SEMESTER-III

	PITHAPUR RAJAH'S GOVERNMENT COLLEGE(A) KAKINADA DEPARTMENT OF CHEMISTY	Program & Semester Chemistry II B.Sc. (III Semester)			
Course Code CHE-5	TITLEOFTHECOURSE **COURSE 5: FUNDAMENTALS IN ORGANIC CHEMISTRY**				
Teaching	HoursAllocated:45 (**Theory**)	L	T	P	C
Pre-requisites	Nature of bonds, Field effects, aromaticity, alicyclic compounds. Saturated & Unsaturated Hydrocarbons	45	10	30	3+1

CourseOutcomes:

On Completion of the course, the students will be able to	
CO1	Understand the types of bond fission, organic reagents, and reaction intermediates (Carbocations, Carbanions, Free Radicals).
CO2	Analyze the effects of bond polarization, inductive, resonance, and hyperconjugation in organic molecules.
CO3	Comprehend the methods of preparation of alkanes and cycloalkanes, including Wurtz and Wurtz Fittig reactions.
CO4	Study the conformational analysis of alkanes and cycloalkanes, including energy diagrams and relative stability
CO5	Learn the preparation, properties, and mechanisms of alkenes and alkynes, including electrophilic additions and elimination reactions.
CO6	Study advanced reactions like ozonolysis, Diels-Alder reactions, and the alkylation of terminal alkynes.
CO7	Understand the structure of benzene and its electrophilic aromatic substitution mechanisms
CO8	Study the preparation and reactions like Friedel-Craft alkylation, acylation, halogenation, and nitration.
CO9	Learn the concept of aromaticity, Huckel's rule, and apply it to both benzenoid and non-benzenoid compounds
CO10	Understand the orientation of aromatic substitution and electronic interpretation of activating and deactivating groups.

Syllabus:

UNIT-I STRUCTURAL THEORY IN ORGANIC CHEMISTRY (9 Hrs.)

Types of bond fission and organic reagents (Electrophilic, Nucleophilic, and free radical reagents). Reaction intermediates – Carbocations, carbanions & free radicals. Bond polarization: Factors influencing the polarization of covalent bonds, inductive effect – Application of inductive effect (a)Basicity of amines (b) Acidity of carboxylic acids (c) Stability of carbonium ions. Resonance or Mesomeric effect, application to (a) acidity of phenol, and (b) acidity of carboxylic acids. Hyperconjugation and its application to stability of carbonium ions, Free radicals, and alkenes

UNIT-II SATURATED HYDROCARBONS (ALKANES AND CYCLOALKANES) (9 Hrs.)

General methods of preparation of alkanes- Wurtz and Wurtz Fittig reaction, Corey House synthesis, physical and chemical properties of alkanes, Conformational analysis of alkanes (Conformations, relative stability and energy diagrams of Ethane, Propane, and butane). General molecular formulae of cycloalkanes and relative stability, Baeyer strain theory, Cyclohexane conformations with energy diagram, Conformations of monosubstituted cyclohexane.

UNIT-III UNSATURATED HYDROCARBONS (ALKENES AND ALKYNES) (9 Hrs.)

General methods of preparation, physical and chemical properties, Saytzeff and Hoffmann eliminations (with mechanism), Electrophilic Additions, (H2, HX) mechanism (Markonikoff's/ Anti Markonikoff's addition) with suitable examples-syn and anti-addition. addition of X2, HX. Oxymercuration demercuration, ozonolysis, hydroxylation, Diels Alder reaction,1,2- and1,4-addition reactions in conjugated dienes. Reactions of alkynes; acidity, electrophilic and nucleophilic additions, hydration to form carbonyl compounds, Alkylation of terminal alkynes

UNIT-IV:BENZENE AND ITS REACTIVITY(9 Hrs.)

Structure of Benzene – Preparation - polymerization of acetylene and decarboxylation- Properties - mechanism of electrophilic aromatic substitution of Friedel- Craft's alkylation and acylation. halogenation and nitration.

UNIT-V: Orientation of aromatic substitution (9 h)

Concept of aromaticity, Huckel's rule - application to Benzenoid (Benzene, Naphthalene) and Non - Benzenoid compounds (cyclo propenyl cation, cyclopentadienyl anion and tropylium cation) Orientation of aromatic substitution - 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, Carbonyl and sulphonic acid groups (iii) Halogens.

Textbooks:

S.NO	AUTHOR	TITLE	PUBLISHER
1	O.P Agarwal	Unified Chemistry	JPNP publications
2	Bhal and Arun Bhal	Textbook of Advanced organic chemistry	S.Chand publications

Reference books

S.NO	AUTHOR	TITLE	PUBLISHER
1	Morrison and Boyd	Organic Chemistry	Oxford University Press
2	I L Finar Vol I	A Text Book of Organic chemistry	
3	Jonathan Clayden, Greeves and Stuart Warren	Organic Chemistry	Oxford University Press

WebLinks:

1. https://www.sandiego.edu/documents/cas/chemistry/structure_function.pdf
2. https://www.youtube.com/watch?v=ib9h_vM4Kp4
3. https://chem.libretexts.org/Bookshelves/Organic_Chemistry/Cyclohexane_Conformations
4. https://www.youtube.com/watch?v=gU8bKZ8IJpU
5. https://www.masterorganicchemistry.com/2010/09/22/the-diels-alder-reaction/
6. https://chem.libretexts.org/Bookshelves/Organic_Chemistry/Electrophilic_Aromatic_Substituti on.pdf
7. https://nptel.ac.in/courses/104/103/104103071/
8. https://chem.libretexts.org/Bookshelves/Organic_Chemistry/Aromaticity.pdf
9. https://en.wikipedia.org/wiki/Electrophilic_aromatic_directing_groups

COURSE OUTCOME & PROGRAM OUTCOME MAPPING

CO-PO Mapping:

1: Low =1 ; 2: Moderate = 2 ; 3: High = 3

CO	PO1 Knowledge	PO2 Critical Thinking	PO3 Problem Solving	PO4 Usage of Modern Tools	PO5 Communication	PO6 Life-long Learning	PO7 Ethical Practices and Social Responsibility	BT LEVELS
CO1	3	2	2	2	1	1	1	BT2
CO2	3	3	2	2	1	1	1	BT4
CO3	3	2	2	2	1	2	1	BT3
CO4	3	3	3	3	1	2	1	BT4
CO5	3	3	3	3	1	2	1	BT3
CO6	3	3	3	3	1	2	1	BT3
CO7	3	3	2	2	1	2	1	BT2
CO8	3	3	3	2	1	2	1	BT3
CO9	3	3	2	2	1	2	1	BT2
CO10	3	3	3	2	1	2	1	BT4

Unit 1: Structural Theory in Organic Chemistry

CO1: Understand the types of bond fission, organic reagents, and reaction intermediates (Carbocations, Carbanions, Free Radicals).
CO2: Analyze the effects of bond polarization, inductive, resonance, and hyperconjugation in organic molecules.

Mapping to POs:

- **PO1 (Knowledge):** Understanding various bond fissions and their effects on organic molecules.
- **PO2 (Critical Thinking):** Applying knowledge of bond polarization, inductive, resonance, and hyperconjugation to explain chemical behaviours.
- **PO3 (Problem Solving):** Using knowledge of reaction intermediates to predict reaction pathways and stability.
- **PO4 (Usage of modern tools):** Application of tools for analyzing the stability and reactivity of organic compounds

Unit 2: Saturated Hydrocarbons (Alkanes and Cycloalkanes)

CO3: Comprehend the methods of preparation of alkanes and cycloalkanes, including Wurtz and Wurtz Fittig reactions.
CO4: Study the conformational analysis of alkanes and cycloalkanes, including energy diagrams and relative stability.

Mapping to POs:

- **PO1 (Knowledge):** Understanding the preparation methods and properties of alkanes and cycloalkanes.
- **PO2 (Critical Thinking):** Analysing the relative stability of different conformers and their energy profiles.
- **PO3 (Problem Solving):** Applying conformational analysis to determine the stability of hydrocarbons.
- **PO4 (Usage of modern tools):** Use molecular modelling tools for conformational analysis of alkanes and cycloalkanes

Unit 3: Unsaturated Hydrocarbons (Alkenes and Alkynes)

CO5: Learn the preparation, properties, and mechanisms of alkenes and alkynes, including electrophilic additions and elimination reactions.
CO6: Study advanced reactions like ozonolysis, Diels-Alder reactions, and the alkylation of terminal alkynes.

Mapping to POs:

- **PO1 (Knowledge):** Understanding of preparation and properties of unsaturated hydrocarbons.
- **PO2 (Critical Thinking):** Analysing reaction mechanisms and predicting products of various reactions.
- **PO3 (Problem Solving):** Using reaction mechanisms to solve complex organic synthesis problems.
- **PO4 (Usage of modern tools):** Using modern techniques (e.g., spectroscopic methods) to analyse reactions and products of alkenes and alkynes.

Unit 4: Benzene and its Reactivity

CO7: Understand the structure of benzene and its electrophilic aromatic substitution mechanisms.
CO8: Study the preparation and reactions like Friedel-Craft alkylation, acylation, halogenation, and nitration.

Mapping to POs:

- **PO1 (Knowledge):** Acquiring in-depth knowledge of benzene's structure and reactivity.
- **PO2 (Critical Thinking):** Evaluating and predicting the outcomes of electrophilic aromatic substitution reactions.
- **PO3 (Problem Solving):** Solving problems related to the synthesis and reactivity of aromatic compounds.
- **PO4 (Usage of modern tools):** Using synthetic techniques to demonstrate electrophilic aromatic substitution reactions.

Unit 5: Orientation of Aromatic Substitution

CO9: Learn the concept of aromaticity, Huckel's rule, and apply it to both benzenoid and non-benzenoid compounds.
CO10: Understand the orientation of aromatic substitution and electronic interpretation of activating and deactivating groups.

Mapping to POs:

- **PO1 (Knowledge):** Deep understanding of aromaticity and its influence on aromatic substitution.
- **PO2 (Critical Thinking):** Analysing how electronic effects influence the orientation of substitution on aromatic rings.
- **PO3 (Problem Solving):** Solving problems related to the reactivity of substituted aromatic compounds.
- **PO4 (Usage of modern tools):** Using tools like computational chemistry software to predict substitution patterns on aromatic compounds.

Weightage to content

Semester -III

Course - 5

S.No	Course Content	Long Answer	Short Answer	Total marks	As per Blooms Taxonomy
1	STRUCTURAL THEORY IN ORGANIC CHEMISTRY	2	1	25	Understanding, Application
2	ALKENES	1	2	20	Remembering, Understanding
3	ALKYNES	1	1	15	Analyzing & Creation
4	CYCLO ALKANES	1	1	15	Evaluation, Understanding
5.	BENZENE AND IT'S REACTIVITY	1	2	20	Understanding, Application
	TOTAL	6	7	95	

P.R. GOVERNMENT COLLEGE (A), KAKINADA

I YEAR B.Sc Chemistry (Examination at the end of III semester)

(COURSE – 5 Fundamentals In Organic Chemistry)

MODEL PAPER

Duration: 2hr **Max.Marks:50M**

Section – 1

Answer any three of the following questions. Must attempt at least one question from each part. Each question carries 10 Marks. **3 X 10M = 30M**

Part -A

1. UNIT 1
2. UNIT 2
3. UNIT 3

Part-B

4. UNIT1
5. UNIT4
6. UNIT 5

Section - II

Answer any four of the following questions. Each carries 5 marks. **4 X 5M= 20M**

7. UNIT 1

8. UNIT 2

9. UNIT 2

10. UNIT 3

11. U INIT 3

12. UNIT 4

13. UNIT 5

SEMESTER-III

COURSE - 5 : **ORGANIC CHEMISTRY**

Practical Credits: 1 2 hrs/week

Learning Out comes:
On successful completion of this practical course, student shall be able to (At the end of Semester)

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

Syllabus: Organic Functional Group Reactions
Analysis of an organic compound through systematic qualitative procedure for functional group identification including the determination of melting point and boiling point with suitable derivatives. Alcohols, Phenols, Aldehydes, Ketones, Carboxylic acids, Aromatic primary amines, amides and simple sugars.

Lab References:

S.NO	AUTHOR	TITLE	PUBLISHER
1	Vogel A.I	Practical Organic Chemistry	Longman Group Ltd.
2	Bansal R.K	Laboratory Manual of Organic Chemistry	Wiley-Eastern
3	Ahluwalia & Aggarwal R	Comprehensive Practical Organic Chemistry	Universitypress. Delhi
4	Mann F.G and Saunders B.C	Practical Organic Chemistry	Pearson Education

Co-Curricular Activities:

a) Mandatory:(Lab/field training of students by teacher:(lab:10+field:05):

1. For Teacher: Training of students by teacher in laboratory and field for not lessthan15 hours on the field techniques/skills of preparation of acetanilide, preparation of azodye, use of separating funnel for solvent extraction, separation of organic compounds in a mixture.
2. For Student: Student shall visit a related industry/chemistry laboratory in universities/research organizations/private sector facility and observe the techniques used for the separation of organic compounds. Write their observations and submit a hand written fieldwork/project work report not exceeding10 pages in the given format to the teacher.
3. Max marks for Fieldwork/project work Report:05.
4. Suggested Format for Fieldwork/project work: Title page, student details, index page, details of place visited, observations, findings, and acknowledgements.

5. Unit tests (IE).

b) Suggested Co-Curricular Activities

1. Training of students' by related industrial experts.
2. Assignments, Seminars and Quiz (on related topics), collection of videos and other material.
3. Visits of facilities, firms, research organizations etc.
4. Invited lectures and presentations on related topics by field/industrial experts

SCHEME OF VALUATION

Practical Paper – 4:: Organic Chemistry(at the end of semester III)

Systematic analysis of each component which involves following	
a. Preliminary Tests (State, Colour, Odour)	03 marks
b. Ignition test	02 marks
c. Detection of the functional group (Preliminary & Confirmation)	02+03 marks
Total Four compounds (4 X 10)	40M
d. Viva voce	05M
e. Record	05M
TOTAL	**50 marks**

QUESTION BANK

Unit 1: Structural Theory in Organic Chemistry

Long Answer Questions (10 Marks)

1. Explain the different types of bond fission in organic reactions and their significance.
2. Discuss the concept of resonance and its application to the acidity of phenols and carboxylic acids.
3. Describe the factors influencing the polarization of covalent bonds.
4. What is hyperconjugation? Discuss its role in the stability of carbocations and free radicals.
5. Explain the inductive effect and its application in the basicity of amines and the acidity of carboxylic acids.

Short Answer Questions (5 Marks)

1. Define the concept of free radicals and provide examples.
2. What is the role of carbocations in organic reactions?
3. State the effect of hyperconjugation on the stability of alkenes.
4. What is the application of resonance in organic chemistry?
5. Discuss the concept of bond polarization and its importance in organic reactions.

Unit 2: Saturated Hydrocarbons (Alkanes and Cycloalkanes)

Long Answer Questions (10 Marks)

1. Discuss the methods of preparation of alkanes with a focus on the Wurtz and Wurtz-Fittig reactions.
2. Explain the conformational analysis of alkanes, including the energy diagrams of ethane, propane, and butane.
3. Discuss the molecular structure and stability of cycloalkanes, highlighting Baeyer's strain theory.
4. What are the properties of alkanes, and how do they influence the chemical reactions they undergo?
5. Compare the stability of different conformations of cyclohexane.

Short Answer Questions (5 Marks)

1. Write a short note on the physical properties of alkanes.
2. What is the Corey House synthesis?
3. Explain Baeyer's strain theory and its relevance to cycloalkanes.
4. What is the significance of the conformational analysis of ethane?
5. How does the molecular formula affect the stability of cycloalkanes?

Unit 3: Unsaturated Hydrocarbons (Alkenes and Alkynes)

Long Answer Questions (10 Marks)

1. Describe the mechanism of electrophilic addition in alkenes, focusing on the Markovnikov's and Anti-Markovnikov's additions.
2. Discuss the Saytzeff and Hoffmann climinations with suitable examples.
3. Explain the mechanism and importance of ozonolysis in alkenes.

additions.

5. Explain the Diels-Alder reaction with mechanisms and its significance in organic synthesis.

Short Answer Questions (5 Marks)

1. What is the mechanism of electrophilic addition in alkenes?
2. Write a note on the hydration of alkynes to form carbonyl compounds.
3. Describe the process of syn and anti-addition in alkenes.
4. What is the significance of ozonolysis in organic chemistry?
5. Explain the 1,2- and 1,4-addition reactions in conjugated dienes.

Unit 4: Benzene and its Reactivity

Long Answer Questions (10 Marks)

1. Explain the structure of benzene and its resonance properties.
2. Describe the mechanism of electrophilic aromatic substitution with examples of Friedel-Crafts alkylation and acylation.
3. Discuss the polymerization of acetylene and its role in organic chemistry.
4. Explain the decarboxylation of benzene derivatives with examples.
5. Discuss the electrophilic aromatic substitution reactions with a focus on nitration and halogenation.

Short Answer Questions (5 Marks)

1. What is the mechanism of Friedel-Crafts alkylation?
2. Write a short note on the polymerization of acetylene.
3. Discuss the halogenation reaction of benzene.
4. What is the decarboxylation of benzene derivatives?
5. Explain the concept of aromaticity and its importance in organic chemistry.

Unit 5: Orientation of Aromatic Substitution

Long Answer Questions (10 Marks)

1. Explain the concept of aromaticity and Huckel's rule with examples from benzenoid and non-benzenoid compounds.
2. Discuss the orientation of aromatic substitution in terms of electron-donating and electron-withdrawing groups.
3. Describe the effect of activating and deactivating groups on the orientation of aromatic substitution.
4. Discuss the electronic interpretation of groups like NO2 and phenolic on aromatic substitution.
5. Explain the effects of amino, methoxy, and methyl groups on the orientation of aromatic substitution.

Short Answer Questions (5 Marks)

1. What is Huckel's rule? Explain its application to benzene.
2. Discuss the effect of halogen groups on aromatic substitution.
3. Explain the concept of ortho-para and meta-directing groups in aromatic substitution.
4. What are activating and deactivating groups in the context of aromatic substitution?
5. Discuss the role of methyl and methoxy groups in the orientation of aromatic substitution.

	PITHAPUR RAJAH'S GOVERNMENT COLLEGE Kakinada	Program & Semester			
Course Code CHE-VI	**ORGANIC CHEMISTRY** (Halogens and Oxygen containing organic compounds) 2024-25 AB	II B.Sc. Chemistry Hons (III Semester)			
Teaching	Hours Allocated: 45 (Theory)	L	T	P	C
Pre-requisites	Halogen compounds, Hydroxy compounds, Carbonyl compounds, Carboxylic acids, Carbohydrates,	45	0	30	3+1

Course Objectives:

1. Halogen compounds
2. Hydroxy compounds
3. Carbonyl compounds
4. Carboxylic acids
5. Carbohydrates

Course Outcomes:

On Completion of the course, the students will be able to	
CO1	Understand the concept of SN1andSN2and SNi mechanisms
CO2	Describe the reactivity of alcohols and phenols.
CO3	Achieve the skills required to propose various mechanisms for carbonyl compounds
CO4	Apply the concepts for synthesizing various organic compounds
CO5	Interconvert the monosaccharides

Course with focus on employability / entrepreneurship / Skill Development modules

Skill Development		Employability		Entrepreneurship	

UNIT-I : HALOGEN COMPOUNDS **(9 h)**

Alkyl halides: Preparation of alkyl halides from i) alkanes, ii) alkenes and iii) alcohols. Properties - nucleophilic substitution reactions–SN1and SN2 and SNi mechanisms with energy profile diagrams, stereo chemical aspects and effect of solvent. 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 : HYDROXY COMPOUNDS (9 h)

Alcohols: Preparation of 1° ,2° ,3° alcohols from Grignard's reagent, Bouveault–Blanc Reduction; Chemical properties – substitution of –OH by using PCl_5, PCl3, PBr3, $SOCl_2$ and with HX / $ZnCl_2$, Oxidation of alcohols with PCC, PDC; Oxidation of diols by HIO_4 and $Pb(OAc)_4$, Pinacol Pinacolone arrangement with mechanism, relative reactivity of 1°, 2°, 3° alcohols.

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

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, semicarbazide. Oxidations and reductions (Clemmensen's, Wolf–Kishner's, with$LiAlH_4$ & $NaBH_4$).

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

Unit-4 : CARBOXYLIC ACIDS AND ACTIVE METHYLENE COMPOUNDS 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, acidchlorides, 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.

Active methylene compounds: Keto-enol tautomerism, preparation of Aceto Acetic 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.

Unit-5: CARBOHYDRATES **9h**

Classification and their biological importance, Monosaccharides: Structural elucidation of glucose and fructose, epimers and anomers, mutarotation, determination of ring size of glucose, Haworth projections and conformational structures; Interconversions of aldoses and ketoses; Killiani-Fischer synthesis and Ruff degradation; Disaccharides– Haworth structure of maltose, lactose and sucrose

Unit No	Additions	Deletions	Remarks as per Blooms Taxonomy
1	Nil		
2	Nil		
3	Nil		
4	Nil		
5	Nil	Ring size of fructose	

Reference & Text 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.

Weightage to content
Semester -III
Paper-VI

S.No	Course Content	Long Answer	Short Answer	Total marks	As per Blooms Taxonomy
1	Halogen Compounds	1	2	20	Understanding, Application
2	Hydroxy Compounds	1	2	20	Remembering, Understanding
3	Carbonyl Compounds	1	1	15	Application & Creation
4	Carboxylic Acids and Active Methylene Compounds	2	1	25	Remembering, Understanding
5	Carbohydrates	1	1	20	Application & Creation
	TOTAL	**6**	**7**	**95**	

PITHAPUR RAJAH'S GOVERNMENT COLLEGE (A) :: KAKINADA

II YEAR B.Sc Chemistry Hons (2024-25 AB)
Examination at the end of III semester)
Paper-VI :: ORGANIC CHEMISTRY
(Halogens and Oxygen containing organic compounds)
MODEL PAPER

Duration: 2hrs **Max. Marks: 50**

PART- A

Answer any **THREE** of the following questions by choosing at least **ONE** from each section. Each carries **TEN** marks 3 X 10 = 30 M

SECTION -A

1. Unit - I
2. Unit - II
3. Unit – III

SECTION -B

4. Unit - IV
5. Unit - IV
6. Unit – V

PART- B

Answer any **FOUR** questions. Each carries FIVE marks 4 X 5 = 20 Marks

7. Unit – I
8. Unit – I
9. Unit – II
10. Unit – II
11. Unit – III
12. Unit – IV
13. Unit – V

Course outcome & Program outcome

On Completion of the course, the students will be able to	
CO1	Understand the concept of SN1andSN2and SNi mechanisms
CO2	Describe the reactivity of alcohols and phenols.
CO3	Achieve the skills required to propose various mechanisms for carbonyl compounds
CO4	Apply the concepts for synthesizing various organic compounds and Interconvert the monosaccharides

CO-PO Mapping:

CO	PO1	PO 2	PO3	PO 4	PO 5	PO6	PO 7	PSO1	PSO2	PSO 3
CO1	3	2	2	2	1	2	1	3	2	2
CO2	3	1	2	2	1	1	1	3	1	2
CO3	3	2	2	3	2	2	2	3	2	2
CO4	3	1	1	1	1	1	1	2	1	1

PROGRAMME OUTCOMES (PO's)

At the completion of the B.Sc. Chemistry program, the students will be able to:

(PO1) Knowledge: Attain in depth knowledge about the fundamental principles, essential facts, conclusions and applications of chemical and scientific theories in various domains of chemistry.

(PO2) Critical Thinking: Carry out experiments in the area of organic analysis, estimation, derivative process, inorganic semi micro analysis, preparation, Kinetic, experiments and spectral analysis applying the domain of critical thinking.

(PO3) Problem Solving: Define the background of reaction mechanisms, complex chemical structures, instrumental method of chemical analysis, and separation techniques and apply appropriate techniques for analyzing specific problems both qualitatively and quantitatively in laboratories and in industries.

(PO4): Usage of modern tools: Create data using modem chemical tools and ICT for

modeling and analyze the data obtained from sophisticated instruments (like UV - Vis, FTIR, NMR, GCMS, Fluorescence, SEM, TEM and XRD) for chemical analysis

(PO5): Communication: Develop Skills to evaluate, analyze and interpret the chemical information and data and to communicate effectively within the chemical community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

(PO6): Life-long Learning: Demonstrate scholarly attitude to pursue a career in the field of chemical education and research and have the zeal and vision to engage in independent and life-long learning in the broadest context of technological and social change.

(PO7) Ethical Practices and Social Responsibility: Generate ideas and solutions for green and sustainable chemistry and approach towards planning and execution of research in frontier areas of chemical sciences

PROGRAM SPECIFIC OUTCOMES (PSO's)

At the time of graduation, our under graduates would be able to:

PSO 1- Evaluate, analyze, interpret and effectively apply the basic laws, principles, phenomena, processes and mechanisms involved in the domain of organic, inorganic, physical and analytical Chemistry

PSO2 - Demonstrate the knowledge of Chemistry in the domain of research, education and perspective entrepreneurship.

PSO3 - Evaluate distinct problems in the field of chemical data analysis, scientific interpretation and reaction mechanisms with an understanding on basic tools to be employed.

PITHAPUR RAJAH'S GOVERNMENT COLLEGE (A) :: KAKINADA

II YEAR B.Sc Chemistry Hons (2024-25 AB)

(Examination at the end of III semester)

Practical Paper – VI :: Organic Chemistry

(Halogens and Oxygen containing organic compounds)

Credits: 01 30 hrs (2 h / W) **50Marks**

Organic preparations

Course outcomes:

On the completion of the course, the student will be able to do the following:

1. How to use glassware, equipment and chemicals and follow experimental procedures in the laboratory.
2. How to calculate limiting reagent, theoretical yield, and percent yield.
3. How to perform common laboratory techniques including reflux, distillation, recrystallization, vacuum filtration.
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.

Syllabus - Organic preparations (50M)

i. Acetylation of β-naphthol by using conventional method

ii. Acetylation of β-naphthol by using green approach

iii. Acetylation of salicylic acid by using conventional method

iv. Acetylation of salicylic acid by using green approach

v. Preparation of Nerolin

Co-curricular activities and Assessment Methods;

1. Continuous Evaluation: Monitoring the progress of student's learning
2. Class Tests, Worksheets and Quizzes
3. Presentations, Projects and Assignments and Group Discussions: Enhances critical thinking skills and personality
4. SEMESTER -End Examination: critical indicator of student's learning and

teaching methods adopted by teachers throughout the SEMESTER .

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

SCHEME OF VALUATION

S.No	Description	Marks
1	Procedure	10
2	Preparation	15
3	Report Yield and Melting point	5 + 5
4	Viva voce	5
5	Record	10

	PITHAPUR RAJAH'S GOVERNMENT COLLEGE KAKINADA DEPARTMENT OF CHEMISTRY	Program & Semester II B.Sc. (III Semester)			
Course Code GC-7	TITLE OF THE COURSE **PHYSICAL CHEMISTRY-1** **2024-25AB**				
Teaching	Hours Allocated: 45 (**Theory**)	L	T	P	C
Pre requisites	Gas laws, Laws of symmetry, Intermolecular interactions	45	10	30	3+1

Course Outcomes:

	On Completion of the course, the students will be able to
CO1	Understand and analyze the behavior of ideal and real gases using kinetic theory, va der Waal's equation, and critical phenomena.
CO2	Apply knowledge of liquid properties and liquid crystals to determine physical behavior and explain their technological applications.
CO3	Interpret crystal structures and symmetry using X-ray diffraction and classify defects in crystalline solids.
CO4	Apply Gibbs phase rule and construct phase diagrams for one- and two-component systems to explain phase equilibria.
CO5	Understand colloidal properties, types of adsorption, and evaluate adsorption isotherms in surface chemical processes.

Course with focus on Employability / Entrepreneurship / Skill Development modules

Skill Development		Employability		Entrepreneurship	

Unit I - Gaseous state (9 h)

Postulates of Kinetic theory of Gases (exclude derivation) – deduction of gas laws from kinetic gas equation-Vander Waal's equation of state. Andrew's isotherms of carbon dioxide, continuity of state. Critical phenomena. Relationship between critical constants and Vander Waal's constants. Law of corresponding states. Joule-Thomson effect. Inversion temperature.

Unit II: Liquid State (9 h)

Physical properties of liquids; vapour pressure, surface tension and coefficient of viscosity, and their determination. Effect of addition of various solutes on surface tension and viscosity. Temperature variation of viscosity of liquids and comparison with that of gases. Qualitative discussion of the structure of water.

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 III - Solid state (9h)

Symmetry in crystals. Law of constancy of interfacial angles. The law of rationality of indices. Miller indices, 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. Powder method. Defects in crystals. Stoichiometric and non-stoichiometric defects.

Unit IV - - Phase Rule (9 h)

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

Unit V - - Surface Chemistry (9 h)

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.

Reference & Text books

1) Principles of physical chemistry by Prutton and Marron

2) Solid state chemistry and its applications by Anthony R. West

3) Text book of physical chemistry by K L Kapoor

4) Text book of physical chemistry by S Glasstone

5) Advanced physical chemistry by Bahl and Tuli

6) Advanced physical chemistry by Gurudeep Raj

7) Principles of physical chemistry by Puri, Sharma and Pathania.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	2	3	2	3	1	2	2	2	2	1	2	2	2
CO2	2	3	3	3	3	2	2	2	2	2	2	2	2
CO3	2	3	3	3	3	2	2	2	2	2	2	2	2
CO4	2	1	1	2	2	2	1	1	1	2	2	2	2
CO5	2	3	3	3	3	2	2	2	2	2	2	2	2

Low =1; Moderate = 2 ; High = 3 ; No Correlation = 0

PO1: Knowledge in Chemistry: Apply the basic knowledge about the fundamental's principles, essential facts and applications of general and physical chemistry

PO2: Problem analysis: Identify, formulate, review research literature, and analyze simple to complex problems reaching substantiated conclusions using fundamental principles of chemistry.

PO3: Design/development of solutions: Design solutions for simple to complex problems and designing novel studies for the development of new methods.

PO4: Conduct investigations of complex problems: Use fundamental research-based knowledge and available research methods including design of experiments, analysis and interpretation of data, and adapting new physical methods.

PO5 : Modern tool usage: Create, select, and apply appropriate techniques, resources, and IT tools for modeling and interpretation of simple to complex molecules.

PO6 : The Chemist & Society: Applying the contextual knowledge to assess societal, health, safety, legal and cultural issues.

PO7: Environment and sustainability: Understand the importance of synthetic organic chemistry for various solutions in societal and environmental context and demonstrate the knowledge and need for sustainable development.

PO8 : Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the science-based practice.

PO9 : Communication: Communicate effectively on complex Chemical activities with the Chemistry community and with society at large, such as, being able to comprehend and write effective reports, design documentation and make effective presentations

PO10: Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.

PSO-1: To identify, formulate and analyze the problems in Chemistry by using principles of Organic, Inorganic and Physical Chemistry fundamentals

PSO-2: Applying Chemistry knowledge to design a system, analyze and interpret data to obtain valid conclusions

PSO-3: Use of various Simulation tools such as CADD Vault, Dotmatics, Schrodinger etc for Molecular design and analysis of various systems.

Weightage to Content
Semester -III Major-7

S.No	Course Content	Long Answer	Short Answer	Total Marks	As per Blooms Taxonomy
1	Gaseous state	2	1	25	Understanding, Application
2	Liquid State	1	1	20	Remembering, Understanding
3	Solid state	1	2	20	Analyzing, Creation
4	Phase Rule	1	1	15	Evaluation, Understanding
5	Surface Chemistry	1	2	20	Understanding, Application
	TOTAL	6	7	95	

PITHAPUR RAJAH'S GOVERNMENT COLLEGE (A) :: KAKINADA

II Year B.Sc HONORS CHEMISTRY

(Examination at the end of III semester)

PHYSICALCHEMISTRY-1

MODEL PAPER

Duration: 2hrs **Max. Marks: 50**

Section -I

Answer any THREE questions choosing at least one from each part. Each question carries TEN marks. **3 X 10 = 30 Marks**

PART-A

1. Unit-I
2. Unit-II
3. Unit-V

PART-B

4. Unit-III
5. Unit-IV
6. Unit-II

Section-II

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

4x5=20 Marks

7. Unit-I
8. Unit-II
9. Unit-III
10. Unit-IV
11. Unit-II
12. Unit-V

PITHAPUR RAJAH'S GOVERNMENT COLLEGE (A) :: KAKINADA

II Year B.Sc Chemistry Hons (2024-25 AB)

(Examination at the end of III semester)

Course-7 :: Physical Chemistry-I

Unit-1:

Essay Questions:

1. Derive the following laws from kinetic theory of gases?
   a) Boyle's law b) Avogadro's law d) Dalton's Law
2. Elaborate Vander Waal equation of state?
3. Derive the mathematical relation between Vander Waal constants and critical constants?

Short answer Questions:

1. Write the postulates of kinetic theory of gases?
2. Discuss the Anderw's Isotherm of carbon dioxide?
3. Explain the reduced equation of state and law of corresponding states?
4. What is Joule-Thomson effect and explain inversion temperature?

Unit-2:

Essay Questions:

1. What are liquid crystals and explain their classification?
2. Define surface tension & explain its determination by using drop count method?
3. What is the coefficient of viscosity & explain its determination by using viscometer.

Short answer Questions:

1. Write the applications of liquid crystals?
2. Explain the differences between liquid crystal and solid/liquids
3. Elaborate on the Qualitative discussion of the structure of water.

Unit-3:

Essay Questions:

1. Explain the law of symmetry in crystals?
2. Derive Bragg's equation for the determination of crystal structure?
3. Explain the stoichiometric and non-stoichiometric defects in crystals?

Short answer Questions:

1. Explain the law of constancy of interfacial angles?
2. Define space lattice, lattice point & unit cell?
3. Write about the different crystal systems with examples?
4. what is law of rational indices?

Unit-4:

Essay Questions:

1. Explain the phase diagram of the Water system?
2. Elaborate the phase diagram of the NaCl- Water system?
3. Discuss the phase diagram of the Ag-Pb system

Short answer Questions:

1. Define phase rule and explain the terms involved in it.
2. Discuss the Pattinson' s process for the desilverisation of lead?
3. Define congruent and incongruent melting points give examples?
4. Write a short note on freezing mixtures.

Unit-5:

Essay Questions:

1. Define is Langmuir adsorption isotherm and explain?
2. What is physisorption and Chemisorption and write their differences?
3. Explain the various factors that effecting adsorption of gases on solids?
4. Explain the following

a) Hardy-Schulze rule. b) Gold number c) Coagulation

Short answer Questions:

1. Define colloids and their classification?
2. Write a short note on Freundlich adsorption isotherm.
3. Write the applications of adsorption?

III - SEMESTER

Course Code 7: Physical Chemistry - 1

Credits: 01

Course outcomes:

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

1) Use glassware, equipment and chemicals and follow experimental procedures in the laboratory

2) Apply concepts of surface chemistry in experiments.

3) Be familiar with the concepts & practical applications of Surface tension and viscosity of liquids.

Physical Chemistry Practical Syllabus:

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.

Co-curricular activities and Assessment Methods:

1) Continuous Evaluation: Monitoring the progress of student's learning

2) Class Tests, Worksheets and Quizzes

3) Presentations, Projects and Assignments and Group Discussions: Enhances critical thinking skills and personality

4) SEMESTER -End Examination: critical indicator of student's learning and teaching methods adopted by teachers throughout the SEMESTER.

List of reference books:

1) A Text Book of Quantitative Inorganic Analysis (3rd Edition) –A.I.Vogel

2) Web related references suggested by teacher.

PITHAPUR RAJAH'S GOVERNMENT COLLEGE(A) KAKINADA

II BSc HONORS IN CHEMISTRY

III - SEMESTER

Paper 7: Physical Chemistry - 1

Scheme of Valuation

Max Marks:50M

11. Experiment Procedure : 10 M

12. Table and Calculation : 5 M

13. Practical : Final Result : < 5% - 25 M

: 5% and < 10% - 20 M

: < 10% - 10 M

14. Viva Voce : 5 M

15. Record : 5 M

	PITHAPUR RAJAH'S GOVERNMENT COLLEGE KAKINADA	Program & Semester			
Course Code - GC-8	TITLE OF THE COURSE **INORGANIC AND PHYSICAL CHEMISTRY**	II B.Sc. (III Semester)			
Teaching	Hours Allocated: 45 (**Theory**)	L	T	P	C
Pre-requisites	Properties of d- Block elements, Basic terminology of Complex compounds, Basic Definitions of thermodynamic Macroscopic properties.	45	10	30	3+1

Course Outcomes:

On Completion of the course, the students will be able to	
CO1	Understanding the Structure and reactivity of Coordination compounds wrt bonding theories like VBT & CFT
CO2	Apply the Knowledge of Coordination chemistry in various applications such as catalysis, material sciences, medicines and Organometallic chemistry.
CO3	Apply the 18-electron rule & identify the importance of metals in Organometallic Chemistry.
CO4	Discuss the basic concepts of Thermodynamics.

Course with focus on employability/entrepreneurship/SkillDevelopment modules

Skill Development		Employability		Entrepreneurship	

Unit I: Coordination Chemistry-I (9 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. Tetragonal distortion of octahedral geometry, Jahn-Teller distortion.

UNIT–II Coordination Chemistry II (9 h)

1. Inorganic molecular Reaction Mechanism: (6 h)

Introduction to inorganic reaction mechanisms. Concept of reaction pathways, transition state, intermediate and activated complex. Labile and inert complexes, ligand substitution reactions – SN1 and SN2, Substitution reactions in square planar complexes, Trans-effect, theories of 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 and mole ratio method.

Unit III Organo metallic compounds (9 h)

Definition and classification of organo metallic Compounds on the basis of bond type, Metalcarbonyls:18electron rule, electron count of mononuclear, poly nuclear and substituted metal carbonyls of 3d series. General methods of preparation of mono and binuclear carbonyls of 3d series. π-acceptor behavior of CO (MO diagram of CO to be discussed), synergic effect and use of IR data to explain extent of back bonding.

Unit IV Thermodynamics- I (9 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, Nernst heat theorem, Spontaneous and nonspontaneous processes, Helmholtz and Gibbs equation - Criteria for spontaneity.

Suggested Co-Curricular and Extra Curricular Activities

1. Training of students by related industrial experts.
2. Assignments, Seminars and Quiz (on related topics), collection of relevant videos and material.
3. Visits of abilities, firms, research organizations etc.
4. Invited lectures and presentations on related topics by field/ industrial experts.

Text books:

1) Concise coordination chemistry by Gopalan and Ramalingam

2) Coordination Chemistry by Basalo and Johnson

3) Text book of physical chemistry by S Glasstone

4) Concise Inorganic Chemistry by J.D. Lee

5) Advanced Inorganic Chemistry Vol-I by Satyaprakash, Tuli, Basu and Madan

6) A Text Book of Physical Chemistry by K. L. Kapoor Vol 2, 6th edition, 2019.

7) Inorganic Chemistry Huheey, Harper and Row.

8) Modern Inorganic Chemistry, W.L. Jolly, Mc Graw Hill.

9) Text book of Physical Chemistry by Atkins

CO-PO Mapping:

On Completion of the course, the students will be able to	
CO1	Understanding the Structure and reactivity of Coordination compounds wrt bonding theories like VBT & CFT
CO2	Apply the Knowledge of Coordination chemistry in various applications such as catalysis, material sciences, medicines and Organometallic chemistry.
CO3	Apply the 18-electron rule & identify the importance of metals in Organometallic Chemistry
CO4	Discuss the basic concepts of Thermodynamics.

1: Low =1 ; 2: Moderate = 2 ; 3: High = 3; 4: No Correlation = 0

	PO1	PO2	PO 3	PO 4	PO5	PO 6	PO7	PSO1	PSO2	PSO3
CO1	3	1	1	2	1	1	2	2	2	2
CO2	3	2	2	3	2	1	1	3	2	2
CO3	3	2	2	3	2	2	1	3	2	2
CO4	3	3	1	2	1	1	1	2	1	1

PROGRAMME OUTCOMES

At the completion of the B.Sc. Chemistry program, the students of our department will be able to:

(PO1) Knowledge: Attain in depth knowledge about the fundamental principles, essential facts, conclusions and applications of chemical and scientific theories in various domains of chemistry.

(PO2) Critical Thinking: Carry out experiments in the area of organic analysis, estimation, derivative process, inorganic semi micro analysis, preparation, Kinetic, conductometric and potentiometric experiments and spectral analysis applying the domain of critical thinking.

(PO3) Problem Solving: Define the background of reaction mechanisms, complex chemical structures, instrumental method of chemical analysis, and separation techniques and apply appropriate techniques for analyzing specific problems both qualitatively and quantitatively in laboratories and in industries.

(PO4): Usage of modern tools: Create data using modem chemical tools and ICT for modeling and analyze the data obtained from sophisticated instruments (like UV-Vis, FTIR, NMR, GCMS, Fluorescence, SEM, TEM and XRD) for chemical analysis

(PO5): Communication: Develop Skills to evaluate, analyze and interpret the chemical information and data and to communicate effectively within the chemical community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

(PO6): Life-long Learning: Demonstrate scholarly attitude to pursue a career in the field of chemical education and research and have the zeal and vision to engage in independent and life-long learning in the broadest context of technological and social change.

(PO7) Ethical Practices and Social Responsibility: Generate ideas and solutions for green and sustainable chemistry and approach towards planning and execution of research in frontier areas of chemical sciences.

PROGRAM SPECIFIC OUTCOMES (PSOs)

At the time of graduation, our under graduates would be able to:

PSO 1- Evaluate, analyze, interpret and effectively apply the basic laws, principles, phenomena, processes and mechanisms involved in the domain of organic, inorganic, physical and analytical Chemistry

PSO2 - Demonstrate the knowledge of Chemistry in the domain of research, education and perspective entreprencurship.

PSO3 - Evaluate distinct problems in the field of chemical data analysis, scientific interpretation and reaction mechanisms with an understanding on basic tools to be employed.

Weightage to contentSemester -III

Paper-VIII

INORGANIC AND PHYSICAL CHEMISTRY

S.No	Course Content	Long Answer	Short Answer	Total marks	As per Blooms Taxonomy
1	**Coordination Chemistry-I**	2	2	30	Understanding, Application
2	Coordination Chemistry II	1	1	15	Remembering, Understanding
3	Organo metallic compounds	1	1	15	Analyzing & Creation
4	Thermodynamics- I	1	2	20	Evaluation, Understanding
5	Thermodynamics- II	1	1	15	Application & Creation
	TOTAL	**6**	**7**	**95**	

PITHPUR RAJAH'S GOVERNMENT COLLEGE (A), KAKINADA

II YEAR B.Sc (Examination at the end of III semester)

INORGANIC AND PHYSICAL CHEMISTRY

Paper-VIII

MODEL PAPER

Duration: 2hrs. **Max.Marks:50**

PART-I

3×10=30M

Answer any **THREE** of the following by Choosing at least **ONE** from each section

SECTION-A

1. Discuss the salient features of crystal field theory. Explain the Crystal field splitting of d- orbitals in Octahedral, complexes?
2. Explain the Geometry and magnetic properties of Following compounds on basis of VBT
   i. $[Co(NH_3)_6]^{+3}$ ii. $[Ni(CO)_4]$
3. Explain the factors affecting the stability of complexes.

SECTION-B

4. What is Organometallic Compounds? Explain the classification of organometallic Compounds on the basis of bonding
5. Derive the equations for work done by ideal gas at isothermal and adiabatic conditions.
6. What is Carnot cycle? Explain Efficiency of Heat Engine by Carnot cycle?

PART-II

4×5=20M

Answer any **Four** Questions from the following

7. Discuss about Structural isomerism in coordination compounds with examples
8. Calculate EAN of the following i. $K_3[Fe(CN)_6]$ ii. $[Co(NH_3)_6]$
9. What is Trans effect? Write its applications?
10. Define 18 electron rule. Explain with an example.
11. Derive the relation between C_P and C_V
12. Explain Joule Thomson Effect.
13. Explain Concept of Entropy?

PITHPUR RAJAH'S GOVERNMENT COLLEGE (A), KAKINADA

II YEAR B. Sc (Examination at the end of III semester)

INORGANIC AND PHYSICAL CHEMISTRY

QUESTION BANK

Unit-I

Essay Questions

1. Explain the Geometry and Magnetic Properties of any two of the following

a) $[Co(NH_3)_6]^{+3}$ b) $[Fe(CN)_6]^{-4}$ c)$[Cr(NH_3)_6]^{+3}$
d) [Ni(CO)4] e)$[Cu(NH_3)_4]^{+2}$ f) $[COF_6]^{-3}$

Complex compounds based on valence Bond theory.

2. Discuss the salient features of crystal field theory. Explain the Crystal field splitting of d-orbitals in Octahedral, complexes?
3. Explain Crystal Field theory in Tetrahedral and Square Planar Complexes?
4. Explain the different types of Structural isomerism exhibited by complexes with examples?

Short Answer Questions

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

Unit-II

Essay Questions

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

Short Answer Questions

1. What is Trans effect? Write its applications?
2. What are labile and inert complexes? Give examples.

Unit-III

Essay Questions

1. What is Organometallic Compounds? Explain the classification of organometallic Compounds on the basis of bonding
2. Give the preparation of mono and binuclear carbonyl Compounds?

Short Answer Questions

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

Unit-IV&V

Essay Questions

1. Define heat capacities and derive the relation between Cp and Cv
2. Derive the equations for work done by ideal gas at isothermal and adiabatic conditions.
3. Derive Kirchhoff's equation.
4. What is Carnot cycle? Explain Efficiency of Heat Engine by Carnot cycle?

Short Answer Questions

1. Explain Concept of Entropy?
2. Explain Joule Thomson Effect
3. State and explain first law of thermodynamics?

SEMESTER-III
COURSE CODE 8: QUALITATIVE INORGANIC ANALYSIS
Credits: 01

Qualitative inorganic analysis

(Minimum of 4 Mixtures should be analyzed)

Course outcomes:

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

1) Understand the basic concepts of qualitative analysis of inorganic mixture.

2) Use glassware, equipment and chemicals and follow experimental procedures in the laboratory.

3) Apply the concepts of common ion effect, solubility product and concepts relatedto qualitative analysis.

Analysis of Mixture 50M

Analysis of mixture salt containing two anions and two cations (From two different groups) from the following:

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

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

Minimum of Four mixtures should be analyzed.

List of Text books:

1. A textbook of qualitative inorganic analysis by A.I. Vogel.

SCHEME OF VALUATION
SEMESTER-III
COURSE CODE 8: QUALITATIVE INORGANIC ANALYSIS

a.	Preliminary tests for Anions	- 6 marks
b.	Sodium carbonate extract preparation	- 4 marks
c.	Confirmation tests for anions	-8 marks
d.	Group separation table	-10 marks
e.	Confirmation tests for cations	- 6 Marks
f.	Report	- 6 Marks
g.	Record	-05 marks
h.	Viva voce	-05 marks
	TOTAL	**-50 marks**

Co-Curricular Activities:

Mandatory: (Lab/field training of students by teacher: (lab:10+field:05):

1. For Teacher: Training of students by the teacher in laboratory and field for not lessthan15 hours on the field techniques/skills of involves identification and conformation of cations and anions containing one less familiar cation and one interfering anion.

2. For Students: Student shall visit a related industry/chemistry laboratory in universities/research organizations/private sector facility and observes the synthetic reactions. Write their observations and submit a hand written fieldwork/project work report not exceeding 10 pages in the given format to the teacher.

3. Max marks for Field work/project work Report: 05.

4. Suggested Format for Fieldwork/project work: Title page, student details, index page, details of place visited, observations, findings, and acknowledgements.

5. Unit tests (IE).

	PITHAPUR RAJAH'S GOVERNMENT COLLEGE(A) KAKINADA DEPARTMENT OF CHEMISTY	Program & Semester Minor Chemistry II B.Sc. (III Semester)			
Course Code CHE-2	TITLE OF THE COURSE **COURSE 2: FUNDAMENTALS IN ORGANIC CHEMISTRY**				
Teaching	HoursAllocated:45 (**Theory**)	L	T	P	C
Pre-requisites	Fundamentals of organic reagents and reactions	45	10	30	3+1

CourseOutcomes:

On Completion of the course, the students will be able to	
CO1	Understand and explain the differential behaviour of organic compounds based on fundamental concepts learnt
CO2	Formulate the mechanism of organic reactions by recalling and correlating the fundamental properties of the reactants involved.
CO3	Learn and identify many organic reaction mechanisms
CO4	Correlate and describe the stereo-chemical properties of organic compounds and reactions

Course with focus on Skill Development/Employability/Entrepreneurship modules

Skill D evelopmen t			Employability			Entrepreneurshi p	

Syllabus:

Unit 1: Structural theory in Organic Chemistry (9 h)

Types of bond fission and organic reagents (Electrophilic, Nucleophilic, and free radical reagents). Reaction intermediates – Carbocations, carbanions & free radicals. Bond polarization: Factors influencing the polarization of covalent bonds, inductive effect - Application of inductive effect (a) Basicity of amines (b) Acidity of carboxylic acids (c) Stability of carbonium ions. Resonance or Mesomeric effect, application to (a) acidity of phenol, and (b) acidity of carboxylic acids. Hyper conjugation and its application to stability of carbonium ions, Free radicals and alkenes.

Unit II: Saturated Hydrocarbons (Alkanes and Cycloalkanes) 9 h

General methods of preparation of alkanes- Wurtz and Wurtz Fittig reaction, Corey House synthesis, physical and chemical properties of alkanes, Conformational analysis of alkanes (Conformations, relative stability and energy diagrams of Ethane, Propane and butane).

General molecular formulae of cycloalkanes and relative stability, Baeyer strain theory,Cyclohexane conformations with energy diagram, Conformations of monosubstituted cyclohexane.

UNIT-III: Unsaturated Hydrocarbons (Alkenes and Alkynes) 9 h

General methods of preparation, physical and chemical properties, Saytzeff and Hoffmann eliminations (with mechanism), Electrophilic Additions, (H_2, HX) mechanism (Markownikoff/ Antimarkownikoff addition) with suitable examples-syn and anti-addition;

addition of X_2, HX. Oxymercuration demercuration, ozonolysis, hydroxylation, Diels Alder reaction, 1,2- and1,4-addition reactions in conjugated dienes. Reactions of alkynes; acidity, electrophilic and nucleophilic additions, hydration to form carbonyl compounds, Alkylationof terminal alkynes.

UNIT-IV: Benzene and its reactivity (9 h)

Structure of Benzene – Preparation - polymerisation of acetylene and decarboxylation- Properties - mechanism of electrophilic aromatic substitution of Friedel- Craft's alkylation and acylation. halogenation and nitration.

UNIT-V: Orientation of aromatic substitution (9 h)

Concept of aromaticity, Huckel's rule - application to Benzenoid (Benzene, Naphthalene) and Non - Benzenoid compounds (cyclopropenylcation, cyclopentadienyl anion and tropylium cation) Orientation of aromatic substitution - ortho, para and meta directing groups. Ring activating and deactivating groups with examples (Electronic interpretation of various groups like NO_2 and Phenolic). Orientation of (i) Amino, methoxy and methyl groups (ii) Carboxy, nitro, nitrile, carbonyl and sulphonic acid groups (iii) Halogens.

Textbooks:

S.NO	AUTHOR	TITLE	PUBLISHER
1	**O.P Agarwal**	**Unified Chemistry**	JPNP publications
2	**Bhal and Arun Bhal**	**Text book of Advanced organic chemistry**	S.Chand publications

Reference books

S.NO	AUTHOR	TITLE	PUBLISHER
1	**Finar, I. L**	**Organic Chemistry (Volume 1)**	Dorling Kindersley (India) Pvt. Ltd. (PearsonEducation).
2	**Morrisson and Boyd**	**Organic Chemistry**	**Oxford University Press**
3	**J.March**	**Organic reaction Mechanisms**	**Oxford University Press**

WebLinks:

1. https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=13G8VouhmrFfuhs6rkiyTA==
2. https://courseware.cutm.ac.in/wp-content/uploads/2020/05/preparationofalkanesclass11-151207081547-lva1-app6891.pd
3. https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=13G8VouhmrFfuhs6rkiyTA==
4. https://byjus.com/chemistry/diene/
5. https://colapret.cm.utexas.edu/courses/Chapter%2022-benzos.pdf

Course outcome & Program outcome mapping

On Completion of the course, the students will be able to	
CO 1	Understand and explain the differential behaviour of organic compounds based onfundamental concepts learnt
CO 2	Formulate the mechanism of organic reactions by recalling and correlating thefundamental properties of the alkanes and cyclo alkanes involved.
CO 3	Learn and identify many organic reaction mechanisms of alkenes and alkynes
CO 4	Correlate and describe aromaticity & orientation effects of various substituents on the electromatic substitution in benzene

CO-PO Mapping: 1: Low =1 ;2: Moderate = 2 ; 3: High = 3 ; 4: No Correlation = 0

CO	PO1	PO 2	PO3	PO 4	PO 5	PO6	PO 7	PSO1	PSO2	PSO 3		
CO1	3	2	2	2	1	2	1	3	2	2		
CO2	3	1	2	2	1	1	1	3	1	2		
CO3	3	2	2	3	2	2	2	3	2	2		
CO4	3	1	1	1	1	1	1	2	1	1		

PROGRAMME OUTCOMES

At the completion of the B.Sc. Chemistry program, the students of our Department will be able to:

(PO1) Knowledge: Attain in depth knowledge about the fundamental principles, essential facts, conclusions and applications of chemical and scientific theories in various domains of chemistry.

(PO2) Critical Thinking: Carry out experiments in the area of organic analysis, estimation, derivative process, inorganic semi micro analysis, preparation, Kinetic, conductometric and potentiometric experiments and spectral analysis applying the domain of critical thinking.

(PO3) Problem Solving: Define the background of reaction mechanisms, complex chemical structures, instrumental method of chemical analysis, and separation techniques and apply appropriate techniques for analyzing specific problems both

qualitatively and quantitatively in laboratories and in industries.

(PO4): Usage of modern tools: Create data using modem chemical tools and ICT for modeling and analyze the data obtained from sophisticated instruments (like UV-Vis, FTIR, NMR, GCMS, Fluorescence, SEM, TEM and XRD) for chemical analysis

(PO5): Communication: Develop Skills to evaluate, analyze and interpret the chemical information and data and to communicate effectively within the chemical community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

(PO6): Life-long Learning: Demonstrate scholarly attitude to pursue a career in the field of chemical education and research and have the zeal and vision to engage in independent and life-long learning in the broadest context of technological and social change.

(PO7) Ethical Practices and Social Responsibility: Generate ideas and solutions for green and sustainable chemistry and approach towards planning and execution of research in frontier areas of chemical sciences.

PROGRAM SPECIFIC OUTCOMES (PSO's)

At the time of graduation, our under graduates would be able to:

PSO 1- Evaluate, analyze, interpret and effectively apply the basic laws, principles, phenomena,
processes and mechanisms involved in the domain of organic, inorganic, physical and analytical Chemistry

PSO2 - Demonstrate the knowledge of Chemistry in the domain of research, education and perspective entrepreneurship.

PSO3 - Evaluate distinct problems in the field of chemical data analysis, scientific interpretation
and reaction mechanisms with an understanding on basic tools to be employed.

Weightage to content

Semester -II

Course - 2

S.No	CourseContent	Long Answer	ShortAnswer	Total marks	As per Blooms Taxonomy
1	Structural theory in Organic Chemistry.	2	1	20	Understanding , Application
2	Saturated Hydrocarbons (Alkanes and Cycloalkanes).	1	2	25	Remembering, Understanding
3	Unsaturated Hydrocarbons (Alkenes and Alkynes)	1	2	15	Analysizing & Creation
4	Benzene and its reactivity	1	1	15	Evaluation, Understanding
5.	Orientation of aromatic substitution	1	1	20	Understanding , Application
	TOTAL	6	7	95	

PITHAPUR RAJAH'S GOVERNMENT COLLEGE (A), KAKINADA

II YEAR B.Sc (Examination at the end of III semester)
(COURSE – 2 Fundamentals in Organic Chemistry)
MODEL PAPER

Duration: 2hr **Max.Marks:50M**

Section – 1

Answer any three of the following questions. Must attempt atleast one question from each part. Each question carries 10 Marks. **3 X 10M = 30M**

Part -A

1. Write about inductive effect and its applications. BT1, CO1
2. Elaborate the mechanism of markonikoff and anti markonikoff addition of HBr to propene. BT2, CO3.
3. Write any two preparation methods of cyclo alkanes? Explain the stability of cyclo alkanes with Baeyer's strain theory.BT1, CO2.

Part-B

4. Discuss the mechanism of electrophilic substitution reactions of benzene. BT3, CO4
   a) Nitration b) Friedel - Craft alkylation
5. Explain the Concept of aromaticity. How the Huckel's rule is applicable to Benzenoid and Non - Benzenoid compounds? BT4, CO4
6. What is the Mesomeric effect and explain the acidity of phenol? BT2, CO1

Section - II

Answer any four of the following questions. Each carry 5 marks. 4 X 5M= 20M

7. Why 2- butene is more stable than 1- butene? Explain. BT3, CO1
8. How do you prepare alkanes by using Wurtz reaction and Corey House synthesis? BT3, CO2
9. Explain the conformational analysis of n - butane. BT2, CO2
10. Write about Diels Alder reaction.BT2, CO3
11. Explain acidity of alkyne. BT3, CO3
12. Write any two methods for the preparation of benzene. BT1, CO4
13. How does the methoxy group effects the incoming electrophile in Benzene towards electrophilic substitution reaction? BT4, CO4

SEMESTER-III

COURSE 2: FUNDAMENTALS IN ORGANIC CHEMISTRY

Practical Credits: 1 2 hrs/week

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

Course outcomes:

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

1. Use glassware, equipment and chemicals and follow experimental procedures in thelaboratory.

2. Determine melting and boiling points of organic compounds.

3. Understand the application of concepts of different organic reactions studied in theory partof organic chemistry.

Lab References:

S.NO	AUTHOR	TITLE	PUBLISHER
1	Vogel A I	Practical organic Analysis	Seventh edition, Pearson.
2	Bansal R.K	Laboratory Manual of Organic **Chemistry**	Wiley-Eastern
3	Ahluwalia & Aggarwal R	Comprehensive Practical Organic Chemistry	University press. Delhi

Co-Curricular Activities:

a) Mandatory:(Lab/field training of students by teacher:(lab:10+field:05):

1. For Teacher: Training of students by teacher in laboratory and field for not lessthan15 hourson the field techniques/skills of preparation of acetanilide, preparation of azodye, use of separating funnel for solvent extraction, separation of organic compounds in a mixture.

2. For Student: Student shall visit a related industry/chemistry laboratory in universities/research organizations/private sector facility and observe the techniques used for the separation of organic compounds. Write their observations and submit a hand written fieldwork/project work report not exceeding10 pages in the given format to the teacher.

3. Max marks for Fieldwork/project work Report:05.

4. Suggested Format for Fieldwork/project work: Title page, student details, index page,details of place visited, observations, findings, and acknowledgements.

5. Unit tests (IE).

b) Suggested Co-Curricular Activities

1. Training of students' by related industrial experts.

2. Assignments, Seminars and Quiz (on related topics), collection of videos and othermaterial.

3. Visits of facilities, firms, research organizations etc.

4. Invited lectures and presentations on related topics by field/industrial experts

SCHEME OF VALUATION

Practical Paper –5 :: Fundamental in organic Chemistry(at the end of semester III)

S.NO	TEST	MARKS
1	Color, State + Melting/Boiling Point	2+2 M
2	Ignition test	2 M
3	Solubility	2 M
4	Unsaturation test	4 M
5	Lassaigne test	4 M
6	Any one preliminary test for Functional group	4 M
7	Any one Confirmation test for Functional group	4 M
8	Any one derivative for Functional group	4 M
9	Report	2 M
10	Record	10 M
11	Viva voce	10 M