

**P. R. GOVERNMENT COLLEGE
(AUTONOMOUS)
KAKINADA**



(Affiliated to Adikavi Nannaya University, Rajamahendravaram)

DEPARTMENT OF CHEMISTRY

B.Sc. Analytical Chemistry

(Syllabus under CBCS)

**Board of Studies
(2021-22)**

P.R.Govt. College (A), Kakinada

Recommended Composition of the Board of Studies of Analytical Chemistry

And it's Functions of an Autonomous College

(AY 2021-22)

I Composition

i. Head of the Department concerned (Chairman):

Sri. RAMBABU VASAMSETTI, M.Sc., B.Ed., SET.

ii. The entire faculty of each specialization.

1. Dr. D. Rama Rao, M.Sc., B. Ed., M.Phil. Ph.D.

2. Dr. D. Chenna Rao, M.Sc., Ph.D.

3. Sri V. Sanjeeva Kumar MSc., NET

4. Sri TVV.Satyanarayana, M.Sc., B.Ed., SET.

5. Sri P. Vijaya Kumar, M.Sc., NET.

6. Smt. G. Pavani, M.Sc., B.Ed., SET

7. Dr. A. Chandra Leela, M.Sc., Ph.D.

8. Dr. T. Umamaheswara Rao, M.Sc., Ph.D.

9. Dr. N. BujjiBabu, M.Sc., Ph.D.

10. Dr. Ch. Praveen, M.Sc., Ph.D.

iii. One expert to be nominated by the Vice-Chancellor from a panel of six recommended by the College Principal

Dr. Dr. K. Jhansi Lakshmi, Principal, ASD WOMEN'S COLLEGE, KAKINADA

iv. Two experts in the subject from outside the college to be nominated by the Academic Council

Sri U. Sai Krishna, Lecturer in Chemistry, Govt. College(A), Rajamahendravaram

Dr. V. Narayanarao, Lecturer in Chemistry Govt. Degree college, Perumallapuram

v. One representative from industry/ Corporate Sector/ allied area relating to

Placement.

Dr. B. Ramesh Babu, Founder & M. D., BogaR Laboratories, Peddapuram

vi. One postgraduate meritorious alumnus to be nominated by the Principal.

The chairman, Board of Studies, may with the approval of the Principal of the College, Co-opt.

Dr. K. Raghava Chari, M.Sc., M.Phil., Ph.D.

II. Term.

The term of the nominated members shall be two years.

III. Meeting


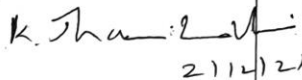

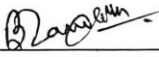


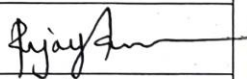
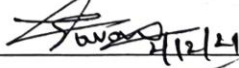

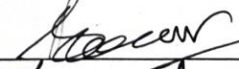
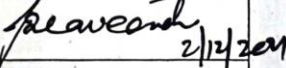
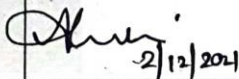
The Principal of the College shall draw the schedule for meeting of the Board of Studies for different Departments. The meeting may be scheduled as and when necessary but at least once a year.

IV. Functions

The Board of Studies of a Department in the College shall:

- a) Prepare syllabus and various courses keeping in view the objectives of the College interest of the stakeholders and national requirement for consideration and approval of the Academic Council.
- b) Suggest methodologies for innovative teaching and evaluation techniques.
- c) Suggest panel of names to the Academic Council for appointment of examiners.
- d) Coordinate research, Teaching, Extension and other academic activities in the Department/College.

Signatures of the members who attended the
Board of studies in Analytical Chemistry on 02. 12 .2021 at 10.00 AM

S. No.	Name of the member	Designation	Signature
1	Sri. Rambabu Vasamsetti	Chairman, Board of Studies, Lecturer in charge	
2	Dr. K. Jhansi Lakshmi	University Nominee Asst. Professor, Department of Chemistry, ASD Women's College, Kakinada.	 21/12/21
3	Sri. U. Sai Krishna	Subject Expert Lecturer in Chemistry, Govt.College(A), Rajamahendravaram	 02/12/21
4	Dr. B. Ramesh Babu	Industry expert/ Founder & M. D., BogaR Laboratories, Peddapuram.	
5	Dr. K. Raghava Chari	Alumnus, Retd .Principal,	
6	Dr. D. Rama Rao	Member Lecturer I/c - Dept. of Chemistry	
7	Dr. D. Chenna Rao	Member Lecturer in Chemistry	
8	Sri V. Sanjeeva Kumar	Member Lecturer in Chemistry	
9	Sri T V V. Satyanarayana	Member Lecturer in Chemistry	
10	Sri P. Vijaya Kumar	Member Lecturer in Chemistry	
11	Smt. G. Pavani	Member Lecturer in Chemistry	 2/12/21
12	Dr. T. Uma Maheswara Rao	Member Lecturer in Chemistry	
13	Dr. N. Bujji Babu	Member Lecturer in Chemistry	
14	Dr.Ch. Praveen	Member Lecturer in Chemistry	 2/12/2021
15	Kum. A. Lakshmi Bhavani	Member Guest Faculty in Analytical Chemistry	 2/12/2021

ACTION PLAN BOS MEETING – ANALYTICAL CHEMISTRY HELD ON 02 -12 - 2021.

Department activities for AY 2021-22.

Annexure - I

S.No.	Month	Activity Proposed	Faculty Member of In charge
1.	Nov -21	Departmental staff meeting to review admissions and faculty recruitment	All Faculty members
2.	Nov – 21	Preparation of curricular plans, time- tables etc.,	All Faculty members
3.	Dec–21	Bridge classes	All Faculty members
4.	Dec–21	Student awareness programs on ragging& eve teasing - consequences, self-discipline.	All Faculty members
5.	Dec–21	World AIDS Day	All Faculty members
6.	Jan – 22	Career guidance, higher education opportunities etc.,	All Faculty members
7.	Feb – 22	Study tour / Field trips	All Faculty members
8.	Feb -22	NATIONAL SCIENCE DAY	All Faculty members
9.	Mar– 22	Study tour / Field trips	All Faculty members
10	Mar- 22	Guest Lecture	All Faculty members

1. Organizing National/ State level seminars/Workshops/ Conferences/ Training programs etc. With topics and other details.

- i). Staff development programs
- ii) Awareness on OZONE protection
- iii) National Chemistry day
- iv) National Science day 2022
- v) Guest lectures / Invited Talks
- vi) Training on Soil analysis
- vii) Training on water analysis

2. Change of modules in the syllabus content.

3. Plan for utilization of funds for Autonomous /CPE / Other grants available for arranging guest lectures, faculty improvement programmes, study tours, equipping laboratories, reference books & other necessary teaching-learning material with ICT enabled teaching.

I. Study visits/ Field tours to Final year students:

Rs. 20,000

1. National Institute of Hydrology, Kakinada.
2. SAR Chandra Environ Solutions, Kakinada.
3. ONGC mini refinery, Tatipaka.
4. Soil analysis laboratory, Samalkot.
5. Venky parenteral, Yanam
6. Any other relevant field visits

II. Lab equipment's:

Rs. 5, 00,000

Lab equipment's required to conduct Practical's and to give hands on training to the students in order to build skill and confidence in the area of Analytical chemistry

III. Reference books & other necessary teaching – learning material: Rs. 10,000

IV. Guest Lectures / Invited talks:

Rs. 10,000

3. Plan for organizing subject oriented community outreach programs & allocation of necessary funds.
(Mandatory for each Department)

i) Awareness programs on various social / Health issue

Rs. 10,000

5. Introduction of new programs - Certificate courses. Rs. 10,000

6. Any other program that enhances the learning capacity of students and their employable & knowledge skills

7. Examination reforms if any,

8. Suggest panel of examiners/paper setters & other experts/nominees for BOS deliberations.

1. Dr. T. Narasimha Murthy, Govt. College(A), Rajamahendravaram

2. Smt. G. Tejaswini, Govt. College(A), Rajamahendravaram

3. Dr. M. Trinadh, Govt. College(A), Rajamahendravaram.

4. Sri. K.Anand, GDC,Pithapuram.

5. Dr. V. Narayana Rao, GDC, Perumallpuram.

6. Dr. CH.Vijay Vardhan, GDC, Perumallpuram.

7. Sri B.Surendra, GDC,Tadepaliigudem.

P.R.GOV.T.COLLEGE (A), KAKINADA

Department of Analytical Chemistry

Minutes of board of studies (BOS) meeting 2021-22 on 02. 12. 2021 at 10.00 am

Meeting of Board of Studies in Chemistry is convened on 02 December 2021 through offline at P.R. Govt. College (A), Kakinada, at 10.00 AM.

Venue: Conference Hall, Dt: 02-12-2021, Thursday - 10.00 AM.

The Principal Dr. B.V. Tirupanyam, Chairman, Sri V.Rambabu, University Nominee, Dr.K.Jhansi Lakshmi, Lecturer in Chemistry, ASD Govt. Degree College for Women (Autonomous), Kakinada, Industrialist Dr. B. Ramesh Babu, Founder & M.D., BogaR laboratories, Peddapuram, Subject Expert Sri. U.Saikrishna, Lecturer in Chemistry, Government College (A) Rajamahendravarm, 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 03 years, i.e., w.e.f. 2018-19.
- To discuss and approve the Continuation/Modifications of the syllabus for the Odd & Even Semesters of I, II & III Years for 2021-22.
- 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. 2021-22.
- Panel of paper setters and examiners.
- Proposals for Community Service Projects/Extension activities for the benefit of the society.
- Department action plan for 2021-22.
- To discuss and resolve the minor modifications/refinement if any, in the Chemistry cluster electives CI, CII & CIII as majority of the students opting this cluster as their choice.

Any Other Proposal with the Permission of the Chairman.

Resolutions:

The following agenda items are discussed and resolutions are made.

1. 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.
2. It is resolved to approve the Continuation/Modifications of the syllabus for the Odd & Even Semesters of I, II & III Years for 2021-22.
3. 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)
4. 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.
5. It is resolved to follow 50%-50% external and internal for first year w.e.f 2021-22 admitted batch.
6. It is resolved to allot 50 marks project work for final year students in chemistry preferably in cluster paper C - 3 practical's, w.e.f 2019-20 in accordance with APSCHE.
7. It is resolved to conduct departmental activities such as OZONE DAY, CHEM FEST, CHEMISTRY DAY and SCIENCE DAY. (Annexure-I)
8. It is resolved to implement the recommended andragogy for the first semester 2021-22
9. Resolved to conduct practical examinations semester wise.
10. It is resolved to organize guest lectures by eminent professors.
11. Resolved to implement pass minimum for internal assessment for CBSE pattern students as the pattern is learner oriented.
12. It is resolved to maintain status quo for same question paper pattern in II, III years.
13. It is resolved that there is no change in the syllabus in the first year (Sem –I & Sem –II) as prescribed by APSCHE, Vijayawada in the last academic year, the same syllabus will be adopted as such.
14. The following paper setters are recommended
 1. Dr. T. Narasimha Murthy, Govt. College(A), Rajamahendravaram
 2. Smt. G. Tejaswini, Govt. College(A), Rajamahendravaram
 3. Dr. M. Trinath, Govt. College(A), Rajamahendravaram.
 4. Sri. K. Anand, GDC, Pithapuram.
 5. Dr. V. Narayana Rao, GDC, Perumallapuram.
 6. Dr. CH. Vijay Vardhan, GDC, Perumallapuram.
 7. Sri B. Surendra, GDC, Tadepaliigudem.

Semester wise/ Paper wise Marks / Credits allotted.

YEAR	SEMESTER	PAPER	TITLE	MARKS	CREDITS	
I	I	I	Basic Principles & Laboratory Operations	100	04	
			Practical – I	50	01	
	II	II	Quantitative Methods Of Analysis	100	04	
			Practical – II	50	01	
II	III	III	Separation Methods – I	100	04	
			Practical – III	50	01	
	IV	IV	Separation Methods – II	100	04	
			Practical – IV	50	01	
III	V	V	Analytical Biochemistry and Environmental Chemistry	100	03	
			Practical – V	50	02	
		VI	Instrumental Methods of Analysis	100	03	
			Practical – VI	50	02	
		* Any one cluster from VIII, A, B OR C	VII	Analysis of Applied Industrial Products (ELECTIVE)	100	03
				Practical – VII	50	02
	VIII (C)		VIII-C-1	100	03	
			VIII-C-2	100	03	
			VIII-C-3	100	03	
			Practical – VIII	50	02	
		Practical –IX	50	02		
		Practical –X: Project Work	50	02		

GUIDELINES FOR ALLOTMENT OF EXTRA CREDITS

Annexure -II

S.No.	Activity	Details of achievement	Credits
1	MOOC Course	SWAYAM /NPTEL /CEC etc., (Course Completion certificate with credits should be produced for the claim of extra credits)	Total credits achieved will be considered
2	NCC	B CERTIFICATE	2
		Participation in National Camp after 'B' certificate	3
		C certificate	4
		Adventure camp/RD parade along with 'B'	5
		Failed in B certificate Examination	1
3	Sports	Intercollegiate selection	2
		South zone selection	3
		All India participation	4
		Winning medals in all India competitions	5
4	NSS	40% attendance in regular NSS activities	1
		50% attendance with Community Service	2
		Conduct of survey/Youth exchange/RD	3
5	JKC	Enrollment and training	1
		Campus recruitment local level	2
		MNCs/reputed companies	3
6	Community service	Participation in community service by departments (outreach programmes)	2
7	Cultural activity	Winning medals at state level-2, District level-1	2 1
8	COP/Add on Course	Pass in Certificate Exam-1, Diploma-2	1 2
9	Support services	Lead India, Health club, RRC and Eco Club etc., participation in various programmes	1

Course Structure:

All theory papers will have 4 hours per week and practical's will have 2 hours per week up to Semester IV (Second year). In final year all theory papers will have 3 hours per week and practical's will have 2 hours per week in Semester V and V I (Final year).

Each Theory Paper shall be of 100 marks and Practical Paper shall be of 50 marks.

Total Number of Papers: 24

Mathematics : 7Papers

Chemistry : 7Papers

Analytical Chemistry: 7 Papers + 1 Cluster elective (3Papers) = 10 Papers

Objectives and outcome of the course Analytical Chemistry

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. It is of fundamental importance not only to all branches of chemistry but also to all biological sciences, engineering sciences, health, medicine, pharmaceuticals, environment, industrial processes, quality control and implementation of legislation.

The objective of B.Sc. Analytical chemistry course is to provide students exposure to chemistry, physics, biological sciences, environmental science, computer application, instrumentation and analytical techniques.

In this three year course spread over six semesters, there are 10 papers of Analytical chemistry 7 papers of chemistry and 7 papers of Mathematics.

After graduating in Analytical Chemistry the students can pursue academics in Chemistry, bioinformatics, forensic science, biochemistry and other disciplines of inter- disciplinary sciences. They can also use it as a stepping stone to pharmaceutical industry and for Research and Development in industry.

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

Course outcomes

Analytical Chemistry

CO: 1	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.
CO: 2	It gives fundamental knowledge on chemistry and also on all biological sciences, engineering sciences, health, medicine, pharmaceuticals, environment, industrial processes, quality control and implementation of legislation.
CO: 3	To provide students exposure to chemistry, physics, biological sciences, environmental science, computer application, instrumentation and analytical techniques
CO: 4	After graduating in Analytical Chemistry the students can pursue academics in Chemistry, bioinformatics, forensic science, biochemistry and other disciplines of Inter- disciplinary sciences
CO: 5	Students can also use Analytical Chemistry as a stepping stone to pharmaceutical industry and for Research and Development in industry.
CO: 6	Are able to use modern instrumentation and classical techniques, to design experiments, and to properly record the results of their experiment.

Specific Program Out comes

Analytical Chemistry

SEMESTER –I	SPO : 1	Gains knowledge on basic concepts of analytical methods
	SPO : 2	Understands the types of errors in chemical analysis
	SPO : 3	Gains knowledge on principles and applications of Thermo gravimetric methods
	SPO : 4	Gains knowledge on use and handling of Common laboratory apparatus.
SEMESTER –II	SPO : 1	Gains knowledge on basic concepts of Gravimetric methods and their importance
	SPO : 2	Gains knowledge on volumetric methods and their importance in Chemical analysis.
	SPO : 3	Gains knowledge on Centrifugation methods
	SPO : 4	Gains knowledge on Environmental and water pollutants and their analysis.
SEMESTER –III	SPO : 1	Gains basic knowledge on Separation techniques and their classification.
	SPO : 2	Gains knowledge on Different chromatographic techniques and their applications.
SEMESTER - IV	SPO : 1	Gains knowledge on Gas chromatographic technique and their applications.
	SPO : 2	Gains knowledge on Electrophoresis concept and its applications
	SPO : 3	Gains basic knowledge on Filtration techniques.
SEMESTER - V	SPO : 1	Gains basic knowledge about Carbohydrates, Proteins & Lipids and their analysis
	SPO : 2	Gains some basic knowledge about Clinical chemistry and Microbiological assay.
	SPO : 3	Gains some basic knowledge and importance of Spectroscopic methods
	SPO : 4	Gains some basic knowledge and importance of Electro analytical methods
SEMESTER - VI	SPO : 1	Gains knowledge and awareness about some applied industrial products.
	SPO : 2	Gains knowledge about analysis of cement, Glasses and Gases
	SPO : 3	Gains some knowledge about Industrial standards and Control
	SPO : 4	Gains knowledge on practical Analytical chemistry and its applications in various fields

B.Sc. Analytical Chemistry
Syllabus
&
Model Papers
&
Question Bank

P. R. GOVERNMENT COLLEGE (A), KAKINADA

B. Sc. (Analytical Chemistry)

SEMESTER –I

Paper I (ANALYTICAL CHEMISTRY-1) 60hrs (4h/w)

BASIC PRINCIPLES & LABORATORY OPERATIONS

UNIT – I

12hrs

A. SI Units:

- i) Definitions of the Seven Base Units (Mass, Length, Time, Temperature, Amount of substance, Electrical current and Luminous intensity).
- ii) Derived units, Conversion between units.

B. Chemical concentrations:

- i) Mole, Molar mass
- ii) Calculations in grams and moles
- iii) Solutions and their concentrations:
 - iv) 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 12hrs

**INTRODUCTION TO ANALYTICAL CHEMISTRY AND
ANALYTICAL METHODS –I:**

- i) General steps in chemical analysis
- ii) Introduction to methods of detecting analytes Physical, Electromagnetic radiations and Electric charge
- iii) 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:
- i). Volumetric flasks, burettes, pipettes,
 - ii). Meniscus readers, weighing bottles, funnels, desiccators, drying ovens, filter crucibles, rubber policeman.
 - iii). 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

12hrs

ERRORS IN CHEMICAL ANALYSIS:

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

UNIT – V

PRINCIPLES OF THERMOGRAVIMETRY:

12hrs

Thermal methods of analysis

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

P. R. GOVERNMENT COLLEGE (A), KAKINADA

B. Sc. (Analytical Chemistry -1)

SEMESTER –I

LABORATORY COURSE-I

30 hrs (2 h /w)

Practical-I (At the end of Semester-I)

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. Determination 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. Freifelder 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 the following questions. Each question carries **10** marks.

3 X 10 = 30M

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

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)

Blue print;

1.

S. No.	Course Content	Essay Questions (10M)	Short Answer Questions (5M)	Total No. Of Questions from each Unit
1	Unit –I	2	1	3
2	Unit –II	1	2	3
3	Unit –III	1	1	2
4	Unit –IV	1	2	3
5	Unit –V	1	1	2
	TOTAL	6	7	13

Note: Questions should be given from Question bank

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

QUESTION BANK

ESSAY QUESTIONS – 10 Marks

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

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

P. R. GOVERNMENT COLLEGE (A), KAKINADA

B. Sc. (Analytical Chemistry)

SEMESTER – II

Paper -II (ANALYTICAL CHEMISTRY-2) 60 hrs(4h/w)

QUANTITATIVE METHODS OF ANALYSIS

UNIT-I

12hrs

GRAVIMETRIC ANALYSIS :

- A. Gravimetric methods introduction and types of gravimetric methods.
- B. Volatilization methods – Principle, Applications of Volatilization methods - Determination of the sodium hydrogen carbonate content of antacid tablets
- C. Precipitation methods – Principle, Various steps involved in Precipitation gravimetry
- D. Properties of precipitates and precipitating reagents: Particle size, Filterability of Precipitates - Factors that determine particle size & formation of Precipitates (Mechanism of Precipitate and Relative super saturation)
- E. i). Colloidal Precipitates - coagulation of colloids, peptization of colloids, Treatment of colloidal precipitates
ii). Crystalline Precipitates (particle size and Filterability).
- F. Co-precipitation & Types of Co –precipitation (surface adsorption, mixed-crystal formation, occlusion, and Mechanical entrapment) and co precipitation errors
- G. Precipitation from Homogeneous Solution (The use of the technique of Homogeneous solutions to effect precipitation).
- H. Drying and Ignition of precipitates

UNIT-II

12hrs

VOLUMETRIC ANALYSIS

- A. Volumetric titrimetry introduction
- B. Definitions of the terms - Titrant, Titrand, The equivalence point, the endpoint and the Indicator
- C. Classification of volumetric methods
 - i. Acid-base titrations
 - ii. Redox titrations
 - iii. Complexometric titrations
 - iv. Precipitation titrations
- I. Indicator, Theories of indicators and Buffer solutions
- J. Sigmoidal Titration Curves
- K. Henderson –Hassel Balch equation for acids and bases.

UNIT-III

12hrs

CENTRIFUGATION METHODS:

- A. Introduction to Centrifugation methods
- B. Types of centrifugation techniques
- C. Sedimentation and relative centrifugal force
- D. Different types of rotors. E. Density gradient

UNIT-IV

12hrs

INTRODUCTION TO ENVIRONMENTAL ANALYSIS:

- A. Sampling methods.
- B. Environmental pollution from industrial effluents and radiochemical waste.
- C. Introduction to water and waste analysis.

UNIT-V

12hrs

Polarography

- A. Basic principles of Polarography, residual current, migration current, diffusion current, half wave potential, the Ilkovic equation.
- B. Instrumentation of Polarography technique -Dropping Mercury Electrode (DME) – Advantages and Disadvantages. Applications. Qualitative and quantitative analysis of inorganic ions: Determination of Copper and Zinc in Brass.

P. R. GOVERNMENT COLLEGE (A), KAKINADA

B. Sc. (Analytical Chemistry)

SEMESTER –II

LABORATORY COURSE -II

30 hrs (2 h /w)

Practical-II Quantitative Analysis

(At the end of Semester-II)

1. Determination of HCl with Standard NaOH solution by using pH meter
2. Determination of Acetic acid with Standard NaOH by using pH meter
3. Determination of the strength of the given magnesium sulphate solution using EDTA and Eriochrome black –T as the indicator by Complexometric titration method.
4. Determination of the Nickel as its Dimethyl glyoxime by Precipitation Gravimetric method.
5. Analysis of soil:
 - i) Determination of pH of soil.
 - ii) Determination of total soluble salts.
 - iii) Determination of carbonate and bicarbonate.

Suggested Readings:

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

P. R. GOVERNMENT COLLEGE, KAKINADA
MODEL QUESTION PAPER
SEMESTER – II
Paper - II (ANALYTICAL CHEMISTRY - 2)
QUANTITATIVE METHODS OF ANALYSIS

Duration: 2hrs. 30Min.

Max. Marks: 50

SECTION – A

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

3 X 10 = 30M

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 –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 – V

P. R. GOVERNMENT COLLEGE, KAKINADA
SEMESTER – II
Paper –II(ANALYTICAL CHEMISTRY - 2)
QUANTITATIVE METHODS OF ANALYSIS

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	1	3
2	Unit –II	1	2	3
3	Unit –III	1	1	2
4	Unit –IV	1	1	2
5	Unit -V	1	2	3
	TOTAL	6	7	13

Note: Questions should be given from Question bank

P. R. GOVERNMENT COLLEGE, KAKINADA
SEMESTER – II
Paper -II (ANALYTICAL CHEMISTRY)
QUANTITATIVE METHODS OF ANALYSIS

Duration: 2hrs. 30Min.

Max. Marks: 60

QUESTION BANK

ESSAY QUESTIONS – 10 MARKS:

1. Explain the principles of Volatilization methods. How do you determine the Sodium Bi-carbonate (NaHCO_3) content of Antacid tablets by using volatilization method?
2. What are Precipitation methods? Explain the various steps involved in precipitation gravimetry.
3. Explain the properties of precipitates and precipitating reagents.
4. What is Co-precipitation? Explain the different types of Co-precipitation methods.
5. What is an Indicator? Explain the various theories of Indicators.
6. Derive Henderson – Hassel Balch equation for acids and bases.
7. Write about the classification of volumetric methods with examples.
8. Explain about the four types of titrations involved in volumetric analysis.
9. Explain about the sigmoidal titration curves.
10. Explain different types of centrifugation techniques.
 11. Explain about Environmental pollution from industrial effluents and radiochemical waste.
 12. Explain about different types of rotors.
 13. Explain about the principle and instrumentation of Polarography technique
 14. Write about the following,
 - i). Ilkovic equation
 - ii). Dropping mercury electrode (DME)
 15. Describe the determination of Cu and Zn in brass by using Polarography technique.

QUESTION BANK

SHORT ANSWER QUESTIONS – 05 MARKS:

1. What are Gravimetric method and Explain briefly?
2. Explain about Colloidal precipitates
3. Write about Crystalline precipitates
4. What is Co-precipitation? Explain Co-precipitation errors
5. Explain briefly about Drying and ignition of precipitates
6. Explain the terms equivalence point end point and the Indicator
7. What is Indicator? Write the examples of indicators for various types of titrations.
8. What is Buffer? Explain briefly about Buffer solutions.
9. Explain briefly about Complexometric and Redox titrations with examples.
10. Explain briefly about centrifugation methods.
11. Write about sedimentation
12. Write briefly about Sampling methods
13. Explain briefly about Water analysis.
14. Explain about Diffusion current and half wave potentials
15. Explain about residual current and migration current
16. Write the advantages and disadvantages of DME
17. State and explain the Ilkovic equation
18. Write the principle and applications of Polarography technique.

P. R. GOVERNMENT COLLEGE (A), KAKINADA

B. Sc. (Analytical Chemistry)

SEMESTER – III

Paper - III (ANALYTICAL CHEMISTRY-3) 60hrs (4h/w)

SEPARATION METHODS - I

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-II

12hrs

CHROMATOGRAPHY:

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-III

12hrs

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-IV

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.

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

UNIT-V

12hrs

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.

P. R. GOVERNMENT COLLEGE (A), KAKINADA

B. Sc. (Analytical Chemistry)

SEMESTER – III

LABORATORY COURSE – III 30 hrs (2 h /w)

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 mixtures 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 asafetida
 - 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. 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 = 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 – II
15. Question from Unit – III
16. Question from Unit - III

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

Duration: 2hrs. 30Min.

Max. Marks: 60

Blue Print:

4.

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

Note: Questions should be given from Question bank

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

Duration: 2hrs. 30Min.

Max. Marks: 60

QUESTION BANK

ESSAY QUESTIONS – 10 MARKS:

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

QUESTION BANK

SHORT ANSWER QUESTIONS – 05MARKS:

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.
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.
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.
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.
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.

P. R. GOVERNMENT COLLEGE (A), KAKINADA

B. Sc. (Analytical Chemistry)

SEMESTER – IV

Paper -IV (ANALYTICAL CHEMISTRY-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: Principle, 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.

P. R. GOVERNMENT COLLEGE (A), KAKINADA

B. Sc. (Analytical Chemistry)

SEMESTER –IV

LABORATORY COURSE -IV

Practical-IV Quantitative analysis

30 hrs (2 h / w)

(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 Ni²⁺ and Cu²⁺ 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. Diltz: 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, 6thedition.
4. Vogel's textbook of quantitative chemical analysis, 7thedition.
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,

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)
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

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.
 5. Explain about anion and cation ion exchange resins with examples.
 6. Write about Ion exchange resins and its applications
 7. Explain the principle and applications of Gel chromatography.
 8. Explain the principle and applications of Affinity chromatography.
 9. Write about principle and applications of Gas chromatography.
 10. Explain about the principle and instrumentation of Gas chromatography.
 11. Explain about the various detectors used in Gas chromatography.
 12. Explain briefly about columns and detectors used in Gas chromatography.
 13. Write about Theory and classifications of Electrophoresis.
 14. Explain about the principle and factors affecting Electrophoresis phenomena.
 15. Explain Capillary electrophoresis with applications.
 16. Explain Zone electrophoresis with applications.
 17. Explain about the principle and instrumentation of Electrophoresis technique.
 18. Write about various types of Filters in Membrane filtration.
 19. What is centrifugation? Explain various types of centrifugation techniques.
 20. 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

P. R. GOVERNMENT COLLEGE (A), KAKINADA

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SEMESTER –V

**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 Biochemical 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 soyabean 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 dimethicone 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, Canesugar

P. R. GOVERNMENT COLLEGE (A), KAKINADA

B. Sc. (Analytical Chemistry)

SEMESTER –V

Laboratory Course - V

Practical-V Analysis of BioProducts

30 hrs (2 h / w)

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-Burchard reaction.
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: Text 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
7. Human Biology.
8. A.L. Lehninger: Biochemistry.
9. O. Mikes, R.A. Chalmers: Laboratory Handbook of Chromatographic Methods.
10. Environmental chemistry by A.K. De
11. A text book of Engineering chemistry by S.S. Dara
12. A text book of Industrial chemistry by B.K. Sharma

P. R. GOVERNMENT COLLEGE, KAKINADA
MODEL QUESTION PAPER
SEMESTER – V
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.

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 – II
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 – II
16. Question from Unit - V

P. R. GOVERNMENT COLLEGE, KAKINADA
SEMESTER – V
Paper - V (ANALYTICAL CHEMISTRY-5)
ANALYTICAL BIOCHEMISTRY AND ENVIRONMENTAL CHEMISTRY
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	2	2	4
3	Unit –III	1	1	2
4	Unit –IV	1	1	2
5	Unit -V	2	2	4
	TOTAL	8	8	16

Note: Questions should be given from Question bank.

P. R. GOVERNMENT COLLEGE, KAKINADA
SEMESTER – V
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

P. R. GOVERNMENT COLLEGE (A), KAKINADA

B. Sc. (Analytical Chemistry)

SEMESTER –V

Paper–VI:ANALYTICALCHEMISTRY-645hrs (3h/w)

INSTRUMENTALMETHODSOFANALYSIS

AN INTRODUCTION TO SPECTROSCOPIC METHODS OF ANALYSIS:

UNIT-I

9 hrs

A. UV - VISIBLE SPECTROPHOTOMETRY:

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

B. IR SPECTROSCOPY:

Principle, Instrumentation – Sources, detectors and applications

UNIT-II

9 hrs

ATOMIC EMISSION SPECTROSCOPY (Flame photometry):

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

UNIT-III:

9hrs

ATOMIC ABSORPTION SPECTROSCOPY: AAS

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.

UNIT-IV:

9hrs

POLOROGRAPHY AND COULOMETRY:

A. 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.

B. Coulometry: Types of coulometric methods: Potentiostatic and amperostatic; principles, instrumentation and applications.

UNIT-V:

9hrs

BASIC ELECTRO-ANALYTICAL CHEMISTRY:

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

B. 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.

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)
INSTRUMENTALMETHODSOFANALYSIS

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. GOVERNMENT COLLEGE, KAKINADA
SEMESTER – V
Paper - VI (ANALYTICAL CHEMISTRY-6)
INSTRUMENTALMETHODSOFFANALYSIS

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	1	1	2
4	Unit –IV	2	2	4
5	Unit -V	2	2	4
	TOTAL	8	8	16

Note:Questions should be given from Question bank

P. R. GOVERNMENT COLLEGE, KAKINADA
SEMESTER – V
Paper - VI (ANALYTICAL CHEMISTRY-6)
INSTRUMENTALMETHODSOFFANALYSIS

Duration: 2hrs. 30Min.

Max. Marks: 60

Question Bank:

Essay Questions: 10 M

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.
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
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
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 amperostatic coulometry technique.
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 applications.

Question Bank:

Short Answer Questions: 05 M

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
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
8. Explain about the radiation sources used in AAS
9. Write about Hollow cathode lamp
10. Write about the applications of AAS
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
18. Write about electrochemical cells
19. Explain about electrode potentials
20. What is emf? write about cell potentials
21. Explain about Glass electrode
22. Explain about calomel electrode
23. Explain about Metal – metal ion electrode

P. R. GOVERNMENT COLLEGE (A), KAKINADA

B. Sc. (Analytical Chemistry)

SEMESTER –VI

**PAPER – VII: ANALYTICAL CHEMISTRY -7
(ELECTIVE)**

ANALYSIS OF APPLIED INDUSTRIAL PRODUCTS 45 hrs (3 h /w)

UNIT-I

9hrs

ANALYSIS OF SOAPS, DETERGENTS AND PAINTS

- A. **Analysis of soaps:** Moisture and volatile matter, combined alkali, total fatty matter, free alkali, total fatty acid, sodium silicate and chlorides.
- B. **Analysis of paints :** Vehicle and pigments, Barium Sulphate, total lead, lead chromate, iron pigments, zinc chromate.

UNIT-II

9 hrs

ANALYSIS OF FATS & OILS AND INDUSTRIAL SOLVENTS

- A. **Analysis of oils:** Saponification value, iodine value, acid value, ester value, bromine value, acetyl value.
- B. **Analysis of industrial solvents** like benzene, acetone, methanol and acetic acid, Determination of methoxyl and N-methyl groups.

UNIT-III

9hrs

ANALYSIS OF FERTILIZERS, STARCH, SUGARS AND PAPER

- A. **Analysis of Fertilizers:** Urea, NPK fertilizer, Super phosphate
- B. Analysis of DDT, BHC, Endrin
- C. Analysis of Starch, Sugars and Paper

UNIT-IV

9 hrs

ANALYSIS OF GASES

- A. **Analysis of Gases:** Carbon dioxide, carbon monoxide, oxygen, hydrogen, saturated hydrocarbons, unsaturated hydrocarbons, nitrogen, Octane number, Cetane number
- B. **Analysis of Fuel gases** like: water gas, producer gas.
- C. **Ultimate analysis** : Carbon, hydrogen, nitrogen, oxygen, Phosphorus and sulfur.

UNIT-V

9 hrs

ANALYSIS OF COMPLEX MATERIALS:

- A. **Analysis of cement-** Loss on ignition, insoluble residue, total silica, sesqui oxides, lime, magnesia, ferric oxide, sulphuric anhydride.
- B. **Analysis of glasses** - Determination of silica, Sulphur, barium, arsenic, antimony, total R_2O_3 , calcium, magnesium, total alkalis, aluminum, chloride, fluoride

P. R. GOVERNMENT COLLEGE (A), KAKINADA

B. Sc. (Analytical Chemistry)

SEMESTER –VI

**PAPER – VII: ANALYTICAL CHEMISTRY -7
(ELECTIVE)**

Practical-VII Analysis of Applied Industrial Products **30 hrs (2 h /w)**

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
MODEL QUESTION PAPER
SEMESTER – VI
Paper - VII (ANALYTICAL CHEMISTRY-7)
ANALYSIS OF APPLIED INDUSTRIAL PRODUCTS
(ELECTIVE)

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

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

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	1	1	2
2	Unit –II	1	2	2
3	Unit –III	2	2	4
4	Unit –IV	2	1	4
5	Unit -V	2	2	4
	TOTAL	8	8	16

Note: Questions should be given from Question bank only

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

Duration: 2hrs. 30Min.

Max. Marks: 60

Question Bank:

Essay Questions: 10 M

1. How do you analyze lead chromate and zinc chromate present in paints?
 1. How do you determine the total fatty matter and free alkali of soaps?
 2. Describe the analysis of benzene.
 3. Explain about the analysis of Oils
 4. Explain about the analysis of NPK fertilizers
 5. Write about the analysis of DDT and BHC
 6. Write about the analysis of starch, paper analysis.
 7. Explain about the analysis of CO₂ and saturated hydrocarbons
 8. Write about the analysis of water gas and producer gas
 9. Write about the ultimate analysis of C and H
 10. Write about the analysis of total silica and lime content in cement
 11. Explain about the analysis of cement
 12. Write about the analysis of silica and total alkalis in glasses.
 13. Explain about the analysis of glass

Question Bank:

Essay Questions:05 M

1. Explain about the analysis of Sodium silicate in soaps
2. Explain about the analysis of BaSO₄ in paints
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 methoxyl group in industrial solvents
6. Explain about the determination of N-Methyl group in industrial solvents.
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
13. Explain about octane number
14. Write about cetane number
15. Write about the analysis of water gas.
16. Write about the analysis of sulphuric anhydride in cement
17. Explain about the analysis of ferric oxide content in cement
18. Explain about the determination of calcium in Glasses
19. Explain about the determination of magnesium in Glasses
20. Explain about the determination of Sulphur in Glasses
21. Write about the composition of cement
22. Write about the composition of glass

CLUSTER ELECTIVES:
Cluster Elective – I Analytical and Physical Chemistry
SEMESTER-VI

PAPER – VIII-A-1: POLYMER CHEMISTRY 45 hrs (3 h / w)

UNIT-I **12h**

Introduction of polymers:

Basic definitions, degree of polymerization, classification of polymers- Natural and Synthetic polymers, Organic and Inorganic polymers, Thermoplastic and Thermosetting polymers, Plastics, Elastomers, Fibers and Resins, Linear, Branched and Cross Linked polymers, Addition polymers and Condensation Polymers, mechanism of polymerization. Free radical, ionic and Zeigler – Natta polymerization.

UNIT-II **10h**

Techniques of Polymerization: Bulk polymerization, solution polymerization, suspension and Emulsion polymerization.

Molecular weights of polymers: Number average and weight average molecular weights
Determination of molecular weight of polymers by Viscometry, Osmometry and light scattering methods.

UNIT-III **6h**

Kinetics of Free radical polymerization, Glass Transition temperature (T_g) and Determination of T_g : Free volume theory, WLF equation, factors affecting glass transition temperature (T_g).

UNIT-IV **9h**

Polymer additives:

Introduction to plastic additives – fillers, Plasticizers and Softeners, Lubricants and Flow Promoters, Anti-aging additives, Flame Retardants, Colourants, Blowing agents, Cross linking agents, Photo stabilizers, Nucleating agents.

UNIT-V **8h**

Polymers and their applications:

Preparation and industrial applications of Polyethylene, Polyvinyl chloride, Teflon, Polyacrylonitrile, Terelene, Nylon6.6 silicones.

SEMESTER-VI

PAPER – VIII-A-2: INSTRUMENTAL METHODS OF ANALYSIS

45 hrs (3 h / w)

UNIT –I

Introduction to spectroscopic methods of analysis: 4 h

Recap of the spectroscopic methods covered in detail in the core chemistry syllabus: Treatment of analytical data, including error analysis. Classification of analytical methods and the types of instrumental methods. Consideration of electromagnetic radiation.

UNIT – II: Molecular spectroscopy: 8h

Infrared spectroscopy:

Interactions with molecules: absorption and scattering. Means of excitation (light sources), separation of spectrum (wavelength dispersion, time resolution), detection of the signal (heat, differential detection), interpretation of spectrum (qualitative, mixtures, resolution), advantages of Fourier Transform (FTIR). Samples and results expected. Applications: Issues of quality assurance and quality control, Special problems for portable instrumentation and rapid detection.

UNIT –III 10h

UV-Visible/ Near IR – emission, absorption, fluorescence and photoacoustic. Excitation sources (lasers, time resolution), wavelength dispersion (gratings, prisms, interference filters, laser, placement of sample relative to dispersion, resolution), Detection of signal (photocells, photomultipliers, diode arrays, sensitivity and S/N), Single and Double Beam instruments, Interpretation (quantification, mixtures, absorption vs. fluorescence and the use of time, photoacoustic, fluorescent tags).

UNIT – IV: Separation techniques

Chromatography: Gas chromatography, liquid chromatography, supercritical fluids, Importance of column technology (packing, capillaries), Separation based on increasing number of factors (volatility, solubility, interactions with stationary phase, size, electrical field), Detection: simple vs. specific (gas and liquid), Detection as a means of further analysis (use of tags and coupling to IR and MS), Electrophoresis (plates and capillary) and use with DNA analysis. 46 Immunoassays and DNA techniques **8h**

Mass spectroscopy: Making the gaseous molecule into an ion (electron impact, chemical ionization), Making liquids and solids into ions (electrospray, electrical discharge, laser desorption, fast atom bombardment), Separation of ions on basis of mass to charge ratio, Magnetic, Time of flight, Electric quadrupole. Resolution, time and multiple separations, Detection and interpretation (how this is linked to excitation).

UNIT – V

Elemental analysis: 10 hr.

Mass spectrometry (electrical discharges).

Atomic spectroscopy: Atomic absorption, Atomic emission, and Atomic fluorescence. Excitation and getting sample into gas phase (flames, electrical discharges, plasmas), Wavelength separation and resolution (dependence on technique), Detection of radiation (simultaneous/scanning, signal noise), Interpretation (errors due to molecular and ionic species, matrix effects, other interferences).

NMR spectroscopy: Principle, Instrumentation, Factors affecting chemical shift, Spin coupling, Applications.

Electro analytical Methods: Potentiometry & Voltammetry

Radiochemical Methods: ray analysis and electron spectroscopy (surface analysis)

SEMESTER-VI

PAPER – VIII-A-3: ANALYSIS OF DRUGS, FOODS, DAIRY PRODUCTS & BIO-CHEMICAL ANALYSIS

45 hrs (3 h / w)

UNIT - I

Analysis of the following drugs and pharmaceuticals preparations: (Knowledge of molecular formula, structure and analysis) Analysis of analgesics and antipyretics like aspirin and paracetamol
Analysis of antimalarials like chloroquine.

Analysis of drugs in the treatment of infections and infestations: Amoxicillin, Chloramphenicol, metronidazole, penicillin, tetracycline, cephalexin(cephalexin).

Anti-tuberculosis drug- isoniazid.

UNIT - II

Analysis of the following drugs and pharmaceuticals preparations: (Knowledge of molecular formula, structure and analysis)

Analysis of antihistamine drugs and sedatives like: allegra, zyrtec(citirizine), alprazolam, trazodone, lorazepam, ambien(zolpidem), diazepam,

UNIT - III

Analysis of anti-epileptic and anti convulsant drugs like phenobarbital and phenacemide. Analysis of drugs used in case of cardiovascular drugs: atenolol, norvasc(amlodipine), Analysis of lipitor(atorvastatin) a drug for the prevention of production of cholesterol.

Analysis of diuretics like: furosemide (Lasix), triamterene

Analysis of prevacid(lansoprazole) a drug used for the prevention of production of acids in stomach.

UNIT - IV

Analysis of Milk and milk products: Acidity, total solids, fat, total nitrogen, proteins, lactose, phosphate activity, casein, chloride. Analysis of food materials- Preservatives: Sodium carbonate, sodium benzoate sorbic acid Coloring matters, - Brilliant blue FCF, fast green FCF, tartrazine, erythrosine, sunset yellow FCF.

Flavoring agents - Vanilla, diacetyl, isoamyl acetate, limonene, ethyl propionate, allyl hexanoate and Adulterants in rice and wheat, wheat flour, sago, coconut oil, coffee powder, tea powder, milk..

UNIT - V

Clinical analysis of blood: Composition of blood, clinical analysis, trace elements in the body. Estimation of blood cholesterol, glucose, enzymes, RBC & WBC, Blood gas analyzer.

Fuels and Industrial Inorganic materials

PAPER – VIII-B-1: FUEL CHEMISTRY AND BATTERIES

45 hrs (3 h / w)

UNIT-I

12h

Review of energy sources (renewable and non-renewable) – classification of fuels and their calorific value. Coal: Uses of Coal (fuel and non-fuel) in various industries , its composition , carbonization of coal - coal gas , producer gas and water gas – composition and uses – fractionation of coal tar – uses of coal tar based chemicals , requisites of a good metallurgical coke , coal gasification (Hydro gasification and catalytic gasification) coal liquefaction and solventrefining.

UNIT-II 6h

Petroleum and petrol chemical industry:

Composition of crude petroleum, refining and different types of petroleum products and their applications.

UNIT-III

10h

Fractional distillation (principle and process) , cracking (Thermal and catalytic cracking). Reforming petroleum and non-petroleum fuels (LPG , CNG , LNG , biogas) ,fuels derived from biomass , fuel from waste , synthetic fuels (gaseous and liquids) , clear fuels , petro chemicals : vinyl acetate , propylene oxide , isoprene , butadiene , toluene and its derivativexylene.

UNIT-IV

10h

Lubricants:

Classification of lubricants, lubricating oils(conducting and non-conducting) , solid and semi solid lubricants , synthetic lubricants. Properties of lubricants (viscosity index, cloud point, pore point) and theirdetermination.

UNIT-V 7h

Batteries:

Primary and secondary batteries, battery components and their role, Characteristics of Battery.Workingoffollowingbatteries:Pbacid,Li-Battery,Solidstateelectrolytebattery. Fuel cells, Solar cell and polymercell.

45 hrs (3 h / w)

UNIT - I

Recapitulation of s- and p-Block Elements

8h

Periodicity in s- and p-block elements with respect to electronic configuration, atomic and ionic size, ionization enthalpy, electronegativity (Pauling, Mulliken, and Alfred - Rochow scales). Allotropy in C, S, and P. Oxidation states with reference to elements in unusual and rare oxidation states like carbides and nitrides), inert pair effect, diagonal relationship and anomalous behaviour of first member of each group.

UNIT -II

15h

Silicate Industries

Glass: Glassy state and its properties, classification (silicate and non-silicate glasses). Manufacture and processing of glass. Composition and properties of the following types of glasses: Soda lime glass, lead glass, armoured glass, safety glass, borosilicate glass, fluorosilicate, coloured glass, photosensitive glass.

Ceramics: Important clays and feldspar, ceramic, their types and manufacture. High technology ceramics and their applications, superconducting and semiconducting oxides, fullerenes carbon nanotubes and carbon fiber.

Cements: Classification of cement, ingredients and their role, Manufacture of cement and the setting process, quick setting cements.

UNIT -III

8h

Fertilizers:

Different types of fertilizers. Manufacture of the following fertilizers: Urea, ammonium nitrate, calcium ammonium nitrate, ammonium phosphates; polyphosphate, superphosphate, compound and mixed fertilizers, potassium chloride, potassium sulphate.

UNIT-IV

8h

Surface Coatings:

Objectives of coatings surfaces, preliminary treatment of surface, classification of surface coatings. Paints and pigments-formulation, composition and related properties. Oil paint, Vehicle, modified oils, Pigments, toners and lakes pigments, Fillers, Thinners, Enamels, emulsifying agents. Special paints (Heat retardant, Fire retardant, Eco-friendly paint, Plastic paint), Dyes, Wax polishing, Water and Oil paints, additives, Metallic coatings (electrolytic and electroless), metal spraying and anodizing.

UNIT-V

6h

Alloys:

Classification of alloys, ferrous and non-ferrous alloys, Specific properties of elements in alloys. Manufacture of Steel (removal of silicon decarbonization, demanganization, desulphurization and phosphorisation) and surface treatment (argon treatment, heat treatment, nitriding, carburizing). Composition and properties of different types of steels.

Chemical explosives:

Origin of explosive properties in organic compounds, preparation and explosive properties of lead azide, PETN, cyclonite (RDX). Introduction to rocket propellants.

IPR, QA & QC and Regulatory Affairs

45hrs (3h/w)

UNIT-I:

9hrs

INTELLECTUAL PROPERTY RIGHTS:

Concept and fundamentals of IPR, need and economic importance of IPR, detail description of various IP Properties (Patents, Trademarks, Copyrights, Geographical Indications Industrial Designs and Trade secrets), IPR with emphasis on patent regime, factors affecting IP protection, penalties for violation or infringement, trade related aspects of IPR, concepts behind GATT, WTO, TRIPS, TRIMS and GATS.

UNIT-II:

9hrs

R & D AND TECHNOLOGY TRANSFER:

Role of R&D, functional structure of R&D, unit research strategies and manufacturing interface, laboratory-industry interface, technology transfer

Pilot Plant Operation and Scale up:

Purpose planning, design and operation, analysis of results, assessment of flexibility of design comprises to cope-up for safety and economic in construction and operation.

UNIT-III:

9hrs

QUALITY CONTROL:

Concept of quality and quality control, nature of variability's, design of QC laboratory for chemical, instrumental and microbiological laboratories, schedule L1, standardization of reagents, labeling of reagents, control samples, data generation and storage, QC documentation, LIMS sampling techniques, sampling plans, steps to improve quality with reference to ISO and TQM, preparation of control charts, sampling, inspection, cost reduction & quality improvement.

UNIT-IV:

9hrs

QUALITY ASSURANCE:

Concepts of Quality Assurance, Total Quality Management, Philosophy of GMP and cGMP, preparation of audit, Conducting audit, Audit Analysis, Audit Report and Audit follow up. Premises: Location, design, plant layout, construction, maintenance of sterile areas, control of contamination.

UNIT-V:

9hrs

INDUSTRIAL STANDARDS AND CONTROL:

Government standards like Agmark, Hallmark, ISI, MINAS, IP, BP, USP; an introduction of ISO, OSHA, CDSCO, USFDA, ICH, FPO, MHRA, SUPAC.

SEMESTER - VI

PAPER – VIII-C-1

ORGANIC SPECTROSCOPIC TECHNIQUES

45 hrs (3 h / w)

UNIT-I

10h

NUCLEAR MAGNETIC RESONANCE SPECTROSCOPY

Nuclear spin, Principles of NMR Magnetic moment and Spin angular momentum. Larmour Frequency. Instrumentation. Relaxation- spin-spin & spin lattice relaxation. Chemical shifts, Shielding and Deshielding mechanism-Factors influencing Chemical shift. Spin-Spin interactions- AX, AX₂ and AB types. Vicinal, Geminal and Long range coupling- Factors influencing coupling constants.

UNIT-II 5h

Spin decoupling, Spin tickling, Deuterium exchange, Chemical shift reagents and nuclear overhauser effect. Applications in Medical diagnostics, Reaction kinetics and Mechanically induced dynamic nuclear polarization. FT NMR and its Advantages.

UNIT-III

10h

UV & VISIBLE SPECTROSCOPY

Electronic spectra of diatomic molecules. The Born-oppenheimer approximation. Vibrational coarse structure: Intensity of Vibrational-electronic spectra: The Franck-Condon principle. Rotational fine structure of electronic vibration transitions. Electronic structure of diatomic molecules. Types of transitions, Chromophores, Conjugated dienes, trienes and polyenes, unsaturated carbonyl compounds-Woodward – Fieser rules.

UNIT-IV

5h

Chemical analysis by Electronic Spectroscopy – Beer-Lambert's Law. Deviation from Beer's law. Quantitative determination of metal ions (Mn⁺², Fe⁺², NO₂⁻). Simultaneous determination of Chromium and Manganese in a mixture

UNIT-V

15h

Electron Spin Resonance Spectroscopy

Basic Principles, Theory of ESR, Comparison of NMR & ESR. Instrumentation, Factors affecting the 'g' value, determination of 'g' value.. Splitting hyper fine splitting coupling constants. Line width, Zero field splitting and Kramer degeneracy..

Applications: - Detection of free radicals;

ESR spectra of

- (a) Methyl radical ($\text{CH}_3\cdot$),
- (b) Benzene anion (C_6H_6^-)
- (c) $\text{CH}_2\cdot\text{CH}_3$ (ETHYL RADICAL)

REFERENCE BOOKS:

1. Electron Spin Resonance Elementary Theory and Practical Applications- John E. Wertz and James R. Bolton, Chapman and Hall, 1986.
2. Spectroscopic Identification of organic compounds – Silverstein, Basseler and Morri.
3. Organic Spectroscopy- William Kemp.
4. Fundamentals of Molecular Spectroscopy- C.N. Banwell and E.A. Mc cash 4th Edition, Tata Mc Graw Hill Publishing Co., Ltd. 1994.
5. NMR, NQR, EPR and Mossbauer Spectroscopy in inorganic chemistry – R.V Parish, Ellis, Harwood.

P. R. GOVERNMENT COLLEGE, KAKINADA
MODEL PAPER FOR SEMESTER – VI (CHEMISTRY)
Paper - VIII: CLUSTER-C-1: ORGANIC SPECTROSCOPIC TECHNIQUES

Duration: 2.30 hrs.

Max. Marks: 60

Answer any **FOUR** questions choosing **AT LEAST ONE** question from each section

4X10=40Marks

Section-I

1. i. Which type of atoms exhibit nuclear magnetic resonance?
ii. Write the principle involved in NMR spectroscopy.
2. Define chemical shift. What are the factors influencing chemical shift?
3. Discuss in detail about the nuclear overhauser effect.

Section-II

4. Write about Born-Oppenheimer approximation.
5. What are the Woodward-Fieser rules of UV-Visible spectroscopy?
6. How is Beer-Lambert's law useful in quantitative determination of Mn (II) and Fe (II)?

Section-III

7. Give the experimental procedure of simultaneous determination of chromium and manganese in a mixture using Beer-Lambert's law.
8. Explain the principle and experimental techniques involved in ESR studies.
9. Write notes on 'g' value and hyperfine structure.

Section-IV

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

4X5=20Marks

10. Describe the factors influencing the coupling constant.
11. Explain about spin decoupling.
12. Write about Franck-Condon principle.
13. What are the different types of electronic transitions?
14. State and explain Beer-Lambert law.
15. Write the quantitative determination of any metal ions.
16. How ESR studies are useful to study the structure of free radicals?
17. How ESR studies are useful to study the structure of benzene anion?

SEMESTER - VI
PAPER – VIII-C-2

ADVANCED ORGANIC REACTIONS.

45 hrs (3 h / w)

UNIT – I

ORGANIC PHOTOCHEMISTRY

Organic photochemistry: Molecular orbitals, carbonyl chromophore–triplet states, Jablonski diagram, inter–system crossing. Energy transfer. Energies properties and reaction of singlet and triplet states of and transitions.

Photochemical reactions:(a) Photo reduction, mechanism, influence of temperature, solvent, nature of hydrogen donors, structure of substrates on the course of photo reduction,.

UNIT –II

ORGANIC PHOTOCHEMISTRY

Norrish cleavages, type I: Mechanism, acyclic cyclic diones, influence of sensitizer, photo Fries rearrangement. Norrish type II cleavage: Mechanism and stereochemistry, type II reactions of esters: 1: 2 diketones, photo decarboxylation, Di - π methane rearrangement, Decomposition of nitrites – Barton reaction.

UNIT – III

PROTECTING GROUPS AND ORGANIC REACTIONS

Principles of (1) Protection of alcohols – ether formation including silyl ethers – ester formation, (2) Protection of diols – acetal and ketal, (3) Protection of carboxylic acids – ester formation, benzyl and t-butylesters, (4) Protection of amines – Acetylation, benzoylation, benzyloxy carbonyl, triphenyl methyl groups, (5) Protection of carbonyl groups – acetal, ketal, 1, 2–glycols and 1, 2–dithioglycols formation.

UNIT – IV

Synthetic reactions: Mannich reaction – Mannich bases – Robinson annulations. The Shapiro reaction, Stork–enamine reaction. Phase transfer catalysis – mechanisms and use of benzyl trialkyl ammonium halides. Wittig reaction.

UNIT –V:

NEW SYNTHETIC REACTIONS

Baylis–Hillman reaction, Mitsunobu reaction, McMurry reaction, Julia–Lythgoe olefination, and Peterson's stereoselective olefination, Heck reaction, Suzuki coupling, Stille coupling and Sonogishira coupling, Buchwald–Hartwig coupling. Ugi reaction, Click reaction

P. R. GOVERNMENT COLLEGE, KAKINADA

MODEL PAPER

SEMESTER – VI (CHEMISTRY)

Paper - VIII : CLUSTER-C-2

ADVANCED ORGANIC REACTIONS

Duration: 2.30 hrs.

Max. Marks: 60

Answer any **FOUR** questions choosing **AT LEAST ONE** question from each section

4X10=40Marks

Section-I

1. Write the mechanism of photo reduction reaction? How it is affected by temperature and solvent?
2. Explain the following:
i) Singlet and triplet states ii) Jablonski diagram
3. Discuss the Norrish type-I cleavage with an example.

Section-II

4. What do you know about the following:
i) Di- π methane rearrangement ii) Barton reaction
5. Give a detailed account on the protection of carbonyl groups.
6. How amine group is protected by acylation and benzoylation.

Section-III

7. Write note on the following:
i) Mannich reaction ii) Wittig reaction
8. Write a note on the following:
i) Use of benzyl trialkyl ammonium halides ii) Phase transfer catalysis
9. Illustrate the following reactions:
i) Baylis-Hillman reaction ii) Heck reaction

Section-IV

Answer any **FOUR** questions. Each question carries **FIVE** marks. **4X5=20Marks**

10. Write notes on inter-system crossing.
11. Explain the nature of hydrogen donors in photochemical reactions
12. Explain about Photo Fries rearrangement.
13. Give a brief account on the protection of carboxylic acids by ester formation.
14. How does carbonate formation protect diols?
15. Write about Robinson annulation.
16. What is Stork-enamine reaction?
17. Write about Buchwald-Hartwig coupling

SEMESTER -VI
PAPER – VIII-C-3
PHARMACEUTICAL AND MEDICINAL CHEMISTRY

45 hrs (3 h / w)

UNIT-I

8h

Pharmaceutical chemistry Terminology: Pharmacy, Pharmacology, Pharmacophore, Pharmacodynamics, Pharmacokinetics (ADME, Receptors - brief treatment) Metabolites and Antimetabolites.

UNIT-II

Drugs:

8h

Nomenclature: Chemical name, Generic name and trade names with examples Classification: Classification based on structures and therapeutic activity with one example each, Administration of drugs

UNIT-III

Synthesis and therapeutic activity of the compounds:

12h

a. Chemotherapeutic Drugs

1. Sulphadugs (Sulphamethoxazole) 2. Antibiotics - β -Lactam Antibiotics, Macrolide Antibiotics, 3. Anti-malarial Drugs (chloroquine)

b. Psycho therapeutic Drugs:

1. Anti pyretics (Paracetamol) 2. Hypnotics, 3. Tranquilizers (Diazepam) 4. Levodopa

UNIT-IV

Pharmacodynamic Drugs:

8h

1. Antiasthma Drugs (Salbutamol) 3. Antianginals (Glycerol Trinitrate)
4. Diuretics (Frusemide)

UNIT-V

HIV-AIDS:

9h

Immunity - CD-4 cells, CD-8 cells, Retro virus, Replication in human body, Investigation available, prevention of AIDS, Drugs available - examples with structures: PIS: Indinavir (crivivan), Nelfinavir (Viracept).

P. R. GOVERNMENT COLLEGE, KAKINADA
MODEL PAPER FOR SEMESTER – VI (CHEMISTRY)
Paper - VIII: CLUSTER-C-3: PHARMACEUTICAL & MEDICINAL CHEMISTRY

Duration: 2.30hrs.

Max. Marks: 60

Answer any **FOUR** questions choosing **AT LEAST ONE** question from each section

4X10=40Marks

Section-I

1. Give a detailed account on pharmacodynamics and pharmacokinetics.
2. Explain the following terms with suitable examples.
i) Metabolites ii) Anti-metabolites
3. How drugs are classified according to their structure?

Section-II

4. Discuss the classification of drugs based on therapeutic activity.
5. Write about the synthesis of chloroquin.
6. Write about the synthesis and therapeutic activity of paracetamol.

Section-III

7. Write about the synthesis of solbutamol.
8. What do you know about CD-4 and CD-8 cells?
9. What are the drugs available for prevention of AIDS? Give their structures.

Section-IV

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

4X5=20Marks

10. Define pharmacy and pharmacology.
11. Define pharmacophore and give two examples.
12. Write the clinical, generic and trade names of paracetamol.
13. Describe the types of administration of drugs.
14. Write about the therapeutic activity of chloroquine.
15. Write the preparation method and uses of antiuritics.
16. Define hypnotics and antipyretics.
17. Write notes on retrovirus.

LABORATORY COURSE –VIII

Practical Paper – VIII- C1

(CUSTER ELECTIVE -1)

(At the end of semester VI)

30 hrs (2 h /W)

1. Preparation of Aspirin
2. Preparation of Paracetamol
3. Preparation of Acetanilide
4. Preparation of Barbituric Acid
5. Preparation of Phenyl Azo- β -naphthol

LABORATORY COURSE – IX

Practical Paper – VIII – C2

(CUSTER ELECTIVE -1I)

(At the end of semester VI)

30 hrs (2 h / W)

1. Green procedure for organic qualitative analysis: Detection of N, S and halogens
2. Acetylation of 1^o amine by green method: Preparation of acetanilide
3. Rearrangement reaction in green conditions: Benzil-Benzilic acid rearrangement
4. Electrophilic aromatic substitution reaction: Nitration of phenol
5. Radical coupling reaction: Preparation of 1,1-bis-2-naphthol
6. Green oxidation reaction: Synthesis of adipic acid
7. Green procedure for Diels Alder reaction between furan and maleic anhydride

LABORATORY COURSE – X

Practical Paper – VIII – C3

(CUSTER ELECTIVE -1II)

(At the end of semester VI)

30 hrs (2 h / W)

Practical Paper: VIII-C-3 Practical

Project Work

