


SEMESTER-V

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|---|---|--|--|----|----|-----|
|  | P.R. GOVERNMENT COLLEGE(A),KAKINADA | | Program & Semester III B.Sc. GENERAL CHEMISTRY (SEMESTER – V) | | | |
| | Course Code GC - 12B | TITLE OF THE COURSE ENVIRONMENTAL CHEMISTRY | | | | |
| Teaching | Hours Allocated: 45 (Theory) (3 hrs. / Wk.) | | L | T | P | C |
| Pre-requisites: | Basic knowledge about Environment and its scope and importance. | | 45 | 10 | 30 | 2+1 |

Course Objectives:

1. To inculcate basic knowledge on basic concepts of environmental Pollution.
2. To illustrate the classification of segments of environment.
3. To provide knowledge and applications on various types of environmental pollutions.
4. To understand about the concepts of ecosystem and Bio-diversity.

Course Outcomes:

| On Completion of the course, the students will be able to- | | Cognitive Domain |
|--|---|------------------|
| CO1 | To inculcate basic knowledge on basic concepts of environmental Pollution. | Knowledge |
| CO2 | To understand the classification of segments of environment. | Understand |
| CO3 | To provide knowledge and applications on various types of environmental pollutions. | Knowledge |
| CO4 | To understand about the concepts of ecosystem and Bio-diversity. | Understand |

Syllabus:

UNIT-1

Introduction

9h

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

UNIT-II

Air Pollution

9h

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

UNIT-III

Water pollution

9h

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

UNIT-IV

Chemical Toxicology

9h

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

UNIT-V

Ecosystem and biodiversity

9h

Ecosystem

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

Biodiversity

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

List of Reference books

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

PROGRAMME OUTCOMES (PO's)

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 Environmental analysis, estimation, hardness of water, preparation, Kinetic, experiments and water analysis applying the domain of critical thinking.

(PO3) Problem Solving: Define the background of heavy metals like Pb, As, Cd, Hg. Cycles of N, C, P. Determination of carbonate and Bicarbonate in water sample and also analysis of alkalinity and turbidity.

(PO4): Usage of modern tools: Create data using modern 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 Environmental 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, analytical and Environmental Chemistry

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

PSO3 - Evaluate distinct problems in the field of Environmental data analysis, scientific interpretation and analysis of water, Air, Soil with an understanding on basic tools to be employed.

WEIGHTAGE TO CONTENT

| S No | Course Content | Essay (10M) | Short (5M) | Total marks | Question Relates as per Bloom's Taxonomy |
|------|----------------|-------------|------------|-------------|--|
| 1. | UNIT-I | 1 | 1 | 15 | Remembering, understanding |
| 2. | UNIT-II | 1 | 2 | 20 | Analyzing, Remembering |
| 3. | UNIT-III | 2 | 1 | 20 | Analyzing, Remembering |
| 4. | UNIT-IV | 1 | 1 | 25 | Analyzing, Evaluating |
| 5. | UNIT-V | 1 | 1 | 15 | Evaluating |
| | Total | 6 | 7 | 95 | |

**PITHAPUR RAJAH'S GOVERNMENT COLLEGE(A)
III B.Sc. ANALYTICAL CHEMISTRY, SEMESTER-V**

COURSE-AC-14: ENVIRONMENTAL CHEMISTRY

MODEL QUESTION PAPER

TIME: 2 hrs.

MAX. MARKS: 50

SECTION-A

Answer any THREE questions choosing at least ONE question from each section Each carries 10 Marks

3x10=30M

1. One question is to be set from unit-I
2. One question is to be set from unit-II
3. One question is to be set from unit-III

SECTION-B

4. One question is to be set from unit-III
5. One question is to be set from unit-IV
6. One question is to be set from unit-V

Answer any FOUR questions Each carries FIVE marks.

4x5=20M

7. One question is to be set from unit-I
8. One question is to be set from unit-II
9. One question is to be set from unit-II
10. One question is to be set from unit-III
11. One question is to be set from unit-IV
12. One question is to be set from unit-V
13. One question is to be set from unit-V

QUESTION BANK

ESSAY QUESTIONS

1. Explain the Segments of Environment.
2. Discuss about Renewable and Non-Renewable energy resources with examples.
3. Explain the reactions of atmospheric Oxygen.
4. Discuss about Hydrological cycle.
5. What is Air pollution. Explain classification and control measures of Air pollution.
6. Explain a) Acid rains b) Global Warming c) Formation and depletion of Ozone layer
 d) Bhopal Gas disaster e) Photo chemical smog
7. Give the methods to convert Permanent hard water into soft water.
8. Give the methods to convert Temporary hard water into soft water.
9. What is the quality parameters of water.
10. What is Eutrophication. How industrial waste water is purified.
11. Explain the Toxicity of a) Lead b) Arsenic c) Mercury d) Cadmium.
12. Define Ecosystem. Explain the types of Ecosystems.
13. Give detailed account on Biodiversity.

SHORT ANSWER QUESTIONS

1. Explain the importance of environment in now a day.
2. Give about the hardness of water.
3. Discuss briefly about Food chain and Food web.
4. What are the toxic effects of cyanide on the environment.
5. Explain the biochemical effects of Pesticides.
6. Define biotic and abiotic components.
7. What are the functions of Ecosystem.
8. Define the terms i) COD II) BOD
9. Write about biogeochemical cycles of C, N, P
10. Explain biogeographical classification of India.

Practical Paper –A C - 1 4 (at the end of semester V)

30 hrs (2 h / W)

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

CLO-PLO Mapping:

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

| | CL OP LO | PLO 1 | PLO 2 | PLO 3 | PLO 4 | PLO 5 | PLO 6 | PLO 7 | PLO 8 | PLO 9 | PLO 0 | GLO PLO | PLO |
|------|----------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|------------|------|
| CLO1 | 3 | 3 | 3 | 2 | 3 | 2 | 2 | 2 | 3 | 2 | 2 | 3 | 3 |
| CLO2 | 3 | 3 | 3 | 2 | 3 | 2 | 2 | 3 | 2 | 3 | 3 | 3 | 3 |
| CLO3 | 3 | 2 | 3 | 2 | 3 | 1 | 2 | 2 | 2 | 2 | 2 | 3 | 2 |
| CLO4 | 3 | 3 | 2 | 1 | 3 | 2 | 2 | 1 | 2 | 3 | 3 | 3 | 3 |
| CLO5 | 3 | 2.75 | 2.75 | 2 | 3 | 2 | 2 | 2 | 2.25 | 2.5 | 2.5 | 3 | 2.75 |

SCHEME OF VALUATION

1. Procedure – 10M

2. Tabular form and values -15M

% of error

3. Below 1% 15

4. 1-2% Error – 10

5. >2%-5M

6. Record-05M

7. Viva-5M

| | | | | | |
|------------------------------|---|---------------------------------------|----|----|-----|
| | PITHAPUR RAJAH'S GOVERNMENT COLLEGE KAKINADA | Program & Semester | | | |
| Course Code CHE-13 | TITLE OF THE COURSE COURSE 13: CHROMATOGRAPHY AND INSTRUMENTAL METHODS OF ANALYSIS | III B.Sc.HONOR Chemistry (V Semester) | | | |
| Teaching | Hours Allocated: 45 (Theory) | L | T | P | C |
| Pre - requisites | Fundamental Knowledge in functional Groups of organic compounds and their general formulas | 45 | 10 | 30 | 3+1 |

Course Outcomes:

At the end of the course , the students will be able to

- 1) Identify the importance of chromatography in the separation and identification of compounds in a mixture
- 2) Acquire a critical knowledge on various chromatographic techniques.
- 3) Demonstrate skills related to analysis of water using different techniques.
- 4) Understand the principles of Spectrophotometry in the determination of metal ions.
- 5) Comprehend the applications of atomic spectroscopy.

| On Completion of the course, the students will be able to | |
|--|--|
| CO1 | Handle in depth of various various Chromatographic and instrumental methods for analysis |
| CO2 | Understand the basic concepts of Chromatography and allied techniques |
| CO3 | Learn and identify applications of Beer-Lamberts Law |
| CO4 | Understand the reactivity and structure of different functional groups of compounds |

Course with focus on employability/entrepreneurship/Skill Development modules

| | | | | | |
|-------------------|--|---------------|--|------------------|--|
| Skill Development | | Employability | | Entrepreneurship | |
|-------------------|--|---------------|--|------------------|--|

COURSE 13 : CHROMATOGRAPHY AND INSTRUMENTAL METHODS OF ANALYSIS I

Syllabus:

Unit-1:

Chromatography-Introduction and classification

Principle, Classification of chromatographic methods, Nature of adsorbents, eluents, Rf-values, factors affecting Rf-values.

UNIT-2:

TLC and paper chromatography

Thin layer chromatography: Principle, Experimental procedure, preparation of plates, adsorbents and solvents, development of chromatogram, detection of spots, applications and advantages.

Paper Chromatography: Principle, Experimental procedure, choice of paper and solvents, various modes of development- ascending, descending, radial and two dimensional, applications.

UNIT-3:

Column chromatography

Column chromatography: Principle, classification, Experimental procedure, stationary and mobile phases, development of the Chromatogram, applications.

HPLC: Basic principles, instrumentation–block diagram and applications.

UNIT-4: Spectrophotometry

Principle, Instrumentation : Single beam and double beam spectrometer, Beer-Lambert's law

Derivation and deviations from Beer-Lambert's law,

applications of Beer-Lambert's law

Quantitative determination of Fe^{+2} , Mn^{+2} and Pb^{+2} .

UNIT-5: Polarimetry and Refractometry

Polarimetry and Refractometry:

Polarimetry : Nature of polarized light, polarimeter, sample cells, operation of the polarimeter, optical purity.

Refractometry; The refractive index, Refractometer.

List of Reference books:

- 1) Fundamentals of Analytical Chemistry by F. James Holler, Stanley R Crouch, Donald M. West and Douglas A. Skoog, Ninth edition, Cengage.
- 2) Analytical Chemistry by Gary D. Christian, Purnendu K. Dasgupta and Kevin A. Schug, Seventh edition, Wiley.
- 3) Quantitative analysis by R. A. Day Jr. and A. L. Underwood, Sixth edition, Pearson.
- 4) Text book of Vogel's Quantitative Chemical Analysis, Sixth edition/Pearson.
- 5) Instrumental methods of Chemical Analysis by Dr. B. K. Sharma 1981

SEMESTER-V

COURSE 14: CHROMATOGRAPHY AND INSTRUMENTAL METHODS OF ANALYSIS

Practical Credits: 1

2 hrs/week

II.

Learning Outcomes:

On successful completion of this practical course, student shall be able to:

- 1) Perform the separation of a given dye mixture using TLC
- 2) Learn the preparation of TLC plates
- 3) Demonstrate the separation of mixture of amino acids using paper chromatography
- 4) Acquire skills in using column chromatography for the separation of dye mixture.

III.

Laboratory course Syllabus:

- 1) Separation of a given dye mixture (methyl orange and methylene blue) using TLC (using alumina as adsorbent).
- 2) Separation of mixture of methyl orange and methylene blue by column chromatography.
- 3) Separation of given mixture of amino acids (glycine and phenyl alanine) using ascending paper chromatography.
- 4) Separation of food dyes using Column Chromatography
- 5) Separation of triglycerides using TLC
- 6) Verification of Beer Lambert's law. (Using potassium permanganate solution) using colorimeter / spectrophotometer.

IV. List of Reference books:

- 1) Text book of Vogel's Quantitative Chemical Analysis, Sixth edition, Pearson.
- 2) Vogel A. I. Practical Organic Chemistry, Longman Group Ltd.

- 3) Bansal R.K. Laboratory Manual of Organic Chemistry, Wiley-Eastern.
 4) Ahluwalia V. K. and Agarwal R. Comprehensive Practical Organic Chemistry, University press.
 5) Mann F. Gand Saunders B.C, Practical Organic Chemistry, Pearson Education.

Course outcome & Program outcome mapping

| On Completion of the course, the students will be able to | |
|---|--|
| CO1 | In depth understanding of theory in Chromatography and Instrumental methods |
| CO2 | Understand and explain properties in various chromatographic methods, types of solvent systems, principles etc. |
| CO3 | Understand the importance of structure, preparation and chemical applications in respect of Chromatographic and Instrumental Methods |
| CO4 | Comprehend the concepts and applications of Chromatography & Instrumental methods |

CO-PO Mapping:

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PSO1 | PSO2 | PSO3 |
|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| 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 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, 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 modern 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.

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(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 the content

| S.No. | Course Content | Long Answer Questions | Short Answer Questions | Total Marks | As per Blooms Taxonomy |
|-------|---|-----------------------|------------------------|-------------|-------------------------------|
| 1 | Chromatography- Introduction and classification | 1 | 1 | 15 | Understanding, Application |
| 2 | TLC and paper chromatography | 1 | 2 | 20 | Remembering, Understanding |
| 3 | Column chromatography | 2 | 1 | 25 | Analyzing & Creation |
| 4 | Spectrophotometry | 1 | 2 | 20 | Evaluation, Understanding |
| 5. | Polarimetry and Refractometry | 1 | 1 | 15 | Understanding, Application |
| | TOTAL | 6 | 7 | 95 | |

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

**III YEAR B.Sc (Examination at the end of V semester)
COURSE-13 :: CHROMATOGRAPHY AND INSTRUMENTAL METHODS OF
ANALYSIS**

MODEL PAPER

Duration: 2hr

Max.Marks: 50M

Section - 1

Answer any THREE questions choosing at least one from each part.
Each question carries TEN marks.

3 X 10 = 30 Marks

PART-A

1. Explain the classification of various chromatographic methods on the basis of Stationery Phase and Mobile Phase [BT1, CO1]
2. Support the advantages of Thin Layer Chromatography with its applications [BT1, CO2]
3. How column chromatography is used to separate a mixture of organic compounds [BT2, CO2]

PART-B

4. Give the block diagram and explain the working, principle of HPLC.[BT3, CO3]
5. Discuss various types of spectro photometers with their block diagrams. [BT2 CO3]
6. Elaborate the working principle of polarimeter with block diagram. [BT3, CO4]

Section-II

Answer any four of the following questions.

Each question carries FIVE marks.

4x5=20 Marks

7. Brief about the factors affecting R_f-values [BT3, CO1]
8. Brief about the development of chromatogram in TLC [BT3, CO1]
9. Write about two dimensional paper chromatography with example [BT1, CO2]
10. Write a note on mobile phase for Column chromatography [BT3, CO3]
11. Brief deviations from Beer-Lamberts Law.[BT3, CO1]
12. Give the procedure for the determination of Mn by colorimetry. [BT2, CO3]
13. Write about refractometry[BT1, CO1]

UNIT- I

Chromatography-Introduction and classification

Essay Questions

1. Explain the general theory of Chromatographic processes
2. Briefly explain the classification of chromatography methods
3. What is meant by R_f-values? Explain. Mention some of the factors which influence the R_f-value

Short Answer Questions

1. Give the principle of chromatography
2. Write about adsorbents and their nature

UNIT – II

TLC and paper chromatography

Essay Questions

1. Explain the general procedure of thin layer chromatography
2. Explain the following
 - A) Ascending Paper Chromatography
 - B) Descending Paper chromatography
3. Explain the following
 - A) Radial Paper Chromatography and
 - B) Two Dimensional Paper Chromatography

Short Answer Questions

1. Write about the applications of thin layer chromatography
2. Explain various ways in which spots due to component compounds of a mixture are detected after development of the plate in TLC
3. What are the commonly used adsorbents in thin layer chromatography
4. Mention some of the advantages of thin layer chromatography

UNIT-III

Column chromatography

Essay Questions

1. Explain the theory and principle of Column Chromatography
2. What is HPLC? Explain the theory and principle involved in HPLC
3. Explain the preparation of Dry and Wet Columns

Short Answer Questions

1. Write about important applications of HPLC
2. Write the important applications of column chromatography

UNIT-IV

Spectrophotometry

Essay Questions

1. State and explain Lambert's Law and Beer-Lamberts Law
2. What are single beam and double beam spectrophotometers? Briefly explain.
3. Derive an expression for Beer-Lamberts Law

Short Answer Questions

1. Write about the applications of Beer-Lamberts law
2. Write about the application of Beer-Lamberts Law for quantitative analysis of Fe(II)
3. Write about the application of Beer-Lamberts Law for quantitative analysis of Mn(II)
4. Write about the application of Beer-Lamberts Law for quantitative analysis of Pb(II)
5. What is molar absorptivity
6. What is absorbance and transmittance explain

UNIT- V

Polarimetry and Refractometry

Essay Questions

1. Explain the Nature of polarized light,
2. Elaborate the working of polarimeter,
3. Explain the operation of the polarimeter
4. Explain the Principle and working of Refractometer

Short Answer Questions

1. Write about sample cells in Polarimeter

2. Explain the term optical Purity
3. What is the significance the refractive index,

SEMESTER-V
COURSE 13 : CHROMATOGRAPHY AND INSTRUMENTAL METHODS OF ANALYSIS

Practical

Credits: 1

2 hrs/week

(At the end of V Semester)

- 1) Separation of a given dye mixture (methyl orange and methylene blue) using TLC (using alumina as adsorbent).
- 2) Separation of mixture of methyl orange and methylene blue by column chromatography.
- 3) Separation of given mixture of amino acids (glycine and phenyl alanine) using ascending paper chromatography.
- 4) Separation of food dyes using Column Chromatography
- 5) Separation of triglycerides using TLC
- 6) Verification of Beer Lambert's law. (Using potassium permanganate solution) using colorimeter / spectrophotometer.

**Scheme of Valuation for Practical
Chromatographic Experiment**

Procedure - 10 M

Principle - 5 M

Mobile Phase and Stationery Phase Composition - 5 M

Detection of Spots - 5 M

Rf-values Calculation - $2 \times 5 = 10$ M

Error - 5 M

Viva-voce - 5 M

Record - 5 M

Colorimetric Experiment

Procedure (Calibration of Instrument) - 5 M

Principle and Formulae - 5 M

Preparation of Stock Solution and Working Solutions - 5 M

Detection of Absorbance Values and Neat Tabular Form - 5 M

Construction of Calibration Graph - 5 M

Calculation for Two Unknowns - $2 \times 5 = 10$ M

Error - 5 M

Viva- 5 M

Record - 5 M

| | | | | | |
|-------------------------|--|-------------------------------|----|----|-----|
| | P R Govt College(A) Kakinada | Program & Semester | | | |
| Course Code CHEM-14A | TITLE OF THE COURSE SYNTHETIC ORGANIC CHEMISTRY | III B.Sc. (V Semester) | | | |
| Teaching | HoursAllocated:60 (Theory) | L | T | P | C |
| Pre-requisites | Symmetry and Photochemistry, Oxidation, Condensation and Reduction reactions | 45 | 10 | 30 | 4+2 |

CourseObjectives:

1. Pericyclic Reactions
2. Organic Photochemistry
3. Retro synthesis
4. C-C bond formation, Oxidation and Reduction Reactions.

CourseOutcomes:

| On Completion of the course, the students will be able to | |
|---|--|
| CO1 | Student will acquire knowledge on basic concepts in different types of pericyclic reactions |
| CO2 | Student will get the knowledge in understanding the fundamental concepts involved in the organic photochemistry and gets acquainted with new kind of reactions |
| CO3 | Student shall have opportunity to understand the importance of retrosynthesis in organic chemistry which is a key analysis in recent research trends. |
| CO4 | Students shall Comprehend the applications of different novel reagents and reactions in synthetic organic chemistry. |

Course with focus on Skill Development/Employability/Entrepreneurship modules

| | | | | | |
|----------------------|--|---------------|--|------------------|--|
| SkillDe velopment | | Employability | | Entrepreneurship | |
|----------------------|--|---------------|--|------------------|--|

Syllabus:

UNIT-I Pericyclic reactions:

9h

A brief introduction to synthetic organic chemistry – Definition and classification of pericyclic reactions: Phases, nodes and symmetry properties of molecular orbitals in ethylene,1,3-butadiene,1,3,5-hexatriene. Thermal and photochemical reactions. Introduction of Frontier Molecular Orbitals –
Electro cyclic reactions: Definition and examples, definitions of con and dis rotation, Woodward-

Hoffmann selection rules. (Correlation diagrams are not required) Cycloaddition reactions: Definition and examples, definitions of suprafacial and antarafacial addition, Woodward-Hoffmann selection rules. (Correlation diagrams are not required)

Additional Inputs: Molecular orbitals in alkyl cation and allyl radical.

UNIT-II Organic photochemistry:

9h

Jablonski diagram-singlet and triplet states -Photochemistry of Carbonyl compounds-

$\pi-\pi^*$ and $n-\pi^*$ transitions, Norrish type-1 and type-2 reactions - Paterno-Buchi reaction - Photo Fries Rearrangement

UNIT-III Retrosynthesis

9 h

Important terms in Retrosynthesis with examples-Disconnection, Target molecule, FGI, Synthon, Retrosynthetic analysis, chemo selectivity, regio selectivity & stereo selectivity.

Importance of Order of events in organic synthesis - Retrosynthetic analysis of the compounds:

a. cyclohexene, b. 4-Nitro toluene, c. Paracetamol.

Unit-4: Synthetic Reactions

9 h

Shapiro reaction, Stork - Enamine reaction (only alkylation), Wittig reaction, Robinson annulation, Bailys-Hillman reaction, Heck reaction, Suzuki coupling. Concept of Umpolung - Synthesis of aldehydes and ketones using 1,3-Dithiane.

Unit-5: Reagents in Organic Chemistry

9h

Oxidizing agents: PCC, PDC, OsO₄, SeO₂ (Riley oxidation), NBS.

Reducing agents: LiAlH₄ (with mechanism), LTBA Metal-solvent reduction (Birch reduction), Introduction Catalytic reduction (Heterogeneous catalysis).

Textbooks:

1. Reaction Mechanism in Organic Chemistry by S.M. Mukherji and S.P. Singh, Revised edition, Trinity Press
2. Organic Chemistry by Jonathan Clayden, Nick Greeves and Stuart Warren, Second Edition, Oxford University Press

Reference books

1. Pericyclic reactions by Ian Fleming, Second edition, Oxford University press.
2. Pericyclic Reactions-A Textbook: Reactions, Applications and Theory by Sankararaman, WILEY-VCH.
3. Pericyclic reactions-A Mechanistic study by S.M. Mukherji, Macmillan India.
4. Organic synthesis: The disconnection approach by Stuart Warren, John Wiley & Sons.
5. Reactions, Reagents and Rearrangements by S.N. Sanyal, Bharati Bhawan Publishers & Distributors

WebLinks:

1. <https://youtu.be/c9-h83KDIak>
2. <https://youtu.be/NDHQ7W2TKIY>****
3. <https://youtu.be/mdWsJWybUcA>
4. <https://youtu.be/CyYUGaSWihE>

Course outcome & Program outcome mapping

| On Completion of the course, the students will be able to | |
|---|--|
| CO1 | Student will acquire knowledge on basic concepts in different types of pericyclic reactions |
| CO2 | Student will get the knowledge in understanding the fundamental concepts involved in the organic photochemistry and gets acquainted with novel reactions |
| CO3 | Student shall have opportunity to understand the importance of retro synthesis in organic chemistry which is a key analysis in recent research trends. |
| CO4 | Students shall Comprehend the applications of different novel reagents and reactions in synthetic organic chemistry. |

CO-PO Mapping:

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

| | 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 |
|------------|------|------|------|------|------|------|------|------|------|-------|-------|-------|-------|
| CO 1 | 3 | 2 | 3 | 1 | 3 | 2 | 3 | 2 | 2 | 2 | 3 | 3 | 2 |
| CO 2 | 3 | 3 | 2 | 3 | 2 | 2 | 1 | 2 | 2 | 2 | 3 | 3 | 2 |
| CO 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 2 |
| CO 4 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 3 | 2 | 3 |
| Avg | 3 | 2.8 | 2.8 | 2.5 | 2.8 | 2 | 2 | 2 | 2 | 2 | 3 | 2.8 | 2.3 |

PO1 : Knowledge in Chemistry : Apply the knowledge of synthetic organic chemistry to the solution of simple to complex synthesis of organic molecules.

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

PO3: Design/development of solutions: Design solutions for simple to complex problems and designing novel routes for the synthesis of bioactive / active pharmaceutical ingredients.

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

synthesis of the organic molecules.

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

PO6 : 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 issues related to synthetic organic chemistry with the chemistry community, being able to write the effective reports and documentation, 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 have a firm foundation in the fundamentals/concepts/theories and its applications in synthetic organic chemistry.

PSO-2: To understand the structure and properties of reagents, Characteristics mechanisms of chemical reactions and their synthetic utility.

PSO-3: To acquaint with safety measures in laboratory and develop skills in proper handling of chemicals and apparatus/instruments and carry out experiments, record the observations and present the inference/results

**Weightage to content Semester -V
Paper-6A**

| S.No | Course Content | Long Answer | Short Answer | Total marks | As per Blooms Taxonomy |
|------|-------------------------------|-------------|--------------|-------------|----------------------------|
| 1 | Pericyclic reactions | 2 | 1 | 25 | Understanding, Application |
| 2 | Organic Photo Chemistry | 1 | 2 | 20 | Remembering, Understanding |
| 3 | Retrosynthesis | 1 | 1 | 15 | Analyzing & Creation |
| 4 | Synthetic Reactions | 1 | 2 | 20 | Evaluation, Understanding |
| 5 | Reagents in Organic Chemistry | 1 | 1 | 15 | Application & Creation |
| | TOTAL | 6 | 7 | 95 | |

P.R. GOVERNMENT COLLEGE (A), KAKINADA
III YEAR B.Sc (Examination at the end of V semester)
(Synthetic Organic Chemistry)

Paper-14A
MODELPAPER

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. How do you explain [2+2] - cycloaddition reaction with example with any one method
2. Elaborate Paterno-Buchi reaction and Norrish type- II reaction with an example.
3. Devise ways for retrosynthetic analysis of Cyclohexene and Paracetamol.

SECTION -B

4. How can you describe the mechanisms of Suzuki coupling and Robinson annulation.
5. Suggest the acceptable mechanism for reduction with LiAlH_4 and give any two synthetic applications of LiAlH_4 .
6. Discuss Electro cyclic reactions by taking anyone example with any one method.

PART-B

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

4X5=20Marks

7. Draw the Molecular orbital diagram of 1,3-butadiene.
8. How would you generalize Norrish Type-I reaction.
9. What is Photo Fries rearrangement
10. What can you infer Target molecule and synthon with an example.
11. Suggest the mechanism of Stork- Enamine alkylation reaction.
12. Explain Heck reaction with mechanism.
13. How would you present SeO_2 as an oxidizing agent?

LABORATORY COURSE
Practical Paper – 14A: Synthetic Organic Chemistry

(at the end of semester V) 30hrs (2h/W)

50Marks

Learning Out comes:

On successful completion of this practical course, students shall be able to:

1. Detect the extra elements in organic compounds in green conditions.
2. Demonstrate the green synthesis and conventional method for the synthesis of organic compounds.

Practical (Laboratory) Syllabus

1. Green procedure for organic qualitative analysis: Detection of N, S and halogens
2. Rearrangement reaction in green conditions: Benzil-Benzilic acid rearrangement
3. Radical coupling reaction: Preparation of 1,1-bis-2-naphthol
4. Benzoylation of aniline (Schotten Baumann reaction)
5. Green reduction reaction: Synthesis of dihydro pyrimidinone

Lab References:

1. Vogel A.I. Practical Organic Chemistry, Longman Group Ltd.
2. Bansal R.K. Laboratory Manual of Organic Chemistry, Wiley-Eastern.
3. Ahluwalia. And Aggarwal R. Comprehensive Practical Organic Chemistry, University press.
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):
5. For Teacher: Training of students by teacher in laboratory and field for not less than 15 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.
 6. 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 exceeding 10 pages in the given format to the teacher.
 7. Max marks for Fieldwork/project work Report: 05.
 8. Suggested Format for Fieldwork/project work: Title page, student details, index page, details of place visited, observations, findings, and acknowledgements.
 9. 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 - 14A:: Synthetic Organic Chemistry
(at the end of semester V)

| | |
|------------------------------------|-----------------|
| a. Correct Equation with Mechanism | 10 marks |
| b. Procedure | 10 marks |
| c. Recrystallization | 10 marks |
| d. Yield | 10 marks |
| e. Record | 05 marks |
| f. Viva voce | 05 marks |
| TOTAL | 50 marks |

| | | | | | |
|--------------------------------|--|-------------------------------|----|----|-----|
| | PITHAPUR RAJH'S GOVERNMENT COLLEGE(A) KAKINADA | Program & Semester | | | |
| CourseCode GEN CHE- XV A | TITLE OF THE COURSE ANALYSIS OF ORGANIC COMPOUNDS | III B.Sc. (V Semester) | | | |
| Teaching | Hours Allocated:45 (Theory) | L | T | P | Cr |
| Pre-requisites | Various Spectroscopic techniques(IR,NMR,MASS) Separation techniques- I & II | 45 | 10 | 30 | 3+2 |

Course Objectives:

1. Identify the importance of NMR in the structural elucidation of organic compound.
2. Gains knowledge in Mass spectrometry.
3. Structural elucidation by IR, NMR and Mass spectroscopic techniques.
4. Applications of Paper and Thin layer chromatographic techniques.
5. Demonstrate the Knowledge gained in solvent extraction for the separation of organic compounds.

Course Outcomes:

| On Completion of the course, the students will be able to | |
|---|--|
| CO1 | Identify the importance of NMR in the structural elucidation of organic compound. |
| CO2 | Identify the importance of mass spectrometry in the structural elucidation of organic compounds |
| CO3 | Acquire the knowledge on structural elucidation of organic compounds |
| CO4 | Understand various chromatography methods in the separation and identification of organic compounds. |
| CO5 | Demonstrate the knowledge gained in solvent extraction for the separation of organic compounds |

Course with focus on employability/entrepreneurship/Skill Development modules

| | | | | | |
|-------------------|--|---------------|--|------------------|--|
| Skill Development | | Employability | | Entrepreneurship | |
|-------------------|--|---------------|--|------------------|--|

Syllabus:

Unit-I: Nuclear Magnetic Resonance (NMR) spectroscopy 9 hours

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

Applications of NMR with suitable examples - ethyl bromide, ethanol, acetaldehyde, 1,1,2-tribromo ethane, ethyl acetate, toluene and acetophenone.

Unit II Mass Spectrometry 9 hours

A brief introduction to analysis of organic compounds

Basic principles, Instrumentation - Mass spectrometer, electron Ionization (Electron Impactionization, EI), Molecular ions, metastable ions, Isotope abundance. Basic fragmentation types. Fragmentation patterns in Toluene, 2-Butanol, Butaldehyde, Propionic acid.

Unit-III : Structural elucidation of organic ompounds 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 hour)

Solvent extraction- Principle and theory, Batch extraction technique, application of batch extraction in the separation of organic compounds from mixture- acid & neutral, base & neutral.

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-V: 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.

Referencebooks

- 1) Organic Spectroscopy by William Kemp, Third Edition, Palgrave USA.
- 2) Introduction to Spectroscopy by Pavia, Lamp man, Kriz and Vyvyan, Fifth edition,
- 3) Organic Spectroscopy: Principles and Applications by Jag Mohan, Second edition, Alpha Science.
- 4) Spectroscopy of Organic Compounds by P.S.Kalsi, Seventh edition, New Age International.
- 5) Spectroscopic Methods in Organic Chemistry by Ian Fleming and Dudley Williams, Seventh edition, Springer.
- 6) Fundamentals of Analytical Chemistry by F.James Holler, Stanley R Crouch, Donald M. West and Douglas A. Skoog, Ninth edition, Cengage.
- 7) Analytical Chemistry by Gary D. Christian, Purnendu K. Dasgupta and Kevin A. Schug, Seventh edition, Wiley.
- 8) Quantitative analysis by R.A. Day Jr. and A.L. Underwood, Sixth edition, Pearson.
- 9) Text book of Vogel's Quantitative Chemical Analysis, Sixth edition, Pearson.

WebLinks:

1. <https://youtu.be/rzF-dW08UIw>
2. <https://youtu.be/bPsXkPYexJY>
3. <https://youtu.be/inbiTYI5Nlw>
4. https://www.youtube.com/watch?v=qpZhc2Zn_Tl

Course outcome & Program outcome mapping

| On Completion of the course, the students will be able to | |
|---|--|
| CO1 | Identify the importance of mass spectrometry in the structural elucidation of organic compounds |
| CO2 | Acquire the knowledge on structural elucidation of organic compounds |
| CO3 | Understand various chromatography methods in the separation and identification of organic compounds. |
| CO4 | Demonstrate the knowledge gained in solvent extraction for the separation of organic compounds |

CO-POMapping:

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

| | P01 | P02 | P03 | P04 | P05 | P06 | P07 | PSO1 | PSO2 | PSO3 |
|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| CO1 | 1 | 2 | 2 | 3 | 2 | 1 | 1 | 1 | 2 | 2 |
| CO2 | 1 | 2 | 2 | 3 | 2 | 1 | 1 | 1 | 2 | 2 |
| CO3 | 1 | 3 | 2 | 3 | 2 | 1 | 1 | 1 | 2 | 2 |
| CO4 | 1 | 2 | 2 | 2 | 1 | 1 | 1 | 2 | 2 | 2 |

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 analysing specific problems both qualitatively and quantitatively in laboratories and in industries.

(PO4): Usage of modern tools: Create data using modern 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 -V Paper-Gen CHE XV - A

| S.No | Course Content | Long Answer | Short Answer | Total marks | As per Blooms Taxonomy |
|------|--|-------------|--------------|-------------|---------------------------|
| 1 | Nuclear Magnetic Resonance (NMR) spectroscopy | 1 | 2 | 20 | Understanding, Evaluating |
| 2 | Mass Spectrometry | 1 | 1 | 15 | Analyzing, Applying |
| 3 | Structural elucidation of organic compounds using IR, NMR & mass spectral data | 1 | 1 | 15 | Analyzing, Applying |
| 4 | Separation techniques-1 | 2 | 2 | 25 | Remembering, Applying |
| 5 | Separation techniques-2 | 1 | 1 | 20 | Evaluating, Creation |
| | TOTAL | 6 | 7 | 95 | |

P.R. GOVERNMENT COLLEGE(A),KAKINADA

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

Paper-17A :: Analysis of Organic Compounds

MODEL PAPER

Duration: 2hrs.30Min

Max.Marks:50

Section -I

Answer any three of the following questions. Must attempt at least one question from each part.

Each question carries 10 Marks.

3 X 10 = 30M

Part – A

1. i) Explain the Principle of nuclear magnetic resonance Spectroscopy.
ii) Identify and explain the NMR signals of the following compounds: acetaldehyde & toluene.
2. i) What is the significance of Isotopic abundance in Mass Spectrometry?
ii) What are metastable ions? How can you describe their characteristics?
3. Write the IR, NMR, and Mass spectral analysis for 2,2,3,3-tetramethyl butane and methyl propionate.

Part – B

4. Explain the Principle, experimental procedure and advantages of Thin-Layer Chromatography?
5. How would you elaborate ascending, descending, radial and two-dimensional paper chromatography. Suggest any of its applications.
6. Explain the Principle, experimental procedure of separation of acid and neutral compounds from their mixture.

Section -II

Answer any four of the following questions. Each question carries 5 marks.

4 X 5 = 20M

7. Explain equivalent and non-equivalent protons with suitable examples.
8. Define Chemical shift and coupling constant
9. Elaborate on McLafferty rearrangement.
10. What is the IR & NMR spectral data analysis for Propionic acid.
11. Explain Batch extraction.
12. Define R_f value, explain factors affecting R_f value.
13. Explain the principle involved in HPLC chromatography.

LABORATORY COURSE

Practical Paper - GEN CHE XV-A:: Analysis of Organic Compounds

(at the end of semester V) 30hrs(2h/W)

50Marks

Learning Outcomes:

On successful completion of this practical course, student shall be able to:

- Acquire knowledge on Spectral Identification of organic compounds using IR, NMR, MASS spectra's.
- Learn the procedure how to separate the given binary organic mixture using Solvent Extraction.

Practical (Laboratory) Syllabus:

- 1) Spectral identification of following Organic compounds by using IR, NMR, MASS spectra's.
 - a) Propanoic Acid.
 - b) Ethyl Acetate.
 - c) Butanone.
 - d) 1,2 di bromo ethane.
 - e) 2- Propanol
 - f) Anisole
 - g) Acetamide
 - h) n -hexyl amine.
- 2) Separation of organic compounds in a mixture (acidic compound + neutral compound) using solvent extraction.
- 3) Separation of organic compounds in a mixture (basic compound+ neutral compound) using solvent extraction.

List of Reference books :

- 1) Spectrometric Identification of Organic compounds, R.M. Silverstein, F.X. Webster and D.J. Kiemle, 7th Ed., (Wiley).
- 2) Practical Organic chemistry by Mann& Saunders.
- 3) Vogel A.I. Practical Organic Chemistry, Longman Group Ltd.
- 4) Bansal R.K. Laboratory Manual of Organic Chemistry, Wiley-Eastern.
- 5) Ahluwalia V. K. and Aggarwal R. Comprehensive Practical Organic Chemistry, University press. Mann F.G and Saunders B.C, Practical Organic Chemistry, Pearson Education.


SCHEME OF VALUATION

Practical Paper – 7 A:: Analysis of Organic
Compounds (at the end of semester V)

Spectral Analysis:

| | | |
|--|-----------------------|-----|
| | IR ANALYSIS | 10M |
| | NMR ANALYSIS | 10M |
| | MASS ANALYSIS | 10M |
| | STRUCTURE OF COMPOUND | 05M |
| | RECORD | 10M |
| | VIVA VOCE | 05M |

| | |
|---|-----------------|
| a. Nature of the mixture | 5 marks |
| b. Separation of the mixture into two components | 10 marks |
| Systematic analysis of each component which involves following | |
| c. Preliminary Tests (Ignition, M.P/B.P, Unsaturation) | 03 + 03 marks |
| d. Detection of extra elements | 04 + 04 marks |
| e. Detection of the functional group (Preliminary & Confirmation) | 04+ 04 marks |
| f. Report | 01 + 01 marks |
| g. Viva voce | 06 |
| h. Record | 05 |
| TOTAL | 50 marks |

| | | | | | | |
|---|---|---|---|----|----|-----|
|  | P.R. GOVERNMENT COLLEGE(A), KAKINADA | | Program & Semester II B.Sc. MICROBIOLOGY(H) (SEMESTER – III) | | | |
| | Course Code MINOR-5B | TITLE OF THE COURSE Course -5B: ENVIRONMENTAL CHEMISTRY | | | | |
| Teaching | Hours Allocated: 45 (Theory) (3 hrs. / Wk.) | | L | T | P | C |
| Pre-requisites: | Basic knowledge about Environment and its scope and importance. | | 45 | 10 | 30 | 2+1 |

Course Objectives:

1. To inculcate basic knowledge on basic concepts of environmental Pollution.
2. To illustrate the classification of segments of environment.
3. To provide knowledge and applications on various types of environmental pollutions.
4. To understand about the concepts of ecosystem and Bio-diversity.

Course Outcomes:

| On Completion of the course, the students will be able to- | | Cognitive Domain |
|--|---|------------------|
| CO1 | To inculcate basic knowledge on basic concepts of environmental Pollution. | Knowledge |
| CO2 | To understand the classification of segments of environment. | Understand |
| CO3 | To provide knowledge and applications on various types of environmental pollutions. | Knowledge |
| CO4 | To understand about the concepts of ecosystem and Bio-diversity. | Understand |
| Skill Development | Employability | Entrepreneurship |

Syllabus:

UNIT-1

Introduction

9h

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

UNIT-II

Air Pollution

9h

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

UNIT-III

Water pollution

9h

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

UNIT-IV

Chemical Toxicology

9h

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

UNIT-V

Ecosystem and biodiversity

9h

Ecosystem

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

Biodiversity

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

List of Reference books

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

CLO-PLO Mapping:

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

| | CL OP LO | 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 |
| CLO5 | 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 |

PROGRAMME OUTCOMES (PO's)

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 Environmental analysis, estimation, hardness of water, preparation, Kinetic, experiments and water analysis applying the domain of critical thinking.

(PO3) Problem Solving: Define the background of heavy metals like Pb, As, Cd, Hg. Cycles of N, C, P. Determination of carbonate and Bicarbonate in water sample and also analysis of alkalinity and turbidity.

(PO4): Usage of modern tools: Create data using modern 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 Environmental 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, analytical and Environmental Chemistry

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

PSO3 - Evaluate distinct problems in the field of Environmental data analysis, scientific interpretation and analysis of water,Air,Soil with an understanding on basic tools to be employed.

WEIGHTAGE TO CONTENT

| S No | Course Content | Essay (10M) | Short (5M) | Total marks | Question Relates as per Bloom's Taxonomy |
|------|----------------|-------------|------------|-------------|--|
| 1. | UNIT-I | 1 | 1 | 15 | Remembering, understanding |
| 2. | UNIT-II | 1 | 2 | 20 | Analyzing, Remembering |
| 3. | UNIT-III | 2 | 1 | 20 | Analyzing, Remembering |
| 4. | UNIT-IV | 1 | 1 | 25 | Analyzing, Evaluating |
| 5. | UNIT-V | 1 | 1 | 15 | Evaluating |
| | Total | 6 | 7 | 95 | |

PITHAPUR RAJAH'S GOVERNMENT COLLEGE(A)
II B.Sc. MICROBIOLOGY , SEMESTER-III
COURSE-MINOR-5B: ENVIRONMENTAL CHEMISTRY

MODEL QUESTION PAPER

TIME: 2 hrs.

MAX. MARKS: 50

SECTION-A

Answer any THREE questions choosing at least ONE question from each section Each carries 10 Marks

3x10=30M

1. One question is to be set from unit-I
2. One question is to be set from unit-II
3. One question is to be set from unit-III

SECTION-B

4. One question is to be set from unit-III
5. One question is to be set from unit-IV
6. One question is to be set from unit-V

Answer any FOUR questions Each carries FIVE marks.

4x5=20M

7. One question is to be set from unit-I
8. One question is to be set from unit-II
9. One question is to be set from unit-II
10. One question is to be set from unit-III
11. One question is to be set from unit-IV
12. One question is to be set from unit-V
13. One question is to be set from unit-V


QUESTION BANK

ESSAY QUESTIONS

1. Explain the Segments of Environment.
2. Discuss about Renewable and Non-Renewable energy resources with examples.
3. Explain the reactions of atmospheric Oxygen.
4. Discuss about Hydrological cycle.
5. What is Air pollution. Explain classification and control measures of Air pollution.
6. Explain a) Acid rains b) Global Warming c) Formation and depletion of Ozone layer
 d) Bhopal Gas disaster e) Photo chemical smog
7. Give the methods to convert Permanent hard water into soft water.
8. Give the methods to convert Temporary hard water into soft water.
9. What is the quality parameters of water.
10. What is Eutrophication. How industrial waste water is purified.
11. Explain the Toxicity of a) Lead b) Arsenic c) Mercury d) Cadmium.
12. Define Ecosystem. Explain the types of Ecosystems.
13. Give detailed account on Biodiversity.

SHORT ANSWER QUESTIONS

1. Explain the importance of environment in now a day.
2. Give about the hardness of water.
3. Discuss briefly about Food chain and Food web.
4. What are the toxic effects of cyanide on the environment.
5. Explain the biochemical effects of Pesticides.
6. Define biotic and abiotic components.
7. What are the functions of Ecosystem.
8. Define the terms i) COD II) BOD
9. Write about biogeochemical cycles of C, N, P
10. Explain biogeographical classification of India.

| | | | | | | | |
|---|--|---|--|--|---|---|---|
|  | PITHAPUR RAJAH'S GOVERNMENT COLLEGE(A) KAKINADA | | | Program & Semester II B.Sc. MICROBIOLOGY (SEMESTER – III) | | | |
| | Course Code MINOR-5B | TITLE OF THE COURSE Course MINOR-5B: ENVIRONMENTAL CHEMISTRY | | | | | |
| 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:

- To demonstrate basic knowledge about the handling of laboratory apparatus
- To illustrate knowledge about the preparation of standard solutions
- 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 | |
|---|---|
| CO1 | Learn to Handle and calibrate the common laboratory glass apparatus and instruments |
| CO2 | Get practical skill to the preparation of different standard solutions used for quantitative analysis |
| CO3 | Identify and confirm the structure of a given organic compounds |
| CO4 | Principles and applications of different molecular spectra |

Course with focus on employability / entrepreneurship / Skill Development modules

| | | | | | |
|-------------------|--|---------------|--|------------------|---|
| Skill Development | | Employability | | Entrepreneurship | - |
|-------------------|--|---------------|--|------------------|---|

Practical Paper – minor 5 B (at the end of semester V)

30 hrs (2 h / W)

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

CLO-PLO Mapping:

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

| | CL O/P LO | PLO 1 | PLO 2 | PLO 3 | PLO 4 | PLO 5 | PLO 6 | PLO 7 | PLO 8 | PLO 9 | PLO1 0 | CLO/ PLO | PLO1 |
|------|-----------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------|-------------|------|
| CLO1 | 3 | 3 | 3 | 2 | 3 | 2 | 2 | 2 | 3 | 2 | 2 | 3 | 3 |
| CLO2 | 3 | 3 | 3 | 2 | 3 | 2 | 2 | 3 | 2 | 3 | 3 | 3 | 3 |
| CLO3 | 3 | 2 | 3 | 2 | 3 | 1 | 2 | 2 | 2 | 2 | 2 | 3 | 2 |
| CLO4 | 3 | 3 | 2 | 1 | 3 | 2 | 2 | 1 | 2 | 3 | 3 | 3 | 3 |
| CLO5 | 3 | 2.75 | 2.75 | 2 | 3 | 2 | 2 | 2 | 2.25 | 2.5 | 2.5 | 3 | 2.75 |

SCHEME OF VALUATION

1. Procedure – 10M

2. Tabular form and values -15M

% of error

3. Below 1% 15

4. 1-2% Error – 10

5. >2%-5M

6. Record-05M

7. Viva-5M

| | | | | | |
|--------------------------|--|-------------------------------|----|----|-----|
| | PITHAPUR RAJAH'S GOVERNMENT COLLEGE KAKINADA | Program & Semester | | | |
| Course Code MIN CHE-6 | TITLE OF THE COURSE MINOR 6 : CHROMATOGRAPHY AND INSTRUMENTAL METHODS OF ANALYSIS | III B.Sc. Minor Chemistry | | | |
| Teaching | Hours Allocated: 45 (Theory) | L | T | P | C |
| Pre - requisites | Fundamental Knowledge in functional Groups of organic compounds and their general formulas | 45 | 10 | 30 | 3+1 |

Course Outcomes:

At the end of the course , the students will be able to

- 1) Identify the importance of chromatography in the separation and identification of compounds in a mixture
- 2) Acquire a critical knowledge on various chromatographic techniques.
- 3) Demonstrate skills related to analysis of water using different techniques.
- 4) Understand the principles of Spectrochemistry in the determination of metal ions.
- 5) Comprehend the applications of atomic spectroscopy.

| On Completion of the course, the students will be able to | |
|---|--|
| CO1 | Handle in depth of various various Chromatographic and instrumental methods for analysis |
| CO2 | Understand the basic concepts of Chromatography and allied techniques |
| CO3 | Learn and identify applications of AAS and AES |
| CO4 | Understand the reactivity and structure of different functional groups of compounds |

Course with focus on employability/entrepreneurship/Skill Development modules

| | | | | | |
|-------------------|--|---------------|--|------------------|--|
| Skill Development | | Employability | | Entrepreneurship | |
|-------------------|--|---------------|--|------------------|--|

COURSE 14: CHROMATOGRAPHY AND INSTRUMENTAL METHODS OF ANALYSIS I

Syllabus:

Unit-1: Chromatography-Introduction and classification

Principle, Classification of chromatographic methods, Nature of adsorbents, eluents, Rf-values, factors affecting Rf-values.

UNIT-2: TLC and paper chromatography

Thin layer chromatography: Principle, Experimental procedure, preparation of plates, adsorbents and solvents, development of chromatogram, detection of spots, applications and advantages.

Paper Chromatography: Principle, Experimental procedure, choice of paper and solvents, various modes of development- ascending, descending, radial and two dimensional, applications.

UNIT-3: Column chromatography

Column chromatography: Principle, classification, Experimental procedure, stationary and mobile phases, development of the Chromatogram, applications.

HPLC: Basic principles, instrumentation–block diagram and applications.

UNIT-4: Spectrophotometry

Principle, Instrumentation : Single beam and double beam spectrometer, Beer-Lambert's law

Derivation and deviations from Beer-Lambert's law,

applications of Beer-Lambert's law

Quantitative determination of Fe^{+2} , Mn^{+2} and Pb^{+2} .

UNIT-5: Polarimetry and Refractometry

Polarimetry and Refractometry:

Polarimetry : Nature of polarized light, polarimeter, sample cells, operation of the polarimeter, optical purity.

Refractometry; The refractive index, Refractometer.

List of Reference books:

- 1) Fundamentals of Analytical Chemistry by F. James Holler, Stanley R Crouch, Donald M. West and Douglas A. Skoog, Ninth edition, Cengage.
- 2) Analytical Chemistry by Gary D. Christian, Purnendu K. Dasgupta and Kevin A. Schug, Seventh edition, Wiley.
- 3) Quantitative analysis by R. A. Day Jr. and A. L. Underwood, Sixth edition, Pearson.
- 4) Text book of Vogel's Quantitative Chemical Analysis, Sixth edition/Pearson.
- 5) Instrumental methods of Chemical Analysis by Dr. B. K. Sharma 1981

SEMESTER-V

MINOR 6: CHROMATOGRAPHY AND INSTRUMENTAL METHODS OF ANALYSIS

2 hrs/week

Practical Credits: 1

II.

Learning Outcomes:

On successful completion of this practical course, student shall be able to:

- 1) Perform the separation of a given dye mixture using TLC
- 2) Learn the preparation of TLC plates
- 3) Demonstrate the separation of mixture of amino acids using paper chromatography
- 4) Acquire skills in using column chromatography for the separation of dye mixture.

III.

Laboratory course Syllabus:

- 1) Separation of a given dye mixture (methyl orange and methylene blue) using TLC (using alumina as adsorbent).
- 2) Separation of mixture of methyl orange and methylene blue by column chromatography.
- 3) Separation of given mixture of amino acids (glycine and phenyl alanine) using ascending paper chromatography.
- 4) Separation of food dyes using Column Chromatography
- 5) Separation of triglycerides using TLC
- 6) Verification of Beer Lambert's law. (Using potassium permanganate solution) using colorimeter / spectrophotometer.

IV. List of Reference books:

- 1) Text book of Vogel's Quantitative Chemical Analysis, Sixth edition, Pearson.
- 2) Vogel A.I. Practical Organic Chemistry, Longman Group Ltd.
- 3) Bansal R.K. Laboratory Manual of Organic Chemistry, Wiley-Eastern.
- 4) Ahluwalia V. K. and Agarwal R. Comprehensive Practical Organic Chemistry, University press.
- 5) Mann F. Gand Saunders B.C, Practical Organic Chemistry, Pearson Education.

Course outcome & Program outcome mapping

| On Completion of the course, the students will be able to | |
|---|---|
| CO1 | In depth understanding of theory in Chromatography and Instrumental methods |

| | |
|-----|--|
| CO2 | Understand and explain properties in various chromatographic methods , types of solvent systems, principles etc. |
| CO3 | Understand the importance of structure, preparation and chemical applications in respect of Chromatographic and Instrumental Methods |
| CO4 | Comprehend the concepts and applications of Chromatography & Instrumental methods |

CO-PO Mapping:

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PSO1 | PSO2 | PSO3 |
|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| 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 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, 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 modern 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 the content

| S.No. | Course Content | Long Answer Questions | Short Answer Questions | Total Marks | As per Blooms Taxonomy |
|--------------|---|------------------------------|-------------------------------|--------------------|-------------------------------|
| 1 | Chromatography- Introduction and classification | 1 | 1 | 15 | Understanding, Application |

| | | | | | |
|----|-------------------------------|----------|----------|-----------|----------------------------|
| 2 | TLC and paper chromatography | 1 | 2 | 20 | Remembering, Understanding |
| 3 | Column chromatography | 2 | 1 | 25 | Analyzing & Creation |
| 4 | Spectrophotometry | 1 | 2 | 20 | Evaluation, Understanding |
| 5. | Polarimetry and Refractometry | 1 | 1 | 15 | Understanding, Application |
| | TOTAL | 6 | 7 | 95 | |

PITHAPUR RAJAH'S GOVERNMENT COLLEGE (A) :: KAKINADA
III YEAR B.Sc (Examination at the end of V semester)
MINOR 6 :: CHROMATOGRAPHY AND INSTRUMENTAL METHODS OF ANALYSIS

MODEL PAPER

Duration: 2hr

Max.Marks: 50M

Section - 1

Answer any THREE questions choosing at least one from each part.
Each question carries TEN marks.

3 X 10 = 30 Marks

PART-A

1. Explain the classification of various chromatographic methods on the basis of Stationery Phase and Mobile Phase [BT1, CO1]
2. Support the advantages of Thin Layer Chromatography with its applications [BT1, CO2]
3. How column chromatography is used to separate a mixture of organic compounds [BT2, CO2]

PART-B

4. Give the block diagram and explain the working, principle of HPLC. [BT3, CO3]
5. Discuss various types of spectro photometers with their block diagrams. [BT2 CO3]
6. Elaborate the working principle of polarimeter with block diagram. [BT3, CO4]

Section-II

Answer any four of the following questions.

Each question carries FIVE marks.

4x5=20 Marks

7. Brief about the factors affecting R_f-values [BT3, CO1]
8. Brief about the development of chromatogram in TLC [BT3, CO1]
9. Write about two dimensional paper chromatography with example [BT1, CO2]
10. Write a note on mobile phase for Column chromatography [BT3, CO3]
11. Brief deviations from Beer-Lamberts Law. [BT3, CO1]
12. Give the procedure for the determination of Mn by colorimetry. [BT2, CO3]
13. Write about refractometry [BT1, CO1]

PITHAPUR RAJAH'S GOVERNMENT COLLEGE (A) : KAKINADA

BOARD OF STUDIES 2025-26

DEPARTMENT OF CHEMISTRY

III B.Sc., Minor Chemistry

SEMESTER- V

**- CHROMATOGRAPHY AND INSTRUMENTAL METHODS OF ANALYSIS
(Minor-6)**

Question Bank

UNIT-I

Chromatography-Introduction and classification

Essay Questions

1. Explain the general theory of Chromatographic processes
2. Briefly explain the classification of chromatography methods
3. What is meant by R_f-values? Explain. Mention some of the factors on which the R_f-value of a compound depends

Short Answer Questions

1. Give the principle of chromatography

UNIT - II

TLC and paper chromatography

Essay Questions

1. Explain the general procedure of thin layer chromatography
2. Explain the following
 - A) Ascending Paper Chromatography B) Descending Paper chromatography
3. Explain the following
 - A) Radial Paper Chromatography and B) Two Dimensional Paper Chromatography

Short Answer Questions

1. Write about the applications of thin layer chromatography
2. Explain various ways in which spots due to component compounds of a mixture are detected after development of the plate in TLC
3. What are the commonly used adsorbents in thin layer chromatography
4. Mention some of the advantages of thin layer chromatography

UNIT-III

Column chromatography

Essay Questions

1. Explain the theory and principle of Column Chromatography
2. What is HPLC? Explain the theory and principle involved in HPLC

Short Answer Questions

1. Write about important applications of HPLC
2. Write the important applications of column chromatography

UNIT-IV

Spectrophotometry

Essay Questions

1. State and explain Lambert's Law and Beer-Lamberts Law
2. What are single beam and double beam spectrophotometers? Briefly explain.
3. Derive an expression for Beer-Lamberts Law

Short Answer Questions

1. Write about the applications of Beer-Lamberts law
2. Write about the application of Beer-Lamberts Law for quantitative analysis of Fe(II)
3. Write about the application of Beer-Lamberts Law for quantitative analysis of Mn(II)
4. Write about the application of Beer-Lamberts Law for quantitative analysis of Pb(II)
5. What is molar absorptivity
6. What is absorbance and transmittance explain

UNIT- V

Polarimetry and Refractometry

Essay Questions

1. Explain the Synthesis of Glycine and Alanine using Gabriel Phthalimide synthesis and Strecker's Method
2. Explain general reactions due to amino and carboxyl groups of amino acids
3. Define Amino acids and explain the classification of Amino acids

Short Answer Questions

1. What are Essential and Non Essential amino acids give examples?
2. Write about Zwitter ion?
3. Summarize the importance of isoelectric point.
4. Explain the solubility of amino acids and their melting points

SEMESTER-V

MINOR 6 : CHROMATOGRAPHY AND INSTRUMENTAL METHODS OF ANALYSIS

Practical

Credits: 1

2 hrs/week

(At the end of V Semester)

- 1) Separation of a given dye mixture (methyl orange and methylene blue) using TLC (using alumina as adsorbent).
- 2) Separation of mixture of methyl orange and methylene blue by column chromatography.
- 3) Separation of given mixture of amino acids (glycine and phenyl alanine) using ascending paper chromatography.
- 4) Separation of food dyes using Column Chromatography
- 5) Separation of triglycerides using TLC
- 6) Verification of Beer Lambert's law. (Using potassium permanganate solution) using colorimeter / spectrophotometer.

Scheme of Valuation for Practical

Chromatographic Experiment

Procedure - 10 M

Principle - 5 M

Mobile Phase and Stationery Phase Composition - 5 M

Detection of Spots - 5 M

Rf-values Calculation - $2 \times 5 = 10$ M

Error - 5 M

Viva-voce - 5 M

Record - 5 M

Colorimetric Experiment

Procedure (Calibration of Instrument) - 5 M

Principle and Formulae - 5 M

Preparation of Stock Solution and Working Solutions - 5 M

Detection of Absorbance Values and Neat Tabular Form - 5 M

Construction of Calibration Graph - 5 M

Calculation for Two Unknowns - $2 \times 5 = 10$ M

Error - 5 M

Viva-voce - 5 M

Record - 5 M