

**PITHAPUR RAJAH'S GOVERNMENT COLLEGE
(AUTONOMOUS)**

KAKINADA - 533 001, EAST GODAVARI, A.P.

Affiliated to Adikavi Nannaya University

NAAC Accredited with "A" Grade (3.17 CGPA)

BOARD OF STUDIES OF CHEMISTRY

B.Sc. ANALYTICAL CHEMISTRY Under CBCS

Meeting Minutes/Resolutions



Convened on 03 November 2022

**DEPARTMENT OF ANALYTICAL CHEMISTRY
P. R. GOVT. COLLEGE (Autonomous)**

**Opp. Mc Laurin High School, Raja Ram Mohan Roy Road,
Kakinada**

WWW.PRGC.AC.IN; E-MAIL: CHEMISTRY_DEPT@PRGC.AC.IN

**PROCEEDINGS OF THE PRINCIPAL
P.R. GOVERNMENT COLLEGE(A), KAKINADA-A. P
PRESENT: DR. B. V. TIRUPANYAM, M.SC.; PH.D.**

R.C.No.12A/A.C./BOS/2022-23, Dated: 24.09.2022

SUB: P.R. Government College(A), Kakinada-UG Board of Studies (BOS)-
Program/Course-B.Sc., /Analytical chemistry, Nomination of Members-Orders issued.

REF: 1. UGC Guidelines of for Autonomous Colleges-2018.

ORDERS: The Principal, P.R. Government College(A), Kakinada is pleased to constitute UG Boards of Studies in Analytical chemistry for framing the syllabi in Analytical chemistry Subject for Semesters duly following the norms of the UGC Autonomous guidelines.

S. No	Name of the Nominee	Designation
1	Dr. D. Chenna Rao	Chairman & Lecturer In charge.
2	Dr. K. Jhansi Lakshmi	University Nominee Lecturer in Chemistry ASD Govt. Degree College Women (Autonomous), Kakinada.
3	Sri. U. Sai Krishna	Subject Expert Lecturer in Chemistry, Govt.College(A), Rajamahendravaram
4	Dr. B. Ramesh Babu	Representative from Industry Founder & M.D., BogaR laboratories, Peddapuram. Ph: 9701712028.
5	V. Sanjeeva Kumar	Member
6	T.V.V. Satya Narayana	Member
7	P. Vijay Kumar	Member
8	V. Rambabu	Member
9	G. Pavani	Member
10	Dr. N. Bujji Babu	Member
11	Dr. Ch. Praveen	Member
12	V. Venkateswara Rao	Member
13	B. Bhavani	Member
14	G. Surya Priya	Student Alumni Member
15	B. Balaji II MCAC	Student Member
16	R. Aditya Naidu II MCAC	Student Member

The above members are requested to attend the BoS meeting on _____ 2022 and share their valuable reviews, and suggestions on the following functionaries.

- Prepare syllabi for the subject keeping in view the objectives of the college, interest of the stake holders and National requirement for consideration and approval of the IQAC and Academic Council.
- Suggested methodologies for innovative teaching and evaluation techniques.
- Suggest the panel of Names to the academic council for appointment of Examiners.
- Coordinate research, teaching, extension and other activities in the Department of the college.


PRINCIPAL
P. R. Government College(A),
Kakinada

Vision and mission of the college:

Vision



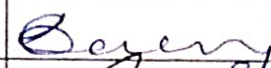
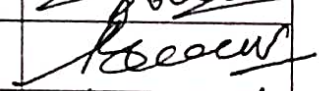
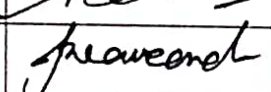
To provide the right academic environment paving way for intellectual excellence, humane feelings and social commitment. The college believes in providing quality education for the socially disadvantaged, economically weaker sections of the society and thereby help them move up the ladder of success and social order.

Mission

- ➔ To impart holistic education with special emphasis on character, culture, updated knowledge and skill-oriented learning.
- ➔ To make the students enjoy the fruits of globalization without prejudice to their local and cultural environment.
- ➔ To impart necessary life skills so as to make them face any challenge in the bigger world – Social, ethical, psychological or professional.

Signatures of the members who attended the

Board of studies in Analytical Chemistry 03- 11 -2022 at 10.00 AM

S. No.	Name of the member	Designation	Signature
1	Dr. D. Chenna Rao	Chairman, Board of Studies, Lecturer in charge	 03/11/2022
2	Dr. K. Jhansi Lakshmi	University Nominee Lecturer in Chemistry, ASD Govt Degree college for women(A),Kakinada	K. Jhansi Lakshmi 3/11/22
3	Sri U. Sai Krishna	Subject Expert Lecturer in Chemistry, Govt.College(A), Rajamahendravaram	U. Sai Krishna 3/11/22
4	Dr. B. Ramesh Babu	Representative from Industry Founder & M.D., BogaR laboratories, Peddapuram. Ph: 9701712028.	
5	Sri. V.Sanjeewa Kumar	Member Lecturer in Chemistry	V. S. K.
6	Sri. T.V.V. Satyanarayana	Member Lecturer in Chemistry	T.V.V. Satyanarayana
7	Sri. P. Vijaya Kumar	Member Lecturer in Chemistry	P. Vijaya Kumar 3/11/22
8	Sri. V. Rambabu	Member Lecturer in Chemistry	
9	Sri.G.Pavani	Member Lecturer in Chemistry	G. Pavani 3/11/22
10	Dr. N. Bujji Babu	Member Lecturer in Chemistry	
11	Dr. Ch. Praveen	Member Lecturer in Chemistry	
12	V. Venkateswara Rao	Member Lecturer in Chemistry	V. Venkateswara Rao
13	G. Surya Priya	Student Almuni	
14	B. Balaji II MCAC	Student Member	
15	R. Aditya Naidu II MCAC	Student Member	

P.R. GOVT.COLLEGE (A), KAKINADA
DEPARTMENT OF ANALYTICAL CHEMISTRY

Minutes of board of studies (BOS) meeting

2022-23 on ---- 2022

Meeting of Board of Studies in analytical chemistry is convened on -----
through offline at P.R. Govt. College (A), Kakinada, .

Venue: Conference Hall, Dt: -----.

- The Principal Dr. B.V. Tirupanyam,
- Chairman, Dr. D. Chenna Rao Chairman and lecturer in charge,
- University Nominee: Dr. K. Jhansi Lakshmi,
Lecturer in Chemistry, ASD Govt. Degree College women's (Autonomous),
Kakinada.
- Industrialist Dr. B. Ramesh Babu, Founder & M.D., Boger laboratories,
Peddapuram,
- Subject Expert: Sri. U. Sai Krishna Lecturer in Chemistry, Government Degree College
Rajamahendravaram

All the faculty members of Chemistry Department and student alumni
attended the meeting

Agenda:

- To discuss the Semester System and Choice Based Credit System (CBCS) being implemented for the past 06 years, i.e., w.e.f. 2015-16.
- To discuss and approve the Continuation/Modifications of the syllabus for the Odd & Even Semesters of I, III & V Years for 2022-23.
- Grant of Extra credits for Online SWAYAM MOOCs etc.
- Syllabus, Model Question Papers and Model Blue Prints for I, II, III, IV, V and VI Semesters.
- Teaching learning methodology by 60:40 (External: Internal) ratio for the present II- and III-Year Students and 50:50 (External: Internal) ratio I Year Students w.e.f. 2022-23.
- Panel of paper setters and examiners.
- Proposals for Community Service Projects/Extension activities for the benefit of the society.
- Department action plan for 2022-23.

RESOLUTIONS:

The following agenda items are discussed and resolutions are made.

- It is resolved to continue choice-based credit system in the chemistry combination programmes as per the directions of the CCE, Vijayawada to the first year and second year and final year student's w.e.f. 2018-19.
- It is resolved to approve the Continuation/Modifications of the syllabus for the Odd & Even Semesters of I, II & III Years for 2021-22.
- It is resolved to encourage students to active participation in various activities and give extra credits for students after successful completion of a particular activity such as SWAYAM, MOOCs etc., (Annexure –II)
- It is Resolved to follow 60%-40% external and internal w.e.f. 2017-2018 admitted batches and it continued in present second- and third-year students.
- It is resolved to follow 50%-50% external and internal for first year w.e.f 2021-22 admitted batch.
- It is resolved that every student should maintain 75% attendance for both theory and practical's in order to attend the Mid and Semester examination.
- It is resolved to conduct departmental activities such as OZONE DAY, CHEM FEST, CHEMISTRY DAY and SCIENCE DAY. (Annexure-I)

- It is resolved to implement the recommended andragogy for the first semester 2022-23 9. Resolved to conduct practical examinations semester wise.
- It is resolved to organize guest lectures by eminent professors.
Resolved to implement pass minimum for internal assessment for CBSE pattern students as the pattern is learner oriented.
- It is resolved to maintain status quo for same question paper pattern in II, III years.
The following paper setters are recommended

- **Resolutions:**

1. Sri. U. Sai Krishna, Govt. College(A), Rajamahendravaram.
2. Dr. M. Trinadh, Govt. College(A), Rajamahendravaram
3. Dr. V. Narayana Rao, GDC, Perumal Puram.
4. Sri. M. Sudhakar, Govt. College(A), Rajamahendravaram.
5. Sri. K. Anand, GDC, Pithapuram.
6. Dr. CH. Vijay Vardhan, GDC, Perumal Puram.
7. Sri B. Surendra, GDC, Tadepaliigudem.

YEAR	SEMESTER	PAPER	TITLE	MARKS	CREDITS	
I	I	I	Basic Principles & Laboratory Operations	100 50:50	04	
			Practical - I	50	02	
	II	II	Quantitative Methods Of Analysis	100 50:50	04	
			Practical - II	50	02	
II	III	III	Separation Methods - I	100 50:50	04	
			Practical - III	50	02	
	IV	IV	Separation Methods - II	100 50:50	04	
			Practical - IV	50	02	
		V	V	Analytical Biochemistry and Environmental Chemistry	100 60:40	04
				Practical - V	50	02
III	V	VI	Instrumental Methods of Analysis	100 60:40	04	
			Practical - VI	50	02	
		VII	VII	Analysis of Applied Industrial Products	100 60:40	04
				Practical - VII	50	02

B.Sc. Analytical chemistry
Syllabus & Model papers
Question Bank



Pithapur Rajah's Government College (Autonomous) Kakinada

Program & Semester
I B.Sc. Mathematics,
Chemistry, Analytical
chemistry & Semester-I

Course Code	Basic laboratory operations				
Teaching	Hours Allocated: 60 (Theory)	L	T	P	C
Pre-requisites:	Primary secondary standard solutions and molarity, ppm	60	10	30	4+2

Course Objectives:

To gain basic knowledge and handling of laboratory apparatus.

Course Outcomes:

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

C01	Analytical chemistry is an applied, experimental field of science and is based not only on chemistry, but also on physics, biology, information theory and many fields of technology.
C02	Gains knowledge on chemical analysis
C03	Understand and calibrations of common laboratory apparatus
C04	Gains knowledge on errors in chemical analysis
C05	Gains knowledge on quantitative methods of analysis

Course with focus on employability / entrepreneurship / Skill Development modules

Skill Development		Employability		Entrepreneurship	
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Syllabus:

UNIT-1

(12hrs)

A. SI Units:

Definitions of the Seven Base Units (Mass, Length, Time, Temperature, Amount of substance, Electrical current and Luminous intensity).

Derived units, Conversion between units.

B. CHEMICAL CONCENTRATIONS:

- Mole, Molar mass
- Calculations in grams and moles
- Solutions and their concentrations:
 - a) Molar concentration
 - b) Analytical molarity
 - c) Equilibrium molarity of a particular species

- d) Percent concentration
- e) Parts per million/billion (ppm, ppb)
- f) Volume ratios for dilution procedures,
- g) p-functions.

C. Preparation of solutions: standard solutions, primary standards, secondary standards and their preparations.

UNIT - II

12 HRS

INTRODUCTION TO ANALYTICAL CHEMISTRY AND ANALYTICAL METHODS -I:

- General steps in chemical analysis
- Introduction to methods of detecting analytes Physical, Electromagnetic radiations and Electric charge
- Single pan analytical balance: (operation and theory of the balance, construction details, errors in weighing, care of an analytical balance).

UNIT -III

12HRS

INTRODUCTION TO ANALYTICAL CHEMISTRY AND ANALYTICAL METHODS - II;

A. Description and use of common laboratory apparatus:

- Volumetric flasks, burettes, pipettes,
- Meniscus readers, weighing bottles, funnels, desiccators, drying ovens, filter crucibles, rubber policeman.
- Calibration of volumetric glass ware – Volumetric flask, Burette and Pipette.

B. pH meter: components of pH meter, use of pH Meter, maintenance of pH meter, applications.

UNIT-IV

12 HRS

ERRORS IN CHEMICAL ANALYSIS:

- Accuracy and Precision, Absolute and relative uncertainty, Types of errors
- Significant figures and Computation rules
- The Gaussian distribution, mean and standard deviation.
- Statistical tests of data (the F test, the t test, Q test for bad data).
- Safety with chemicals and waste in Laboratory.

PRINCIPLES OF THERMOGRAVIMETRY:

Thermal methods of analysis

- Principles of TGA, application of TGA to $\text{CaC}_2\text{O}_4 \cdot \text{H}_2\text{O}$.
- Principles of DTA, Application of DTA to $(\text{CH}_3\text{COO})_2\text{Ca} \cdot \text{H}_2\text{O}$.
- Thermometric titrations and application of Thermometric titrations (HCl vs. NaOH Thermometric titrations).

Reference books

1. Seamus P.J. Higson: Analytical Chemistry.
2. Douglas A. Skoog and Donald M. West: Fundamentals of Analytical Chemistry.
3. Adion A. Gordus: Schaum's Outline of Analytical Chemistry, Tata McGraw-Hill.
4. Gary D. Christian: Analytical Chemistry.

Weblink's:

1. <https://youtu.be/lrgMPIbL7yM>
2. <https://youtu.be/BQjTtIaP01g>
3. <https://youtu.be/NzbDEjI8IKE>

ACTIVITIES & BENCHMARKS PROPOSED

1. Assignments
2. Seminars
3. Group Discussion
4. Quiz

CO-PO Mapping:

Program Outcomes B.Sc. (Chemistry):

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

PO: 1 Have firm foundations in the fundamentals and application of current chemical and scientific theories.

PO: 2 An understanding of major concepts, theoretical principles and experimental findings in chemistry.

PO: 3 Are able to design, carry out, record and analyze the results of chemical experiments

PO: 4 Are able to use modern instrumentation and classical techniques, to design experiments, and to properly record the results of their experiment.

PO: 5 Are skilled in problems solving, critical thinking and analytical reasoning.

PO: 6 Are able to identify and solve chemical problems and explore new areas of research.

PO: 7 Are able to use modern library searching and retrieval methods to obtain information about a topic, chemical, chemical technique, or an issue relating to chemistry.

PO: 8 Knows the proper procedures and regulations for safe handling and use of chemicals and can follow the proper procedures and regulations for safe handling when using chemicals

PO: 9 Are able to communicate the results of their work to chemists and non-chemists.

PO: 10 Understand the ethical, historic, philosophical, and environmental dimensions of problems and issues facing chemists.

PO: 11 Find gainful employment in industry or government, be accepted at graduate or professional schools (law, medicine, etc.), or find employment in school systems as instructors or administrators.

PO: 12 Are able to pursue Higher education in Chemistry and other disciplines of inter disciplinary

Weightage to content

Semester -I

Paper-I

S. No	Course Content	Long Answer	Short Answer	Total marks	As per Blooms Taxonomy
1	SI units & Chemical concentrations	2	1	25	Understanding, Application
2	Introduction to Analytical chemistry and analytical method-1	1	2	20	Remembering, Understanding
3	Introduction to Analytical chemistry and analytical method-2	1	1	15	Application & Creation
4	Errors in Chemical analysis	1	1	15	Remembering, Understanding
5	Principles of thermogravimetry	1	2	20	Application & Creation
	TOTAL	6	7	95	

P. R. GOVERNMENT COLLEGE (A), KAKINADA

(B.Sc. Analytical Chemistry -1) SEMESTER -I

LABORATORYCOURSE-I

30 hrs. (2 h/w)

Practical-I (At the end of Semester-I) Max Marks:50 M

- 1. Calibration of volumetric equipment:**
 - i. Volumetric flasks,**
 - ii. Pipette's**
 - iii. Burettes.**
- 2. Preparation of standard solutions:**
 - i. Preparation of standard acid solutions**
 - ii. Preparation of standard base solutions**
- 3. Estimation of sodium carbonate by titrating with hydrochloric acid (HCl).**
- 4. Preparation of standard EDTA solution.**
- 5. Preparation of buffer solutions.**
- 6. Determiation of HCl by using standard NaOH solution**

SUGGESTED BOOKS

- 1. Seamus P.J. Higson: Analytical Chemistry.**
- 2. Douglas A. Skoog and Donald M. West: Fundamentals of Analytical Chemistry.**
- 3. Adion A. Gordus: Schaum's Outline of Analytical Chemistry, Tata McGraw-Hill.**
- 4. Gary D. Christian: Analytical Chemistry.**
- 5. Frei Felder and Kealy: Analytical Chemistry.**
- 6. Daniel C Harris: Exploring Chemical Analysis.**
- 7. Daniel C Harris: Quantitative Chemical Analysis.**

**P. R. GOVERNMENT COLLEGE, KAKINADA MODEL QUESTION PAPER
SEMESTER - I**

**Paper -I (ANALYTICAL CHEMISTRY-1)
BASIC PRINCIPLES AND LABORATORY OPERATIONS**

Duration: 2hrs. 30Min.

Max. Marks: 50

SECTION - A

Answer any THREE questions. Each question carries 10 marks. 3 X 10 = 30M

GROUP -I

- 1. Any Question from Unit -I**
- 2. Any Question from Unit -II**
- 3. Any Question from Unit -III**

GROUP -II

- 4. Any Question from Unit - IV**
- 5. Any Question from Unit - V**
- 6. Any Question from Unit -I**

SECTION - B

Answer any FOUR questions. Each question carries 5 marks. 4 x 5 = 20M

- 7. Any Question from Unit - I**
- 8. Any Question from Unit - II**
- 9. Any Question from Unit - III**
- 10. Any Question from Unit - IV**
- 11. Any Question from Unit - V**
- 12. Any Question from Unit - II**
- 13. Any Question from Unit - IV**

P. R. GOVERNMENT COLLEGE, KAKINADA SEMESTER - I
Paper -I (ANALYTICAL CHEMISTRY - 1)
(BASIC PRINCIPLES AND LABORATORY OPERATIONS)

QUESTION BANK ESSAY QUESTIONS - 10 Marks

UNIT-1

1. Explain Primary standard solutions with examples and write the experimental procedure for preparation of a primary standard solution.
2. Explain Secondary standard solutions with examples and write the experimental Procedure for Preparation of a secondary standard solution.
3. What are Standard Solutions? Explain Primary and Secondary standard solutions with examples.

UNIT-2

4. Explain the methods of detecting analytes based on Physical means and Electromagnetic radiations.
5. Explain the methods of detecting analytes based on Electromagnetic radiations and Electric Charge.
6. What is an analyte? Explain the different methods of detecting analytes.
7. Explain briefly about Single pan analytical balance.

UNIT-3

8. Explain about the Calibration of volumetric glass ware.
9. Explain about the description and use of
 - i). Volumetric flask, ii). Burette and iii). Pipette.
10. Explain in detail about the pH meter and its components

UNIT-4

11. What are Significant figures? Write the computation rules for significant figures.

UNIT-5

12. Write the Principles and applications of Thermometric titrations
13. Explain the Principle, Experimental set up and application of TGA
14. Explain the principle, Experimental set up and application of DTA

QUESTION BANK SHORT ANSWER QUESTIONS -05MARKS:

UNIT-1

1. What are Base units? Explain briefly
2. Explain briefly about Derived units.
3. Explain about Mole and Molar mass
4. Explain about the Molar concentration, Analytical Molarity and Equilibrium Molarity
5. Explain about the Percent concentration, Parts Per Million (ppm) and p-functions.

UNIT-2

6. Write about the General steps involved in chemical analysis.
7. What is analyte? Explain briefly about the methods of detecting analytes.
8. Explain briefly about Care and errors in weighing in Analytical balance

UNIT-3

9. Describe briefly about any two common laboratory glassware items.
10. Write the uses of common Laboratory apparatus.
11. Write the use and applications of pH Meter
12. Write about the description and use of Weighing bottle and Funnel

UNIT-4

13. Write briefly about Safety with chemicals and waste in Laboratory.
14. Explain about Mean and Standard deviation.
15. Explain briefly about Accuracy and Precision.
16. Explain about the Gaussian distribution.
17. Explain briefly about F test and t - test.

UNIT-5

18. Explain briefly about Thermometric titrations
19. What are Thermal methods? Explain briefly.



**Pithapur Rajah's Government College
(Autonomous) Kakinada**

**Program & Semester
IIB.Sc. Mathematics,
Chemistry, Analytical
chemistry
Semester-III
(P-III)**

CourseCode	SEPARATION METHODS - I				
Teaching	Hours Allocated: 60 (Theory)	L	T	P	C
Pre-requisites:	Separation methods chromatography techniques (paper, column, TLC, HPLC, partition, and adsorption)	60	10	30	4+2

Course Objectives:

To gain knowledge on chromatography and separation of liquid mixtures.

Course Outcomes:

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

C01	Gains knowledge on extraction based on densities of liquids
C02	Understand the basic knowledge on chromatography
C03	Gains knowledge on separation of compounds by Paper & Thin layer chromatography
C04	Understand the separation of compounds by column chromatography
C05	Gains knowledge on separation of compounds by partition and adsorption chr

Course with focus on employability / entrepreneurship / Skill Development modules

Skill Development		Employability		Entrepreneurship	
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Unit: I

12hrs

SOLVENT EXTRACTION:

Introduction, principle, techniques, factors affecting solvent extraction. Different types of Solvent extraction techniques- Batch extraction, continuous extraction and counter current extraction.

Application - Determination of Iron (III)

Unit: 2

CHROMATOGRPY:

12 hrs

A. Classification of chromatographic methods: Principle of differential migration, description of the chromatographic process, distribution coefficients.

B. Chromatography – theory and practice: Introduction, the chromatograph (elution time and volume), Capacity factor column efficiency and resolution.

Unit 3:

12hrs

CHROMATOGRAPHY

A. Techniques of paper chromatography: Experimental modifications, various modes of development, nature of the paper, detection of spots, retardation factors, factors that affect the reproducibility of R_f values (due to paper, solvent system, sample, development procedure), selection of solvent, quantitative analysis. Applications.

B. Thin layer chromatography: stationary phase, adsorbents, liquid phase supports, plate preparation, mobile phase, sample application, development, saturation of chamber, detection of spot, R_f values (effect of adsorbent, solvent, solute, development process). Quantitative analysis: applications

Unit 4:

12hrs

COLUMN CHROMATOGRAPHY.

A. General: columns, matrix materials, stationary phase, column packing, application of sample, column development and sample elution, detectors and fraction collectors, applications

HPLC

B. High performance liquid chromatography: Principle, column, matrices and stationary phases, column packing, mobile phase and pumps, application of sample, detectors, applications

Unit 5:

12hrs

CHROMATOGRAPHY

A. Partition chromatography: Principle of liquid - liquid partition chromatography, Normal phase chromatography, Reversed phase liquid chromatography, applications.

B. Adsorption chromatography: Principle, adsorbents, solvents, nature of solute, operating parameters, retention volumes and times, applications.

Reference books

F.W. Fifield and D. Kealy: Analytical Chemistry.

Daniel C Harris: Exploring chemical analysis.

Daniel C Harris: Quantitative chemical analysis.

R.V. Dilts Analytical Chemistry- Methods of Separation.

O. Mikes, R.A. Chalmers: Laboratory Handbook of Chromatographic Methods

Weblink's:

1. <https://youtu.be/gaBXQW9rCDA>

2. https://youtu.be/hj4uq29_qLw

3. <https://youtu.be/6mDhFgBl1T4>

ACTIVITIES & BENCHMARKS PROPOSED (TABLE)

1. Assignments
2. Seminars
3. Group Discussion
4. Quiz

CO-PO Mapping:

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

Program Outcomes B.Sc. (Chemistry):

Undergraduate students upon graduation with a B.Sc. degree in chemistry:

PO: 1 Have firm foundations in the fundamentals and application of current chemical and scientific theories.

PO: 2 An understanding of major concepts, theoretical principles and experimental findings in chemistry.

PO: 3 Are able to design, carry out, record and analyze the results of chemical experiments

PO: 4 Are able to use modern instrumentation and classical techniques, to design experiments, and to properly record the results of their experiment.

PO: 5 Are skilled in problems solving, critical thinking and analytical reasoning.

PO: 6 Are able to identify and solve chemical problems and explore new areas of research.

PO: 7 Are able to use modern library searching and retrieval methods to obtain information about a topic, chemical, chemical technique, or an issue relating to chemistry.

PO: 8 Knows the proper procedures and regulations for safe handling and use of chemicals and can follow the proper procedures and regulations for safe handling when using chemicals

PO: 9 Are able to communicate the results of their work to chemists and non-chemists.

PO: 10 Understand the ethical, historic, philosophical, and environmental dimensions of problems and issues facing chemists.

PO: 11 Find gainful employment in industry or government, be accepted at graduate or professional schools (law, medicine, etc.), or find employment in school systems as instructors or administrators.

PO: 12 Are able to pursue Higher education in Chemistry and other disciplines of inter disciplinary

Weightage to content

Semester -III

Paper-III

S. NO	Course Content	Long Answer	Short Answer	Total marks	As per Blooms Taxonomy
1	Solvent Extraction	1	1	15	Understanding, Application
2	Chromatography	1	2	20	Remembering, Understanding
3	Chromatography (paper and TLC)	2	3	35	Application & Creation
4	Column and HPLC	2	1	25	Remembering, Understanding
5	Partition and Adsorption chromatography	2	1	25	Application & Creation
	TOTAL	8	8	120	

P.R. GOVERNMENT COLLEGE (A) KAKINADA
B.Sc. (Analytical Chemistry)

SEMESTER-III

LABORATORY COURSE-III 30 hrs. (2h/w)

Max Marks: 50 M

Practical-III: Separation techniques

(At the end of Semester-III)

1. Determination of R_f value of amino acids using paper chromatography.
2. Separation and identification of monosaccharide present in a given mixture by paper chromatography.
3. Determination of Fe (III) by solvent Extraction
4. Separation of organic mixture through acid/base solvent extraction
5. Analysis of soil
 - i) Determination of pH of soil
 - ii) Determination of total soluble salts.
 - iii) Determination of carbonate and bicarbonate
 - iv) Determination of calcium magnesium and iron'
6. Determination of adulterant in some common food items:
 - i) Chicory in coffee powder
 - ii) Foreign resin in asafoetida
 - iii) Chilli powder
 - iv) Turmeric powder
 - v) Pulses

Suggested Readings:

1. F.W. Fifield and D. Kealy: Analytical chemistry
2. Daniel C Harris: Exploring chemical analysis
3. Daniel C Harris: Quantitative chemical analysis.
4. R.V. Dilts Analytical chemistry-Methods of Separation.
5. O. Mikes, R.A. Chalmers: Laboratory Handbook of Chromatographic methods

P. R. GOVERNMENT COLLEGE, KAKINADA

MODEL QUESTION PAPER

SEMESTER - III

Paper -III (ANALYTICAL CHEMISTRY-3)

SEPARATION METHODS-I

Duration: 2hrs. 30Min.

Max. Marks: 60

SECTION - A

Answer any FOUR questions. Each question carries 10 marks. 4 X 10 = 40M

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

SECTION - B

Answer any FOUR questions. Each question carries 5 marks. 4 x 5 = 20M

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

P. R. GOVERNMENT COLLEGE, KAKINADA
SEMESTER – III
Paper- III (ANALYTICAL CHEMISTRY-3)
SEPARATION METHODS-I

Duration: 2hrs. 30Min.

MAX MARKS 60M

QUESTION BANK

ESSAY QUESTIONS – 10 MARKS:

UNIT-I

1. Explain the principles and applications of Solvent extraction.
2. Explain the principle and experimental techniques of solvent extraction
3. Explain about different types of Solvent extraction techniques.

UNIT-II

4. Explain about the Principle and classification of Chromatographic methods
5. Explain about the theory and description of Chromatographic process

UNIT-III

6. Write about various modes of developments in Paper chromatographic technique.
7. Explain about the principle, experimental set up and applications of Paper chromatography.
8. Explain about principle, experimental set up and applications of TLC.
9. Explain briefly about Plate preparation, Adsorbents and development process in TLC

UNIT-IV

10. Explain about the principle and application of Column chromatography.
11. Explain the principle, Column packing and column developments in Column chromatography.
12. Explain the principle, Experimental set up and applications of HPLC
13. Write about Columns and detectors used in HPLC
14. Explain briefly about HPLC Chromatographic technique

UNIT-V

15. Explain about the Principle, Adsorbents, Solvents used in Adsorption Chromatography.
16. Explain about the principle and applications of Adsorption chromatography
17. Write about Principle and applications of Liquid –liquid partition chromatography.
18. Explain about Normal phase and Reversed - phase chromatographic technique

SHORT ANSWER QUESTIONS – 05MARKS:

UNIT-I

1. Explain factors affecting solvent extraction.
2. How do you determine Fe (III) by using solvent extraction technique?
3. Explain the principle and applications of solvent extraction.

UNIT-II

4. Explain briefly about efficiency of a chromatographic column.
5. What are distribution coefficients? Explain briefly
6. Write about the principle of differential migration.
7. Explain briefly about Resolution and capacity factor.

UNIT-III

8. Write about nature of paper, detection of spots in paper chromatography.
9. Explain about the Quantitative analysis of Paper chromatography.
10. Write about Quantitative analysis of TLC.
11. Explain about Sample application and plate preparation in TLC.
12. Explain about Stationary phase, Support materials and Liquid phases in TLC.
13. Define R_f value and write its significance.

UNIT-IV

14. Write about Columns and Column packing in Column chromatography.
15. Explain about Column development and sample elution in Column chromatography.
16. Explain about various Detectors used in HPLC.
17. Write about Stationary phases and Mobile phases used in HPLC.
18. Explain about Retention volumes and Retention times.

UNIT-V

19. Write the principle and applications of Adsorption chromatography
20. What are the differences between NPC and RPC?
21. Explain the principle of Partition chromatography.



**Pithapur Rajah's Government College
(Autonomous) Kakinada**

**Program & Semester
IIB.Sc. Mathematics,
Chemistry, Analytical
chemistry
Semester-V
(P-VI)**

CourseCode	INSTRUMENTAL METHODS OF ANALYSIS-VI				
Teaching	Hours Allocated: 60 (Theory)	L	T	P	C
Pre-requisites:	Spectroscopic methods: UV-VISIBLE, IR, ATOMIC EMISSION, ATOMIC ABSORPTION, POLAROGRAPHY AND BASIC ELECTRO-ANALYTICAL CHEMISTRY	60	10	30	4+2

Course Objectives:

1. To gain knowledge on spectroscopy and electro analytical chemistry.
2. Gains basic knowledge on Separation techniques and their Classification.
3. Gains knowledge on Different chromatographic techniques and their applications.

Course Outcomes:

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

C01	Understand the U.V -visible & I.R spectroscopy
C02	Gains knowledge on emission spectroscopy
C03	Gains knowledge on absorption spectroscopy
C04	Gains knowledge on polarography and coulometry
C05	Gains knowledge on basic electro analytical chemistry
C06	Are able to use modern instrumentation and classical techniques, to design experiments, and to properly record the results of their experiment.

Course with focus on employability / entrepreneurship / Skill Development modules

Skill Development		Employability		Entrepreneurship	
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UNIT 1:

UV - VISIBLE SPECTROPHOTOMETRY: 9HRS

Principle, Lambert-Beer's law and its deviations, UV- Visible spectrophotometer Instrumentation - sources, detectors, Single and double beam spectrophotometers and its applications

IR SPECTROSCOPY: Principle, Instrumentation - Sources, detectors and applications

Unit 2:

ATOMIC EMISSION SPECTROSCOPY (Flame photometry): 9hrs

Principle - Instrumentation - Interferences - Analytical techniques for Flame photometry - Calibration plots (Working curves). Applications - Determination of Alkali and Alkaline earth metals in natural water

Unit 3:

ATOMIC ABSORPTION SPECTROSCOPY: AAS 9hrs

Principle - Instrumentation - Radiation sources (line sources) - Hollow cathode lamps and Discharge lamps. Interferences - Analytical techniques for AAS - Calibration plots. Applications - Determinations of Calcium and Magnesium in tap water.

Unit4: (9hrs)

POLOROGRAPHY AND COULOMETRY:

Polarography:

Basic Principles of Polarography, residual current, migration current, diffusion current, half wave potential, Ilkovic equation.

Instrumentation, Dropping mercury electrode (DME), advantages and disadvantages of DME, Qualitative and quantitative analysis of inorganic ions.

Coulometry:

Types of coulometric methods: Potentiostatic and amperostatic; principles, instrumentation and application

Unit-V:

9hrs

Electrochemical cells, Electrode potentials, cell potentials, Nernst equation, Determination of EMF of cell, Applications of EMF measurements – Potentiometric titrations.

Ion selective electrodes: Reference electrodes – Hydrogen electrode, Calomel electrode, silver chloride electrode. Indicator electrodes –Hydrogen and glass electrodes, Metal –metal ion electrode, inert electrode, Applications of ion selective electrodes.

Reference books :

P.W. Atkins: Physical Chemistry.

G.W. Castellan: Physical Chemistry.

C.N. Banwell: Fundamentals of Molecular Spectroscopy.

Brian Smith: Infra-red Spectral Interpretations: A Systematic Approach.

W.J. Moore: Physical Chemistry.

Weblink's:

1. https://youtu.be/3olOk_xNq8g
2. <https://youtu.be/m8LSsdRafLo>
3. https://youtu.be/ck0qEruFy_o

ACTIVITIES & BENCHMARKS PROPOSED (TABLE)

1. Assignments
2. Seminars
3. Group Discussion
4. Quiz

CO-PO Mapping:

CO1	3	2	3	1	3	2	3	2	2	2	3	3	2
CO2	3	3	2	3	2	2	1	2	2	2	3	3	2
CO3	3	3	3	3	3	2	2	2	2	2	3	3	2
CO4	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

Program Outcomes B.Sc. (Chemistry):

Undergraduate students upon graduation with a B.Sc. degree in chemistry:

PO: 1 Have firm foundations in the fundamentals and application of current chemical and scientific theories.

PO: 2 An understanding of major concepts, theoretical principles and experimental findings in chemistry.

PO: 3 Are able to design, carry out, record and analyze the results of chemical experiments

PO: 4 Are able to use modern instrumentation and classical techniques, to design experiments, and to properly record the results of their experiment.

PO: 5 Are skilled in problems solving, critical thinking and analytical reasoning.

PO: 6 Are able to identify and solve chemical problems and explore new areas of research.

PO: 7 Are able to use modern library searching and retrieval methods to obtain information about a topic, chemical, chemical technique, or an issue relating to chemistry.

PO: 8 Knows the proper procedures and regulations for safe handling and use of chemicals and can follow the proper procedures and regulations for safe handling when using chemicals

PO: 9 Are able to communicate the results of their work to chemists and non-chemists.

PO: 10 Understand the ethical, historic, philosophical, and environmental dimensions of problems and issues facing chemists.

PO: 11 Find gainful employment in industry or government, be accepted at graduate or professional schools (law, medicine, etc.), or find employment in school systems as instructors or administrators.

PO: 12 Are able to pursue Higher education in Chemistry and other disciplines of inter disciplinary

Weightage to content

Semester -V

Paper-VI

S. NO	Course Content	Long Answer	Short Answer	Total marks	As per Blooms Taxonomy
1	UV-VISIBLE and IR Spectroscopy	2	2	30	Understanding, Application
2	Atomic Emission Spectroscopy	1	1	15	Remembering, Understanding
3	Atomic Absorption Spectroscopy	1	1	15	Application & Creation
4	Polarography and Coulometry	2	2	30	Remembering, Understanding
5	Basic Electro-Analytical Chemistry	2	2	30	Application & Creation
	TOTAL	8	8	120	

P. R. GOVERNMENT COLLEGE (A), KAKINADA

B. Sc. (Analytical Chemistry

SEMESTER –V

Practical – VI

Instrumental methods of analysis

30 hrs.(2 h/w)

1. Determination of Fe (II) with Cr (VI) by using Potentiometric titration method.
2. Determination of Fe (II) with Mn (VII) by using Potentiometric titration method.
3. Determination of metals in given samples by AAS technique.
4. Preparation of standard calibration graphs of Pb, Cd, Zn and Fe by AAS
5. Determination of Fe (III) by Spectrophotometric method.

Suggested Readings:

1. P.W. Atkins: Physical Chemistry.
2. G.W. Castellan: Physical Chemistry.
3. C.N. Banwell: Fundamentals of Molecular Spectroscopy.
4. Brian Smith: Infra-red Spectral Interpretations: A Systematic Approach.
5. W.J. Moore: Physical chemistry.

P. R. GOVERNMENT COLLEGE, KAKINADA
MODEL QUESTION PAPER
SEMESTER-V Paper - VI (ANALYTICAL CHEMISTRY-6)
INSTRUMENTAL METHODS OF ANALYSIS

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 – IV
8. Question from Unit - V

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 – IV
16. Question from Unit -V

P.R. GOVT COLLEGE(A) KAKINADA

SEMESTER – V

Paper - VI (ANALYTICAL CHEMISTRY-6)

INSTRUMENTAL METHODS OF ANALYSIS

Duration: 2hrs. 30Min.

Max. Marks: 60

Question Bank:

Essay Questions: 10 M

UNIT-I

1. State and Explain Beers –Lamberts law and explain the principle of UV – Visible spectroscopy.
2. Explain about the instrumentation and applications of UV –Visible spectrophotometer.
3. Write about the principle and instrumentation of IR Spectroscopy.
4. Explain about Single beam and double beam spectrophotometers.

UNIT-II

5. Explain about the Principle and instrumentation of Flame photometry
6. Explain about the following,
 - i. Determination of alkali and alkaline earth metals in natural waters by flame photometry
 - ii. Calibration plots in Flame photometry

UNIT-III

7. Explain about the principle and instrumentation of atomic absorption spectroscopy (AAS)
8. Explain about the following, i. Determination of Calcium and Magnesium in tap water by AAS ii. Calibration plots in AASS

UNIT-IV

9. Explain about the principle and instrumentation of Polarography technique.
10. Explain about the following, i. Ilkovic equation ii. Dropping mercury electrode (DME)
11. Explain about the potentiostatic coulometry technique
12. Explain about the amperistatic coulometry technique

UNIT-V

13. Explain about the Nernst equation and its applications
14. Write about potentiometric titrations
15. Explain about the following,
 - i. Reference electrodes ii. Indicator electrodes
16. Explain about the ion selective electrodes and write its application

Question Bank:

Short Answer Questions: 05 M

UNIT-1

1. State Beers – Lamberts law and write its deviations
2. Explain about the photo multiplier tube detector used in Spectrophotometer
3. Write the advantages and disadvantages of double beam Spectrophotometer over single beam spectrophotometer
4. Write the applications of IR spectroscopy

UNIT-II

5. Explain about the interferences and its eliminations in Flame photometry
6. Explain about the calibration plots in Flame photometry
7. Write about the applications of Flame photometry

UNIT-III

8. Explain about the radiation sources used in AAS
9. Write about Hollow cathode lamp
10. Write about the applications of AAS

UNIT-IV

11. Write about qualitative and quantitative applications of Polarography
12. State and explain about Ilkovic equation
13. Explain about Diffusion current and half wave potentials.
14. Explain about residual current and migration current.
15. Write about DME
16. Explain the principles of coulometry
17. Write about the applications of coulometry

UNIT-V

18. Write about electrochemical cells
19. Explain about electrode potentials.
20. What is EMF? Write about cell potential.
21. Explain about Glass electrode.
22. Explain about calomel electrode.
23. Explain about metal-metal ion electrode



**Pithapur Rajah's Government College
(Autonomous) Kakinada**

**Program & Semester
III B.Sc. Mathematics,
Chemistry, Analytical
chemistry
Semester-V
(P-VII)**

CourseCode	ANALYSIS OF APPLIED INDUSTRIAL PRODUCTS				
Teaching	Hours Allocated: 60 (Theory)	L	T	P	C
Pre-requisites:	Analysis of soaps, paints, oils, fats, industrial solvents, fertilizers, gases and complex materials.	60	10	30	4+2

Course Objectives:

1. Gains knowledge and awareness about some applied industrial Products
2. Gains some knowledge about Industrial standards and Control
3. Gains knowledge on practical Analytical chemistry and its applications in various fields

Course Outcomes:

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

CO1	Gains knowledge on analysis and estimation of soaps and paints
CO2	Gains knowledge on analysis and estimation of fats and oils
CO3	Gains knowledge on analysis and estimation of fertilizers starch and sugars
CO4	Gains knowledge on analysis of gases & fuel gases
CO5	Gains knowledge on analysis on cement and glass

Course with focus on employability / entrepreneurship / Skill Development modules

Skill Development		Employability		Entrepreneurship	
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UNIT-I

9hrs

ANALYSIS OF SOAPS, DETERGENTS AND PAINTS

Analysis of soaps: Moisture and volatile matter, combined alkali, total fatty matter, free alkali, total fatty acid, sodium silicate and chlorides.

Analysis of paints: Vehicle and pigments, Barium Sulphate, total lead, lead chromate, iron pigments, zinc chromate.

UNIT-II

9hrs

ANALYSIS OF FATS & OILS AND INDUSTRIAL SOLVENTS

Analysis of oils: Saponification value, iodine value, acid value, ester value, bromine value, acetyl value.

Analysis of industrial solvents like benzene, acetone, methanol and acetic acid, Determination of methomyl and N-methyl groups.

UNIT-III

9hrs

ANALYSIS OF FERTILIZERS STARCH, SUGAR, AND PAPER

Analysis of Fertilizers: Urea, NPK fertilizer, Super phosphate

Analysis of DDT, BHC, Endrin

Analysis of Starch, Sugars and Paper

UNIT-IV

9hrs

ANALYSIS OF GASES

Analysis of Gases: Carbon dioxide, carbon monoxide, oxygen, hydrogen, saturated hydrocarbons, unsaturated hydrocarbons, nitrogen, Octane number, Cetane number.

Analysis of Fuel gases like: water gas, producer gas.

Ultimate analysis: Carbon, hydrogen, nitrogen, oxygen, Phosphorus and sulfur.

UNIT-V

9hrs

ANALYSIS OF COMPLEX MATERIALS

Analysis of cement- Loss on ignition, insoluble residue, total silica, sesquioxides, lime, magnesia, ferric oxide, sulphonic anhydride.

Analysis of glasses - Determination of silica, Sulphur, barium, arsenic, antimony, total R₂O₃, calcium, magnesium, total alkalis, aluminum, chloride, fluoride

Reference books

F.J. Welcher-Standard methods of analysis,

A.I. Vogel-A text book of quantitative Inorganic analysis-ELBS,

H.H. Willard and H. Deal- Advanced quantitative analysis- Van Nostrand Co,

F.D. Snell & F.M. Biffen-Commercial methods of analysis-D.B. Taraporavala &sons,

G.Z. Weig - Analytical methods for pesticides, plant growth regulators and food additives - Vols I to VII,

Weblink's:

1. https://youtu.be/iipY_DDuAeg

2. <https://youtu.be/gflizOBI5wY>

3. <https://youtu.be/XITEF0ipje8>

ACTIVITIES & BENCHMARKS PROPOSED (TABLE)

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2. Seminars

3. Group Discussion

4. Quiz

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CO4	3	3	3	3	3	2	2	2	2	2	3	2	3
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Undergraduate students upon graduation with a B.Sc. degree in chemistry

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PO: 3 Are able to design, carry out, record and analyze the results of chemical experiments

PO: 4 Are able to use modern instrumentation and classical techniques, to design experiments, and to properly record the results of their experiment.

PO: 5 Are skilled in problems solving, critical thinking and analytical reasoning.

PO: 6 Are able to identify and solve chemical problems and explore new areas of research.

PO: 7 Are able to use modern library searching and retrieval methods to obtain information about a topic, chemical, chemical technique, or an issue relating to chemistry.

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PO: 9 Are able to communicate the results of their work to chemists and non-chemists

PO: 10 Understand the ethical, historic, philosophical, and environmental dimensions of problems and issues facing chemists.

PO: 11 Find gainful employment in industry or government, be accepted at graduate or professional schools (law, medicine, etc.), or find employment in school systems as instructors or administrators.

PO: 12 Are able to pursue Higher education in Chemistry and other disciplines of inter disciplinary

Weightage to content

Semester -V

Paper-VII

S. NO	Course Content	Long Answer	Short Answer	Total marks	As per Blooms Taxonomy
1	Analysis of soaps, detergents and paints	1	1	15	Understanding, Application
2	Analysis of fats & oils and industrial solvents	1	2	20	Remembering, Understanding
3	Analysis of fertilizers, starch, sugars and paper	2	2	30	Application & Creation
4	Analysis of gases	2	1	25	Remembering, Understanding
5	Analysis of complex materials	2	2	30	Application & Creation
	TOTAL	8	8	120	

P. R. GOVERNMENT COLLEGE, KAKINADA

MODEL QUESTION PAPER

SEMESTER – V Paper - VII (ANALYTICAL CHEMISTRY-7)

ANALYSIS OF APPLIED INDUSTRIAL PRODUCTS

Duration: 2hrs. 30Min.

Max. Marks: 60

SECTION – A

Answer any FOUR questions. Each question carries 10 marks.

4 X 10 = 40M 1.

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 – III
7. Question from Unit – IV
8. Question from Unit – V

SECTION – B

Answer any four questions. Each question carries 5 marks.

4 x 5 = 20

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 – II
15. Question from Unit – III
16. Question from Unit – V

P. R. GOVERNMENT COLLEGE (A), KAKINADA

SEMESTER –VI

PAPER – VII: ANALYTICAL CHEMISTRY

Practical-VII (Analysis of Applied Industrial Products)

30 hrs. (2 h /w)

Max.Marks : 50 M

Analysis of Heavy & Fine Chemicals:

1. Preparation of soaps and detergents.
2. Assay of soaps and detergent
3. Determination of Na/K/Li/Ca in given sample by flame photometry method.
4. Preparation and characterization of copper sulphate.
5. Preparation and characterization of methyl orange and methyl red.
6. Estimation of $\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$ in washing soda.
7. Determination of total hardness (Ca^{+2} & Mg^{+2}) present in the water sample
8. Determination of Chloride (Cl^-) content present in the water sample
9. Determination of concentration of Calcium present in the milk powder by complexometric titration with EDTA
10. Determination of Calcium and Magnesium present in the Limestone or Dolomite Samples
11. Determination of Ammonia from ammonia containing fertilizer

SUGGESTED BOOKS:

1. F.J. Welcher-Standard methods of analysis,
2. A.I. Vogel-A text book of quantitative Inorganic analysis-ELBS,
3. H.H. Willard and H. Deal- Advanced quantitative analysis- Van Nostrand Co,
4. F.D. Snell & F.M. Biffen-Commercial methods of analysis-D.B. Taraporavala & sons,
5. G.Z. Weig - Analytical methods for pesticides, plant growth regulators and food additives - Vols I to VII, 6. Analytical Agricultural Chemistry by S.L. Chopra & J.S. Kanwar – Kalyani Publishers
7. F.J. Welcher-Standard methods of analysis,
8. Quantitative analysis of drugs in pharmaceutical formulations by P.D. Sethi, CBS Publishers and Distributors, New Delhi
9. G. Ingram- Methods of organic elemental micro analysis- Chapman and Hall

P. R. GOVERNMENT COLLEGE, KAKINADA
SEMESTER – VI Paper - VII (ANALYTICAL CHEMISTRY-7)
ANALYSIS OF APPLIED INDUSTRIAL PRODUCTS

Duration: 2hrs. 30Min.

Max. Marks: 60

Question Bank:

Essay Questions: 10 M

UNIT-I

1. How do you analyse lead chromate and zinc chromate present in paints?
2. How do you determine the total fatty matter and free alkali of soaps?

UNIT-II

3. Describe the analysis of benzene.
4. Explain about the analysis of Oils

UNIT-III

5. Explain about the analysis of NPK fertilizers
6. Write about the analysis of DDT and BHC
7. Write about the analysis of starch, paper analysis

UNIT-IV

8. Explain about the analysis of CO₂ and saturated hydrocarbons
9. Write about the analysis of water gas and producer gas
10. Write about the ultimate analysis of C and H

UNIT-V

11. Write about the analysis of total silica and lime content in cement
12. Explain about the analysis of cement
13. Write about the analysis of silica and total alkalis in glasses.
14. Explain about the analysis of glass

Short Questions:05 M

UNIT-I

1. Explain about the analysis of Sodium silicate in soaps
2. Explain about the analysis of BaSO₄ in paints

UNIT-II

3. Write about the analysis of Iodine value in oils
4. Explain about the analysis of acid value in oils
5. Explain about the determination of methomyl group in industrial solvents
6. Explain about the determination of N-Methyl group in industrial solvents.

UNIT-III

7. Write about the analysis of Urea
8. Explain about the analysis of Super phosphate
9. Write about the analysis of DDT
10. Explain about the analysis of endrin.
11. Write about the analysis of sugars
12. Explain about the analysis of paper

UNIT-IV

13. Explain about octane number
14. Write about cetane number
15. Write about the analysis of water gas.
16. Write about the analysis of producer gas.

UNIT-V

17. Write about the analysis of sulphuric anhydride in cement
18. Explain about the analysis of ferric oxide content in cement
19. Explain about the determination of calcium in Glasses
20. Explain about the determination of magnesium in Glasses
21. Explain about the determination of Sulphur in Glasses
22. Write about the composition of cement
23. Write about the composition of glass

