PITHAPUR RAJAH'S GOVERNMENT COLLEGE

An Outcome Based Autonomous Institution Accredited with NAAC Grade "A" (3.17 CGPA)

Affiliated to Adikavi Nannaya University Rajamahendravaram

KAKINADA - 533 001, AP.

BOARD OF STUDIES OF CHEMISTRY

B.Sc. Hons. ANALYTICAL CHEMISTRY MAJORS

UNDER CBCS

Meeting Minutes/ Resolutions

***Convened on 30 April 2024*AY 2024- 25**

DEPARTMENT OF CHEMISTRY

PITHAPUR RAJAH'S GOVERNMENTCOLLEGE (AUTONOMOUS)

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

www.prgc.edu.in; e-mail: chemistry@prgc.edu.in

PROCEEDINGS OF THE PRINCIPAL,

P.R. GOVERNMENT COLLEGE (A)KAKINADA- A.P

Present: Dr. B. V. Tirupanyam, M. Sc;

Ph.D.R.C.No.2/A.C./BOS/2024-25,

Dated: 23.04.2024

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

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

ORDERS:

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

S. No	Name of the Person	Designation
1	V. Sanjeeva Kumar	Chairman & Lecturer In charge
2	Dr. K. Jhansi Lakshmi ASD Govt. Degree College for Women (Autonomous)Kakinada	University Nominee
3	Dr. D. Chenna Rao Lecturer in Chemistry, Govt. Degree College, Yeleswaram	Subject Expert -I
4	U. Sai Krishna Lecturer in Chemistry, Govt. College, (Autonomous)Rajamahendravaram	Subject Expert - II
5	Dr. N. Ratnakar, AARKISH PHARMACEUTICALS INS NJ,NEW JERSEY	Subject Expert - III
6	Dr. P. KARUNA RAMAN MD, IDEAL ORGANICSHYDERABAD.	Representative from Industry
7	T. V. V. Satyanarayana	Member
8	P. Vijay Kumar	Member
9	V. Ram babu	Member
10	G. Pavani	Member
11	Dr. N. Bujji Babu	Member
12	Dr. Ch. Praveen	Member
13	V. Venkateswara Rao	Member
14	U.S.N. Prasad	Member
15	K.N.S. Swami	Member
16	S. Vijaya Lakshmi	Member
17	D.Bhavyasri	Member
18	K.Umamaheswari	Student Alumni Member
19	Deepthi Anusha II FBC	Student Member
20	BVNagendra Kumar, II MCCS	Student Member
21	J.Veera Durga I CHEMISTRY MAJORS	Student Member

The above members are requested to attend the BoS meeting on 30-04-2024 and share their valuablereviews, and suggestions on the following functionaries.

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

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

PITHAPUR RAJAH'S GOVERNMENT COLLEGE (A)
DEPARTMENT OF CHEMISTRY

Meeting of Board of Studies in Analytical Chemistry is convened on 30 April 2024 through offline/ onlineat P.R. Govt. College (A), Kakinada, at 10.00 AM.

Venue: JKC AC HALLS, Dt: 30-04-2024, Tuesday – 10.00 A.M.

The Principal Dr. B.V. Tirupanyam; Chairman V. Sanjeeva Kumar; University Nominee Dr. K. JhansiLakshmi, Lecturer in Chemistry, ASD Govt. Degree College for Women (Autonomous), Kakinada; Dr. P. KARUNA RAMAN MD, IDEAL ORGANICS HYDERABAD. Industrialist: Subject Experts Dr. D. Chenna Rao, Lecturer in Chemistry, Govt. Degree College, Yeleswaram and U. Sai Krishna Lecturer in Chemistry, Govt. College, (Autonomous), Rajamahendravaram all the faculty members of the Chemistry Department and student alumni attended the meeting.

Agenda:

1. To discuss the I,II,III, IV semesters of a Single major system as B.Sc. Chemistry (Hons), B.Sc. Organic Chemistry (Hons), B.Sc. Analytical Chemistry (Hons) from the academic year 2024-25. &V ,VI semesters of CBCS System
2. To discuss the Semester System and revised Choice Based Credit System (CBCS)being implemented for the past 04 years, i.e., i.e. 2020-21.
3. To discuss and approve the Continuation/Modifications of the syllabus for the Odd& Even Semesters of I, II Years for 2024-25.
4. Grant of Extra credits for Online SWAYAM MOOCs, edX, Coursera etc.
5. Syllabus, Model Question Papers and Model Blue Prints, Cos, POs, & PSOs mapping for I, II, III and IV Semesters.
6. Teaching-learning methodology by 50:50 (External: Internal) ratio I& II Year Students commenced w.e.f. 2021-22.
7. Minimum attendance of 75% for both I mid-term examination, and II mid- term examinationunder CIA component shall be the benchmark for attendance and it shall be approved in theBOS.
8. Minimum of 50% integration of ICT into a transaction of curriculum.
9. Remedial coaching and assignments for slow learners, project works, research, Conferences, Industrial /academic tours & PG Entrance Coaching etc., for advanced learners.
10. Panel of paper setters and examiners.
11. Implementation of compulsory Community Service Project (CSP)/ Internships/ Apprenticeship and Extension activities for the benefit of the society.
12. Department action plan for 2024-25.
13. To discuss and resolve the minor modifications/refinement if any, in the I, II, III and IV, Semester.
14. Any Other Proposal with the permission of the Chairman.
15. Proposal to start new UG honors course i.e., BSc., Pharmaceutical Chemistry for the AY 2024-25.

Resolutions:

1. It is resolved to Approve the syllabus after certain additions and deletions were made during the

BOS meeting in the existing syllabus for I,II,III, IV semesters of a Single major system as B.Sc. Chemistry (Hons), B.Sc. Organic Chemistry (Hons), B.Sc. Analytical Chemistry (Hons) from the academic year 2024-25. &V ,VI semesters of CBCS System.

2. It is resolved to approve the syllabus as per the recommendations of the BOS for the Semester System and revised Choice Based Credit System (CBCS)beingimplemented for the past 04 years, i.e., i.e. 2020-21.
3. It is resolved to approve the Continuation/Modifications of the syllabus for the Odd& Even Semesters of I, II Years for 2024-25. As per the recommendations of the BOS.
4. IIt is resolved to approve the Extra credits for Online SWAYAM MOOCs, edX, Coursera etc. which is as per the guidelines of Autonomous examination Cell.
5. It is resolved to approve Syllabus, Model Question Papers and Model Blue Prints, Cos, POs, & PSOs mapping for I, II,III and IV Semesters. With respect to the discussions held in the BOS.
6. It is resolved to approve the teaching learning methodology by 50:50 (External: Internal) ratio I, II & Year Students commenced w.e.f. 2021-22.
7. It is resolved to implement the Minimum attendance of 75% for both I mid-term examination and II mid- term examination under CIA component shall be the benchmark for attendance.
8. It is resolved to approve Minimum of 50% integration of ICT in transaction of curriculum.
9. It is resolved to implement Remedial coaching and assignments for slow learners, project works, research works, Conferences, Industrial /academic tours & PG Entrance Coaching etc., for advancedlearners.
10. It is resolved to propose Panel of paper setters and examiners for the academic year 2024-25.
11. It is resolved that the mandatory Community Service Project (CSP)/ Internships/ Apprenticeship and Extension activities are mandatory for overall growth of the student and benefit to the society.
12. It is resolved to approve Department action plan for the AY 2024-25.
13. It is resolved to approve the minor modifications/refinement if any, in the I, II, III and IV Semester.
14. It is resolved to send proposal to start new UG honors course i.e., B.Sc., Pharmaceutical Chemistry for the AY 2024-25.
15. It is resolved to send proposal to start diploma course in as per the NEP-2020 norms for the academic year 2024-25.

DEPARTMENT OF CHEMISTRY

ACTION PLAN

ACADEMIC YEAR 2024-2025

S.No	Month	Activity planned
1	July 2024	Enrollment of 3 months MOOCS/SWAYAM/NPTL/Edex etc by staff
2	July 2024	Placement Drive through JKC
3	August 2024	Invited talk
4	August 2024	Study tour
5	August 2024	Certificate/ Diploma course
6	September 2024	National seminar/ online/offline
7	September 2024	Sep 16 Ozone Day
8	October 2024	Certificate course/Diploma course
9	November 2024	Invited talk
10	December 2024	Enrollment of 3 months MOOCS/SWAYAM/NPTL/Edex etc by students
11	December 2024	International webinar
12	December 2024	10 December National Chemistry Day
13	January 2025	Invited talk
14	January 2025	Career Guidance
15	February 2025	Community outreach program (In connection with the National Science Day)
16	March 2025	Review of Research Publications for 24-25

PITHAPUR RAJAH'S GOVERNMENT COLLEGE(A)

KAKINADA

IMPORTNANT DAYS OF OBSERVATION FOR AY 2024-25

MONTH	DATE	NAME OF DAY	DEPARTMENT/STUDENT SUPPORTING WING
JANUARY	26th	Republic Day	All Departments and student supporting wings
FEBRUARY	28th	National Science Day	All Science departments
MARCH	22nd	World Water Day	Chemistry
JUNE	5th	World Environment Day	All Science departments
JULY	11th	World Population Day	All Arts depts.
	28th	World Nature Conservation Day	Life sciences
AUGUST	15th	Independence Day	All Departments and student supporting wings
SEPTEMBER	16th	World Ozone Day	Chemistry
	21st	International Day of Peace	History
	23rd	Mole Day	Chemistry
NOVEMBER	11th	National Education Day	

Signature of the members who attended the board of studies in B.sc Honors Chemistry and B.sc Three major system chemistry on 30th April 2024 at 10 a.m. Mode of conduct of meeting offline / online

SL.NO	NAME	SIGNATURE	CONTACT NO.
1	V. Sanjeeva Kumar	V. S.	9849324988
2	Dr. K. Jhansi Lakshmi	K. Jhansi Lakshmi	9441256409
3	Dr. P. KARUNA RAMAN MD, IDEAL ORGANICS, HYDERABAD.	Dr.P.Karuna Raman	9398249493
4	Dr. D. Chenna Rao		9560740108
5	U. Sai Krishna	U. Sai Krishna	9347334707
6	T. V. V. Satyanarayana	T. V. V. Satya	9490876913
7	P. Vijay Kumar	Pvijay	9652023082
8	V. Ram babu		9948485537
9	G. Pavani		9912526493
10	Dr. N. Bujji Babu		9441394792
11	Dr. Ch. Praveen	praveen	9491185518
12	V. Venkateswara Rao	V. Venkateswara Rao	9885165588
13	U.S.N. Prasad	USNP	6300882584
14	K.N.S. Swamy	KNSSwamy	9908900962
15	S. Vijaya Lakshmi	S. Vijaya Lakshmi	9133941966
16	D.Bhavyasri	D. Bhavyasri	
17	Ch. Veni	Ch Veni	
18	Deepthi Anusha II FBC	P. Deepthi Anusha	7382468859
19	Syamala, II MCCS	A. Syamala	6300192780
20			

B. SC ANALYTICAL CHEMISTRY MAJOR COURSE STRUCTURE

SEMESTER-III ACADEMIC YEAR 2024-25

YEAR	SEMESTER	PAPER	TITLE	MARKS	CREDITS
II	**III**	**V**	Quantitative Methods of Analysis	**50**	**3**
			Practical-V	**50**	**1**
		VI	Separation Methods – I	**50**	**3**
			Practical-VI	**50**	**1**
		VII	Physical Chemistry-I	**50**	**3**
			Practical-VII	**50**	**1**
		VIII	General Chemistry and Inorganic Chemistry	**50**	**3**
			Practical-VIII	**50**	**1**

	Pithapur Rajah's Government College(Autonomous) Kakinada	Program &Semester II B.Sc. B. SC ANALYTICAL CHEMISTRY MAJOR & Semester-III (Course-V)			
CourseCode	**COURSE-V: QUANTITATIVE METHODS OF ANALYSIS**				
Teaching	**Hours Allocated: 60** **(Theory)**	**L**	**T**	**P**	**C**
Pre-requisites:	Basic understanding of stoichiometry, chemical equations, concept of concentration and solutions, basic principles of centrifugation, electrochemistry fundamentals	45	10	30	3+1

Course Objectives:

To gains knowledge on production, purification, properties of natural gases.

Course Outcomes:

On Completion of the course, the students will be able to-	
CO1	Understand Various methods in Gravimetric Analysis and its applications.
CO2	To Gain Knowledge on Basic Principles of Volumetric analysis
CO3	To Learn about the Principle and Types of Centrifugation methods and Environmental Analysis.
CO4	To Know the Applications of electroanalytical methods.

Course with focus on employability / entrepreneurship / Skill Development modules

Skill Development		Employability		Entrepreneurship	

Syllabus:

UNIT–I **09 hrs**

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. Properties of precipitates and precipitating reagents: Particle size, Filterability of

Precipitates - Factors that determine particle size &formation of Precipitates. (Mechanism of Precipitate and Relative supper saturation).

D. Colloidal Precipitates - coagulation of colloids, peptization of colloids, Treatment of colloidal precipitates.
E. 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 **09 hrs**

VOLUMETRIC ANALYSIS

Volumetric titrimetry introduction-Definitions of the terms - Titrant, Titrand, The equivalence point, the endpoint and the indicator. Classification of volumetric methods-Acid-base titrations, Redox titrations, Complexometric titrations, Precipitation titrations, Indicator, Theories of indicators and Buffer solutions, Sigmoidal Titration Curves, Henderson –Hassel Balch equation for acids and bases.

UNIT–III **09 hrs**

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 **09 hrs**

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 **09 hrs**

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.

Unit No	Additions	Deletions	Expected levels of learning as per Blooms taxonomy assessment of CO	Percentage added/deleted
I	--	--	K_3, K_4	
II	--	--	K_1, K_2	
III	--	--	K_2, K_3	
IV	--	--	K_5, K_6	
V	--	--	K_3, K_4	

K_1= Remembering, K_2= Understanding, K_3= Applying,
K_4= Analysing, K_5= Evaluating, K_6=Create.

Textbooks & Reference Books

S. No	Author	Title	Publisher
1	R.V.Dilts	Analytical Chemistry-Methods of Separation	---
2	O. Mikes, R.A. Chalmers	Laboratory Handbook of Chromatographic Methods	---
3	F.W. Fifield and D. Kealy	Analytical Chemistry	---
4	GH Jeffery, J. Bassett, J. Mendham,R.C Denny.	Vogel's textbook of quantitative chemical analysis, 6thedition.	Longman Scientific& Technical
5	Skoog& West	Fundamentals of Analyti Chemistry	---

CO-PO Mapping

On Completion of the course, the students will be able to-	
CO1	Understand Various methods in Gravimetric Analysis and its applications.
CO2	To Gain Knowledge on Basic Principles of Volumetric analysis
CO3	To Learn about the Principle and Types of Centrifugation methods and Environmental Analysis.
CO4	To Know the Applications of electroanalytical methods.

CO-PO Mapping

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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	3	1	1	1	1	1	0	1	0	1	3	0
CO2	3	3	1	1	2	1	1	1	2	2	1	0	2
CO3	3	3	1	3	1	1	0	1	1	0	0	1	3
CO4	3	1	0	1	3	3	1	0	1	1	3	2	1

Programme Outcomes (PO):

PO-1 Foundational Knowledge: Graduates will demonstrate a comprehensive understanding of the fundamental principles and theories of analytical chemistry.

PO-2 Laboratory Skills: Graduates will possess practical laboratory skills, including proficiency in using a wide range of analytical instruments and techniques.

PO-3 Data Analysis and Interpretation: Graduates will be able to collect, analyze, and interpret experimental data using statistical methods and computational tools.

PO-4 Quality Assurance: Graduates will understand and apply quality assurance principles to ensure the accuracy and reliability of analytical results.

PO-5 Problem-Solving Abilities: Graduates will develop critical thinking and problem-solving skills to address challenges encountered in analytical chemistry research and practice.

PO-6 Communication Skills: Graduates will effectively communicate scientific concepts and research findings through written reports, oral presentations, and visual aids.

PO-7 Ethical Conduct: Graduates will adhere to ethical principles and professional standards in conducting research and interacting with colleagues and stakeholders.

PO-8 Continuous Learning: Graduates will recognize the importance of lifelong learning and professional development to stay updated with advancements in the field of analytical chemistry.

PO-9 Interdisciplinary Collaboration: Graduates will collaborate effectively with professionals from other disciplines to address complex scientific problems requiring multidisciplinary approaches.

PO-10: Career Readiness: Graduates will be prepared for various career pathways in analytical chemistry, including roles in academia, industry, government, and research institutions.

Programme-Specific Outcomes (PSO):

PSO-1 Instrumentation Proficiency: Graduates will demonstrate advanced proficiency in operating and troubleshooting analytical instruments specific to analytical chemistry, such as spectrophotometers, chromatographs, and mass spectrometers.

PSO-2 Method Development and Optimization: Graduates will have the ability to develop and optimize analytical methods tailored to specific sample matrices and analytical targets.

PSO-3 Specialization in Separation Techniques: Graduates will specialize in separation techniques, including chromatography and electrophoresis, for the analysis of complex mixtures and compounds.

PSO-4 Applications in Industry and Research: Graduates will apply analytical chemistry principles and techniques to address industry-specific challenges in fields such as pharmaceuticals, environmental science, food and beverages, and materials science.

WEIGHTAGE TO CONTENT
SEMESTER -III
COURSE-V: QUANTITATIVE METHODS OF ANALYSIS

S. No	Course Content	Long Answer	Short Answer	Total marks	As per Blooms Taxonomy
1	GRAVIMETRIC ANALYSIS	2	1	25	Evaluating, Analysis
2	VOLUMETRIC ANALYSIS	1	2	20	Remembering, Understanding, Analysis
3	CENTRIFUGATION METHODS	1	1	15	Understanding, Applying
4	INTRODUCTION TO ENVIRONMENTAL ANALYSIS	1	1	15	Understanding, Applying
5	POLAROGRAPHY	1	2	20	Create, Applying, Understanding
	TOTAL	**6**	**7**	**95**	

PITHAPUR RAJAH'S GOVERNMENT COLLEGE(A), KAKINADA.
B.SC.-ANALYTICAL CHEMISTRY
MODEL QUESTIONPAPER
COURSE-V: QUANTITATIVE METHODS OF ANALYSIS

Time: 2 Hrs. **Max. Marks 50**

PART-I

Answer any THREE questions by attempting at least ONE question from each section.
Each Question carries TEN marks. **3X10=30M**

SECTION – A

1. Examine the concept of Precipitation methods in analytical chemistry? Elucidate the various steps involved in precipitation gravimetry. **BT2, CO1, PO2**
2. Evaluate the properties of precipitates and precipitating reagents. **BT3, CO1, PO4**
3. What is an Indicator? List out the various theories of Indicators. **BT1, CO2, PO1**

SECTION – B

4. By using the concept of centrifugation, Explain different types of centrifugation techniques. **BT2, CO3, PO3**
5. How would you demonestrate Environmental pollution from industrial effluents and radiochemical waste. **BT2, CO3, PO9**.
6. Demonstrate the principle and instrumentation of Polarography technique. **BT2, CO4, PO2**.

PART-II

Answer any FOUR Questions from the following.
Each Question carries FIVE marks. **4 x 5 =20M**

7. Evaluate the concept involved in Crystalline precipitates. **BT3, CO1, PO2**.
8. What is Buffer? Explain briefly about Buffer solutions. **BT1, CO2, PO1**.
9. Explain briefly about Complexometric and Redox titrations with examples. **BT1, CO2, PO1**.
10. Write about sedimentation. **BT1, CO3, PO1**.
11. Write briefly about Sampling methods **BT1, CO3, PO1**.
12. Explain about Diffusion current and half wave potentials **BT1, CO4, PO1**.
13. Explain about residual current and migration current **BT1, CO4, PO1**.

PITHAPUR RAJAH'S GOVERNMENT COLLEGE(A), KAKINADA.
B.SC.-ANALYTICAL CHEMISTRY
QUESTION BANK
COURSE-V: QUANTITATIVE METHODS OF ANALYSIS

UNIT-I

Essay Questions:

1. Specify the principles of Volatilization methods. How do you determine the Sodium Bi-carbonate ($NaHCO_3$) content of Antacid tablets by using volatilization method? **BT2, CO1, PO3**
2. Examine the concept of Precipitation methods in analytical chemistry? Elucidate the various steps involved in precipitation gravimetry. **BT2, CO1, PO2**
3. Evaluate the properties of precipitates and precipitating reagents. **BT3, CO1, PO4**
4. Analyse Co-precipitation? Elucidate the different types of Co-precipitation methods. **BT2, CO1, PO3**

Short Answer Questions:

1. Analyse the Gravimetric methods and explain briefly? **BT2, CO1, PO3**
2. Evaluate the concept involved in Colloidal precipitates. **BT3, CO1, PO2**
3. Evaluate the concept involved in Crystalline precipitates. **BT3, CO1, PO2**
4. Analyse Co-precipitation? By using the knowledge of Co-precipitation, explain Co-precipitation errors. **BT2, CO1, PO3**
5. Compare and Contrast Drying and ignition of precipitates. **BT2, CO1, PO2**

UNIT-II

Essay Questions:

1. What is an Indicator? List out the various theories of Indicators. **BT1, CO2, PO1**
2. Derive Henderson – Hassel Balch equation for acids and bases. **BT2, CO2, PO5**
3. Write about the classification of volumetric methods with examples. **BT1, CO2, PO2**
4. Explain about the four types of titrations involved in volumetric analysis. **BT1, CO2, PO2**
5. Explain about the sigmoidal titration curves. **BT1, CO2, PO5**

Short Answer Questions:

1. Explain the terms equivalence point, end point and the Indictor. **BT1, CO2, PO1**
2. What is Indicator? Write the examples of indicators for various types of titrations. **BT1, CO2, PO1**
3. What is Buffer? Explain briefly about Buffer solutions. **BT1, CO2, PO1**
4. Explain briefly about Complexometric and Redox titrations with examples. **BT1, CO2, PO1**

UNIT-III

Essay Questions:

1. ssBy using the concept of centrifugation, Explain different types of centrifugation techniques. **BT2, CO3, PO3**

Short Answer Questions:

1. Explain briefly about centrifugation methods. **BT1, CO3, PO1**
2. Write about sedimentation. **BT1, CO3, PO1**

UNIT-IV

Essay Questions:

1. How would you demonestrate Environmental pollution from industrial effluents and radiochemical waste. **BT2, CO3, PO9**
2. Explain about different types of rotors. **BT1, CO3, PO1**

Short Answer Questions:

1. Write briefly about Sampling methods **BT1, CO3, PO1**
2. Explain briefly about Water analysis. **BT1, CO3, PO1**

UNIT-V

Essay Questions:

1. Demonstrate the principle and instrumentation of Polarography technique. **BT2, CO4, PO2**
2. Elucidate the following. **BT4, CO4, PO3**

   i). Ilkovic equation ii). Dropping mercury electrode (DME).

3. Develop the process to determination of Cu and Zn in brass by using Polarography technique. **BT4, CO4, PO5**

Short Answer Questions:

1. Explain about Diffusion current and half wave potentials **BT1, CO4, PO1**
2. Explain about residual current and migration current **BT1, CO4, PO1**
3. Write the advantages and disadvantages of DME **BT1, CO4, PO1**
4. State and explain the Ilkovic equation **BT1, CO4, PO1**
5. How do you explain the principle and applications of Polarography technique. **BT2, CO4, PO4**

PITHAPUR RAJAH'S GOVERNMENT COLLEGE(A), KAKINADA.
B.SC.-ANALYTICAL CHEMISTRY
QUESTION BANK
COURSE-V: QUANTITATIVE METHODS OF ANALYSIS

LABORATORY COURSE -V **30** hrs. (2 h /w) Max.Marks: 50M

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.

SCHEME OF VALUATION **Max. Marks: 50**

1. Procedure to be written in the first 15 minutes	….	10 Marks
2. Recording of data and reporting the value	Up to 2% error…	25 Marks
3. Error up to 5%	…….	10 Marks
Error greater than 5%	……	5 Marks
4. Viva – Voice	……...	05 Marks
5. Record	……...	10 Marks

Co-Curricular Activities:

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

For Teacher: Training of students by teacher in laboratory and field for not less than15 hours on the field techniques/skills of Volumetric Analysis and their applications.

For Student: Student shall visit a related industry/chemistry laboratory in universities/research organizations/private sector facility and observe the techniques used for Chemical Analysis and their applications. Write their observations and submit a handwritten fieldwork/project work report not exceeding10 pages in the given format to the teacher.

Max marks for Fieldwork/project work Report:05.

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

Unit tests (IE).

a) Suggested Co-Curricular Activities

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

	Pithapur Rajah's Government College(Autonomous) Kakinada	**Program &Semester** **II B.Sc. B. SC ANALYTICAL CHEMISTRY MAJOR** **& Semester-III (Course-V)**			
CourseCode	**COURSE-VI: SEPARATION METHOD**				
Teaching	**Hours Allocated: 60** **(Theory)**	**L**	**T**	**P**	**C**
Pre-requisites:		45	10	30	3+1

Course Objectives:

To gains knowledge on Sparatiom, purification, properties of Various Chemicals and Mixtures.

Course Outcomes:

On Completion of the course, the students will be able to-	
CO1	Understand Principles and Techniques of Solvent Extraction.
CO2	To Gain Knowledge on Principles and Classification of Chromatographic Techniques.
CO3	To Learn about the Principle and Types of Paper, Thin Layer, Column Chromatography.
CO4	To Know the Applications of Normal Phase and Reverse Phase Chromatography.

Course with focus on employability / entrepreneurship / Skill Development modules

Skill Development			Employability			Entrepreneurship	

Syllabus:

UNIT–I **09 hrs**

SOLVENTEXTRACTION:

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 **09 hrs**

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 **09 hrs**

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 Rf 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, Rf values (effect of adsorbent, solvent, solute, development process).

UNIT–IV **09 hrs**

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 **09 hrs**

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.

Unit No	Additions	Deletions	Expected levels of learning as per Blooms taxonomy assessment of CO	Percentage added/deleted
I	--	--	K_3, K_4	
II	--	--	K_1, K_2	
III	--	--	K_2, K_3	
IV	--	--	K_5, K_6	
V	--	--	K_3, K_4	

K_1= Remembering, K_2= Understanding, K_3= Applying,
K_4= Analysing, K_5= Evaluating, K_6=Create.

Textbooks & Reference Books

S. No	Author	Title	Publisher
1	R.V.Dilts	Analytical Chemistry-Methods of Separation	---
2	O. Mikes, R.A. Chalmers	Laboratory Handbook of Chromatographic Methods	---
3	F.W. Fifield and D. Kealy	Analytical Chemistry	---
4	GH Jeffery, J. Bassett, J. Mendham,R.C Denny.	Vogel's textbook of quantitative chemical analysis, 6thedition.	Longman Scientific& Technical
5	Skoog& West	Fundamentals of Analyti Chemistry	---

CO-PO Mapping

On Completion of the course, the students will be able to-	
CO1	Understand Principles and Techniques of Solvent Extraction.
CO2	To Gain Knowledge on Principles and Classification of Chromatographic Techniques.
CO3	To Learn about the Principle and Types of Paper, Thin Layer, Column Chromatography.
CO4	To Know the Applications of Normal Phase and Reverse Phase Chromatography.

CO-PO Mapping

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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	3	1	1	1	1	1	0	1	0	1	3	0
CO2	3	3	1	1	2	1	1	1	2	2	1	0	2
CO3	3	3	1	3	1	1	0	1	1	0	0	1	3
CO4	3	1	0	1	3	3	1	0	1	1	3	2	1

Programme Outcomes (PO):

PO-1 Foundational Knowledge: Graduates will demonstrate a comprehensive understanding of the fundamental principles and theories of analytical chemistry.

PO-2 Laboratory Skills: Graduates will possess practical laboratory skills, including proficiency in using a wide range of analytical instruments and techniques.

PO-3 Data Analysis and Interpretation: Graduates will be able to collect, analyze, and interpret experimental data using statistical methods and computational tools.

PO-4 Quality Assurance: Graduates will understand and apply quality assurance principles to ensure the accuracy and reliability of analytical results.

PO-5 Problem-Solving Abilities: Graduates will develop critical thinking and problem-solving skills to address challenges encountered in analytical chemistry research and practice.

PO-6 Communication Skills: Graduates will effectively communicate scientific concepts and research findings through written reports, oral presentations, and visual aids.

PO-7 Ethical Conduct: Graduates will adhere to ethical principles and professional standards in conducting research and interacting with colleagues and stakeholders.

PO-8 Continuous Learning: Graduates will recognize the importance of lifelong learning and professional development to stay updated with advancements in the field of analytical chemistry.

PO-9 Interdisciplinary Collaboration: Graduates will collaborate effectively with professionals from other disciplines to address complex scientific problems requiring multidisciplinary approaches.

PO-10: Career Readiness: Graduates will be prepared for various career pathways in analytical chemistry, including roles in academia, industry, government, and research institutions.

Programme-Specific Outcomes (PSO):

PSO-1 Instrumentation Proficiency: Graduates will demonstrate advanced proficiency in operating and troubleshooting analytical instruments specific to analytical chemistry, such as spectrophotometers, chromatographs, and mass spectrometers.

PSO-2 Method Development and Optimization: Graduates will have the ability to develop and optimize analytical methods tailored to specific sample matrices and analytical targets.

PSO-3 Specialization in Separation Techniques: Graduates will specialize in separation techniques, including chromatography and electrophoresis, for the analysis of complex mixtures and compounds.

PSO-4 Applications in Industry and Research: Graduates will apply analytical chemistry principles and techniques to address industry-specific challenges in fields such as pharmaceuticals, environmental science, food and beverages, and materials science.

WEIGHTAGE TO CONTENT

SEMESTER -III
COURSE-VI: SEPARATION METHOD

S. No	Course Content	Long Answer	Short Answer	Total marks	As per Blooms Taxonomy
1	Solvent Extraction	1	2	20	Applying, Understanding
2	Chromatography	1	1	15	Remembering, Understanding
3	Paper, Thin layer Chromatography	2	1	25	Understanding, Applying
4	Column Chromatography	1	2	15	Understanding, Create
5	Partition & Adsorption Chromatography	1	1	15	Applying, Analysis
	TOTAL	**6**	**7**	**95**	

PITHAPUR RAJAH'S GOVERNMENT COLLEGE(A), KAKINADA.
B.SC.-ANALYTICAL CHEMISTRY
MODEL QUESTIONPAPER
COURSE-VI: SEPARATION METHOD

Time: 2 Hrs. **Max. Marks 50**

PART-I

Answer any THREE questions by attempting at least ONE question from each section.

Each Question carries TEN marks. **3X10=30M**

SECTION – A

1. Illustrate the principles and applications of Solvent extraction. **BT2, CO1, PO3**.
2. Explain about the Principle and classification of Chromatographic methods **BT1, CO2, PO2**.
3. Write about various modes of developments in Paper chromatographic technique. **BT1, CO3, PO2**.

SECTION – B

4. Explain the principle and Design the Experimental set up and applications of HPLC **BT4, CO3, PO3**
5. Analyse the Principle, Adsorbents, Solvents used in Adsorption Chromatography. **BT2, CO4, PO4**.
6. Demonstrate the principle, experimental set up and applications of TLC. **BT2, CO3, PO2**.

PART-II

Answer any FOUR Questions from the following.

Each Question carries FIVE marks. **4 x 5 =20M**

7. How do you determine Fe(III) by using solvent extraction technique? **BT2, CO1, PO4**.
8. Explain briefly about efficiency of a chromatographic column. **BT1, CO2, PO4.**
9. Write about nature of paper, detection of spots in paper chromatography Write about nature of paper, detection of spots in paper chromatography. **BT1, CO3, PO1**.
10. Explain about Column development and sample elution in Column chromatography. **BT1, CO3, PO2**.
11. Analyse the principle and applications of Adsorption chromatography. **BT2, CO4, PO4.**
12. Explain factors affecting solvent extraction. **BT1, CO1, PO1**.
13. Explain about various Detectors used in HPLC. **BT1, CO3, PO1**.

PITHAPUR RAJAH'S GOVERNMENT COLLEGE(A), KAKINADA.
B.SC.-ANALYTICAL CHEMISTRY
QUESTION BANK
COURSE-V: QUANTITATIVE METHODS OF ANALYSIS

UNIT-I

Essay Questions:

1. Illustrate the principles and applications of Solvent extraction. **BT2, CO1, PO3**

2. Demonstrate the principle and experimental techniques of solvent extraction. **BT2, CO1, PO2**

3.Explain about different types of Solvent extraction techniques. **BT1, CO1, PO2**

Short Answer Questions:

1. Explain factors affecting solvent extraction. **BT1, CO1, PO1**
2. How do you determine Fe(III) by using solvent extraction technique? **BT2, CO1, PO4**
3. Explain the principle and applications of solvent extraction. **BT1, CO1, PO4**

UNIT-II

Essay Questions:

1. Explain about the Principle and classification of Chromatographic methods **BT1, CO2, PO2**
2. Explain about the theory and description of Chromatographic process. **BT1, CO2, PO2**

Short Answer Questions:

1. Explain briefly about efficiency of a chromatographic column. **BT1, CO2, PO4**
2. What are distribution coefficients? Explain briefly **BT1, CO2, PO3**
3. Write about the principle of differential migration. **BT1, CO2, PO1**
4. Explain briefly about Resolution and capacity factor. **BT1, CO2, PO1**

UNIT-III

Essay Questions:

1. Write about various modes of developments in Paper chromatographic technique. **BT1, CO3, PO2**
2. Demonstrate the principle, experimental set up and applications of Paper chromatography. **BT2, CO3, PO2**
3. Demonstrate the principle, experimental set up and applications of TLC. **BT2, CO3, PO2**
4. Explain briefly about Plate preparation, Adsorbents and development process in TLC **BT1, CO3, PO2**

Short Answer Questions:

1. Write about nature of paper, detection of spots in paper chromatography. **BT1, CO3, PO 1**
2. Explain about the Quantitative analysis of Paper chromatography. **BT1, CO3, PO4**
3. Write about Quantitative analysis of TLC. **BT1, CO3, PO4**
4. Illustrate the Sample application and plate preparation in TLC. **BT2, CO3, PO2**
5. Explain about Stationary phase, Support materials and Liquid phases in TLC. **BT1, CO3, PO1**
6. Define Rf value and write its significance. **BT1, CO3, PO1**

UNIT-IV

Essay Questions:

1. Explain the principle and Design the Experimental set up and applications of HPLC **BT4, CO3, PO3**
2. Write about Columns and detectors used in HPLC **BT1, CO3, PO1**
3. Explain briefly about HPLC Chromatographic technique **BT1, CO3, PO2**

Short Answer Questions:

1. Write about Columns and Column packing in Column chromatography. **BT1, CO3, PO2**.
2. Explain about Column development and sample elution in Column chromatography. **BT1, CO3, PO2**
3. Explain about various Detectors used in HPLC. **BT1, CO3, PO1**
4. Write about Stationary phases and Mobile phases used in HPLC. **BT1, CO3, PO1**
5. Explain about Retention volumes and Retention times. **BT1, CO3, PO1**

UNIT-V

Essay Questions:

1. Analyse the Principle, Adsorbents, Solvents used in Adsorption Chromatography. **BT2, CO4, PO4**.
2. Analyse the principle and applications of Adsorption chromatography. **BT2, CO4, PO4**.
3. Analyse Principle and applications of Liquid –liquid partition chromatography. **BT2, CO4, PO4**.
4. Demonstrate the Normal phase and Reversed - phase chromatographic techniques. **BT2, CO4, PO4**.

Short Answer Questions:

1. Write the principle and applications of Adsorption chromatography. **BT2, CO4, PO1**.
2. Compare and Contrast the NPC and RPC? **BT2, CO4, PO3.**
3. Illustrate the principle of Partition chromatography. **BT2, CO4, PO3**.

PITHAPUR RAJAH'S GOVERNMENT COLLEGE(A), KAKINADA.
B.SC.-ANALYTICAL CHEMISTRY
QUESTION BANK
COURSE-VI: SEPARATION METHODS

LABORATORY COURSE -VI **30** hrs. (2 h /w) Max.Marks: 50M

1. Determination of Rf 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:
7. Chicory in coffee powder,
8. Foreign resin in asafoetida
9. Chilli powder
10. Turmeric powder
11. Pulses

SCHEME OF VALUATION **Max. Marks: 50**

1.Procedure to be written in the first 15 minutes	….	10 Marks
2.Recording of data and reporting the value up to 2% error……		25 Marks
Error up to 5%	…….	15 Marks
Error greater than 5%	……	5 Marks
4.Viva – Voice	……..	05 Marks
5. Record	……..	10 Marks

Co-Curricular Activities:

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

For Teacher: Training of students by teacher in laboratory and field for not less than15 hours on the field techniques/skills of Volumetric Analysis and their applications.

For Student: Student shall visit a related industry/chemistry laboratory in universities/research organizations/private sector facility and observe the techniques used for Chemical Analysis and their applications. Write their observations and submit a handwritten fieldwork/project work report not exceeding10 pages in the given format to the teacher.

Max marks for Fieldwork/project work Report:05.

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

Unit tests (IE).

a) Suggested Co-Curricular Activities

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

	PITHAPUR RAJAH'S GOVERNMENT COLEGE(A) Kakinada DEPARTMENT OF CHEMISTRY	Program & Semester			
Course Code CHE-7	TITLEOFTHECOURSE PHYSICAL CHEMISTRY – I (Solutions & Electro Chemistry)	II B.Sc. (III Semester)			
Teaching	HoursAllocated:45 (**Theory**)	L	T	P	C
Pre-requisites		45	10	30	3+1

Course Objectives:

1. Understanding Solutions
2. Electrochemical Concepts
3. Equilibrium in Electrochemical Systems
4. Applications of Electrochemistry
5. Problem-solving Skills

Course Outcomes:

On Completion of the course, the students will be able to	
CO1	Understand the ideal and non ideal behaviour of solutions
CO2	Determine the molecular mass of non-volatile solutes.
CO3	Discuss the basic concepts of Photochemistry.
CO4	Apply the principles of electrical conductivity.
CO5	Explain the importance of emf and its applications

Course with focus on Skill Development/Employability/Entrepreneurship modules

Skill Development		Employability		Entrepreneurship	

PHYSICAL CHEMISTRY – I

(Solutions & Electro Chemistry **Syllabus)**

Unit I Solutions (9 hs

Classification - Miscible, Partially miscible and Immiscible - Raoult's Law - AzeotropesHCl-H2O system and ethanol-water system. Partially miscible liquids-phenol- water system. Critical solution temperature (CST), Effect of impurity on consulate temperature. Immiscible liquids and steam distillation. Nernst distribution law. Calculation of the partition coefficient. Applications of distribution law.

Unit II Colligative Properties (9 h)

Relative lowering of Vapour Pressure, Elevation in boing point depression in freezing point and Osmotic pressure. Determination of molecular mass of non-volatile solute by OstwaldWalker method, Cottrell's method, Rast method and Barkeley-Hartley method. Abnormal colligative properties. Van't Hoff factor.

Unit III – Photochemistry (9h)

Difference between thermal and photochemical processes, Laws of photochemistry- Grothus-Draper's law and Stark-Einstein's law of photochemical equivalence, Quantum yield- Photochemical reaction mechanism- hydrogen- chlorine and hydrogen- bromine reaction. Qualitative description of fluorescence, phosphorescence, Jablonski diagram, chemiluminescence - Photosensitized reactions- energy transfer processes (simple example), quenching, Photo stationary state.

Unit IV Electrochemistry-I (9 h)

Conductance, Specific conductance, equivalent conductance and molar conductance - effect of dilution. Cell constant. Strong and weak electrolytes, Kohlrausch's law and its applications, Definition of transport number, determination of transport number by Hittorf's method. Debye-Huckel - Onsagar's equation for strong electrolytes (derivation excluded), Application of conductivity measurements- conductometric titrations.

Unit V Electrochemistry-II (9 h)

Electrochemical Cells- Single electrode potential, Types of electrodes with examples: Metalmetal ion, Gas electrode, Inert electrode, Redox electrode, Metal-metal insoluble salt- salt anion. Determination of EMF of a cell, Nernst equation, Applications of EMF measurements - Potentiometric titrations. Fuelcells – Basic concepts, examples and applications

Reference books

S.NO	AUTHOR	TITLE	PUBLISHER
1	Prutton and Marron	Principles of physical chemistry	
2	Anthony R. West	Solid State Chemistry and its applications	
3	K L Kapoor	Text book of physical chemistry	
4	S Glasstone	Text book of physical chemistry	
5	Bahl and Tuli	Advanced physical chemistry	
6	GurudeepRaj	Advanced physical chemistry	
7	Puri, Sharma and Pathania	Principles of physical chemistry	

WebLinks:

Course outcome & Program outcome mapping

On Completion of the course, the students will be able to	
CO1	Understand the ideal and non ideal behaviour of solutions
CO2	Determine the molecular mass of non-volatile solutes.
CO3	Discuss the basic concepts of Photochemistry.
CO4	Apply the principles of electrical conductivity.
CO5	Explain the importance of emf and its applications

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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	2	3	1	2	3	1	4	1	4	2
CO2	2	4	1	4	1	3	2	1	3	2
CO3	2	3	2	3	1	2	4	2	1	2
CO4	2	4	2	2	3	2	1	2	3	1
CO5	1	3	2	2	2	3	1	2	2	1

PROGRAMME OUTCOMES

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

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

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

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

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

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

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

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

PROGRAM SPECIFIC OUTCOMES (PSO's)

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

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

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

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

Weightage to content

Semester -III

Course - 7

S.No	Course Content	Long Answer	Short Answer	Total marks	As per Blooms Taxonomy
1	Unit I Solutions	2	2	30	Understanding, Application
2	Unit II Colligative Properties	1	1	15	Remembering, Understanding
3	Unit III – Photochemistry	1	1	15	Analysizing & Creation
4	Unit IV Electrochemistry-I	1	1	15	Evaluation, Understanding
5.	Unit V Electrochemistry-II	1	2	20	Understanding, Application
	TOTAL	**6**	**7**	**95**	

P.R. GOVERNMENT COLLEGE (A), KAKINADA

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

(COURSE – 7 - PHYSICAL CHEMISTRY – I

(Solutions & Electro Chemistry)

MODEL PAPER

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

Section -I

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

Part – A

1. UNIT-I
2. UNIT-I
3. UNIT-II

Part - B

4. UNIT-III
5. UNIT-IV
6. UNIT-V

Section II

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

7. UNIT-I
8. UNIT-I
9. UNIT-I I
10. UNIT-III
11. UNIT-IV
12. UNIT-V
1. T-V

SEMESTER-III

COURSE 7: PHYSICAL CHEMISTRY -I

Practical Credits: 1 2 hrs/week

Practical- PHYSICAL CHEMISTRY -I (PHYSICAL CHEMISTRY) 50 M

I. tcomes: At the end of the course, the student will be able to;

- y the principles of phase equilibrium to determine the critical solution temperature (CST) for a binary system.
- tand the role of electrolytes in altering the intermolecular forces and interactions between solvent and solute molecules.
- tand the principles of conductometric titration, including the equivalence point, conductivity changes, and titration curves.
- y the principles of conductometric titration to determine the concentration of weak acid solutions.
- t experimental data to calculate the concentration of acetic acid solution using standard sodium hydroxide solution.
- tand the principles of potentiometric titration, including the use of a pH meter to monitor changes in solution acidity.
- y titration calculations and the Nernst equation to determine the concentration of hydrochloric acid solution accurately.

Laboratory course syllabus: CST, Conductometric and Potentiometric Titrimetry 50 M

1. Determination of CST for Phenol-water system.
2. Effect of electrolyte on CST.
3. Conductometric titration - Determination of concentration of HCl solution using standard NaOH solution.
4. Conductometric titration – Determination of concentration of CH3COOH Solution using standard NaOH solution.
5. Potentiometric titration-Determination of concentration of HCl using standard NaOH solution.

Co-curricular Activities and Assessment Methods

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

2) Class Tests, Worksheets, and Quizzes

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

SCHEME OF VALUATION

a. Procedure in first 20 Minutes	10 M
b. Tabular form& Formula	10 M
c. Graph & Calculation	10 M
d. Result with error <2% >2%	10 M 05 M
e. Viva voce	05 M
f. Record	05 M
TOTAL	**50 marks**

	PITHAPUR RAJAH'S GOVERNMENT COLEGE(A) Kakinada DEPARTMENT OF CHEMISTRY	Program & Semester			
Course Code CHE-VIII	TITLEOFTHECOURSE **GENERAL AND INORGANIC CHEMISTRY**	II B.Sc. (III Semester)			
Teaching	HoursAllocated:45 (**Theory**)	L	T	P	C
Pre-requisites	Atomic models and chemical bonding	45	10	30	3+1

Course Objectives:

1. Atomic Structure and Periodic table
2. Ionic bond
3. The Covalent Bond
4. Metallic and Weak Bonds
5. Acids and Bases.

Course Outcomes:

On Completion of the course, the students will be able to	
CO1	Understand the structure of atom and the arrangement of elements in the periodic table
CO2	Understand the properties of Ionic bond.
CO3	Identify the structure of a given inorganic compound.
CO4	Explain the existence of special types of compounds through weak chemical forces.
CO5	Define acids and bases and predict the nature of salts

Course with focus on Skill Development/Employability/Entrepreneurship modules

Skill Developement		Employability		Entrepreneurship	

Syllabus:

UNIT-I: Atomic Structure and Periodic table **9 h**

Electronic configuration: Bohr theory, dual nature of electrons, Heisenberg uncertainty principle, the Schrodinger equation, significance of wave functions, normalization of wave function, radial and angular wave functions, Pauli's exclusion principle, Hund's rule, sequence of energy levels (Aufbau principle).

Periodicity: periodic law and arrangement of elements in the periodic table, IUPAC nomenclature and group number, horizontal, vertical, and diagonal relationships in the periodic table. General

properties of atoms: size of atoms and ions-atomic radii, ionic radii, covalent radii; trend in ionic radii, ionization potential, electron affinity; electronegativity - Pauling, Mulliken-Jaffe, Allred-Rochow definitions; oxidation states and variable valency; isoelectronic relationship; inert-pair effect

UNIT-II : Ionic bond **9h**

Properties of ionic compounds, factors favouring the formation of ionic compounds- ionization potential, electron affinity, and electronegativity. Lattice energy: definition, factors affecting lattice energy, Born-Haber cycle-enthalpy of formation of ionic compound and stability. Stability of ionic compounds in terms of ΔHf and Uo. Solubility and thermal stability of ionic compounds. Covalent character in ionic compounds-polarization and Fajan's rules; effects of polarization-solubility, melting points, and thermal stability of typical ionic compounds.

UNIT-III: The Covalent Bond **12 h**

Valance Bond theory-arrangement of electrons in molecules, hybridization of atomic orbitals and geometry of molecules-$BeCl_2$, BF_3, CH_4, PCl_5, SF_6– VSEPR model-effect of bonding and nonbonding electrons on the structure of molecules, effect of electronegativity, isoelectronic principle, illustration of structures by VSEPR model-NH_3, H_2O, SF_4, ICl^-, XeF_4, XeF_6

Molecular orbital theory -LCAO method, construction of M.O. diagrams for homo-nuclear and hetero-nuclear diatomic molecules (N_2, O_2, CO and NO)

Unit-IV: Metallic and Weak Bonds **9 h**

The Metallic bond: metallic properties, free electron theory, Valence Bond Theory, band theory of metals. Explanation of conductors, semiconductors and insulators.

Weak bonds: hydrogen bonding-intra- and intermolecular hydrogen bonding, influence on the physical properties of molecules, comparison of hydrogen bond strength and properties of hydrogen bonded N, O and F compounds; associated molecules-ethanol and acetic acid; Vander Waals forces, ion dipole-dipole interactions.

Unit-5: Acid Bases **9h**

Theories of acids and bases: Arrhenius theory, Bronsted-Lowry theory, Lewis theory, the solvent system, Non-aqueous solvents: classification-protonic and aprotic solvents, liquid ammonia as solvent-solutions of alkali and alkaline earth metals in ammonia.

Types of chemical reactions: acid-base, oxidation-reduction, calculation of oxidation number. Definition of pH, pK_a, pK_b. Types of salts, Salt hydrolysis. Pearson's concept, HSAB principle & its importance, bonding in Hard-Hard and Soft-Soft combinations.

Reference books

S.NO	AUTHOR	TITLE	PUBLISHER
1	J. D. Lee	Concise Inorganic Chemistry	Blackwell Science
2	B. R. Puri, L. R. Sharma, K. C. Kalia,	Principles of Inorganic Chemistry	Shoban Lal Nagin Chand and Co
3	D. F. Shriver and P. W. Atkins,	Inorganic Chemistry	W. H. Freeman and Co

WebLinks:

Course outcome & Program outcome mapping

On Completion of the course, the students will be able to	
CO1	Understand the structure of atom and the arrangement of elements in the periodic table
CO2	Understand the structure of atom and the arrangement of elements in the periodic table
CO3	Identify the structure of a given inorganic compound.
CO4	Explain the existence of special types of compounds through weak chemical forces.
CO5	Define acids and bases and predict the nature of salts

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

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

PROGRAMME OUTCOMES

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

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

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

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

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

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

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

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

PROGRAM SPECIFIC OUTCOMES (PSO's)

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

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

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

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

Weightage to content

Semester -III

Course - VIII

S.No	CourseContent	Long Answer	ShortAnswer	Totalmarks	As per Blooms Taxonomy
1	Atomic Structure and Periodic table	2	2	30	Understanding, Application
2	Ionic bond	1	1	15	Remembering, Understanding
3	Covalent bond	1	1	15	Analysizing & Creation
4	Metallic and Weak bonds	1	1	15	Evaluation, Understanding
5.	ACIDS & BASES	1	2	20	Understanding, Application
	TOTAL	**6**	**7**	**95**	

P.R. GOVERNMENT COLLEGE (A), KAKINADA

II YEAR B.Sc (Examination at the end of II semester)
(COURSE – VIII - Inorganic and General Chemistry)

MODEL PAPER

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

Section -I

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

Part – A

1. Write a short note on a) Significance of wave function
   b) Electronic configuration rules.
2. Define lattice enthalpy. Determine lattice enthalpy by using born Haber cycle take an example.
3. Write about ionization energy and atomic size. What is the relation between them and justify your answer with an example.

Part - B

4. Why O_2 is paramagnetic and N_2 is diamagnetic? Explain with the help of molecular orbital diagrams.
5. Describe the properties of metals by using free electron theory and band theory.
6. Write a brief note on Pearson concept of HSAB principle.

Section II

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

7. Predict the relation between pauling and Mulliken scale to explain electron negativity.
8. Explain Heisenberg uncertainty principle.
9. Write the factors favourable for the formation of ionic compounds. Explain with examples.
10. Illustrate the structure of ammonia and XeF_4 by VSEPR model.
11. Compare strength of hydrogen bonding strength In o-Nitrophenol and p- Nitro phenol.
12. Describe the nature of salts NH_4Cl, $CuSO_4$ and KNO_3.
13. Explain solvent effect of ammonia on alkali metals and alkaline earth metals.

SEMESTER-III

COURSE VIII: GENERAL AND INORGANIC CHEMISTRY

Practical Credits: 1 2 hrs/week

Practical- I Qualitative Analysis of SIMPLE SALT

Qualitative inorganic analysis (Minimum of Six simple salts should be analysed) 50 M

I. Course outcomes:

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

1. Understand the basic concepts of qualitative analysis of inorganic simple salt.
2. Use glassware, equipment and chemicals and follow experimental procedures inthe laboratory
3. Apply the concepts of common ion effect, solubility product and concepts relatedto qualitative analysis

Laboratory course syllabus: Analysis of SIMPLE SALT 50 M

I.

Analysis of simple salt containing ONE anion and ONE cation from the following:
Anions: Carbonate, Sulphate, Chloride, Bromide, Acetate, Nitrate, Borate, Phosphate.

Cations: Lead, Copper, Iron, Aluminium, Zinc, Nickel, Manganese,Calcium, Strontium, Barium, Magnesium and Ammonium.

Co-curricular activities and Assessment Methods

1. Continuous Evaluation: Monitoring the progress of student's learning.
2. Class Tests, Work sheets and Quizzes
3. Presentations, Projects and Assignments and Group Discussions: Enhances critical thinking skills and personality
4. SEMESTER -End Examination: critical indicator of student's learning and teaching methods adopted by teachers throughout theSEMESTER

SCHEME OF VALUATION

a. Preliminary Tests	05 M
b. Identification of anion	08 M
c. Conformation tests for anion	10 M
d. Identification cation(Group separation table)	10 M
e. Conformation of Cation	05 M
f. Report	02 M
g. Viva voce	05 M
h. Record	05 M
TOTAL	**50 marks**