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(A) KAKINADA DEPARTMENT OF CHEMISTY	Program & Semester Ana Chemistry II B.Sc. (IV Semester)			
Course Code CHE-9	TITLEOFTHECOURSE **COURSE 9: PHYSICAL CHEMISTRY-II** 2023-24 AB				
Teaching	HoursAllocated:45 (**Theory**)	L	T	P	C
Pre-requisites	Gas laws, Laws of symmetry, Intermolecular interactions	45	10	30	3+1

CourseOutcomes:

On Completion of the course, the students will be able to	
CO1	Explain the difference between solids liquids and gases in terms of intermolecular interactions
CO2	Understand the basic concepts of crystallography.
CO3	Discuss the basic concepts of two component systems
CO4	Apply the concepts of adsorption

Course with focus on Skill Development/Employability/Entrepreneurship modules

SkillDevelopment		Employability		Entrepreneurship	

Syllabus:

Unit I - Gaseous state (9 h)

Postulates of Kinetic theory of Gases (exclude derivation) – deduction of gas laws from kinetic gas equation-Vander Waal's equation of state. Andrew's isotherms of carbon dioxide, continuity of state. Critical phenomena. Relationship between critical constants and vander Waal's constants. Law of corresponding states. Joule- Thomson effect. Inversion temperature.

Unit II: Liquid State (9 h)

Physical properties of liquids; vapour pressure, surface tension and coefficient of viscosity, and their determination. Effect of addition of various solutes on surface tension and viscosity. Temperature variation of viscosity of liquids and comparison with that of gases. Qualitative discussion of the structure of water.

Liquid crystals, mesomorphic state. Differences between liquid crystal and solid/liquid. Classification of liquid crystals into Smectic and Nematic. Application of liquid crystals as LCD devices

UNIT-III - Solid state (9h)

Symmetry in crystals. Law of constancy of interfacial angles. The law of rationality of indices. Miller indices, Definition of lattice point, space lattice, unit cell. Bravais lattices and crystal systems. X-ray diffraction and crystal structure. Bragg's law and its derivation. Powder method. Defects in crystals. Stoichiometric and non-stoichiometric defects.

Unit IV - Phase Rule (9 h)

The Concept of phase, components, degrees of freedom. Gibbs phase rule. Phase diagram of one component system – water system, Study of Phase diagrams of Simple eutectic systems i) Pb-Ag system, desilverisation of lead ii) NaCl-Water system, Congruent and incongruent melting point- Definition and examples for systems having congruent and incongruent melting point, freezing mixtures.

Unit V Surface Chemistry (9 h)

Definition and classification of Colloids- Coagulation of colloids- Hardy-Schulze rule. Stability of colloids, Protection of Colloids, Gold number.

Adsorption - Physical and chemical adsorption, Freundlich and Langmuir adsorption isotherm, applications of adsorption.

Textbooks:

S.NO	AUTHOR	TITLE	PUBLISHER
1	**K L Kapoor Vol.1**	**Text book of physical chemistry**	JPNP publications
2	**Puri, Sharma and Pathania.**	**Principles of physical chemistry**	S.Chand publications

Reference books

S.NO	AUTHOR	TITLE	PUBLISHER
1	**Anthony R. West**	**Solid State Chemistry and its applications**	
2	**S Glasstone**	**Text book of physical chemistry**	**Oxford University Press**
3	**Bahl and Tuli.**	**Advanced physical chemistry**	**Oxford University Press**

WebLinks:

1. https://r.search.yahoo.com/_ylt=Awrx_2xJRzhntwIAF1K7HAx.;_ylu=Y29sbwNzZzMEcG9zAzEEdnRpZAMEc2VjA3Ny/RV=2/RE=1732951113/RO=10/RU=https%3a%2f%2fncert.nic.in%2fncerts%2fl%2fkech105.pdf/RK=2/RS=Vm9QfnIDc3bV3suL2OFEa2QmVNU-
2. https://ncert.nic.in/ncerts/l/kech105.pdf
3. https://ncert.nic.in/ncerts/l/lech101.pdf
4. https://in.video.search.yahoo.com/search/video;_ylt=Awr1QGxgSDhn6gEAOiO7HAx.;_ylu=Y29sbwNzZzMEcG9zAzEEdnRpZAMEc2VjA3Nj?type=E210IN885G0&p=Phase+rule+ncert+pdf&fr=mcafee&turl=https%3A%2F%2Ftse4.mm.bing.net%2Fth%3Fid%3DOVP.JxFcEpp5NbDamMSQrb4TBgHgFo%26pid%3DApi%26w%3D296%26h%3D156%26c%3D7%26p%3D0&rurl=https%3A%2F%2Fwww.youtube.com%2Fwatch%3Fv%3DlkyOlL0yuCo&tit=PHASE+RULE+%28+Phase%2C+components+and+degree+of+freedom+in+a+single+shot+with+examples%29&pos=11&vid=81f4608b48f4687d75f45904baeaac3e&sigr=N6uflKlnj6Q5&sigt=hJJod0UFuWJ9&sigi=7h78CUEbal4Y
5. https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=13G8VouhmrFfuhs6rkiyTA==

Course outcome & Program outcome mapping

On Completion of the course, the students will be able to	
CO 1	Explain the difference between solids liquids and gases in terms of intermolecular interactions
CO 2	Understand the basic concepts of crystallography.
CO 3	Discuss the basic concepts of two component systems
CO 4	Apply the concepts of adsorption

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

CO	PO1	PO 2	PO3	PO 4	PO 5	PO6	PO 7	PSO1	PSO2	PSO 3		
CO1	3	2	2	2	1	2	1	3	2	2		
CO2	3	1	2	2	1	1	1	3	1	2		
CO3	3	2	2	3	2	2	2	3	2	2		
CO4	3	1	1	1	1	1	1	2	1	1		

PROGRAMME OUTCOMES

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 employed.

Weightage to content

Semester -IV

Course - 9

S.No	Course Content	Long Answer	ShortAnswer	Total marks	As per Blooms Taxonomy
1	Gaseous state	2	1	25	Understanding, Application
2	Liquid State	1	1	20	Remembering, Understanding
3	Solid state	1	2	20	Analysizing & Creation
4	Phase Rule	1	1	15	Evaluation, Understanding
5.	Surface Chemistry	1	2	20	Understanding, Application
	TOTAL	**6**	**7**	**95**	

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

II YEAR B.Sc Chemistry Hons (2023-24 AB)
(Examination at the end of IV semester)
Course-9 :: Physical Chemistry-II
MODEL PAPER

Duration: 2hrs **Max. Marks: 50**

PART- A

Answer any **THREE** of the following questions by choosing at least **ONE** from each section. Each carries **TEN** marks 3 X 10 = 30 M

SECTION -A

1. Unit - I
2. Unit - II
3. Unit – V

SECTION -B

4. Unit - III
5. Unit - IV
6. Unit – I

PART- B

Answer any **FOUR** questions. Each carries FIVE marks 4 X 5 = 20 Marks

7. Unit – I
8. Unit – II
9. Unit – III
10. Unit – III
11. Unit – IV
12. Unit – V
13. Unit – V

PITHAPUR RAJAH'S GOVERNMENT COLLEGE (A) :: KAKINADA
II YEAR B.Sc Chemistry Hons (2023-24 AB)
(Examination at the end of IV semester)
Course-9 :: Physical Chemistry-II

Question Bank

Unit-1:
Essay Questions:
1. Derive the following laws from kinetic theory of gases?
   a) Boyle's law b) Avogadro's law d) Dalton's Law
2. Elaborate Vander Waal equation of state?
3. Derive the mathematical relation between Vander Waal constants and critical constants?

Short answer Questions:
1. Write the postulates of kinetic theory of gases**?**
2. Discuss the Anderw's Isotherm of carbon dioxide?
3. Explain the reduced equation of state and law of corresponding states?
4. What is Joule-Thomson effect and explain inversion temperature?

Unit-2:
Essay Questions:
1. What are liquid crystals and explain their classification?
2. Define surface tension & explain its determination by using drop count method?
3. What is the coefficient of viscosity & explain its determination by using viscometer.

Short answer Questions:
1. Write the applications of liquid crystals?
2. Explain the differences between liquid crystal and solid/liquids
3. Elaborate on the Qualitative discussion of the structure of water.

Unit-3:
Essay Questions:
1. Explain the law of symmetry in crystals?
2. Derive Bragg's equation for the determination of crystal structure?
3. Explain the stoichiometric and non-stoichiometric defects in crystals?

Short answer Questions:
1. Explain the law of constancy of interfacial angles?
2. Define space lattice, lattice point & unit cell?
3. Write about the different crystal systems with examples?
4. what is law of rational indices?

Unit-4:
Essay Questions:
1. Explain the phase diagram of the Water system?
2. Elaborate the phase diagram of the NaCl- Water system?
3. Discuss the phase diagram of the Ag-Pb system

Short answer Questions:
1. Define phase rule and explain the terms involved in it.
2. Discuss the Pattinson' s process for the desilverisation of lead?
3. Define congruent and incongruent melting points give examples?
4. Write a short note on freezing mixtures.

Unit-5:

Essay Questions:

1. Define is Langmuir adsorption isotherm and explain?
2. What is physisorption and Chemisorption and write their differences?
3. Explain the various factors that effecting adsorption of gases on solids?
4. Explain the following

    a) Hardy-Schulze rule. b) Gold number c) Coagulation

Short answer Questions:

1. Define colloids and their classification?
2. Write a short note on Freundlich adsorption isotherm.
3. Write the applications of adsorption?

SEMESTER-IV

COURSE 9: PHYSICAL CHEMISTRY-II

Practical Credits: 1 2 hrs/week

Course outcomes:

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

1. Use glassware, equipment and chemicals and follow experimental procedures in the laboratory
2. Apply concepts of surface chemistry in experiments.
3. Be familiar with the concepts & practical applications of Surface tension and viscosity of liquids.

Physical Chemistry Practical Syllabus:

1. Determination of surface tension of liquid by drop count method
2. Determination of surface tension of liquid by drop weight method
3. Determination of surface tension of mixture (liquid + detergent) using stalagmometer.
4. Determination of coefficient of viscosity of an organic liquid.
5. Determination of composition of a glycerol in glycerol + water mixture using viscometer.
6. Adsorption of acetic acid on animal charcoal, verification of Freundlich isotherm

Co-Curricular Activities:

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

1. For Teacher: Training of students by teacher in laboratory and field for not lessthan15 hourson the field techniques/skills of preparation of acetanilide, preparation of azodye, use of separating funnel for solvent extraction, separation of organic compounds in a mixture.
2. For Student: Student shall visit a related industry/chemistry laboratory in universities/research organizations/private sector facility and observe the techniques used for the separation of organic compounds. Write their observations and submit a hand written fieldwork/project work report not exceeding10 pages in the given format to the teacher.
3. Max marks for Fieldwork/project work Report:05.
4. Suggested Format for Fieldwork/project work: Title page, student details, index page,details of place visited, observations, findings, and acknowledgements.
5. Unit tests (IE).

b) Suggested Co-Curricular Activities

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

	P.R. GOVERNMENT COLLEGE(A), KAKINADA	**Program & Semester** **II B.Sc. ANALYTICAL CHEMISTRY(H)** **(SEMESTER – IV)**			
Course Code 10	TITLE OF THE COURSE Course -10**: SPECTROSCOPY**				
Teaching	Hours Allocated: 45 (**Theory**) (3 hrs. / Wk.)	L	T	P	C
Pre-requisites:	Basic knowledge about spectrum and its classification	3	-	-	3

Course Objectives:

To inculcate basic knowledge on basic concepts like Beer-Lambert's law
To understand the concept of Spectroscopy
To illustrate the classification of spectroscopies
To provide knowledge and applications on various spectroscopies

Course Outcomes:

On Completion of the course, the students will be able to-		**Cognitive Domain**
CO1	Understand the basic governing law of spectroscopy – Beer lamberts law and interaction of electromagnetic radiation with matter	Knowledge
CO2	Learn Principles of Electronic, IR and NMR spectroscopies	Understand
CO3	Understand Applications of Electronic, IR and NMR spectroscopies	Application
CO4	Applying principles of various spectroscopies to various organic compounds	Application

Skill Development			Employability			Entrepreneurship	

Syllabus:

UNIT-I

GENERAL FEATURES OF ABSORPTION

- Beer-Lambert's law and its limitations, transmittance, Absorbance, and molar absorptivity. Single and double beam spectrophotometers. Application of Beer-Lambert law for quantitative analysis of 1. Chromium in $K_2Cr_2O_7$ 2. Manganese in Manganous sulphate

UNIT-II

ELECTRONIC SPECTROSCOPY:

Interaction of electromagnetic radiation with molecules and types of molecular spectra. Energy levels of molecular orbitals (σ, π, n). Selection rules for electronic spectra. Types of electronic

transitions in molecules effect of conjugation. Concept of chromophore and auxochrome.

UNIT-III

INFRA RED SPECTROSCOPY:

Different Regions in Infrared radiations. Modes of vibrations in diatomic and polyatomic molecules. Characteristic absorption bands of various functional groups. Interpretation of spectra-Alkanes, Aromatic, Alcohols carbonyls, and amines with one example to each.
Functional group and finger print Region.

UNIT-IV

PROTON MAGNETIC RESONANCE SPECTROSCOPY (1H-NMR)

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

UNIT-V
APPLICATIONS

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

Applications of UV-Visible and IR-Spectroscopy

List of Reference Books:

- Spectroscopy by William Kemp
- Spectroscopy by Pavia
- Organic Spectroscopy by J. R. Dyer
- Elementary organic spectroscopy by Y.R. Sharma
- Spectroscopy by P.S. Kalsi
- Organic spectroscopy by Jagmohan

CLO-PLO Mapping:

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

	CLO\PLO	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	CLO\PLO	PLO1
CLO1	3	2	3	2	2	2	3	3	2	2	3	3	3
CLO2	2	3	3	3	3	2	1	2	2	3	2	2	3
CLO3	3	3	3	2	2	1	1	2	3	1	2	3	3
CLO4	2	1	2	1	3	2	3	1	2	3	2	3	2
CLO5	2.5	2.25	2.75	2.0	2.5	1.75	2.0	2.0	2.25	2.25	2.25	2.75	2.75

WEIGHTAGE TO CONTENT

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

PITHAPUR RAJAH'S GOVERNMENT COLLEGE (A), KAKINADA

II B.Sc. ANALYTICAL CHEMISTRY. SEMESTER–IV

COURSE-10: SPECTROSCOPY

MODEL QUESTION PAPER

TIME: 2 hrs. **MAX. MARKS: 50**

SECTION-A

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

3x10=30M

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

SECTION-B

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

SECTION-C

Answer any FOUR questions each carries FIVE marks. **4x5=20M**

7.One question is to be set from unit-I

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

P.R. GOVERNMENT COLLEGE(A), KAKINADA

II B.Sc. ORGANIC CHEMISTRY, SEMESTER–IV 2024-25

CHEMISTRY COURSE-10: SPECTROSCOPY

QUESTION BANK

UNIT-I

GENERAL FEATURES OF ABSORPTION

1. What is Beer-Lambert's law. What are its limitations.
2. Describe Single beam and double beam spectrophotometer.
3. Explain the determination of Chromium in $K_2Cr_2O_7$ using spectrophotometer.
4. Explain the determination of Manganese in MnSO4 using spectrophotometer.
5. Define the following terms.
   a) Transmittance b) Absorbance c) Molar absorptivity
6. Write the working principle of Spectrophotometer.

UNIT-II

ELECTRONIC SPECTROSCOPY

7. Explain different types of electronic transitions occur in a molecule.
8. Write about Chromophore and Auxochrome with examples.
9. What is electromagnetic spectrum.
10. Write the selection rules for electronic spectra.
11. Explain the impact of conjugation on electronic transitions in a molecule.
12. Write about different types of molecular spectra.
13. Explain energy levels of molecular orbitals.

UNIT-III

INFRA RED SPECTROSCOPY

14. Explain the characteristic absorption bands of various functional groups in IR spectroscopy.
15. Write about the different regions of Infrared radiations.
16. What are the modes of vibrations in diatomic and poly atomic molecules.
17. What are the applications of IR spectroscopy.
18. Explain about Finger print region in IR spectrum.

UNIT-IV

NMR SPECTROSCOPY

19. Explain the Principle involved in NMR spectroscopy.

20. Explain the following

    a) Equivalent and Non-Equivalent protons b) Spin – Spin coupling

21. Write a note on Chemical shift.

22. Explain about the position of signals and splitting of signals in NMR spectroscopy.

UNIT-V

APPLICATIONS NMR SPECTROSCOPY

23. Explain the Applications of NMR spectra of

    a) Ethyl bromide b) Ethyl alcohol c) Acetaldehyde d) 1,1,2-Tribromoethane

    e) Ethyl Acetate f) Acetophenone.

24. Applications of UV-Visible and IR spectroscopy.

	P.R. GOVERNMENT COLLEGE(A), KAKINADA	Program & Semester II B.Sc. ANALYTICAL (SEMESTER – IV)			
Course Code C10P	TITLE OF THE COURSE **Course 10: SPECTROSCOPY**				
Teaching	Hours Allocated: 30 (**Practical**)	L	T	P	C
Pre-requisites	Preparation of standard solutions and handling of laboratory apparatus and instruments	-	-	2	1

Course Objectives:

- To demonstrate basic knowledge about the handling of laboratory apparatus
- To illustrate knowledge about the preparation of standard solutions
- To provide hands-on training for the determination of different organic compounds

Course Outcomes:

On Completion of the course, the students will be able to	
CO1	Learn to Handle and calibrate the common laboratory glass apparatus and instruments
CO2	Get practical skill to the preparation of different standard solutions used for quantitative analysis
CO3	Identify and confirm the structure of a given organic compounds
CO4	Principles and applications of different molecular spectra

Course with focus on employability / entrepreneurship / Skill Development modules

Skill Development			**Employability**			**Entrepreneurship**	-

Practical- IR-Spectral Analysis **50 M**

IR spectral analysis of the following functional groups with examples

- Hydroxyl Groups
- Carbonyl Groups
- Amino Groups
- Aromatic Groups

CLO-PLO Mapping:

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

	CLO\PLO	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	CLO\PLO	PLO1
CLO1	3	3	3	2	3	2	2	2	3	2	2	3	3
CLO2	3	3	3	2	3	2	2	3	2	3	3	3	3
CLO3	3	2	3	2	3	1	2	2	2	2	2	3	2
CLO4	3	3	2	1	3	2	2	1	2	3	3	3	3
CLO5	3	2.75	2.75	2	3	2	2	2	2.25	2.5	2.5	3	2.75

	P.R.GOVERNMENT COLLEGE(A),KAKINADA	Program & Semester II B. Sc., Analytical chemistry			
Course Code 11	**TITLE OF THE COURSE** **SEPARATION METHODS- II**				
Teaching	Hours Allocated: (**Theory**)	L	T	P	C
Pre-requisites	fundamental knowledge on different separation techniques.	45	10	30	4+1

Course Objectives:

Upon completion of this course the student should be able to:

- Understand the Fundamental Principles of Separation
- Identify Different Separation Method
- Evaluate the Efficiency and Suitability of Separation Method
- Analyze the Applications of Separation Techniques in Industry

Course Outcomes:

On Completion of the course, the students will be able to	
CO1	Demonstrate Proficiency in Applying Separation Methods
CO2	Evaluate and Choose Appropriate Separation Techniques
CO3	Analyze and Interpret Data from Separation Processes
CO4	Understand the Practical and Ethical Implications of Separation Techniques

SYLLABUS

UNIT–I

ION EXCHANGE AND ION EXCHANGE CHROMATOGRAPHY

A. **ION EXCHANGE**: principles of ion exchange systems, synthetic ion -exchange systems, synthetic ion-exchange resins, ion-exchange mechanism, ion-exchange equilibria, selectivity, ion-exchange capacity, applications, separation of inorganic mixtures
B. **ION-EXCHANGE CHROMATOGRAPHY:** principle, equipment and experimental set up, procedure aand applications of ion exchange chromatography

UNIT-II

GEL AND AFFINITY CHROMATOGRAPHY

A. Gel chromatography, principle, types of gels, separation by gel chromatography, applications
B. Affinity chromatography , principle , materials, selection and attachement of ligand, practical procedure and applications.

UNIT-III

GAS CHROMATOGRAPHY

Gas chromatography: Principle, theory, apparatus and instrumentation, columns, preparation and application of samples, carrier gas, detectors, applications.

UNIT-IV

A.ELECTROPHORESIS-I

Electrolysis and electro-osmosis phenomenon , theory and classification of electrophoresis, factors affecting electrophoresis phenomenon(mobility, size and charge interactions with the supporting electrolytes, pH, and concentration discontinuities) ,applications.

B.ELECTROPHORESIS-II

Capillary electrophoresis: principle, instrumentation and applications

Zone electrophoresis: principle, instrumentation and applications

UNIT –V

A. DIALYSIS AND MEMBRANE FILTRATION

Filters -nitrocellulose, fiber glass, polycarbonate, general laboratory methods

B. CENTRIFUGATION METHODS

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

REFERENCES

1. "Introduction to Chemical Engineering: Tools for Today's Informed Decision Maker" by Kenneth A. Solen and John N. Harb
2. "Separation Process Principles: Chemical and Biochemical Operations" by J. D. Seader and Ernest J. Henley
3. "Principles of Chemical Engineering Processes: Material and Energy Balances" by Nayef Ghasem and Redhouane Henda
4. "Fundamentals of Analytical Chemistry" by Douglas A. Skoog, Donald M. West, and F. James Holler

CO-POMapping:

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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	2	3	2	3	3	3	1	2	2	3	2	3	3
CO2	3	2	3	3	2	3	3	1	3	3	2	3	2
CO3	3	3	3	3	2	2	2	2	2	3	3	3	2
CO4	3	2	2	2	2	2	3	3	1	1	3	3	3
Avg.	**2.75**	**2.5**	**2.5**	**2.75**	**2.25**	**2.5**	**2.25**	**2**	**2**	**2.5**	2.5	3	2.5

PO1 : Knowledge in Pharmaceutical Chemistry : Apply the knowledge of different dosage forms and their routes of administration.

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

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

PO4: Conduct investigations on new drug discoveries: Use fundamental research-based knowledge and available research methodologies including design of experiments, analysis and interpretation of data, and synthesis of the drug molecules.

PO5 : Modern tool usage: Create, select, and apply appropriate techniques, resources, and IT tools for drug modeling and interpretation of simple to complex drug molecules. PO6 : Society: Applying the contextual knowledge to assess societal, health, safety, legal issues.

PO7: Environment and sustainability: Understand the importance of synthetic drug chemistry for various discoveries in the field of health science and demonstrate the knowledge for sustainable development.

PO8 : Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the pharmaceutical manufacturing practice.

PO9 : Communication: Communicate effectively on issues related to pharmaceutical chemistry with the medical community, being able to write the effective reports and documentations and presentations.

PO10: Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change new drug investigations for new diseases.

PSO-1: To have a firm foundation in the fundamentals/concepts/theories and its applications in pharmaceutical chemistry.

PSO-2: To understand the structure and properties of drugs, Characteristics mechanisms of chemical reactions and their usage in pharmaceutical chemistry

PSO-3: To acquaint with safety measures that are to be taken in pharmaceutical chemistry laboratory and develop skills in proper manufacturing methods of pharmaceuticals and usage of different apparatus/instruments and carry out experimental procedures, record the observations and results and present the inference/conclusion

WEIGHTAGETOCONTENT

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

MODEL QUESTION PAPER

Time2hrs **Max.Marks-50**

SECTION-A

Answer any THREE questions choosing at least ONE question from each section 3x10=30M

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

SECTION-B

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

Answer any FOUR questions **4x5=20M**

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

QUESTION BANK

ESSAY QUESTIONS(10 MARKS)

UNIT:I

1. Explain the principles of ion exchange systems and describe the mechanism behind ion exchange.
2. Describe the principle, experimental setup, and procedure of ion-exchange chromatography.
3. Discuss the various applications of ion-exchange systems in industrial and laboratory settings.

UNIT:II

1. Explain the principle and procedure involved in gel chromatography
2. What is affinity chromatography, and how does it work to isolate specific molecules?
3. Describe the different types of gels used in gel chromatography

UNIT:III

1. Explain the principle and theory behind gas chromatography.
2. Describe the components of a gas chromatography system, including the apparatus and instrumentation.
3. What are the detectors of gas chromatography

UNIT:IV

1. Explain the electrolysis and electro-osmosis phenomena and their role in electrophoresis.
2. Describe the theory and classification of electrophoresis. What are the factors that affect the electrophoresis phenomenon?
3. Discuss capillary electrophoresis and zone electrophoresis, comparing their principles, instrumentation, and applications.

UNIT -V

1. Explain the principle of dialysis and membrane filtration, and describe the types of filters used in these processes.

2. Describe the process of centrifugation and explain the importance of sedimentation and relative centrifugal force in this method.

SHORT QUESTIONS

UNIT-I

1. What is ion-exchange capacity, and why is it important in ion exchange systems?
2. Define ion-exchange equilibrium and its significance in the ion exchange process.
3. What are synthetic ion-exchange resins
4. Explain the concept of selectivity in ion-exchange systems.
5. What are the main differences between ion-exchange chromatography and other types of chromatography techniques

UNIT–II

1. What is the main principle behind gel chromatography?
2. Name two types of gels used in gel chromatography and briefly describe each.
3. In affinity chromatography, what is the purpose of the ligand?
4. How is the ligand attached to the stationary phase in affinity chromatography?
5. What is one common application of gel chromatography in laboratories

UNIT-III

1. What is the role of the carrier gas in gas chromatography?
2. Name two common types of detectors used in gas chromatography.
3. What is the function of the column in gas chromatography?

UNIT-IV

1. What is electro-osmosis, and how does it affect electrophoresis?
2. List the factors that affect the mobility of particles during electrophoresis.
3. What is the principle behind capillary electrophoresis?
4. Explain the concept of zone electrophoresis and its main application.

UNIT-V

1. What are the key differences between nitrocellulose and fiberglass filters in laboratory applications?
2. What is relative centrifugal force (RCF), and how is it calculated?
3. Explain the purpose of using density gradients in centrifugation.
4. What are the common applications of membrane filtration in scientific research?

PRACTICALS:

1. Preparation of acetanilide from aniline by conventional method
2. Preparation of acetanilide using green synthetic approach
3. Preparation of benzanilide from aniline using conventional method
4. Preparation of p- nitro acetanilide from acetanilide using conventional method
5. Preparation of 1,1 – bis -2-naphthol