

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

**B. Sc. (Analytical Chemistry)**

**SEMESTER – IV**

**Paper -IV (ANALYTICALCHEMISTRY-4)**

**60hrs (4h/w)**

**SEPARATION METHODS – II**

**UNIT-I**

**12 hrs.**

**ION EXCHANGE AND ION EXCHANGE CHROMATOGRAPHY**

A. ION EXCHANGE: principles of ion-exchange systems, synthetic ion-exchange resins, properties of anion and cation exchange resins, ion-exchange mechanism, ion- exchange equilibria, selectivity, ion-exchange capacity, Applications, separation of inorganic mixtures.

B. ION EXCHANGE CHROMATOGRAPHY:

Principle of Ion exchange chromatography, Equipment and Experimental set up & procedure, Application

**UNIT-II**

**12hrs**

**GEL AND AFFINITY CHROMATOGRAPHY**

A. Gel chromatography: Principle, types of gels, separation by gel chromatography, applications.

B. Affinity chromatography: Principle, materials, selection and attachment of ligand, practical procedure, applications.

**UNIT –III**

**12 hrs.**

**GAS CHROMATOGRAPHY**

Gas chromatography: Principe, Theory, Apparatus& Instrumentation, Columns, preparation and application of samples, Carrier gases, Detectors, Programmed temperature gas chromatography, Applications.

## **UNIT-IV**

**12hrs**

### **A. ELECTROPHORESIS I**

Electrolysis and Electro – osmosis phenomenon, Theory and classification of electrophoresis, Factors affecting electrophoresis phenomena (mobility, macromolecular size and charge interactions with supporting electrolyte, pH and concentration discontinuities). Applications.

### **B. ELECTROPHORESIS - II**

Capillary Electrophoresis: Principle, Instrumentation and applications of Capillary electrophoresis  
Zone Electrophoresis: Principle, Instrumentation and applications of Zone electrophoresis.

## **UNIT-V**

**12hrs**

### **A. DIALYSIS AND MEMBRANE FILTRATION**

Filters- nitrocellulose, fiberglass, polycarbonate, General laboratory methods.

### **B. CENTRIFUGATION METHODS:**

Introduction, sedimentation and relative centrifugal force, different types of rotors, density gradients, types of centrifugation techniques.

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**B. Sc. (Analytical Chemistry)**

**SEMESTER –IV**

**LABORATORY COURSE -IV**

**Practical-IV Quantitative analysis 30 hrs. (2 h / w)**

**Max.Marks : 50 M**

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

1. Determination of the strength of HCl solution with standard NaOH solution by using conductometric titration method
2. Determination of the strength of Acetic acid solution with standard NaOH solution by using conductometric titration method.
3. Determination of equivalent conductance of a weak electrolyte (acetic acid) at different concentrations.
4. Separation of a mixture of  $\text{Ni}^{2+}$  and  $\text{Cu}^{2+}$  by TLC and identify the ions.
5. Determination of residual chlorine in city water supply using colorimetry.
6. Determination of adsorption isotherm of acetic acid on activated charcoal.

**Suggested Readings:**

1. R.V. Dils: Analytical Chemistry- Methods of Separation.
2. F.W. Fifield and D. Kealy: Principles and practice of analytical chemistry.
3. Vogel's textbook of quantitative chemical analysis, 6<sup>th</sup> edition.
4. Vogel's textbook of quantitative chemical analysis, 7<sup>th</sup> edition.
5. Principles & Practices of Chromatography by R. P. W. Scott, Library for Science
6. Fundamentals of Analytical Chemistry, VIII Edn., D. A. Skoog, D. M. West, F.J. Holler and S.R. Crouch, Thomson Brooks/Cole Publishers, 2004.
7. Principles of Instrumental Analysis by D.A. Skoog, F.J. Holler and T.A.
8. Instrumental Methods of Chemical Analysis, Chatwal and Anand, Himalaya Publishing House, Meerut.
9. Basic Gas Chromatography 2nd Edition by Harold M. McNair, James M. Miller,

### SCHEME OF VALUATION

Max. Marks: 50

- |   |       |          |
|---|-------|----------|
| 1. Procedure to be written in the first 15 minutes              | ....  | 10 Marks |
| 2. Recording of data and reporting the value upto 2% error..... |       | 20 Marks |
| 3. Error up to 5%   | ..... | 10 Marks |
| Error greater than 5%   | ..... | 5 Marks  |
| 4. Viva – Voice   | ..... | 10 Marks |
| 5. Record   | ..... | 10 Marks |

**P. R. GOVERNMENT COLLEGE, KAKINADA**  
**MODEL QUESTION PAPER**  
**SEMESTER – IV**  
**Paper - IV (ANALYTICAL CHEMISTRY-4)**  
**SEPARATION METHODS-II**

**Duration: 2hrs. 30Min.**

**Max. Marks: 60**

**SECTION – A**

Answer any **FOUR** questions. Each question carries **10** marks.

4 X 10 = 40M

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

**SECTION – B**

Answer any **four** questions. Each question carries **5** marks.

4 x 5 = 20M

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

**P. R. GOVERNMENT COLLEGE, KAKINADA**  
**SEMESTER – IV**  
**Paper - IV (ANALYTICAL CHEMISTRY-4)**  
**SEPARATION METHODS-II**

**Duration: 2hrs. 30Min.**

**Max. Marks: 60**

**Blue Print:**

S. No.	Course Content	Essay Questions (10M)	Short Answer Questions (5M)	Total No. Of Questions from each Unit
1	Unit -I	2	2	4
2	Unit –II	1	1	2
3	Unit –III	2	2	2
4	Unit –IV	2	2	4
5	Unit -V	1	1	2
	TOTAL	8	8	16

**Note: Questions should be given from Question bank**

**P. R. GOVERNMENT COLLEGE, KAKINADA**  
**SEMESTER – IV**  
**Paper -IV (ANALYTICAL CHEMISTRY-4)**  
**SEPARATION METHODS-II**

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**QUESTION BANK**

**ESSAY QUESTIONS – 10 MARKS:**

1. Explain about the Principle and applications of Ion – exchange chromatography.
2. Explain about the Principle and experimental set up of ion exchange Chromatography.
3. Explain about anion and cation ion exchange resins with examples.
4. Write about Ion exchange resins and its applications
5. Explain the principle and applications of Gel chromatography.
6. Explain the principle and applications of Affinity chromatography.
7. Write about principle and applications of Gas chromatography.
8. Explain about the principle and instrumentation of Gas chromatography.
9. Explain about the various detectors used in Gas chromatography.
10. Explain briefly about columns and detectors used in Gas chromatography.
11. Write about Theory and classifications of Electrophoresis.
12. Explain about the principle and factors affecting Electrophoresis phenomena.
13. Explain Capillary electrophoresis with applications.
14. Explain Zone electrophoresis with applications.
15. Explain about the principle and instrumentation of Electrophoresis technique.
16. Write about various types of Filters in Membrane filtration.
17. What is centrifugation? Explain various types of centrifugation techniques.
18. Explain about different types of rotors

## **QUESTION BANK**

### **SHORT ANSWER QUESTIONS – 05MARKS:**

1. Explain separation of inorganic mixtures through Ion - exchange resins.
2. Explain about ion – exchange equilibria and ion – exchange resin selectivity.
3. Write about the applications of ion exchange chromatography.
4. What are gels? Explain different types of gels.
5. Explain briefly about the separation process by Gel chromatography.
6. Write about practical procedure of affinity chromatography.
7. Explain briefly about various Detectors used in Gas chromatography.
8. Write about preparation of samples and separation conditions in Gas chromatography.
9. Explain about temperature programmed gas chromatography.
10. Write about carrier gases used in gas chromatography
11. Explain about columns and column packing's used in gas chromatography
12. Write about Electrolysis phenomena.
13. Write about Electro – osmosis phenomenon.
14. What is electrophoresis? Write its applications.
15. Write about the classification of electrophoresis.
16. Explain about the factors affecting electrophoresis phenomenon.
17. Explain about Nitrocellulose filters
18. Write about Sedimentation technique
19. Explain about Density gradients.
20. What is centrifugation? Write about relative centrifugal force.
21. Write about General laboratory methods related to dialysis



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**B. Sc. (Analytical Chemistry)**

**SEMESTER –IV**

**Paper–V (ANALYTICAL CHEMISTRY-5)**

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

**ANALYTICAL BIOCHEMISTRY AND ENVIRONMENTAL CHEMISTRY**

**UNIT–I**

**9 hrs.**

**BASIC UNDERSTANDING OF THE STRUCTURES, PROPERTIES AND FUNCTIONS OF CARBOHYDRATES, LIPIDS, AND PROTEINS**

1. Isolation and characterization of polysaccharides.
2. Classification of lipids, properties, functions and Bio chemical functions of steroid hormones.
3. Proteins- structure, classification, isolation, characterization and functions.
4. Biochemistry of peptide hormones.
5. Enzymes- nomenclature, classification, effect of pH, temperature on enzyme activity, enzyme inhibition.
6. Lipoproteins

**UNIT–II**

**9 hrs**

**BIOCHEMISTRY OF DISEASE: A DIAGNOSTIC APPROACH**

**Clinical chemistry: a diagnostic approach by blood/urine analysis.**

1. Blood: Composition and functions of blood, blood coagulation.
2. Blood collection and preservation of samples.
3. Anemia
4. Regulation, estimation and interpretation of data for blood sugar, urea, creatinine, cholesterol and bilirubin.
5. Urine: Collection and preservation of samples.
6. Formation of urine.
7. Composition and estimation of constituents of normal and pathological urine.

**Unit-III:**

**9hrs**

**Microbiological Tests and Assays:**

Microbiological Assay of antibiotics, (std. preparations and units of activity, test organisms and inoculum, apparatus, methods: cylinder or cup plate method and two level factorial assay (ampicillin), microbial limit test (preliminary testing, medium soya bean casein digest agar medium only) and total microbial count only), test of sterility-membrane filtration method, determination of thiomersal.

#### **Unit-IV:**

**9hrs**

##### **Standardization and Quality Control of different Dosage Forms:**

Brief introduction to different dosage forms with the IP requirements,

Analytical methods for the following:

Tablets (aspirin), additives used in tablet manufacture, capsules (Rifampicin),

Powders (Sodium benzoate), solutions (saline, NaCl) suspensions

(Barium sulphate—limit test for impurity), mouthwashes (Ointments - salicylic acid) and creams dimethazone by IR), injections (Mannitol), ophthalmic preparations (sulphacteamine), aerosols (salbutamol), blood products and reporting protocols.

#### **UNIT-V**

**9 hrs.**

Concept and scope of environmental chemistry –nomenclature –environmental segments –  
The natural cycles of the environment -the hydrological cycle –the oxygen cycle –the nitrogen cycle.

Classification of water pollutants –Characterization –Dissolved Oxygen –BOD-COD- Waste water treatment (General). Disposal of radioactive wastes. Pollution due to some typical industries like Textile, Pulp and Paper, Electroplating, Dairy, Cane sugar

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**SEMESTER –IV**

**Laboratory Course - V**

**Practical-V      Analysis of Bio Products      30 hrs. (2 h / w)      Max.marks : 50M**

Identification and estimation of the following:

1. Carbohydrates – qualitative and quantitative.
2. Lipids –qualitative.
3. Determination of the iodine number of oil.
4. Determination of the saponification number of oil.
5. Determination of cholesterol using Liebermann-Burchardreaction.
6. Proteins –qualitative.
7. Isolation of protein.
8. Determination of protein by the Biuret reaction.
9. Determination of nucleic acids

**Suggested Readings:**

1. T. G. Cooper: Tool of Biochemistry.
2. Keith Wilson and John Walker: Practical Biochemistry.
3. Alan H Gowenlock: Varley's Practical Clinical Biochemistry.
4. Thomas M. Devlin: Textbook of Biochemistry.
5. Jeremy M. Berg, John L Tymoczko, Lubert Stryer: Biochemistry.
6. G. P. Talwar and M Srivastava: Textbook of Biochemistry and Human Biology.
7. A.L. Lehninger: Biochemistry.
8. O. Mikes, R.A. Chalmers: Laboratory Handbook of Chromatographic Methods.
9. Environmental chemistry by A.K. De
10. A text book of Engineering chemistry by S.S. Dara
11. A text book of Industrial chemistry by B.K.Sharma

## SCHEME OF VALUATION

Max. Marks: 50

- |                          |       |          |
|--------------------------|-------|----------|
| 1. Quantitative Analysis | ....  | 15 Marks |
| 2. Qualitative Analysis  | ..... | 15 Marks |
| 3. Viva – Voice          | ..... | 10 Marks |
| 4. Record                | ..... | 10 Marks |

**P. R. GOVERNMENT COLLEGE, KAKINADA**  
**MODEL QUESTION PAPER**  
**SEMESTER – IV**  
**Paper - V (ANALYTICAL CHEMISTRY-5)**  
**ANALYTICAL BIOCHEMISTRY AND ENVIRONMENTAL CHEMISTRY**  
**Duration: 2hrs. 30Min.** **Max. Marks: 60**

**SECTION – A**

Answer any **FOUR** questions. Each question carries **10** marks.

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1. Question from Unit –I
2. Question from Unit –II
3. Question from Unit –III
4. Question from Unit - IV
5. Question from Unit – V
6. Question from Unit – I
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**SECTION – B**

Answer any **four** questions. Each question carries **5** marks.

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**SEMESTER –IV**  
**Paper - V (ANALYTICAL CHEMISTRY-5)**  
**ANALYTICAL BIOCHEMISTRY AND ENVIRONMENTAL CHEMISTRY**  
**Duration: 2hrs. 30Min. Max. Marks: 60**

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**SEMESTER – IV**  
**Paper - V (ANALYTICAL CHEMISTRY-5)**  
**ANALYTICAL BIOCHEMISTRY AND ENVIRONMENTAL CHEMISTRY**  
**Duration: 2hrs. 30Min.** **Max. Marks: 60**

**Question Bank**

**Essay Questions:10 M**

1. Write about the isolation and characterization of polysaccharides
2. Write about the classification and functions of lipids
3. Explain about the classification and isolation of proteins
4. Write about the classification of enzymes and explain the effect of pH & temperature on enzymes
5. Write about composition of blood and explain about coagulation of blood
6. Explain about the collection and preservation of urine samples
7. Explain about the estimation of constituents in pathological urine.
8. Write about the collection and preservation of blood samples
9. Explain about the estimation and interpretation of blood sugar and cholesterol
10. Write about the microbiological assay of antibiotics
11. Explain about the determination of thiomersal.
12. Explain about the analytical methods of Aspirin tablet
13. Write about the analytical methods of Rifampicin capsule
14. Explain about the Oxygen cycle
15. Write about the nitrogen cycle
16. Explain about waste water treatment
17. Explain the methods of determination of DO and COD
18. Write about the water pollutants released from various industries

## **Question Bank:**

### **Short answer Questions: 05 M**

1. Write the biochemical functions of steroid hormones
2. Explain about the structure of proteins
3. Write about peptide hormones
4. Explain about enzyme inhibition
5. Write about the functions of blood
6. Explain about anemia.
7. Write about the estimation of bilirubin
8. Explain about the estimation of creatinine
9. Write about the formation of urine
10. Explain about the total microbial count
11. Explain about the microbial limit test
12. Write about the preparation of saline solution
13. Explain about mouth washes.
14. Write briefly about environmental segments
15. Explain about the classification of water pollutants
16. Define DO and COD and write their significances.
17. Explain about the disposal of radiochemical wastes
18. Explain about hydrogen cycle