂ hrs.

Max. Marks : 50

PART –A

Answer **ALL** the Questions

5x7 =35 M

1. 2 Questions from UNIT-I
2. 2 Questions from UNIT- II
3. 2 Questions from UNIT – III
4. 2 Questions from UNIT – IV
5. 2 Questions from UNIT – V

PART-B

Answer any **FIVE** Questions

5 x3 =15M

6. 1 Question from UNIT-I
 7. 2 Questions from UNIT-II
 8. 2 Questions from UNIT – III
 9. 2 Questions from UNIT – IV
 10. 1 Question from UNIT – V
-

III B.Sc. DEGREE EXAMINATIONS

SEMESTER – V/VI (2023-24)

CHEMISTRY COURSE - 12 : ENVIRONMENTAL CHEMISTRY

TIME : 2½ hrs.

Max.Marks : 50 M

PART –A

Answer **ALL** the Questions . Each carries **SEVEN** marks.

5 x7 =35 M

1. Explain about the segments of environment.
(OR)
2. Explain the Renewable Energy resources.
3. Explain the formation and depletion of Ozone layer.
(OR)
4. Discuss the green house effect and write the consequences of it.
5. Give the principle of wastage treatment? Explain the industrial waste water treatment.
(OR)
6. Define chemical toxicology. Give toxic effects of lead and mercury.
7. What is hardness of water? Explain any two methods to convert permanent hard water into softwater.
(OR)
8. What are pesticides? Give biochemical effects of pesticides.
9. What is ecosystem? Describe the types of ecosystem.
(OR)
10. Define Biodiversity. Explain the types of biodiversity.

PART- B

Answer any **FIVE** Questions

5 x 3 =15 M

11. Write about Hydrological cycle.
12. Explain the formation of Acid rains and give it's adverse effects.
13. Explain Bhopal gas disaster.
14. Write about Eutrophication and it's effects.
15. Define BOD and COD.
16. Write brief note on Solid waste management.
17. Give the biochemical effects of arsenic.
18. Explain food chain and food web.

	Government College (Autonomous) Rajahmundry	Program & Semester			
CourseCode CHE-114CP	TITLE OF THE COURSE VIC-ENVIRONMENTAL CHEMISTRY	III B.Sc. (V/VI Semester)			
Teaching	Hours Allocated: 30 (Practical)	L	T	P	C
Pre- requisites	Determination of alkalinity, acidity, hardness & chloride content in water.	-	-	2	2

Course Objectives:

1. Learn the procedures of preparation of standard solutions.
2. Analyse acidity and alkalinity in water samples.
3. Acquire skills in estimate the chloride content in water.
4. Analyse water samples by using minimum quantity of reagents.

Course Outcomes:

On Completion of the course, the students will be able to	
CO1	Determine the alkalinity in water samples.
CO2	Determine the acidity of water samples .
CO3	Estimate the hardness of water in laboratories for the use of industrial usage
CO4	Estimate the chloride content in water samples for drinking purpose

Course with focus on employability / entrepreneurship / Skill Development modules

Skill Developme nt		Employabilit y		Entrepreneurshi p	

Syllabus

Practical Course - VIC: Environmental Chemistry

50 M

1. Determination of alkalinity in water sample by double titration method.
2. Determination of acidity in water sample by double titration method
3. Determination of hardness of water using EDTA
 - a) Permanent hardness
 - b) Temporary hardness
4. Determination of Chlorides in water samples by Mohr's method.
5. Determination of pH in soil samples using pH metry.

Text books:

1. III B.Sc. Unified Environmental Chemistry by R.K.Agarwal- Jai prakashnath publications
2. Practical volumetric analysis by Peter AC Pherson

Reference books:

1. Practical hand book of Water analysis by Kanwaljit kaur
2. Volumetric analysis by Mc grew-Hill
3. Volumetric analysis by Henry W.Schimpf

Web links:

1. <https://youtu.be/Set3XdRshGo>
2. <https://youtu.be/zXvEmlFqicw>
3. <https://youtu.be/OiWMSopuuLU>

CO-PO Mapping:

(1: Slight [Low]; 2: Moderate [Medium]; 3: Substantial [High]; 4 : No Correlation)

	P O 1	P O 2	P O 3	P O 4	P O 5	P O 6	P O 7	P O 8	P O 9	P O 10	P S O 1	PSO 2	PSO 3
CO1	3	3	2	2	3	3	3	3	3	3	3	3	3
CO2	3	2	3	3	3	3	3	2	3	3	2	3	3
CO3	3	3	3	3	3	2	3	2	1	2	3	3	1
CO4	3	2	2	2	2	3	2	3	2	2	2	2	2
Avg.	3	2 .5	2 .5	2 .5	2 .7 5	2 .7 5	2.75	2 .5	2 .2 5	2. 25	2. 5	2.7 5	2.25

GOVERNMENT COLLEGE (A),
RAJAHMUNDRY V/VI SEMESTER END
EXAMINATIONS

III B. Sc. CHEMISTRY 2023 - 24

LABORATORY COURSE-VIC: ENVIRONMENTAL CHEMISTRY -
PRACTICAL

Scheme of Valuation

Time 3hrs

Max marks:50M

Record: 10 M

Viva: 5 M

Practical: 35 M

Splitting of Practical Marks:

1.	Aim, apparatus, chemicals	5 M
2.	Principle	5 M
3.	Procedure	5 M
4.	Tabulation	5 M
5.	Report:	
	error < 10% error	1 5 M
	error 10% -15%	10 M
	error > 15%	5 M

	Government College (Autonomous) Rajahmundry	Program & Semester III B.Sc. (V/VI Semester)			
Course Code C-13	TITLE OF THE COURSE GREEN CHEMISTRY & NANO TECHNOLOGY				
Teaching	Hours Allocated: 45 (Theory)	L	T	P	C
Pre-requisites	Types of syntheses, solvents selected in syntheses, catalysis, Nano technology in chemistry.	3	-	-	3

Course Objectives:

1. 100% atom economy reactions
2. Green catalysis, micro wave and ultra sonic assisted syntheses
3. Synthesis of nano particles, preparations and applications.

Course Outcomes:

On Completion of the course, the students will be able to		
CLO1	Understand the importance of green chemistry and green synthesis. Demonstrate skills using the alternative green solvents in synthesis	Understanding
CLO2	Engage in Microwave assisted organic synthesis (MAOS)	Applying
CLO3	Demonstrate and explain enzymatic catalysis. Analyze alternative sources of energy and carry out green synthesis.	Evaluating
CLO4	Examine synthetic routes of key compounds using greener alternatives.	Application Evaluation
CLO5	Carry out the chemical method of nanomaterial synthesis.	Applying

Course with focus on employability / entrepreneurship / Skill Development modules

Skill Development		Employability		Entrepreneurship	

III BSc ANALYTICAL CHEMISTRY

SEMESTER-V

PAPER C-13: GREEN CHEMISTRY AND NANOTECHNOLOGY

45 Hrs (03 Hrs/Wk)

Syllabus:

UNIT-I Green Chemistry: Part- I

10 h

Introduction - Definition of green Chemistry, Need for green chemistry, Goals of Green chemistry Basic principles of green chemistry. Green synthesis- Evaluation of the type of the reaction i) Rearrangements (100% atom economic), ii) Addition reaction (100% atom economic). Organic reactions by Sonication method: apparatus required and examples of sonochemical reactions (Heck, Hunsdiecker and Wittig reactions).

UNIT- II Green Chemistry: Part- II

10 h

1. Selection of solvent:

i) Aqueous phase reactions ii) Reactions in ionic liquids, Heck reaction, Suzuki reactions, epoxidation, iii) Solid supported synthesis.

2. **Supercritical CO₂**: Preparation, properties and applications, (decaffeination, drycleaning)

3. Green energy and sustainability.

UNIT-III

Microwave and Ultrasound assisted green synthesis:

10 h

Apparatus required, examples of MAOS (synthesis of fused anthraquinones, Leuckart reductive amination of ketones) - Advantages and disadvantages of MAOS.

Aldol condensation - Cannizzaro reaction - Diels-Alder reactions - Strecker's synthesis.

UNIT-IV

Green catalysis and green synthesis

15 h

Heterogeneous catalysis, use of zeolites, silica, alumina, supported catalysis - biocatalysis: Enzymes, microbes Phase transfer catalysis (micellar /surfactant)

1. Green synthesis of the following compounds: adipic acid, catechol, disodium menadione acetate (alternative Strecker's synthesis)
2. Microwave assisted reaction in water - Hoffmann elimination – methyl benzoate to benzoic acid – oxidation of toluene and alcohols–microwave assisted reactions in organic solvents. Diels-Alder reactions and decarboxylation reaction.
3. Ultrasound assisted reactions - sonochemical Simmons–Smith reaction (ultrasonic alternative to iodine)

UNIT – V

Nanotechnology in Green chemistry

15 h

Basic concepts of Nano science and Nanotechnology – Bottom-up approach and Top-down approaches with examples – **Synthesis of Nano materials** – Classification of Nanomaterials – Properties and Application of Nanomaterials. Chemical and Physical properties of Nanoparticles – **Physical synthesis of nanoparticles** – Inert gas condensation - aerosol method

- **Chemical Synthesis of nanoparticles** – precipitation and co-precipitation method, sol-gel method.

Additional Inputs:

Enzymatic catalysis - Lock & Key theory - Recent innovations in Nano technology

Text books:

4. III B.Sc. Unified Chemistry by Dr.Dasharath Domal & Y.R.Sharma
5. Green Chemistry by Rakesh K Sharma

Reference books

7. Green Chemistry Theory and Practical. P.T.Anatas and J.C. Warner
8. Green Chemistry V.K. Ahluwalia Narosa, New Delhi.
9. Real world cases in Green Chemistry M.C. Cann and M.E. Connelly
10. Green Chemistry: Introductory Text M.Lancaster: Royal Society of Chemistry(London)
4. Nanotechnology: Health and Environmental Risks, Jo Anne Shatkin, CRC Press(2008).
5. Green Processes for Nanotechnology: From Inorganic to Bioinspired Nanomaterials, Vladimir A. Basiuk, Elena V. Basiuk Springer (2015)

Web Links:

1. <https://youtu.be/Dam3cyRyGrI>
2. <https://youtu.be/2bDf7JSRvf8>

CO-PO Mapping:

Green Chemistry & Nano Technology	CLO /PLO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
	CLO 1	3	2	3	2	2	2	3	3	2	2
	CLO 2	2	3	3	3	3	2	2	2	2	3
	CLO 3	3	3	3	2	2	1	1	2	3	1
	CLO 4	2	3	2	1	3	2	3	1	2	3
	CLO 5	3	2	1	2	3	3	1	2	2	1
	Avg.	2.6	2.6	2.4	2	2.6	2	2	2	2.2	2

Proposed activities:

Skill Development: Synthesis of 100% atom economic reactions and selection of Solvents in green synthesis

Employability: Development of nano materials

Entrepreneurship: Application of nano particals in various electronic products

GOVERNMENT COLLEGE (A), RAJAMAHENDRAVARAM

III B.Sc. CHEMISTRY SEMESTER – V 2025-26

QUESTION PAPER BLUE PRINT

Paper- C-13: GREEN CHEMISTRY & NANO TECHNOLOGY

TIME: 2¹/₂ hrs.

Max.Marks: 50

PART –A

Answer **ALL** the Questions

5x7 =35 M

1a. Question from UNIT-I

(OR)

1b. Question from UNIT- I

2a. Question from UNIT-I I

(OR)

2b. Question from UNIT- II

3a. Question from UNIT-III

(OR)

3b. Question from UNIT- III

4a. Question from UNIT-IV

(OR)

4b. Question from UNIT- IV

5a. Question from UNIT-V

(OR)

5b. Question from UNIT- V

PART –B

Answer **Any Five** of the following Questions

1. x 3 =15M

6. Question from Unit-I

7. Question from Unit-I

8. Question from Unit-II

9. Question from Unit-II

10. Question from Unit-III

11. Question from Unit-IV

12. Question from Unit-V

13. Question from Unit-V

III B.Sc. DEGREE EXAMINATIONS

SEMESTER – V (2025-26)

CHEMISTRY COURSE – C-13: GREEN CHEMISTRY & NANO TECHNOLOGY

TIME: 2½ hrs.

Max. Marks: 50

PART –A

Answer **ALL** the Questions.

5x7 =35M

		Marks	BL	CL O	PLO
1.a)	Explain the basic principles of green chemistry. (OR)	7	2, 3	1	1, 4
1.b)	Explain the following sono chemical reactions i) Huds dicker reaction ii) Witting reaction	7	2, 3	1	1, 4
2.a)	Describe the preparation and properties of super critical carbon dioxide. (OR)	7	4, 5	2	1, 2, 3
2.b)	What are ionic liquids? Explain with any two examples?	7	4, 5	2	1, 2, 3
3.a)	Explain the synthesis of fused Anthro quinines by microwave assisted organic synthesis (OR)	7	2, 4	3	1, 2, 3
3.b)	Describe the green synthesis of a) Aldol condensation b) Cannizaro reaction	7	2, 4	3	1, 2, 3
4.a)	How are adipic acid and catechol prepared by green synthesis? (OR)	7	2, 4, 5	4	1, 2, 3
4.b)	Write about ultra sound assisted reaction? With example	7	2, 4, 5	4	1, 2, 3
5.a)	Discuss the classification and applications of Nanomaterials? (OR)	7	2, 3, 5	5	1, 2, 3, 4
5.b)	Give any two methods for chemical synthesis of nano materials?	7	2, 3, 5	5	1, 2, 3, 4

PART – B

Answer any **FIVE** of the following questions.

5x3 = 15 M

		M ar ks	B L	C L O	PLO
6)	Discuss atom economy reactions?	3	2	1	1, 4
7)	Explain solid supported synthesis?	3	2	1	1, 4
8)	Describe advantages and disadvantages of MAOS?	3	2	1	1, 4
9)	How do you perform Strecker's synthesis by green synthesis?	3	4 , 5	2	1, 2, 3
10)	Write brief note on bio catalysis?	3	2 , 4	3	1, 2, 3
11)	Discuss about ultra sound assisted reactions?	3	2 , 4	3	1, 2, 3
12)	Explain synthesis of nanoparticles by aerosol method?	3	2 , 4 , 5	4	1, 2, 3
13)	Explain bottom-up and top-down approaches with examples?	3	2 , 4	5	1, 2, 3, 4

GOVERNMENT COLLEGE (A) RAJAMAHENDRAVARAM
III B.Sc., ANALYTICAL CHEMISTRY

SEMESTER – V
PAPER –C-13 : GREEN CHEMISTRY AND NANO TECHNOLOGY

QUESTION BANK

Essay type questions. Each question carries 7 marks.				
Unit-1	Marks	BL	CL O	PLO
1.What is green chemistry? Give the basic principles of green chemistry?	7	2	1	1, 4
2. Discuss the 100% atom economy reactions?	7	2, 3	1	1, 4
3. Explain the following sono chemical reactions i) Huds dicker reaction ii) Witting reaction?	7	2, 3	1	1, 4
Unit-II	Marks	BL	CL O	PLO
1.What are ionic liquids? Explain with any two examples?	7	4, 5	2	1, 2, 3
2. Describe the preparation and properties of super critical carbon dioxide?	7	4, 5	2	1, 2, 3
3. Write about the solid supported synthesis?	7	4, 5	2	1, 2, 3
Unit-III	Marks	BL	CL O	PLO
1.Explain the synthesis of fused anthro quinines by microwave assisted organic synthesis?	7	2, 4	3	1, 2, 3
2. Describe the green synthesis of a) Aldol condensation b) Cannizaro's reaction?	7	2, 4	3	1, 2, 3
3. Explain the advantages and disadvantages of MAOS ?	7	2, 4	3	1, 2, 3
Unit-IV	Marks	BL	CL O	PLO
1 How are Adipic acid and Catechol prepared by green synthesis?	7	2, 4, 5	4	1, 2, 3
2. Write about micro wave assited reactions with examples?	7	2, 4, 5	4	1, 2, 3
Unit-V	Marks	BL	CL O	PLO

1. Discuss the classification, synthesis and applications of nano materials?	7	2, 3, 5	5	1, 2, 3, 4
2. Give any two methods for chemical synthesis of nanomaterials?	7	2, 3, 5	5	1, 2, 3, 4
3 Explain synthesis of nano materials by aerosol method?	7	2, 3	5	1, 4

Short answer questions. Each question carries 3 marks.

Unit-1	Marks	BL	CL O	PLO
1. Needs and goals of green Chemistry	3	2	1	1, 4
2. Give an example of atom economy	3	2	1	1, 4
3. Define green synthesis & green Chemistry	3	2	1	1, 4
Unit-II	Marks	BL	CL O	PLO
1. What is green energy? give its sustainability?	3	4, 5	1	1, 4
2. What is Epoxidation? give example.	3	4, 5	2	1, 2, 3
3. Define ionic Liquids	3	2, 4	2	1, 2, 3
4. Explain solid supported synthesis?	3	2	1	1, 4
Unit-III	Marks	BL	CL O	PLO
1. How do you perform Strecker's synthesis by green synthesis?	3	2, 4	3	1, 2, 3
2. What is Diel's-Alder reaction?	3	2, 4	3	1, 2, 3
3. Describe the green synthetic procedure for Leuckart reductive amination of ketones	3	4, 5	1	1, 4
Unit-IV	Marks	BL	CL O	PLO
1. Give brief note on bio catalysis?	3	2, 4	4	1, 2, 3
2. What are the uses of Zeolites?	3	4, 5	1	1, 4
3. Write about silica supported catalysis?	3	2, 4	4	1, 2, 3
Unit-V	Marks	BL	CL O	PLO
1. Explain bottom-up and top-up approaches with examples?	3	2, 4	5	1, 2, 3, 4
2. What is sol-gel method for synthesis of nanomaterials?	3	2, 4	3	1, 2, 3
3. Briefly explain Precipitation and Co-precipitation	3	4, 5	1	1, 4

	Government College (Autonomous) Rajahmundry	Program & Semester			
CourseCode CHE-115CP	TITLE OF THE COURSE GREEN CHEMISTRY & NANO TECHNOLOGY	III B.Sc. (V/VI Semester)			
Teaching	Hours Allocated: 30 (Practical)	L	T	P	C
Pre-requisites	Organic synthesis, photo reduction reactions, addition reactions, rearrangement reactions.	-	-	2	2

Course Objectives:

1. To learn the skill of the conducting reaction and maintain the conditions, overall synthesis and crystallisation.
2. To study the various green synthesis and percentage of yield calculation.
3. To understand about the 100% atom economic green reactions .
4. To learn about the photo reduction reactions and mechanisms

Course Outcomes:

On Completion of the course, the students will be able to	
CO1	Learn the procedures of green synthesis.
CO2	Demonstrate skills in the preparation of 100% atom economic green reactions .
CO3	Acquire skills in Microwave assisted organic synthesis.
CO4	learn photo reduction reactions

Course with focus on employability / entrepreneurship / Skill Development modules

Skill Development		Employability		Entrepreneurship	

Syllabus:

Organic Synthesis

50 M

1. Acetylation of 1⁰ amine by green method: Preparation of acetanilide
2. Rearrangement reaction in green conditions: Benzil - Benzilic acid rearrangement
3. Benzoin condensation using Thiamine Hydrochloride as a catalyst instead of cyanide.
4. Photo reduction of Benzophenone to Benzo -pinacol in the presence of sunlight.
5. Radical coupling reaction - Preparation of 1,1-bis-(2-naphthol)

Text books:

1. 1.A.I.Vogel –A text book of quantitative organic synthesis-ELBS
2. Green chemistry practical by P.T.Anatas and J.C. Warner.

Reference books

1. Practical book of green synthesis by Dar Bashir Ahmed
2. Laboratory manual of green chemistry by Anuradha Mukherjee.

Web Links:

1. <https://youtu.be/eFh9CfQltqo>
2. <https://youtu.be/FxqWzZnzleg>

CO-PO Mapping:

(1: Slight [Low]; 2: Moderate [Medium]; 3: Substantial [High]; 4 : No Correlation)

	P O 1	P O 2	P O 3	PO4	P O 5	P O 6	P O 7	P O 8	P O 9	P O 10	P S O 1	PS O 2	PS O3
CO1	3	3	2	2	3	3	3	3	3	3	3	2	3
CO2	3	2	3	3	3	3	3	2	3	3	3	3	3
CO3	3	3	3	3	3	2	3	2	1	2	2	3	1
CO4	3	2	2	2	2	3	2	3	2	2	3	2	2
Avg.	3	2 . 5	2 . 5	2.5	2 . 7 5	2 . 7 5	2 . 7 5	2 . 5	2 . 2 5	2 . 2 5	2 . 7 5	2. 5	2. 25

GOVERNMENT COLLEGE (A) RAJAHMUNDRY

V-SEMESTER

III B. Sc. CHEMISTRY 2025 – 26 LABORATORY COURSE-
C-13: GREEN CHEMISTRY

Scheme of Valuation

Time hrs	Max. Marks. 50
: 3	
Rec ord:	10 M
Viva:	5 M
Pract ical:	35 M

Splitting of Practical Marks:

1. Aim, apparatus, chemicals	5 M
2. Principle	5 M
3. Procedure	5 M
4. MP	5 M
5. Yield report: error < 5% error	15 M
error 5% -10%	10 M
error > 10%	5 M

	Government College (Autonomous) Rajahmundry	Program & Semester Chemistry(H), Organic(H), Analytical(H) & Industrial(H)) (V Semester)			
Course Code C14	TITLE OF THE COURSE C14: Analysis of Organic Compounds				
Teaching	Hours Allocated: 45 (Theory)	L	T	P	C
Pre-requisites	Basic knowledge on Electromagnetic radiation and quantized energy levels of molecules	3	-	-	3

Course Objectives:

1. To Identify the importance of mass spectrometry in the structural elucidation of organic compounds.
2. To Acquire the knowledge on structural elucidation of organic compounds.
3. To Understand various chromatography methods in the separation and identification of organic compounds.

Course Outcomes:

On Completion of the course, the students will be able to		Cognitive Domain
CO1	Identify the importance of mass spectrometry in the structural elucidation of organic compounds.	Understanding
CO2	Acquire the knowledge on structural elucidation of organic compounds.	Skill
CO3	Understand various chromatography methods in the separation and identification of organic compounds.	Understanding
CO4	Understand the principle and experimental techniques of chromatographic methods.	Skill

Course with focus on employability / entrepreneurship / Skill Development modules

Skill Development		Employability		Entrepreneurship	

SYLLABUS

Unit-I: Nuclear Magnetic Resonance (NMR) spectroscopy 9 h

Principles of nuclear magnetic resonance and **basic instrumentation**, equivalent and non-equivalent protons, Precessional frequency, shielding and deshielding of magnetic nuclei, Chemical shift and Factors influencing chemical shift. NMR splitting of signals - spin-spin coupling, coupling constant J and types of coupling constant J, **Applications of NMR** with suitable examples - ethyl bromide, acetaldehyde, ethyl acetate, toluene and acetophenone.

Unit II Mass Spectrometry 9hrs

A brief introduction to analysis of organic compounds

Basic principle, **Instrumentation - Mass spectrometer**, Molecular ions, Base peak. Basic fragmentation types (McLafferty fragmentation, Retro-Diels Alder fragmentation). Fragmentation patterns in Toluene, 2-Butanol, Butanaldehyde, Propionic acid.

Unit-III : Structural elucidation of organic compounds using IR, NMR & mass spectral data- 9 hours

2,2,3,3-Tetramethyl butane, Butane-2,3-dione, Propionic acid and methyl propionate. Phenyl acetylene, acetophenone, cinnamic acid and p-nitroaniline.

Unit-IV: Separation techniques-1 9 hours

Chromatography – Principle and theory, classification, types of adsorbents, eluents, R_f values and factors affecting R_f values. Thin layer chromatography - principle, experimental procedure, advantages and applications.

Unit-5: Separation techniques - 2 9 hours

Paper chromatography- Principle, **experimental procedure**, ascending, descending, radial and two dimensional, applications. Column chromatography - Principle, classification, experimental procedure and applications. HPLC-Principle, Instrumentation – block diagram and **applications**.

1. List of Reference books:

- Organic Spectroscopy by William Kemp, Third Edition, Palgrave USA.
 - Introduction to Spectroscopy by Pavia, Lampman, Kriz and Vyvyan, Fifth edition, Cengage.
- Organic Spectroscopy: Principles and Applications by Jag Mohan, Second edition, Alpha Science.
- Spectroscopy of Organic Compounds by P.S. Kalsi, Seventh edition, New Age International.
 - Spectroscopic Methods in Organic Chemistry by Ian Fleming and Dudley Williams, Seventh edition, Springer.

- Fundamentals of Analytical Chemistry by F.James Holler, Stanley R Crouch, Donald M.West and Douglas A.Skoog, Ninth edition, Cengage.
- Analytical Chemistry by Gary D.Christian, Purnendu K.Dasgupta and KevinA.Schug, Seventh edition, Wiley.
- Quantitative analysis by R.A.DayJr.andA.L.Underwood, Sixth edition, Pearson.
- Text book of Vogel's Quantitative Chemical Analysis, Sixth edition, Pearson.

CO-PO Mapping:

(1: Slight [Low];2: Moderate [Medium]; 3: Substantial [High], '-' : No

Correlation)

	P O 1	P O 2	P O 3	P O 4	P O 5	P O 6	P O 7	P O 8	P O 9	P O 10	P S O 1	P S O 2	P S O 3
CO1	3	2	3	2	2	2	3	3	2	2	3	3	3
CO2	2	3	3	3	3	2	2	2	2	3	2	2	3
CO3	3	3	3	2	2	1	1	2	3	1	2	3	3
CO4	2	3	2	1	3	2	3	1	2	3	3	2	2
Avg.	2.5	2.75	2.75	2	2.5	1.75	2.25	2	2.25	2.25	2.5	2.5	2.75

**GOVERNMENT
COLLEGE (A),
RAJAMAHENDRAVARA
M**

**III B.Sc. Chemistry(H),
Organic(H), Analytical(H) &
Industrial Chemistry(H)
SEMESTER -V**

**Course-14: Analysis of Organic
Compound BLUE PRINT**

S . N o.	Course Content	Essay Questions (7M)	Short Answer Questions (3M)	Total No. Of Questions from each Unit
1	Unit –I	2	2	4
2	Unit –II	2	2	4
3	Unit –III	2	1	3
4	Unit –IV	2	1	3
5	Unit –V	2	2	4
	TOTAL	10	8	18

Course-14: Analysis of Organic Compound Model Paper

Time: 21/2

Max.Marks: 50

PART-A

Answer ALL the following questions.

5 x 7 = 35

1. Explain basic principle and instrumentation of Mass spectrometry. Or)
2. Write the mass spectral fragmentation pattern for the following molecules
i) Toluene ii) 2- Butanol
3. What is chemical shift? Explain various factors influencing chemical shift values.

Or

4. Define Coupling constant? Write different types of coupling constant
5. Explain structural elucidation of following compounds using IR,NMR & Mass spectral data i)2,2,3,3-Tetramethyl butane ii)Methyl propionate

Or

6. Explain structural elucidation of following compounds using IR,NMR & Mass spectral data
1. Butane 2,3-dione ii)Aceto Phenone
7. Explain about principle, experimental set up and applications of TLC. Or
8. Write about the classification of Chromatographic methods
9. Explain about the principle and application of Column chromatography.

Or

10. Discuss the principle and Instrumentation of HPLC and give two applications.

PART-B

5 x 3 = 15

11. Write a note on Mc.Lafferty fragmentation.
12. What is Molecular ion ? give two examples .
13. Write basic principle of nuclear magnetic resonance spectroscopy.
14. Explain the term shielding and Deshielding of magnetic nuclei.
15. Elucidate the structure of propionic acid using IR,NMR & Mass Spectral data.
16. Define R_f value and write its significance.
17. Explain ascending and descending methods in paper chromatography
18. Write about classification of column chromatography.

GOVERNMENT COLLEGE (A), RAJAMAHENDRAVARAM

III B.Sc., CHEMISTRY & ANALYTICAL CHEMISTRY

SEMESTER – V

PAPER –C-14 : Analysis of Organic Compound

QUESTION BANK

Essay type questions. Each question carries 7 marks.				
Unit-1	Marks	BL	CLO	PLO
1.Explain the Principle and instrumentation of Mass spectrometry?	7	2	1	1, 4
2. Write spectral fragmentation pattern for Toluene and 2- Butanol.	7	1, 3	1	1, 4
3.Discuss Instrumentation and working principle of Mass spectrometry with neat diagram.	7	2, 4	1	1, 4
Unit-II	Marks	BL	CLO	PLO
1.Define chemical shift? Explain factors effecting the chemical shift values.	7	1,2,3	2	1, 3
2. What is coupling constant? Write different types of couplings in Proton NMR.	7	1,2	2	1, 2, 3
3. Write detailed note on principle and Instrumentation of NMR.	7	1,3	2	1, 2
Unit-III	Marks	BL	CLO	PLO
1.Explain structural elucidation of following compounds using IR,NMR & Mass spectral data i)2,2,3,3-Tetramethyl butane ii)Methyl Propionate	7	1,2,3	2	1, 3
2.Explain structural elucidation of following compounds using IR,NMR & Mass spectral data i)Butane 2,3-dione ii)Acetophenone	7	1,2	2	1, 2, 3
3.Explain structural elucidation of following compounds using IR,NMR & Mass spectral data i)2,2,3,3-Tetramethyl butane ii)Butane 2,3-dione	7	1, 3	1	1, 4
Unit-IV	Marks	BL	CLO	PLO
1.Write about the classification of Chromatographic methods	7	1,2,3	2	1, 3
2. Explain about principle, experimental set up and applications of TLC.	7	1, 3	1	1, 4
3. What is chromatography? Write about classification of chromatographic methods.	7	1,2	2	1, 2, 3
Unit-V	Marks	BL	CLO	PLO
1. Explain about the principle and application of Column chromatography.	7	1,3	2	1, 2
2. Discuss the principle and Instrumentation of HPLC and give two applications.	7	1,2	2	1, 2, 3
3.write about principle , experimental procedure for paper chromatography and give two applications.	7	1,2,3	2	1, 3

Short answer questions. Each question carries 3 marks.				
Unit-1	Marks	BL	CLO	PLO
1.what is Mc.Laffetty rearrangement? Give one example.	3	1	1	1, 2
2. Define Molecular ion peak in Mass spectrum with examples.	3	1,2	1	1, 2
3. Write a note on retro diels- alder fragmentation in mass spectrometry	3	2	1	1, 3
Unit-II	Marks	BL	CLO	PLO
1. Give a short note on shielding and deshielding of Proton.	3	1,2	1	1, 4
2. Write a note on principle involved in Proton NMR.	3	1 2	2	1, 2, 3
3. Write NMR spectrum for Ethyl bromide.	3	2, 4	2	1, 2, 3
Unit-III	Marks	BL	CLO	PLO
Elucidate the structure of propionic acid using IR,NMR & Mass spectral data	3	1,2	1	1, 2
Elucidate the structure of acetophenone using IR,NMR & Mass spectral data	3	2	1	1, 3
Unit-IV	Marks	BL	CLO	PLO
1. Define Rf value and write its significance.	3	1, 3	2	1, 2
2. Write about different types of adsorbents.	3	1	1	1, 2
Unit-V	Marks	BL	CLO	PLO
1. Explain ascending and descending methods in paper chromatography.	3	2	1	1, 3
2. Write about classification of column chromatography.	3	1, 3	2	1, 2
3. Define stationary phase and mobile phase in chromatography.	3	1 2	2	1, 2, 3

	Government College (Autonomous) Rajahmundry	Program & Semester Chemistry(H), Organic(H), Analytical
	Course Code C14	

TITLE OF THE COURSE
SEPARATION OF BINARY
ORGANIC MIXTURE

		(H) & Industrial(H)) (V Semester)			
Teaching	Hours Allocated: 30 (Practical)	L	T	P	C
Pre-requisites	Solubility of Various organic compounds	-	-	2	2

Course Objectives:

To provide basic knowledge about separation techniques

To provide knowledge and practical skill on Solvent extraction

Course Outcomes:

On Completion of the course, the students will be able to	
CO1	Analyse IR spectra of Organic molecules
CO2	Analyse NMR spectra of organic molecules
CO3	Analyse Mass spectra of organic molecules
CO4	Separate organic compounds in the given mixture

Course with focus on employability / entrepreneurship / Skill Development modules

Skill Development		Employability		Entrepreneurship	

C14- SEPARATION OF BINARY ORGANIC MIXTURE

PRACTICAL SYLLABUS

30 Hrs. (02 Hrs. / Wk.)

Separation of binary organic mixtures (Solid-solid) using solvent extraction.

1. acidic compound + neutral compound
2. Acidic + Basic compound
3. Acidic + Phenolic compound
4. Phenolic + Neutral compound
5. Phenolic + Basic Compound
6. Basic + Neutral Compound

Analysis of organic compounds using IR, NMR & Mass Spectral data.

List of Reference books :

1. Vogel A.I. Practical Organic Chemistry, Longman Group Ltd.
2. Bansal R.K. Laboratory Manual of Organic Chemistry, Wiley-Eastern.
3. Ahluwalia V. K. and Aggarwal R. Comprehensive Practical Organic Chemistry, University press.
4. Mann F.G and Saunders B.C, Practical Organic Chemistry, Pearson Education.

CO-PO Mapping:

(1: Slight [Low]; 2: Moderate [Medium]; 3: Substantial [High], '-' : No Correlation)

	P O 1	P O 2	P O 3	P O 4	P O 5	P O 6	P O 7	P O 8	P O 9	P O 10	P S O 1	P S O 2	P S O 3
CO1	3	2	3	2	2	2	3	3	2	2	3	3	3
CO2	2	3	3	3	3	2	2	2	2	3	2	2	3
CO3	3	3	3	2	2	1	1	2	3	1	2	3	3
CO4	2	3	2	1	3	2	3	1	2	3	3	2	2
Avg.	2.5	2.75	2.75	2	2.5	1.75	2.25	2	2.25	2.25	2.5	2.5	2.75

GOVERNMENT COLLEGE (A),RAJAMAHENDRAVARAM
III B.Sc. SEPERATION OF BINARY ORGANIC MIXTURE
(PRACTICAL –III)

AT THE END OF SEMESTER –III

SCHEME OF VALUATION

Time: 03 Hrs.

Max. Marks: 50 M

1.	Record	-----	10 Marks
2.	Practical	-----	35 Marks
3.	Viva - voce	-----	05 Marks

Splitting of Practical Marks : (35M)

Procedure in 10 minutes : 10 M

Principle : 05 M

Experimental set up : 05 M

Effective separation : 15 M

COURSE 15:
SYNTHETIC ORGANIC
CHEMISTRY FOR
ORGANIC
CHEMISTRY(H)
AND
ORGANIC
CHEMISTRY(H)

	Government College (Autonomous) Rajahmundry	Program & Semester			
Course Code C-15	TITLE OF THE COURSE SYNTHETIC ORGANIC CHEMISTRY	III B.Sc. Chemistry(H) & ORGANIC CHEMISTRY(H) SEMESTER - V			
Teaching	Hours Allocated: 45 (Theory)	L	T	P	C
Pre-requisites:	Atomic structure, Molecular orbital theory, Organic chemistry basics		3	-	4

Course Objectives:

1. To get acquaintance with pericyclic reactions and photo chemical reactions.
2. To understand and apply various reaction mechanisms.
3. To learn and appreciate the named reactions and their mechanisms.
4. To draw the molecular orbital diagrams for conjugated molecules.

Course Outcomes:

On Completion of the course, the students will be able to-		Cognitive Domain
CO 1	1. Identify the importance of reagents used in the synthesis of organic compounds.	Understanding
CO 2	2. Acquire knowledge on basic concepts in different types of pericyclic reactions.	Understanding
CO 3	3. Understand the importance of heterocyclic chemistry.	Application
CO 4	4. Comprehend the applications of different reactions in synthetic organic chemistry.	Application

Course with focus on employability / entrepreneurship / Skill Development modules

Skill Development		Employability		Entrepreneurship	

SYLLUBUS:

UNIT-I: PERICYCLIC REACTIONS

9 h

Definition and classification of pericyclic reactions: Phases, nodes and symmetry properties of molecular orbital's in ethylene, 1,3-butadiene, 1,3,5-hexatriene, alkylation and allyl radical. Thermal and photochemical reactions. Electro cyclic reactions: Definition and examples, definitions of con and disrotation, Woodward-Hoffmann selection rules. (Correlation diagrams excluded) Cyclo addition reactions: Definition and examples, definitions of supra facial and antar facial addition, Woodward-Hoffmann selection rules. (Correlation diagrams excluded)

UNIT-II: ORGANIC PHOTOCHEMISTRY

9h

Jablonski diagram-singlet and triplet States Photochemistry of Carbonyl compounds $\pi-\pi^*$ and

$\pi-\pi^*$ transitions, Norrish type-1 and type-2 reactions, Paterno-Buchi reaction.

UNIT-III: HETEROCYCLIC COMPOUNDS

9h

Classification and nomenclature, Structure, aromaticity in 5 and 6-membered rings containing one heteroatom; Synthesis, reactions and mechanism of substitution reactions of: Furan, Pyrrole (Paal-Knorr synthesis, Knorr pyrrole synthesis, Hantzsch synthesis), Thiophene and Pyridine (Hantzsch synthesis).

UNIT-IV: SYNTHETIC REACTIONS

9h

Hofmann, Curtius, Lossen rearrangement, Wolff rearrangement, Simmons-Smith reaction, Michael reaction, Darzens reaction, McMurry reaction, Favorskii, Benzil-Benzilic acid rearrangement,

UNIT-V: REAGENTS IN ORGANIC CHEMISTRY

9h

Oxidizing agents: PCC, PDC, SeO_2 (Riley oxidation), NBS.

Reducing agents: LiAlH_4 (with mechanism), NaBH_4 , Metal-solvent reduction (Birch reduction), Catalytic reduction.

Reference and Text books:

1. Pericyclic reactions by Ian Fleming, Second edition, Oxford University press.
2. Pericyclic Reactions- A Text book: Reactions, Applications and Theory by S. Sankararaman, WILEY-VCH.
3. Reaction Mechanism in Organic Chemistry by S.M. Mukherji and S.P. Singh, Revised edition, Trinity Press.
4. Pericyclic reactions – A Mechanistic study by S.M. Mukherji, Macmillan India.
5. Organic chemistry by Jonathan Clayden, Nick Greeves and Stuart Warren, Second edition, Oxford university press.
6. Reactions, Reagents and Rearrangements by S.N. Sanyal, Bharati Bhawan Publishers & Distributors

Web Links:

1. <https://www.youtube.com/watch?v=T72nanpjQ80&list=PLDjIJRH6sIC7GJs6zqldCs-tvPJ29vym4>

- <https://www.youtube.com/watch?v=DHPXKASQ7LE&list=PLDjIJRH6sIC6Ee5jn67JUouch4IN0KVJ>
- <https://www.youtube.com/watch?v=P6EKl2rWClo&list=PLDjIJRH6sIC4D7H0sR0jxvHHmP3zNh-Fq>
- <https://www.youtube.com/watch?v=ZraoU9a1eQA>
- https://www.youtube.com/watch?v=1mZUlluWaoQ&list=PLdZcCa6mtW233hnUC42MCJjOFuX4_LTWv

CO-PO Mapping:

(1: Slight[Low]; 2: Moderate[Medium]; 3: Substantial[High], '-' : No Correlation)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PS O1	PS O2	PS O3
CO 1	3	2	3	2	2	2	3	3	2	2	3	3	3
CO 2	2	3	3	3	3	2	1	2	2	3	2	2	3
CO 3	3	3	3	2	2	1	1	2	3	1	2	3	3
CO	2	1	2	1	3	2	3	1	2	3	3	2	2
4 A vg .	2 . 5	2. 2 5	2. 7 5	2 . 0	2 . 5	1. 7 5	2 . 0	2 . 0	2. 2 5	2. 25	2. 5	2. 5	2. 75

PROPOSED ACTIVITIES:

SKILL DEVELOPMENT :

- Reagents used in organic synthesis.

EMPLOYABILITY :

- Pericyclic reactions.
- Photochemical reactions.

ENTREPRENEURSHIP :

- Heterocyclic synthesis and reagents used in synthesis.

GOVERNMENT COLLEGE (A), RAJAHMUNDRY

III B.Sc. Chemistry(Hons), SEMESTER –V

QUESTION PAPER BLUE PRINT

SYNTHETIC ORGANIC CHEMISTRY

TIME: 2 1/2 hr.

MARKS: 50 M

PART -A

Answer ALL the Questions

5 X 7 = 35 M

1. 2 Questions from UNIT- I
2. 2 Questions from UNIT- II
3. 2 Questions from UNIT-III
4. 2 Questions from UNIT IV
5. 2 Questions from UNIT-V

PART – B

Answer any FIVE Questions

5 x 3 = 15 M

5. 2 Question from UNIT- I
6. 2 Questions from UNIT- II
7. 1 Question from UNIT- III
8. 2 Questions from UNIT- IV
9. 1 Questions from UNIT- V

GOVERNMENT COLLEGE (A), RAJAMAHENDRAVARAM

III B.Sc. Chemistry (Hons), DEGREE EXAMINATION

SEMESTER-V: MODEL PAPER (From 2025-26)

CHEMISTRY COURSE: SYNTHETIC ORGANIC CHEMISTRY

Time: 2 1/2 hours

Maximum Marks: 50

PART- A

Answer **ALL** the questions. Each carries **SEVEN** marks

5 X 7 = 35 Marks

1. Define electrocyclic reactions. Explain CON & DIS rotation with suitable example.

(Or)

2. What are cycloaddition reactions? Explain Suprafacial & antarafacial addition in cyclo addition reactions.

3. Define and explain the terms 1) ISC, 2) Fluorescence, 3) Phosphorescence by using Jablonski diagram.

(Or)

4. Write a short note on Norrish type-1 and Norrish type-2.

5. Write any two methods of synthesis of pyrrole.

(Or)

6. Discuss the chemical properties of pyridine.

7. Write about Hofmann, Curtius and Lossen rearrangements.

(Or)

8. Explain 1) Michael reaction and 2) Darzen's reaction.

9. Explain the reagents 1) PCC 2) PDC and 3) SeO₂.

(Or)

10. Discuss about LiAlH₄ and Birch reduction?

PART- B

Answer any **FIVE** of the following questions. Each carries **THREE** marks 3 X 5 = 15 Marks

9. Define and classify the pericyclic reactions.

10. Write nodes & symmetry properties of molecular orbitals in 1,3,5,- Hexa triene.

11. Explain patterno- Buchi reaction with mechanism.

12. Write note on photosensitization.

13. Discuss the aromaticity of heterocyclic compounds.

14. Discuss the mechanism of favorskii rearrangement.

15. Write about Benzil-Benzilic acid rearrangement.

16. Discuss the catalytic reductions (Pd, Pt and Ni, one reaction for each metal).

SEM-V, CHEMISTRY HONS AND ORGANIC CHEMISTRY HONS

SYNTHETIC ORGANIC CHEMISTRY

UNIT-I: PERICYCLIC REACTIONS:

ESSAY QUESTIONS:

1. Define electrocyclic reactions. Explain CON & DIS rotation with suitable example.
2. What are cycloaddition reactions? Explain Suprafacial & antarafacial addition in cyclo addition reactions.
3. Write an account on Diels alder reaction.
4. Explain Woodward –Hoffmann rules for electrocyclic reactions.
5. Explain Woodward –Hoffmann rules for cycloaddition reactions.

SHORT ANSWER QUESTIONS:

1. Define and classify the pericyclic reactions.
2. Write nodes & symmetry properties of molecular orbitals in 1,3,5-Hexatriene.
3. Write nodes & symmetry properties of molecular orbitals in 1,3-butadiene.
4. Give examples for cycloaddition reaction.
5. Give examples for electrocyclic reactions.

UNIT-II: ORGANIC PHOTOCHEMISTRY:

ESSAY QUESTIONS:

1. Define and explain the terms 1) ISC, 2) Fluorescence, 3) Phosphorescence by using Jablonski diagram.
2. Write a short note on Norrish type-1 and Norrish type-2.
3. Write an essay on Jablonski diagram.
4. Explain Norrish type-1 reaction with examples.
5. Explain Norrish type-2 reaction with examples.

SHORT ANSWER QUESTIONS:

1. Explain pattern of Buchi reaction with mechanism.
2. Write note on photosensitization.
3. Define ISC
4. Define singlet and triplet states.
5. Define Fluorescence
6. Define Phosphorescence.

UNIT-III: Heterocyclic Compounds

1. Classify heterocyclic compounds and explain their nomenclature.
2. Explain aromaticity in five-membered heterocyclic compounds containing one heteroatom.
3. Describe the structure and aromaticity of pyridine.
4. Explain the Paal–Knorr synthesis of pyrrole with mechanism.

5. Describe the Knorr pyrrole synthesis with mechanism.
6. Explain the Hantzsch synthesis of pyridine.
7. Discuss the electrophilic substitution reactions of furan and thiophene.

UNIT-IV: Synthetic Reactions

1. Explain the Hofmann rearrangement with mechanism.
2. Describe the Curtius rearrangement with mechanism.
3. Explain the Lossen rearrangement with mechanism.
4. Discuss the Wolff rearrangement with mechanism.
5. Explain the Michael addition reaction with mechanism and applications.
6. Describe the Simmons-Smith reaction with mechanism.
7. Explain the Darzens reaction with mechanism.
8. Discuss the McMurry reaction with mechanism.
9. Explain the Favorskii rearrangement with mechanism.
10. Describe the Benzil-Benzilic acid rearrangement with mechanism.

UNIT-V: Reagents in Organic Chemistry

1. Explain the oxidizing action of PCC and PDC with examples.
2. Describe Riley oxidation using SeO_2 with mechanism.
3. Explain the role of NBS in allylic bromination.
4. Describe the reduction by LiAlH_4 with mechanism.
5. Explain the reducing action of NaBH_4 with examples.
6. Discuss the Birch reduction (metal-solvent reduction) with mechanism.
7. Explain catalytic hydrogenation and its applications.

	Government College (Autonomous) Rajahmundry	Program & Semester III B.Sc. Chemistry(H) & Organic Chemistry (H) SEMESTER - V			
Course Code C-15	TITLE OF THE LABORATORY COURSE Extra element detection in organic compounds and Chromatography				
Teaching	Hours Allocated: 30 (Practical)	L	T	P	C
Pre- requisites:	Functional group identification of organic compounds and chromatography	4	-	2	3

Course Objectives:

1. To provide basic knowledge on separation of given organic mixtures.
2. To understand the method for detection of extra elements in organic compounds.
3. To learn perform the TLC, Paper and Column chromatography.

Course Outcomes:

On Completion of the course, the students will be able to-	
CO1	1. Perform the organic qualitative analysis for the detection of N, S and halogens using the green procedure.
CO2	2. Learn the procedure for the separation of mixture fatty acids using paper Chromatography.
CO3	3. Prepare the TLC plates for TL chromatography.
CO4	4. Acquire skills in conducting column chromatography for the separation of dyes in the given mixture.

Course with focus on employability / entrepreneurship / Skill Development modules

Skill Developm ent		Employabilit y		Entrepreneurs hip	

Syllabus:

- 1) Green procedure for organic qualitative analysis: Detection of N,S and halogens
- 2) Separation of a given mixture (Para-Nitro Aniline and Ortho-Nitro Aniline) using TLC (using alumina as adsorbent).
- 3) Separation of mixture of Para-Nitro Aniline and Ortho-Nitro Aniline by column chromatography.
- 4) Separation of given mixture of amino acids (glycine and phenyl alanine) using ascending paper chromatography.

Reference and Text books:

1. Quantitative methods of Analysis - Vogel
2. Quantitative Analysis - Alexeyev
3. Quantitative Analysis - Day and Underwood

Web Links:

1. <https://www.youtube.com/watch?v=ltT8vr5Wmz8>
2. <https://www.youtube.com/watch?v=UmWMIKJAdSk>
3. <https://www.youtube.com/watch?v=TdJ57SQ6GAQ>
4. <https://www.youtube.com/watch?v=dPXgUFDqSik>

CO-PO Mapping:

(1: Slight[Low]; 2: Moderate[Medium]; 3: Substantial[High], '-': No Correlation)

	PO 1	PO 2	P O 3	PO 4	PO 5	P O 6	PO 7	P O 8	PO 9	PO 10	PS O1	PS O2	PS O3
C O 1	3	2	3	2	2	2	3	3	2	2	3	3	3
C O	2	3	3	3	3	2	2	2	2	3	2	2	3

2													
C O 3	3	3	3	2	2	2	2	2	3	1	2	2	3
C O 4	2	2	2	3	3	2	1	3	2	3	3	2	2
A vg .	2.5	2.5	2.75	2.5	2.5	2.0	2.0	2.5	2.25	2.2	2.5	2.25	2.75

LABORATORY COURSE
Extra element detection in organic compounds and Chromatography (C-15)

III BSc Chem(Hons)

(At the end of Semester-V)

(Scheme of Valuation)

Time : 3 Hrs

Max. Marks .50

1. Record	10 Marks
2. Practical	35 Marks
3. Viva - voce	5 Marks

Splitting of Practical Marks (35)

i. Procedure in 10 minutes	: 5 M
ii. Formula with units	: 5 M
iii. Neat tabulation	: 5 M
iv. Correct calculation	: 5 M

Error < 1 %	15 M

1- 2 %	

	10 M

>2 %	

	5 M

Course 15: Advanced
Analytical chemistry
for
Analytical
Chemistry(H)

	Government College (Autonomous) Rajahmundry	Program & Semester			
Course Code C-15	TITLE OF THE COURSE ADVANCED ANALYTICAL CHEMISTRY	III B.Sc. Analytical chemistry (V - Semester)			
Teaching	Hours Allocated: 45 (Theory)	L	T	P	C
Pre-requisites	Separation techniques, Gas chromatography UV-Visible IR spectroscopy, Electrophoresis	-	3	-	4

Course Objectives:

1. To provide knowledge about solvent extraction techniques,
2. To provide knowledge and importance of Gas chromatography.
3. To inculcate knowledge on UV and IR spectroscopy.
4. To give awareness on Electrophoresis technique.

Course Outcomes:

On Completion of the course, the students will be able to	
CO 1	Get awareness on separation methods and understand the theory behind the separation methods
CO 2	Get experimental ability and hands on experience on solvent extraction technique.
CO 3	Understand the principles of Gas chromatography, UV & IR spectroscopy.
CO 4	Get awareness and understand the principles of Electrophoresis technique.

Course with focus on employability / entrepreneurship / Skill Development modules

Skill Development		Employability		Entrepreneurship	

IIIB.Sc. ANALYTICAL CHEMISTRY SEMESTER-V

PAPER- C-15: ADVANCED ANALYTICAL CHEMISTRY

45 Hrs. (03 Hrs./Wk.)

Syllabus :

UNIT-I

SEPARATION TECHNIQUE: 9 Hrs

1. Introduction of solvent extraction
2. Principle and process of solvent extraction
3. Nernst Distribution Law - Limitations
4. Types of solvent extraction techniques : Batch extraction , Contineous extraction , Counter-current extraction.
5. Application of solvent extraction : Determination of Iron (III) by 8- Hydroxyl Quinoline.

UNIT-II GAS CHROMATOGRAPHY : 9 Hrs

6. Gas chromatography: Introduction
7. Instrumentation of Gas chromatography: Equipment
8. Sample injection systems : Split injection and Split less injection
9. GC Column : Packed columns, Capillary columns - Wall coated open tubular columns (WCOT) , Porous open tubular columns (PLOT), Support coated open tabular columns (SCOT).
10. Carrier gas and its selection
11. Detectors used in GC : Flame ionization detector , Thermal conductivity detector
12. Applications of Gas chromatography.

UNIT-III : 9Hrs

UV-Visible Spectroscopy:

1. Introduction and principle of UV-Visible Spectroscopy.
2. Beer – Lamberts law and its limitations.
3. UV-Visible Spectro photometer: Instrumentation – Source, Mono chromator, Sample cells, Detectors .
4. Detectors types - a. photovoltaic cells (or) barrier- layer cell
b. phototubes (or) photo emissive cell
c. photomultiplier tubes
5. Single beam and Double beam UV-Visible Spectro photometers.
1. Applications of UV-Visible Spectroscopy.

UNIT-IV : 9 Hrs

IR – Spectroscopy :

1. Introduction and principle of IR Spectroscopy.
2. Instrumentation of IR Spectro photo meter – Source , Sample cells, Detectors and Recording systems.
3. Applications of IR Spectroscopy : Qualitative and quantitative chemical analysis.

UNIT-V : 9 Hrs

ELECTROPHORESIS

1. Electrolysis and Electro-Osmosis phenomenon.
2. Theory of electorophoretic separations.
3. Factors affecting electrophoresis phenomenon : Mobility , Macromolecular size and charge , PH and Concentration discontinuties.
4. Types of Electrophoresis :
 1. Capillary electrophoresis - Principle , Instrumentation and applications of Capillary electrophoresis
 2. Zone electrophoresis - Principle , Instrumentation and applications of Zone electrophoresi

Text books:

1. Separation methods by M.N.Sastri
2. Vogel's textbook of quantitative chemical analysis, 6th & 7th editions
1. O.Mikes, R.A.Chalmers: Laboratory Handbook of Chromatographic methods.

Reference books R.V.Dilts : Analytical chemistry- Method sof separation.

2. O.Mikes, R.A.Chalmers: Laboratory Handbook of Chromatographic methods.
3. F.W. Fifield and D.Kelay : Principles and practice of analytical chemistry
4. Separation methods by M.N.Sastri
5. Vogel's textbook of quantitative chemical analysis, 6th & 7th editions

Web Links:

1. <https://youtu.be/OiukFtC8E04?si=es5Kt6j19WY0KxgL>
2. <https://youtu.be/aYcP2qzYDaw?si=KqsDnQPpe3EAGGhE>

CO-PO Mapping:

(1: Slight [Low]; 2: Moderate [Medium]; 3: Substantial [High]; 4 : No Correlation)

	P O 1	P O 2	P O 3	P O 4	PO5	P O 6	PO7	P O 8	PO9	PO10	P S O 1	P S O 2	P S O 3
CO1	3	2	3	2	2	2	3	3	2	2	3	3	3
CO2	2	3	3	3	3	2	2	2	2	3	2	2	3
CO3	3	3	3	2	2	1	1	2	3	1	2	3	3
CO4	2	3	2	1	3	2	3	1	2	3	3	2	2
Avg.	2. 5	2 . 7 5	2 . 7 5	2	2 . 5	1 . 7 5	2 . 2 5	2	2 . 2 5	2 . 2 5	2. 5	2. 5	2 . 7 5

PROPOSED ACTIVITIES**Skill Development :**

Separation of compounds by using solvent extraction technique.

1. Determination of Fe(III) by solvent extraction technique

Employability :

6. Principles and applications of UV & IR –spectroscopy
7. Principles and applications of Gas chromatography.

8. Entrepreneurship :

9. Gas chromatography technique.

GOVERNMENT COLLEGE (A) RAJAMAHENDRAVARAM

IIIB.Sc. ANALYTICAL CHEMISTRY ; SEMESTER - V

QUESTION PAPER BLUE PRINT

PAPER- C-15 : ADVANCED ANALYTICAL CHEMISTRY

TIME : 2¹/₂ hr

Max.marks : 50 M

PART –A

I Answer **ALL** the Questions

5x7 = 35 M

1. Two Questions from UNIT-I
2. Two Questions from UNIT – II
3. Two Questions from UNIT – III
4. Two Questions from UNIT – IV
5. Two Questions from UNIT – V

i. PART- B

ii. Answer any **Five** Questions

5 x 3 =15 M

6. Two Questions from UNIT-I
7. Two Questions from UNIT-II
8. One Question from UNIT – III
9. One Question from UNIT – IV
10. Two Questions from UNIT – V

GOVERNMENT COLLEGE (A) RAJAMAHENDRAVARAM
III B.Sc., ANALYTICAL CHEMISTRY

SEMESTER – V

PAPER - C-15 : ADVANCED ANALYTICAL CHEMISTRY
MODEL PAPER

TIME : 2¹/₂ hr

Max.marks : 50 M

PART –A

Answer **ALL** the Questions

5x7 = 35 M

1. Explain the following CLO1 PLO1 BLO1

- a. Batch extraction
- b. Continuous extraction

i. (OR)

2. What is the principle involved in solvent extraction and how do you determine the Fe(III) by solvent extraction . CLO1 PLO1 BLO3

3. Explain about the principle and instrumentation of Gas chromatography. CLO3 PLO3 BLO3

(OR)

4. Explain the following Detectors in Gas chromatography. CLO3 PLO3 BLO2

- a. Flame ionization detector
- b) Thermal conductivity detector

5. Write about Single beam and Double beam UV-Visible Spectro photometers. CLO3 PLO3 BLO1

(OR)

6. Write about the instrumentation of UV-Visible Spectro photometer. CLO3 PLO3 BLO2

7. Explain the instrumentation of IR spectro photometer. CLO3 PLO3 BLO2

(OR)

8. Give the Qualitative and Quantitative applications of IR Spectroscopy. CLO3 PLO3BLO3

9. Explain Capillary electrophoresis with applications. CLO4 PLO2 BLO2

(OR)

10. Explain Zone Capillary electrophoresis with applications. CLO4 PLO2 BLO2

PART –B

a. Answer **any FIVE of** the following Questions

5 X 3 = 15 M

11. Write about Nernst Distribution Law CLO1 BLO1

12. Give short note on process of solvent extraction. CLO2 BLO2
13. Write about capillary columns in Gas chromatography. CLO3BLO1
14. Write the applications of Gas chromatography. CLO3BLO3
15. Give the Beer – Lambert's law and its limitations. PLO2 BLO4
16. Write the principle of IR spectroscopy. CLO3BLO2
17. Define Electro-Osmosis. CLO4 BLO1
18. Write any two factors affecting electrophoresis. CLO4 BLO5

i. *****

GOVERNMENT COLLEGE (A) RAJAMAHENDRAVARAM
III B.Sc., ANALYTICAL CHEMISTRY

SEMESTER – V

PAPER –C-15 : ADVANCED ANALYTICAL CHEMISTRY

QUESTION BANK

UNIT-I

Essay questions:

1. Explain the following
 2. Batch extraction
 3. Continuous extraction
1. What is the principle involved in solvent extraction and how do you determine the Fe(III) by solvent extraction .
2. Explain the following
 1. Batch extraction
 2. Counter-current extraction

Short questions :

3. Give the principle of solvent extraction
4. Write about Nernst Distribution Law
5. Give short note on process of solvent extraction.

UNIT-II

Essay questions:

6. Explain about the principle and instrumentation of Gas chromatography.
7. Write the following Detectors in Gas chromatography.
 1. Flame ionization detector b) Thermal conductivity detector
8. Write the principle and applications of Gas chromatography.

Short questions :

9. Write about capillary columns in Gas chromatography.
10. Write the applications of Gas chromatography.

11. What are the carrier gases in Gas chromatography. How do you select these gases.

UNIT-III

Essay questions:

12. Write about the instrumentation of UV-Visible Spectro photometer.
13. Explain about Single beam and Double beam Spectrophotometers.
14. Explain the The following Detectors in UV-Visible spectrophotometer. a) photovoltaic cells
b) Photo emissive cell

Short questions :

15. Give the Beer – Lambert’s law and its limitations.
16. What are the applications of UV Spectroscopy.

UNIT-IV

Essay questions:

17. Explain the instrumentation of IR spectro photometer.
18. Write the Qualitative and Quantitative applications of IR Spectroscopy.
19. Write about principle and applications of IR Spectroscopy.

Short questions :

20. Write the principle of IR spectroscopy.
21. Write short note on applications of IR spectroscopy.

UNIT-V

Essay questions:

22. Explain Capillary electrophoresis with applications.
23. Explain Zone Capillary electrophoresis with applications.
24. Explain the following a) Electrolysis b) Electro-Osmosis

Short questions :

25. Define Electro-Osmosis.
26. Write any two factors affecting electrophoresis.
27. Define electrolysis.

	Government College (Autonomous) Rajahmundry	Program & Semester III B.Sc.ANALYTICAL CHEMISTRY (V Semester)			
Course Code : C- 15	TITLE OF THE COURSE ADVANCED ANALYTICAL CHEMISTRY				
Teaching	Hours Allocated: 30 (Practical)	L	T	P	C
Pre-requisites	Separation of Aniline and Naphthalene ; Benzoic acid and Benzophenone ; O-Nitro phenol and P-Nitro phenol by solvent extraction technique.	4	0	2	3

Course Objectives:

1. To provide basic knowledge and practical experience on solvent extraction technique.
2. To provide knowledge on determination of Fe (III) by solvent extraction.
3. To provide knowledge and hands on experience of separation funnel usage
4. To get knowledge and experience on separation of organic solvents .

Course Outcomes:

On Completion of the course, the students will be able to	
CO 1	Separation of base and acidic compounds by solvent extraction technique
CO 2	Separation of acid and neutral compounds by solvent extraction technique
CO 3	Separation of O-Nitro phenol and P-Nitro phenol by solvent extraction technique
CO 4	Determine the Fe(III) by solvent extraction

Course with focus on employability / entrepreneurship / Skill Development modules

Skill Development		Employability		Entrepreneurship	

SYLLABUS LABORATORY

Practical Course –PAPER- C-15 : ADVANCED ANALYTICAL CHEMISTRY

Separation techniques :

Max. Marks : 50M

1. Separation of mixture of Aniline and Naphthalene by using acid-base solvent extraction technique
2. Separation of mixture of Benzoic acid and Benzophenone by using acid-base solvent extraction technique
3. Separation of mixture of O-Nitro phenol and P-Nitro phenol by column chromatography.
4. Determination of Fe(III) by solvent extraction technique

Separation methods by M.N. Sastri

Douglas A. Skoog and Donald M. West Fundamentals of Analytical chemistry

Qualitative chemical analysis by Vogel's 6th and 7th edition.

Solvent extraction by Bruce A. Hoyer vol.21

<https://youtu.be/TjMwH3fafiU?si=R7p1F-JoCirmZsls>

<https://youtu.be/C70RBynocCQ?si=RB0sqV9hzWVCxUFU>

<https://youtu.be/5b2LNdsfQdQ?si=1s8qbkMmxQfmH958>

(1: Slight [Low]; 2: Moderate [Medium]; 3: Substantial [High]; 4 : No Correlation)

	P O 1	P O 2	P O 3	P O 4	PO5	P O 6	PO7	P O 8	PO9	PO10	P S O 1	P S O 2	P S O 3
CO1	3	3	2	2	3	3	3	3	3	3	3	3	3
CO2	3	2	3	3	3	3	3	2	3	3	2	3	3
CO3	3	3	3	3	3	2	3	2	1	2	3	3	1
CO4	3	2	2	2	2	3	2	3	2	2	2	2	2
Avg.	3	2 .5	2 .5	2 .5	2 .75	2 .75	2 .75	2 .5	2 .25	2 .5	2.5	2.75	2 .25

LABORATORY COURSE

Practical Course –PAPER – C-15 : ADVANCED ANALYTICAL CHEMISTRY

Separation techniques :

50 M

SCHEME OF VALUATION

- 9. Practical ...35M
- 10. Record 10M
- 11. Viva.....05M

Splitting pf practical marks : (35 M)

- 1. Aim, chemicals & Apparatus 05M
- 2. Principle.....05M
- 3. Procedure 10M
- 4. Experimental set up 05M
- 5. Effective separation..... 10M

@****@****@****@

Course 15:
Polymer chemistry
for
Industrial Chemistry(H)

	Government College (Autonomous) Rajahmundry	Program & Semester III B.Sc. Industrial Chemistry (Hons) (V/VI Semester)			
Course Code	TITLE OF THE COURSE POLYMER CHEMISTRY(C-15)				
Teaching	Hours Allocated:45(Theory)	L	T	P	C
Pre-requisites	Importance of polymers	-	3	-	3

Course Objectives:

1. To understand and the significance of the chemical perspective towards polymers and the subject gives an introduction to polymer chemistry with respect to synthesis, types of polymerization.
2. To Study the various kinds of measuring the molecular weight, polymerization techniques.
3. To understand about the preparations, structures, properties and applications of polymers.
4. To study the Glass transition temperature & Polymer degradation

Course Outcomes:

On Completion of the course, the students will be able to	
C O1	Understand the classification of polymers, bonding and functioning in polymers. about the basics of polymer and the differences between crystalline melting temperature and glass transition temperature, as well as the effect of kinetics on both
C O2	Students will develop specific skill formulate and writing mechanism, Competencies and encouragement to support further study or work in this field of Polymer Chemistry
C O3	Evaluate the molecular weight, and Polymerization techniques
C O4	Students analyze the structural properties and application of natural and synthetic polymers
C O5	Develop fundamental knowledge of thermal transitions of temperature Apply the fundamental knowledge of Polymer degradation methods.

Course with focus on employability/entrepreneurship/Skill Development modules

Skill Development		Employability		Entrepreneurship	

SYLLABUS

UNIT-I: Introduction of polymers: (9 H)

Definition- Nomenclature, Classification of polymers: Natural, synthetic, inorganic, organic polymers. Molecular forces and chemical bonding in polymers. Copolymerization.

Functionality and its importance: Synthetic polymer–Rubber, vulcanization, Criteria for synthetic polymer formation - Degree of polymerization.

UNIT-II: Types and Mechanism of Polymerization: (9 H)

Polymerization reactions: Mechanism of condensation polymerization - Mechanism of addition polymerization - Free radical, ionic (cationic, anionic) - Coordination polymerizations- Ziegler Natta catalysis.

UNIT-III: Determination of Molecular weight of polymers & Polymerization techniques:(9 H)

Number average molecular method (M_n)- Weight average molecular method (M_w) - Viscosity and osmotic pressure methods.

Polymerization techniques: Bulk, Solution, Emulsion, Polymerization methods.

Unit-IV: Preparation, structure, properties & applications of the following polymers: (9 H)

Polyethylene – Polypropylene – Polystyrene - Polyvinyl chloride - Polyvinyl acetate - Teflon
Nylon-6 -Nylon 6, 6 - Phenol formaldehyde resins (Bakelite).

Unit-V: Glass transition temperature & Polymer degradation: (9 H)

Definition of Glass transition temperature (T_g)–factors affecting–determination of glass transition temperature, Free volume theory, WLF equation.

Polymer degradation: Physical methods- Thermal degradation- oxidation degradation- Photo degradation stabilization of polymers-antioxidants and stabilizers.

Billmeyer, F.W.Text book of Polymer Science, 2ndEd.WileyInterscience, 1971.

PBahadur, NVSastry, Principles of Polymer Science, 2ndEd, Narosapublishinghouse

Reference books:

1. Seymour, R. B.& Carraher, C.E. Polymer Chemistry: AnIntroduction, Marcel Dekker,Inc. New York, 1981.
2. Odian, G. Principles of Polymerization, 4thEd.Wiley, 2004.
3. Ghosh, P.Polymer Science & Technology, Tata McGraw-Hill Education, 1991.34

4. Lenz, R.W.Organic Chemistry of Synthetic High Polymers. Inter science Publishers, NewYork,1967.

Web Links:

1. <https://ncerthelp.com/cbse%20notes/class%2012/chemistry/Chemistry%20Notes%20for%20 class%2012%20Chapter%2015%20Polymers%20.pdf>
3. <http://web.mit.edu/5.33/www/lec/poly.pdf>
4. <https://www.nios.ac.in/media/documents/313courseE/L33A.pdf>

CO-PO Mapping:

(1: Slight [Low]; 2: Moderate [Medium]; 3: Substantial [High],'-': No Correlation)

	P O 1	P O 2	P O 3	P O 4	P O 5	P O 6	P O 7	P O 8	P O 9	PO1 0	P S O 1	P S O 2	P S O 3
C O 1	3	3	3	2	3	3	3	3	3	3	3	3	3
C O 2	3	3	3	2	3	3	3	2	2	3	2	3	3
C O 3	3	2	2	2	3	2	3	2	2	2	2	2	2
C O 4	3	2	2	3	2	3	2	3	1	1	1	3	2
C O 5	3	2	3	2	2	3	3	2	1	1	2	2	2
A v g .	3	2 . 4	2 . 6	2 . 2	2 . 6	2 . 8	2 . 8	2 . 4	1 . 8	2	2	2. 6	2. 4

III B.Sc., Industrial chemistry (Honors) CHEMISTRY V/VI-SEMESTER

BLUE PRINT

POLYMER CHEMISTRY

Sl. No.	Chapter	Essay questions (7M) Knowledge/Understanding/ skill /Application	Short questions (3M) Knowledge/Understanding/ skill /Application
1	Unit-I	02	02
2	Unit-II	02	01
3	Unit-III	02	01
4	Unit-IV	02	02
5	Unit-V	02	02
Total number of questions		10	08

GOVERNMENT COLLEGE (A), RAJAMAHENDRAVARAM

DEPARTMENT OF CHEMISTRY

III B.Sc., Industrial chemistry (Honors) CHEMISTRY V/VI-SEMESTER

MODEL QUESTION PAPER

Time: 2½hrs

Max.Marks:50 M

SECTION-A

Answer **ALL** Questions.

5X7=35M

1. Define polymers? Write the classification of polymers. (CO1-BT1&2)
(OR)
2. What is functionality of polymers? Explain vulcanization of rubber. (CO1-BT1&2)
3. Explain the ionic polymerization mechanism with examples. (CO2-BT2 &3)
(OR)
4. Discuss Coordination polymerization and Ziegler Natta catalysis. (CO2-BT2 &3)
5. Explain the Bulk and Emulsion polymerization. (CO3-BT2) (OR)
6. How do you determine the molecular weight of polymers by Osmosis method? (CO3-BT4)
7. Discuss the preparation, structure and applications of Polystyrene and Polyvinyl chloride. (CO4 -BT 2 & 3) (OR)
8. Discuss the preparation, structure and applications of Nylon 6, 6 and Bakelite. (CO4 – BT2 &3)
9. Define glass transition temperature (T_g)? Discuss the factors affecting Glass transition temperature (T_g)? (CO5-BT1, (OR)
10. What is Polymer degradation? Explain different types of Polymer degradation. (CO5-BT1 &2)

SECTION-B

Answer any **FIVE** Questions.

5X3=15M

11. Write short note on Copolymerization. (CO1-BT3)
12. Write short note on Degree of polymerization. (CO1-BT3)
13. Discuss condensation polymerization. (CO2-BT2)
14. Determine the Number average molecular weight of polymers. (CO3-BT4)
15. Preparation and two applications of Teflon. (CO4-BT3)
16. Preparation and any two applications of Polyethylene. (CO4-BT3)
17. Explain WLF equation. (CO5-BT2)
18. Short note on stabilization of polymers. (CO5-BT3)

QUESTION BANK

Essay Questions:

1. Define polymers? Write the classification of polymers. (CO1-BT1&2)
2. Explain the molecular forces and chemical bonding in polymers. (CO1-BT1&2)
3. What is functionality of polymers? Explain vulcanization of rubber. (CO1-BT1&2)
4. Explain the ionic polymerization mechanism with examples. (CO2-BT2 &3)
5. What are Polymerization reactions? Explain the mechanism of condensation polymerization with suitable example. (CO2-BT2 &3)
6. Discuss Coordination polymerization and Ziegler Natta catalysis. (CO2-BT2 &3)
7. Explain the Bulk and Emulsion polymerization. (CO3-BT2)
8. Explain the solution and Polymerization methods. (CO3-BT2)
9. How do you determine the molecular weight of polymers by Osmosis method? (CO3-BT4)
10. Discuss the preparation, structure and applications of Polystyrene and Polyvinyl chloride. (CO4 -BT 2 & 3)
11. Discuss the preparation, structure and applications of Nylon- 6,6 and Bakelite. (CO4 BT2 &3)
12. Discuss the preparation, structure and applications of Polyethylene and Nylon-6. (CO4 -BT 2 & 3)
13. Define glass transition temperature (T_g)? Discuss the factors affecting Glass transition temperature (T_g)? (CO5-BT1, 2 &4)
14. What is Polymer degradation? Explain different types of Polymer degradation. (CO5-BT1 &2)

Short Questions:

15. Write short note on Copolymerization. (CO1-BT3)
16. Write short note on Degree of polymerization. (CO1-BT3)
17. Discuss polymer rubber. (CO1-BT2)
18. Discuss condensation polymerization. (CO2-BT2)
19. How do you determine the molecular weight of polymers by Osmosis method? (CO3-BT4)
20. Determine the Number average molecular weight of polymers. (CO3-BT4)
21. Preparation and two applications of Teflon. (CO4-BT3)
22. Preparation and any two applications of Polyethylene. (CO4-BT3)
23. Explain WLF equation. (CO5-BT2)
24. Short note on stabilization of polymers. (CO5-BT3)
25. Short note on free volume theory. (CO5-BT3)
26. Note on Photo degradation stabilization of polymers. (CO5-BT3)

	Government College (Autonomous) Rajahmundry	Program & Semester III B.Sc. Industrial Chemistry (Hons) (V/VI Semester)			
Course Code :	TITLE OF THE COURSE POLYMER CHEMISTRY (DSE-I)				
Teaching	Hours Allocated: 30 (Practical)	L	T	P	C
Pre-requisites	Instrumental techniques introduced	2	-	-	2

Course Objectives:

1. To learn the skill of the conducting reaction and maintain the conditions, overall synthesis and crystallization
2. To Study the various kinds of named reactions and percentage of yield calculation
3. To understand about the physical properties of polymers and crystalline nature
4. To study principles and applications of instrumental techniques

Course Outcomes:

On Completion of the course, the students will be able to	
C O1	Understand and about the basic reactions of organic compounds and polymers.
C O2	Students acquired specific skills of formulate and writing mechanism, conducting reactions and crystallization.
C O3	Learn and evaluate basic instrumental techniques.
C O4	Students also known about the structural properties and applications of different polymers.

Course with focus on employability/entrepreneurship/Skill Development modules

Skill Develop ment		Employabi lity		Entrepreneur ship	

Syllabus:**CHEMISTRY PRACTICAL-C15 LAB: POLYMER CHEMISTRY****Polymer synthesis:**

1. Preparation of Acetanilide
2. Preparation of Benzanilide
3. Preparation of Phenylazo β -naphthol
4. Preparation of urea-formaldehyde resin
5. Preparation of Phenol-formaldehyde resin

Polymer analysis:

1. Estimation of the amount of HCHO in the given solution by sodium sulphite method
2. IR studies of polymers

Reference books: Instrumental Methods of Chemical Analysis-H.Kaur, Pragathi Prakashan, 2003

1.A.I.Vogel-A text book of quantitative organic analysis-ELBS

Web Links:

1. [https://chem.libretexts.org/Ancillary_Materials/Laboratory_Experiments/Wet_Lab_Experiments/Organic_Chemistry_Labs/Experiments/1%3ASynthesis_of_Aspirin_\(Experiment\)](https://chem.libretexts.org/Ancillary_Materials/Laboratory_Experiments/Wet_Lab_Experiments/Organic_Chemistry_Labs/Experiments/1%3ASynthesis_of_Aspirin_(Experiment))
2. <https://www.eng.uc.edu/~beaucag/Classes/IntrotoPolySci/UWaterlooLabPolyChem/experiment2.pdf>
3. <https://www.learnbse.in/prepare-2-naphthol-aniline-phenyl-azo-%CE%B2-naphtholdye/>

CO-PO Mapping:

(1: Slight [Low]; 2: Moderate[Medium];3:Substantial[High], '-' :No Correlation)

	P O 1	P O 2	P O 3	PO4	P O 5	P O 6	P O 7	P O 8	P O 9	PO1 0	P S O 1	P S O 2	P S O 3
CO 1	3	3	2	2	3	3	3	3	3	3	2	3	3
CO 2	3	2	3	3	3	3	3	2	3	3	3	3	3
CO 3	3	3	3	3	3	2	3	2	1	2	3	3	1
CO 4	3	2	2	2	2	3	2	3	2	2	2	2	2
Avg.	3	2 .5	2 .5	2.5	2 .7 5	2 .7 5	2 .7 5	2 .5	2 .2 5	2 .2 5	2.5	2.7 5	2.2 5

CHEMISTRY PRACTICAL-C15 LAB: POLYMER CHEMISTRY

SCHEME OF VALUATION

Record-10M Viva voce-5M,
Polymer Synthesis and Analysis 35M

(Breakup for 35 marks)

1. Aim, Chemicals & Apparatus	5 M
2. Procedure	5 M
3. Yield Report	5 M
4. Yield error Less than 10%	

	1
[Above 10%	0
	M

5M]

5. IR analysis for two polymers	(2x5M)	1 0 M

6. Record		1 0 M

1. Viva		5M

*****@*****

**SKILL ENHANCED
COURSE
FOR V/VI SEMSTER
BA, B.COM, BBA
AND B.SC
STUDENTS**

ENVIRONMENTAL EDUCATION

DEPARTMENT OF CHEMISTRY

COMMON VALUE-ADDED COURSE

ENVIRONMENTAL EDUCATION

Credits: 2 2 hrs/week

Course objective: A Generic Course intended to create awareness that the life of human beings is an integral part of environment and to inculcate the skills required to protect environment from all sides.

Learning outcomes: On completion of this course the students will be able to

1. Understand the nature, components of an ecosystem and that humans are an integral part of nature.
2. Realize the importance of environment, the goods and services of a healthy biodiversity, dependence of humans on environment.
3. Evaluate the ways and ill effects of destruction of environment, population explosion on ecosystems and global problems consequent to anthropogenic activities.
4. Discuss the laws/ acts made by government to prevent pollution, to protect biodiversity and environment as a whole.
5. Acquaint with international agreements and national movements, and realize citizen's role in protecting environment and nature.

Unit 1: Environment and Natural Resources 06 Hrs.

1. Multidisciplinary nature of environmental education; scope and importance.
2. Man as an integral product and part of the Nature.
3. A brief account of land, forest and water resources in India and their importance.
4. Biodiversity : Definition; importance of Biodiversity - ecological, consumptive, productive, social, ethical and moral, aesthetic, and option value.
5. Levels of Biodiversity: genetic, species and ecosystem diversity.

Unit-2: Environmental degradation and impacts 10Hrs

- 1. Human population growth and its impacts on environment; land use change, land degradation, soil erosion and desertification.**
- 2. Use and over-exploitation of surface and ground water, construction of dams, floods, conflicts over water (within India).**
- 3. Deforestation: Causes and effects due to expansion of agriculture, firewood, mining, forest fires and building of new habitats.**
- 4. Non-renewable energy resources, their utilization and influences.**
- 5. A brief account of air, water, soil and noise pollutions; Biological, industrial and solid wastes in urban areas. Human health and economic risks.**
- 6. Green house effect - global warming; ocean acidification, ozone layer depletion, acid rains and impacts on human communities and agriculture.**
- 7. Threats to biodiversity: Natural calamities, habitat destruction and fragmentation, over exploitation, hunting and poaching, introduction of exotic species, pollution, predator and pest control.**

Unit 3: Conservation of Environment 10 Hrs

- 1. Concept of sustainability and sustainable development with judicious use of land, water and forest resources; afforestation.**
- 2. Control measures for various types of pollution; use of renewable and alternate sources of energy.**
- 3. Solid waste management: Control measures of urban and industrial waste.**
- 4. Conservation of biodiversity: In-situ and ex-situ conservation of biodiversity.**
- 5. Environment Laws: Environment Protection Act; Act; Wildlife Protection Act; Forest Conservation Act.**
- 6. International agreements: Montreal and Kyoto protocols; Environmental movements: Bishnois of Rajasthan, Chipko, Silent valley.**
- 7.**

Suggested activities to learner: (4 hours)

- 1. Visit to an area to document environmental assets: river/ forest/ flora/fauna, etc**
 - 2. Visit to a local polluted site-Urban/Rural/Industrial/Agricultural site.**
 - 3. Study of common plants, insects, birds and basic principles of identification.**
 - 4. Study of simple ecosystems-forest, tank, pond, lake, mangroves etc.**
- 5. Case study of a Forest ecosystem or a pond ecosystem. suggested text book :**
- **ErachBarucha (2004) *Text book of Environmental Studies for Undergraduate courses***

(Prepared for University Grants Commission) Universities Press.

➤ Purnima Smarath (2018) *Environmental studies* Kalyani Publishers, Ludhiana

Reference books : Odum, E.P., Odum, H.T. & Andrews, J. (1971) *Fundamentals of Ecology*. Philadelphia:Saunders.

➤ Pepper, I.L., Gerba, C.P. & Brusseau, M.L. (2011).

Environmental and Pollution Science. Academic Press.

➤ Raven, P.H., Hassenzehl, D.M. & Berg, L.R. (2012)

Environment. 8th edition. John Wiley & Sons.

➤ Singh, J.S., Singh, S.P. and Gupta, S.R. (2014) *Ecology, Environmental Science and Conservation*. S. Chand Publishing, New Delhi.

➤ Sengupta, R. (2003) *Ecology and economics: An approach to sustainable development*. OUP.

➤ Wilson, E. O. (2006) *The Creation: An appeal to save life on earth*. New York: Norton.

➤ Groom, Martha J., Gary K. Meffe, and Carl Ronald Carroll (2006) *Principles of Conservation Biology*. Sunderland: Sinauer Associates,

ENVIRONMENTAL EDUCATION -QUESTION BANK

Unit – 1: Environment and Natural Resources

10 Marks Questions

1. Write an essay on scope, and importance of environmental education.
2. Describe various levels of biodiversity with suitable examples.
3. Explain the role of man as an integral part and product of nature.
4. Discuss the importance of natural resources like land, forest, and water in India.

5 Marks Questions

1. Define biodiversity and write its different levels.
 2. Write short note on importance of Biodiversity.
 3. Write a short note on forest resources in India.
 4. What are the consumptive and productive values of biodiversity?
-

Unit – 2: Environmental Degradation and Impacts

10 Marks Questions

1. Discuss the impact of human population growth on the environment.
2. Explain the causes and effects of deforestation.
3. Describe various types of pollution and their effects on human health.
4. Write an essay on global environmental problems like greenhouse effect, global warming, and ozone depletion.

5 Marks Questions

1. What are the main causes of land degradation and desertification?
 2. Write a short note on over-exploitation of water resources.
 3. What are the effects of non-renewable energy resource utilization?
 4. Write briefly about acid rain and its impacts.
 5. Mention any four threats to biodiversity.
-

Unit – 3: Conservation of Environment

10 Marks Questions

1. Discuss the control measures for air, water, and soil pollution.
2. Write an essay about solid waste management.
3. Explain in-situ and ex-situ conservation of biodiversity with examples.
4. Discuss various environmental laws and their significance.
5. Write an essay on international environmental agreements and movements in India.

5 Marks Questions

1. What is sustainable development?
2. Write short notes on Montreal and Kyoto Protocols.
3. Mention any two methods of solid waste management.
4. What are renewable and alternate sources of energy?
5. Write briefly about the Chipko and Silent Valley movements.

**GOVERNMENT COLLEGE(A), RAJAHMUNDY
DEPARTMENT OF CHEMISTRY
COMMON VALUE-ADDED COURSE
ENVIRONMENTAL EDUCATION
Model Question Paper – 50 Marks**

SECTION – A

Answer any THREE questions from the following Each question carries 10 marks.

(3 × 10 = 30 Marks)

- 1. Write an essay on scope and importance of environmental education.**
- 2. Discuss the importance and different values of biodiversity.**
- 3. Describe the causes and effects of deforestation and its impact on the environment.**
- 4. Write an essay on global environmental problems such as greenhouse effect, and ozone depletion.**
- 5. Discuss various environmental laws and their significance.**
- 6. Explain in-situ and ex-situ conservation of biodiversity with suitable examples.**

SECTION – B

Answer any FOUR questions from the following. Each question carries 5 marks.

(4 × 5 = 20 Marks)

- 7. Write short notes on forest resources in India.**
- 8. Write short note on importance of Biodiversity.**
- 9. What are the main causes of land degradation and desertification?**
- 10. What are the effects of non-renewable energy resource utilization?**
- 11. Write briefly about solid waste management in urban areas.**
- 12. Write briefly about the Chipko movement.**

CERTIFICATE COURSE

BASIC ANALYTICAL TECHNIQUES

TECHNIQUES (Credits: 02)

(Hands on Exercises:
60 Lectures)

Introduction: Introduction to Analytical Chemistry and its interdisciplinary nature.

Concept of sampling. Importance of accuracy, precision and sources of error in analytical measurements.

Presentation of experimental data and results, from the point of view of significant figures.

Analysis of soil: Composition of soil, Concept of pH and pH measurement, Complexometric titrations, Chelation, Chelating agents, use of indicators

a. Determination of pH of soil samples.

b. Estimation of Calcium and Magnesium ions as Calcium carbonate by complexometric titration.

Analysis of water: Definition of pure water, sources responsible for contaminating water, water sampling methods, water purification methods.

a. Determination of pH, acidity and alkalinity of a water sample.

b. Determination of conductivity, TDS, TSS of water sample

b. Determination of dissolved oxygen (DO) of a water sample.

Chromatography: Definition, general introduction on principles of chromatography, paper chromatography, TLC etc.

Paper chromatographic separation of mixture of metal ions Ni (II) and Co(II).

Ion-exchange: Column, ion-exchange chromatography etc. Determination of ion exchange capacity of anion/cation exchange resin (using batch procedure if use of column is not feasible).

Suggested Applications (Any one):

a. To study the use of phenolphthalein in traps cases

b. To analyze arson accelerants

c. To carry out analysis of gasoline.

Suggested Instrumental demonstrations:

a. Estimation of macro nutrients: Potassium, Calcium, Magnesium in soil samples by flame photometry.

b. Spectrophotometric determination of Iron in Vitamin/Dietary Tablets.

c. Spectrophotometric Identification and Determination of Caffeine and Benzoic Acid in Soft Drink

Reference Books:

1. Willand, H. H. Instrumental Methods of Analysis, CBS Publishers, 1988
2. Skoog, D.A. and Leary, J.J., Instrumental Methods of Analysis, Saunders College Publications, New York, 1992
3. Skoog, D.A.; West, D.M. and Holler, F.J. Fundamentals of Analytical Chemistry 6th Ed, Saunders College Publishing, Fort Worth, 1992
4. Harris, D. C. Quantitative Chemical Analysis 7thEd. W. H. Freeman and Co., New York, 2007
5. Dean, J. A. Analytical Chemistry Handbook, McGraw Hill, 2007
6. Vogel's quantitative methods of analysis 5 th Edition.

Government College (Autonomous) Rajahmundry

DEPARTMENT OF CHEMISTRY
BASIC ANALYTICAL TECHNIQUES

Modal question paper

TOTAL 50 M

Write **any five** of the following questions

5x8 =40 M

1. Write about importance of analytical chemistry and its interdisciplinary nature
2. Explain Presentation of experimental data and results, from the point of view of significant figures.
3. Write about chelation and chelating agents
4. How can you determine the pH of soil sample?
5. Explain the determination of TDS and TSS of water sample
6. Explain the determination of dissolved oxygen present water sample
7. Explain paper chromatographic separation of Co (II) and Ni (II) ions
8. Explain the determination of ion exchange capacity of anion/ cation exchange resin

Write **any five** of the following questions

5x2 = 10 M

1. What is accuracy and precision?
2. Write the concept of sampling
3. Draw the [Ca-EDTA] complex structure
4. Discuss the concept of p^H
5. Define pure water
6. What is alkalinity of water
7. Write the principle of chromatography
8. Write different stationary phases present in TLC