PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS)

KAKINADA - 533 001,

EAST GODAVARI, A.P.

Affiliated to Adikavi Nannaya University

NAAC Accredited with "A" Grade (3.17 CGPA)

BOARD OF STUDIES OF CHEMISTRY

I SEMESTER

M.Sc ORGANIC CHEMISTRY Under CBCS

Convened on 30th APRIL 2024

AY 2024-25

DEPARTMENT OF CHEMISTRY

P. R. GOVT. COLLEGE (Autonomous)

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

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

PITHAPUR RAJAHS GOVERNMENT COLLEGE(A), KAKINADA-A. P

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

R.C.No.12A/A.C./BOS/2023-24, Dated: _____.

SUB: P.R. Government College(A), Kakinada-PG Board of Studies (BOS)-Program/Course-M.Sc. Organic Chemistry/Chemistry, Nomination of Members-Orders issued.

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

ORDERS:

The Principal, Pithapur Rajahs Government College(A), Kakinada is pleased to constitute PG Boards of Studies in Chemistry for framing the syllabi in Organic Chemistry Subject for III AND IV Semesters duly following the norms of the UGC Autonomous guidelines.

S. No	Name of the Nominee	Designation
1	V. Sanjeeva Kumar	Chairman& Lecturer Incharge.
2	Dr. B. Jagan Mohan Reddy	University Nominee Associate ProfessorDepartment of Chemistry Adikavi Nannaya University, Rajamahendravaram
3	Dr.S.K.Mustafa	Subject Expert Assistant Professor Dr.S.R.K. Govt. Arts CollegeYanam Govt. of Puducherry.
4	Dr. Sreenivasalu Reddymasu	Subject Expert Assistant Professor JNTU KAKINADA.
5	Dr. G. Chandrasekhar Reddy Managing Director HIQ Pharma Pvt ,Ltd. Hyderabad	Representative from Industry
6	T.V.V. Satya Narayana	Member
7	P. Vijay Kumar	Member
8	V. Rambabu	Member
9	G. Pavani	Member
10	Dr. N. Bujji Babu	Member
11	Dr. Ch. Praveen	Member
12	V. Venkateswara Rao	Member
13	U.S.N. Prasad	Member
14	T. Pavan Kumar	Member
15	P.R.Ravi Varma	Member
16	K. Srilekha	Member
17	P. Sirisha	Member
18	R. Ramya Sri	Member
19	G. Chandrika	Student Alumni Member
20	A Naga devi	Student Member
21	B.Madhava rao	Student Member
22	S. Venkateswara rao	Student Member
23	Ch. Surya swamy	Student Member

he above members are requested to attend the BoS meeting on 30th April 2024 and share their valuable reviews, and suggestions on the following functionaries.

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

PRINCIPAL
P.R. Govt. College (A)
KAKINADA

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

PITHAPUR RAJAH'S GOVERNMENT COLLEGE (A), KAKINADA
DEPARTMENT OF CHEMISTRY
MINUTES OF PG BOARD OF STUDIES (BOS) MEETING

2024-25 on 30th APRIL2024 Meeting of Board of Studies in M. Sc Organic Chemistry is convened on 30th APRIL 2024 through offline at Pithapur Rajah's Government College (A), Kakinada.

Venue: JKC Dt: 30th APRIL2024

The Principal Dr. B.V. Tirupanyam, Chairman, Sri. V. Sanjeeva Kumar, Chairman and lecturer in charge, University Nominee, Dr. B. Jagan Mohan Reddy, Industrialist Dr. Chadrasekhar Reddy , Subject Expert, Dr. S.K. Mustafa, All the faculty members of Chemistry Department and student alumni attended the meeting.

Agenda:

1. To discuss the Semester System and revised Choice Based Credit System (CBCS) being implemented for the past 03 years, i.e., w.e.f. 2020-21.
2. To discuss and approve the Continuation/Modifications of the syllabus for the Odd & Even Semesters of III & IV for 2024-2025.
3. Grant of Extra credits for Online SWAYAM MOOCs etc.
4. Syllabus, Model Question Papers and Model Blueprints, POs, PSOs & COs mapping for III and IV Semesters.
5. Minimum of 60% integration of ICT into transaction of curriculum.
6. Minimum attendance of 75% for both I mid-term examination, and II mid- term examination under CIA component shall be the benchmark for attendance and it shall be approved in the BOS.
7. Teaching learning methodology by 75:25 (External: Internal) ratio w.e.f. 2017-18 admitted batches and continued it.
8. Remedial coaching and Assignments for slow learners, project work, research, Conferences and CSIR NET&GATE coaching for advanced learners.
9. Panel of paper setters and examiners.
10. Proposals for project work in fourth semester for the benefit of students.
11. Department action plan for 2024-25. To discuss and resolve the minor modifications/refinement if any.
12. Any Other Proposal with the Permission of the Chairman.

The following paper setters are recommended.

1. Dr. V. Siddaiah Department of Chemistry, Andhra University, Visakhapatnam

2. Dr. D. Jaya Prashanthi Department of Chemistry, Andhra University, Visakhapatnam
3. Dr. S. K. Mustafa, Department of Chemistry, Dr, SKR Govt. College, Yanam.
4. Dr. B. Mallikarjun, Department of Chemistry, GDC(A), Rajamahendravaram.
5. Dr. K. Deepthi, Department of Chemistry, ANUR Rajamahendravaram
6. Dr. B. Jagan Mohan Reddy, Department of Chemistry, ANUR Rajamahendravaram
7. Dr. Ravindra Babu, Department of Chemistry, GDC, Tanuku
8. Dr. A. Chandraleela, Department of Chemistry, Andhra University, Visakhapatnam

Resolution:

It is resolved to introduce the following new courses in the programme M.Sc Chemistry from the AY 2023-24

S. No	Course Code	Title of the new course	Programmes in which it is introduced
1		Nil	Nil

ADDITIONS/DELETIONS IN COURSES CHEMISTRY 2023-24

Year	Semester& Paper	Additions	Deletions
I	**I&I**	Schrondinger's cat paradox (qualitative analysis only)	solution of wave equation- selection rules
I	**I&II**	Walsh diagram for H_2S molecule	-
I	**I&III**	Electromeric effect Pseudo Aromaticity	
I	**I&IV**	Trounton's law	**-**
I	**II&I**	**-**	**-**
I	**II&II**	Na+, Mg+2, Co+3 Zn+2	Biological and a biological Nitrogen Fixation
I	**II&III**	E1cB mechanism	--
I	**II&IV**	**-**	**-**

Course structure of M. Sc Chemistry (Previous)

S. No	Semester	Title of the Paper	Theory/ Practical / Viva	Internal marks	External Marks	Total Marks	Credits
1	I	General Chemistry- I	T	25	75	100	4
2		Inorganic Chemistry-I	T	25	75	100	4
3		Organic Chemistry- I	T	25	75	100	4
4		Physical Chemistry- I	T	25	75	100	4
5		Inorganic Chemistry Practical- I	P	25	75	100	4
6		Organic Chemistry Practical -I	P	25	75	100	4
7		Physical Chemistry Practical -I	P	25	75	100	4
8	II	General Chemistry	T	25	75	100	4
9		Inorganic Chemistry	T	25	75	100	4
10		Organic Chemistry	T	25	75	100	4
11		Physical Chemistry	T	25	75	100	4
12		Inorganic Chemistry Practical- II	P	25	75	100	4
13		Organic Chemistry Practical -II	P	25	75	100	4
14		Physical Chemistry Practical -II	P	25	75	100	4
Total Credits							

	PITHAPUR RAJAH'S GOVERNMENT COLLEGE(A) KAKINADA DEPARTMENT OF CHEMISTRY	Program & Semester			
Course Code	TITLE OF THE COURSE **GENERAL CHEMISTRY – I**	I M.Sc. (I Semester)			
Teaching	Hours Allocated: 60 (**Theory**)	L	T	P	C
Pre-requisites	Operators, wave mechanics	60	10	---	4

Course Objectives:

1. Quantum chemistry
2. Fundamentals of molecular spectroscopy

Course Outcomes:

On Completion of the course, the students will be able to	
CO1	Derivation of wave equation and energy for various systems
CO2	Quantization of energy for rotating and oscillating bodies and in various dimensional Boxes
CO3	IR spectral studies of various oscillating bodies and micro wave spectral studies of various rotating bodies
CO4	Basic theory of NMR spectroscopy, instrumentation with applications

Course with focus on employability / entrepreneurship / Skill Development modules

Skill Development		Employability		Entrepreneurship	

Syllabus:

UNIT-I

Basic Quantum Chemistry-I:

(A) Wave equation-interpretation of wave function-properties of wave function-normalization And orthogonalization, Operators- linear and non-linear- commutators of operators. Postulates of quantum mechanics; setting up of operators to observables;

(B) Hermitian operator- Eigen values and Eigen functions of Hermitian operator; Expansion theorems. Eigen functions of commuting operators-significance. Simultaneous measurement of properties and the uncertainty principle.

(C) Hermitian operator- Eigen values and Eigen functions of Hermitian operator; Expansion theorems.

Eigen functions of commuting operators-significance. Simultaneous measurement of properties and the uncertainty principle.

UNIT-II

Basic Quantum Chemistry-II:

(A) Wave mechanics of simple systems with constant potential energy, particle in one dimensional box-factors influencing color transition- dipole integral, Symmetry arguments in deriving the selection rules, the concept of tunneling. Schrondinger's cat paradox(qualitative analaysis only)

(B) Particle in three -dimensional box. Calculations using wave functions of the particle in a box-Orthogonality, measurability of energy, position and momentum, average values and probabilities. Rigid rotor, Wave mechanics of systems with variable potential energy-simple harmonic oscillator- hydrogen atom, including shapes of atomic orbitals

UNIT-III

Fundamentals of Molecular Spectroscopy-I:

(A) Microwave and IR- Spectroscopy- Rotational spectra of diatomic molecules-Rigid Rotor-Selection rules- Calculations of bond length- Isotopic effect, Second order stark effect and its applications.

(B) Infrared spectra of diatomic molecules- harmonic and anharmonic oscillators- Selection rules-Overtones- Combination bands- Calculation of force constant, anharmonicity constant and zero-point energy. Fermi resonance, simultaneous vibrational-rotational spectra of diatomic molecules.

UNIT- IV

Fundamentals of Molecular Spectroscopy-II:

(A) Raman and Electronic Spectra- Classical and quantum mechanical explanations- Rotational Raman and Vibrational Raman spectra.

(B) Electronic spectra of diatomic molecules- Vibrational Coarse structure- intensities of spectral lines-Franck-Condon principle- applications, Rotational Fine structure- band head and band shading. Charge transfer spectra

Unit no	**Additions**	**Deletions**	**Expected levels of learning as per Blooms Taxonomy for assessment of CO**	**Percentage added/added**
2	Schrondinger's cat paradox (qualitative analysis only)	solution of wave equation- selection rules	K_3	2%

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

Text books:

S. No	AUTHOR	TITLE	PUBLISHER
	1 A.K. Chandra	Introductory quantum mechanics	Tata McGraw Hill
2	R.K. Prasad	Quantum chemistry	New Age International Publications
	3 C.N. Banwell	Fundamentals of molecular spectroscopy	McGraw Hill

Reference books

S. No	AUTHOR	TITLE	PUBLISHER
	1 R.S. Drago	Physical Methods for Chemists	Affiliated East West Press Pvt. Ltd.
2	B.K. Sharma	Molecular Spectroscopy	Oxford University Press
3	Aruldas	Molecular Spectroscopy	Oxford University Press

Web Links:

1. https://youtu.be/8zDhIf50HIc?si=Bk2XhT1x8fzudcpQ
2. https://youtu.be/g2sqX3FkcRo
3. https://youtu.be/e4VHMSO5eqM
4. https://youtu.be/5VZm7IsT1xM

Course Outcome & Program outcome mapping

On Completion of the course, the students will be able to	
CO1	Derivation of wave equation and energy for various systems
CO2	Quantization of energy for rotating and oscillating bodies and in various dimensional boxes
CO3	IR spectral studies of various oscillating bodies and micro wave spectral studies of various rotating bodies
CO4	Basic theory of NMR spectroscopy, instrumentation with applications

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

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

(**PO1) Knowledge:** Apply the knowledge of Quantum chemistry to the solution of simple to complex synthesis of organic molecules.

(PO2) Critical Thinking: Carry out experiments in the area of Molecular Spectroscopy for Structural analysis inorganic and Organic Compounds and applying the domain of critical thinking.

(PO3) Problem Solving: Identify, formulate, review research literature, and analyze simple to complex problems reaching substantiated conclusions using fundamental principles of Molecular Spectroscopy and Quantum Chemistry.

(PO4): Usage of modern tools: Create data using modern chemical tools and ICT for modeling and analyze the data obtained from sophisticated instruments 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 Post-graduation, our Post graduates would be able to:

PSO 1- Evaluate, analyse, interpret, and effectively apply the basic laws, principles, phenomena, processes and Experiments involved in the domain of Quantum Chemistry.

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

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

Weightage to content

Semester -I

Paper-I

S.No	Course Content	Long Answer	Short Answer	Total marks	As per Blooms Taxonomy
1	Basic Quantum Chemistry-I	2	2	36	Understanding, Application
2	Basic Quantum Chemistry-II	2	2	36	Remembering, Understanding
3	Fundamentals of Molecular Spectroscopy-I	2	2	36	Application & Creation
4	Fundamentals of Molecular Spectroscopy-II	2	2	36	Remembering, Understanding
	TOTAL	**8**	**8**	**144**	

P.R. GOVERNMENT COLLEGE (A), KAKINADA

I YEAR MSc (Examination at the end of I semester)

(General chemistry)

Paper- I

MODEL PAPER

Duration: 3hrs **Max. Marks: 75M**

PART- A

Answer all questions **(4 × 15 = 60M)**

1. (a) Write note on postulates of quantum mechanics.

(OR)

(b) Setting the operators for various physical quantities.

2. (a)Derive wave equation for Rigid Rotor.

(OR)

(b) Derive wave function for one dimensional harmonic oscillator.

3. (a) Explain the rotational spectra of rigid diatomic molecule and also explain the effect of isotope.

(OR)

(b) Write a brief note on simultaneous rotational and vibrational spectra of diatomic molecule.

4. (a) i) Write a note on pure Raman rotational spectra.

ii) Classical theory of Raman effect.

(OR)

(b) i) Write a note on charge transfer spectra.

ii) Write a note on vibrational coarse structure.

PART-B

Answer any Five questions **(5 ×3 = 15M)**

5. Write a note on Normalization.
6. Write about interpretations of wave function.
7. Write a note on factors affecting colour.
8. Derive wave functions for particle in one dimensional box.
9. Write about anharmonic oscillator.
10. Write about rotational spectra of non-rigid rotor.
11. Write a note on Quantum theory of Raman effect.
12. Write about Rotational fine structure

	PITHAPUR RAJAH'S GOVERNMENT COLLEGE(A) KAKINADA DEPARTMENT OF CHEMISTRY	Program & Semester			
Course Code	TITLE OF THE COURSE **INORGANIC CHEMISTRY-I**	I M Sc (I Semester)			
Teaching	Hours Allocated: 60 (**Theory**)	L	T	P	C
Pre-requisites	Electronic configurations, calculation of oxidation states, trends in periodic table, shape of the orbitals,theories in bonding	60	10	30	4+3

Course Objectives:

1. Structure & Bonding
2. Inorganic cage and ring compounds
3. Coordination compounds
4. Electronic spectra of transition metal complexes

Course Outcomes:

On Completion of the course, the students will be able to	
CO1	Understand the theories of bonding in compounds and applications
CO2	Preparation, structure, classification and reactivity of boranes and also nano technology
CO3	Theories of coordination compounds and its applications
CO4	Gain knowledge on Selection rules and Electronic spectra of transition metal complexes

Course with focus on employability / entrepreneurship / Skill Development modules

Skill Development		Employability		Entrepreneurship	

Syllabus:

UNIT-1

Structure & Bonding:

(A) Applications of VSEPR, Valence Bond and Molecular orbital theories in explaining the structures of simple molecules- role of p and d orbitals in π-bonding.

(B) Application of MO theory to Tetrahedral $[CoCl_4]^{2-}$, Square planar($[PtCl_4]^{2-}$) and Octahedral complexes ($[CoF_6]^{3-}$, $[Co(NH_3)_6]^{3+}$). Classification of ligands based on π-bonding using MO theory. Walsh diagram for H_2O and H_2S molecule.

UNIT-II

Inorganic cage and ring compounds:

(A) Preparation, structure and reactions of boranes, carboranes, metallo carboranes. Electron counting inboranes – Wades rules (Polyhedral skeletal electron pair theory). Heterocyclic inorganic ring systems: Boron–Nitrogen ($H_3B_3N_3H_3$). Phosphorus–Nitrogen ($N_3P_3Cl_6$) and Sulphur-Nitrogen (S_4N_4, $(SN)_x$) cyclic compounds. Cage Compounds: Phosphorous oxides and Phosphorous sulphides. Isopoly and heteropoly anions.

B. Nano materials, Synthetic techniques, properties and applications of Nano materials.

UNIT-III

Coordination compounds:

(A) Crystal field theory - crystal field splitting patterns in octahedral, tetrahedral, tetragonal, square planar, square pyramidal and trigonal bipyramidal geometries. Calculation of crystal field stabilization energies. Factors effecting crystal field splitting energies – Spectrochemical series.

(B) Jahn – Teller effect, nephelauxetic effect – ligand field theory. Term symbols – Russell-Sanders coupling – derivation of term symbols for various configurations. Spectroscopic ground states.

UNIT- IV

Electronic spectra of transition metal complexes:

(A) Types of electronic transitions – d-d transitions - Selection rules, breakdown of selection rules – Orgel and Tanabe-Sugano diagrams for d1 –d9 octahedral and tetrahedral transition metal complexes of 3d series – Calculation of Dq, B and β parameters.

(B) Charge transfer spectra. Magnetic properties of transition and inner transition metal complexes – spin and orbital moments – quenching of orbital momentum by crystal fields in complexes.

Unit no	Additions	Deletions	Expected levels of learning as per Blooms Taxonomy for assessment of CO	Percentage added/added
1	Walsh diagram for H_2S molecule	-	K_4	2%
2	-	-	-	-
3	-	-	-	-
4	-	-	-	-

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

Reference books

S. No	AUTHOR	TITLE	PUBLISHER
1	F.A. Cotton	Advanced Inorganic chemistry IV Edition	John Wiley and Sons
2	J.E. Huheey	Inorganic chemistry III Edition	Harper International Edition
3	Mc. Day and J. Selbin	Theoretical inorganic chemistry II Edition	Affiliated East west press
4	Shriver Atkins	Inorganic chemistry	Oxford University Press
5	Garry L.Meissler	Inorganic chemistry, V Edition	Pearson Publications

Web Links:

1. https://youtu.be/JxjUGCp9aUs
2. https://youtu.be/-MH_uwkxyAA
3. https://youtu.be/akDgsFPf4Ho?si=Z4eX1qVV_98Dl094

Course Outcome & Program outcome mapping

On Completion of the course, the students will be able to	
CO1	Theories of bonding in compounds and applications
CO2	Preparation, structure, classification and reactivity of boranes and also nano technology
CO3	Theories of coordination compounds and its applications
CO4	Electronic spectra of transition metal complexes

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

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

(**PO1) Knowledge:** Apply the knowledge of Inorganic Chemistry to the solution of simple to complex synthesis of Inorganic molecules.

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(PO3) Problem Solving: Identify, formulate, review research literature, and analyze simple to complex problems reaching substantiated conclusions using fundamental principles of Coordination chemistry.

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(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 Post-graduation, our Post graduates would be able to:

PSO 1- Evaluate, analyse, interpret, and effectively apply the basic laws, principles, phenomena, processes and Experiments involved in the domain of Inorganic Chemistry.

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

PSO3 - Evaluate distinct problems in the field of Coordination chemistry, scientific interpretation, and reaction mechanisms with an understanding on basic tools to be employed.

Weightage to content

Semester -I

Paper-II

S.No	Course Content	Long Answer	Short Answer	Total marks	As per Blooms Taxonomy

1	Structure & Bonding	2	2	36	Understanding, Application
2	Inorganic cage and ring compounds	2	2	36	Remembering, Understanding
3	Coordination compounds:	2	2	36	Application & Creation
4	Electronic spectra of transition metal complexes	2	2	36	Remembering, Understanding
	TOTAL	**8**	**8**	**144**	

P.R. COLLEGE (A), KAKINADA
I YEAR M Sc (Examination at the end of V semester)

Paper-II INORGANIC CHEMISTRY-I

MODEL PAPER

Duration: 3 hrs **Max. Marks: 75M**

PART-A

Answer all questions **(4 × 15 = 60M)**

1. (a) Derive the term symbols for d^2 and p^2 configuration and put them in the order of decreasing energy.

(OR)

b) i) What is VSFPR theory Explain how this model its useful in expiring the shape of molecules.

ii) Give the MO configuration of NO and O_2. Mention the bond order and magnetic properties.

2. (a) Write notes on preparation, properties and structures of carboranes.

b) i) Applications of Nanomaterials

ii) How do you account for the structures of closo, nido and arachno boranes.

3. a) What is Jahn-Teller effect? How does it influence the geometry of octahedral complexes? Explain with suitable examples.

(OR)

b) Discuss the energy level diagram for $[Co(NH_3)_6]^{3+}$ based on molecular orbital theory.

4. a) Discuss the advantages of Tanabe-Sugano diagrams compared to orgel diagrams. Predict the possible transitions of $[CoF_6]^{3-}$ using tunabe-sugano diagrams.

(OR)

b) Discuss the factors affecting the para magnetism of transition metal complexes.

PART-B

Answer any Five questions **(5 ×3 = 15M)**

5. Draw the MO diagram for CO molecule and calculate their bond order.
6. Write a short account on valence bond theory.
7. Define Nano technology
8. What are three centred bonds? Explain the different types of bonds in boranes.
9. Draw and explain the crystal field splitting of orbitals in tetragonal, square planar and trigonal bipyramidal geometries.
10. What is crystal field stabilization energy? Calculate the CFSE in terms of Dq units for Mn^{3+} in weak and Fe^{3+} in strong octahedral field.
11. Write notes on spin-orbit coupling.
12. What is charge transfer spectra? How is it differs from ligand field spectra?

LABORATORY COURSE

Practical Paper – I :: Inorganic Chemistry

(at the end of semester I) 6hr/week 75Marks

Learning Outcomes:

On successful completion of this practical course, student shall be able to:

1. Learn the systematic procedure for the semi micro qualitative analysis.
2. Acquire skills to identify the cations and the anions present in the given inorganic mixture
3. Detect the interfering anions and its elimination processes.
4. Detect the less familiar cation.
5. Acquire knowledge to prepare the Tetra ammine copper(II) sulphate, Potassium tris (oxalato) ferrate (III) trihydrate, Tris(thiourea)copper(I) sulphate

INORGANIC CHEMISTRY PRACTICALS - I

Practical (Laboratory) Syllabus:

I. Inorganic Synthesis: Preparation of

(i) Tetraamminecopper(II) sulphate

(ii) Potassium tris(oxalato)ferrate(III) trihydrate

(iii) Tris(thiourea)copper(I) sulphate

II. Semi micro qualitative analysis of six radical mixtures

(One interfering anion and one less familiar cation for each mixture)

Anions: CO_3^{2-} , S^{2-} , SO_3^{2-} , Cl^- , Br^- , I^- , NO_3^- , SO_4^{2-}, $CH3COO^-$, $C_2O_4^{2-}$, $C_4H_4O_6^{2-}$, PO_4^{3-} , CrO_4^{2-}, AsO_4^{3-}, F^- , BO_3^{3-}

Cations: Ammonium (NH_4^+)

1st group: Hg, Ag, Pb, Tl, W

2nd group: Hg, Pb, Bi, Cu, Cd, As, Sb, Sn, Mo 3rd

group: Fe, Al, Cr, Ce, Th, Ti, Zr, V, U, Be4th

group: Zn, Mn, Co, Ni

5th group: Ca, Ba, Sr

6th group: Mg, K, Li

Lab References

S. No	Author	Title	Publisher
1	G. Svehla	Vogel's Qualitative Inorganic Analysis	Pearson.
2	E. MinShall	Systematic semi- Micro Qualitative Analysis	Mc. Donold and Evans Ltd.
3	Dr. L. Rakesh Sharma	semi- Micro Qualitative Inorganic Analysis	Mayas publication.

Scheme of valuation

1. FOR RECORD	10 Marks
2. FOR VIVA VOCE	15 Marks
3. SALT ANALYSIS ::	50 Marks

Marks Systematic Procedure should be adopted Break up of marks for Salt Analysis:

1.Physical state & Colour	2M
2. Solubility	2 M
3. Flame test	2 M
4. Action of heat	2 M
5. Action of dil. HCl	2 M
6. Action of conc. H_2SO_4	2 M
7. Action of MnO_2	2 M
8. Action of cupper turnings	2 M
9. Na_2CO_3 Extract preparation	2 M
10. Three confirmation tests Anions (each test 3 marks)	9 M
11. General group separation table with all reagents	5 M
12. Identification of Cation in the correct group	3 M
13. Three Conformation tests for Cation (each test 3 marks)	9M
14. Reporting of correct salt	6M
Total =	**75M**

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 identification of cations and the anions present in the given unknown inorganic mixture.

For Student: Student shall visit a related industry/chemistry laboratory in universities/research organizations/private sector facility and observe the techniques used for identification of cations and the anions present in the given unknown inorganic mixture. Write their observations and submit a hand written 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.

	P R Govt College (A)Kakinada	Program & Semester			
Course Code	TITLE OF THE COURSE **ORGANIC CHEMISTRY-I**	I M Sc (I Semester)			
Teaching	Hours Allocated: 60 (**Theory**)	L	T	P	C
Pre-requisites	Hybridisation, bond polarisations and migrations, EDG, EWG	60	10	30	4+3

Course Objectives:

Study the aromaticity, stereochemistry of organic compounds, heterocyclic compounds and natural products

Course Outcomes:

On Completion of the course, the students will be able to	
CO1	Nature of the organic compound
CO2	Structural orientation in 3D
CO3	Reactivity and structure of heterocyclic compounds
CO4	Structure and synthesis of natural products

Course with focus on employability / entrepreneurship / Skill Development modules

Skill Development		Employability		Entrepreneurship	

Syllabus:

UNIT – I

Nature of bonding in organic molecules and Aromaticity:

(A) Electronic Effects and Reactive intermediates: -Inductive effect, Mesomeric effect (Resonance), Hyperconjugation, Electromeric effect, Steric effect, Tautomerism, Generation, structure, stability and reactivity of carbocations, carbanions, free radicals, carbenes, nitrenes and arynes

(B) Criteria of Aromaticity: - Huckle`s rule and MO Theory, aromaticity in benzenoid non-benzenoid compounds, Aromaticity in Charged and Fused-Ring Systems, Hetero-aromatic Systems, Annulenes: Cyclobutadiene, Benzene,1,3,5,7-Cyclooctatetraene, [10] Annulenes- [12], [14], [16] and [18]

annulenes, azulenes, fulvenes, fullerenes, ferrocene, antiaromaticity and homo-aromaticity,Pseudo Aromaticity.

UNIT – II

Stereo Chemistry & Molecular representation of organic molecules:

(A) Molecular Symmetry and Chirality: Symmetry elements, Definition and classification of Stereoisomers, Enantiomer, Homomer, Epimer, Anomer, Configuration and Conformation, Configurational nomenclature: D,L and R, S nomenclature, Molecules with a single chiral center: Molecules with two or more chiral centers. Stereoisomerism in molecules without chiral Center -Axial chirality Allenes, Alkylidene cycloalkanes, spiranes, nomenclature. Atropsomerism: Biphenyl derivatives, nomenclature.

(B) Geometrical Isomerism and Conformations of Cyclic Systems: Cis-trans, E, Z- and Syn& anti nomenclature, Methods of determining configuration of Geometrical isomers using physical, spectral and chemical methods, Stability, Cis-trans interconversion. Conformations of cyclo butane, cyclopentane, cyclohexane, mono and disubstituted cyclo hexanes. Planar chirality: Ansa compounds, para cyclophanes, trans -cyclooctene and Helicity.

UNIT – III

Heterocyclic compounds:

(A) Importance of heterocyclic compounds as drugs. Nomenclature of heterocyclic systems based onring size, number and nature of hetero atoms. Chemistry of heterocyclic compounds, synthesis andreactivity of the following systems: Quinoline, Iso quinoline, Indole, Pyrazole, Imidazole,

(B) Structure, synthesis and reactivity of Oxazole, Isoxazole, Pyridazine, pyrimidine and Pyrazine.

UNIT - IV

Chemistry of some typical natural products (Alkaloids and Terpenoids):

(A) A study of the following compounds involving their isolation, structure elucidation, synthesis ofAlkaloids; Atropine, Nicotine, and Quinine.

(B) A study of the following compounds involving their classification, isolation, structure elucidation,synthesis of Alkaloids Terpenoids: α- Terpeneol, α-Pinene and Camphor.

Unit no	Additions	Deletions	Expected levels of learning as per Blooms Taxonomy for assessment of CO	Percentage added/added
1	Electromeric effect Pseudo Aromaticity	-	K_2, K_5	5%
2	-	-	-	-

3	-	-	-	-
4	-	-	-	-

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

Reference books

S. No	AUTHOR	TITLE	PUBLISHER
1	Jerry March	Advanced Organic Chemistry: Reactions Mechanisms and Structure,6th Edition	John Wiley and Sons
2	Peter Sykes	A Guide Book to Mechanism in Organic chemistry,6th Edition	Longman
3	P.S. Kalsi	Reaction Mechanism in Organic chemistry,2nd Edition	New Age International press
4	R.T. Morrison and R.N. Boyd	Organic chemistry	Prentice Hall
5	E.L. Eliel	Stereochemistry to Organic compounds	John Wiley
6	P.S. Kalsi	Stereochemistry 5th Edition	New Age International press
7	Raj.K. Bansal	Heterocyclic chemistry	
8	R.M. Achenson	An Introduction to the Heterocyclic compounds	John Wiley
9	K.W.Bentley	Chemistry of Natural Products	Tata McGraw Hill
10	D. Nasipuri	Stereochemistry to Organic compounds 2nd Edition	NewAge International press
11	R.S.Kalsi	Chemistry of natural products	Kalyani Publishers
12	William Kemp	Organic Spectroscopy	Palgrave USA

Web Links:

1 https://youtu.be/R6XBNLDamgU

2 https://youtu.be/u-nzVKpzrAs

CO-PO Mapping:

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

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

(**PO1) Knowledge:** Apply the knowledge of organic Chemistry to the solution of simple to complex synthesis of organic compounds.

(PO2) Critical Thinking: Carry out experiments in the area of organic chemistry for Structural analysis and its stereochemistry of the organic Compounds and applying the domain of critical thinking.

(PO3) Problem Solving: Identify, formulate, review research literature, and analyze simple to complex problems reaching substantiated conclusions using fundamental principles of organic chemistry.

(PO4): Usage of modern tools: Create data using modern chemical tools and ICT for modeling and analyze the data obtained from sophisticated instruments for Natural product 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 Post-graduation, our Post graduates would be able to:

PSO 1- Evaluate, analyse, interpret, and effectively apply the basic laws, principles, phenomena, processes and Experiments involved in the domain of organic Chemistry.

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

PSO3 - Evaluate distinct problems in the field of Heterocyclic and Natural product chemistry, scientific interpretation, and reaction mechanisms with an understanding on basic tools to be employed.

Weightage to content

Semester -I

Paper-III

S.No	Course Content	Long Answer	Short Answer	Total marks	As per Blooms Taxonomy
1	Nature of bonding in organic molecules and Aromaticity	2	2	36	Understanding, Application
2	Stereo Chemistry & Molecular representation of organic Molecules	2	2	36	Remembering, Understanding
3	Heterocyclic compounds:	2	2	36	Application & Creation
4	Chemistry of some typical natural products (Alkaloids and Terpenoids)	2	2	36	Remembering, Understanding
	TOTAL	**8**	**8**	**144**	

P.R. COLLEGE (A), KAKINADA

I YEAR M Sc (Examination at the end of I semester)

Paper-III ORGANIC CHEMISTRY-I

MODEL PAPER

Duration: 3hrs **Max. Marks: 75**

PART-A

Answer all questions **(4 × 15 = 60M)**

1. a) i) Explain the role of inductive effect, Mesomeric effect (resonance) and Hyper conjugation in organic molecules.

(OR)

b) Define terms aromaticity, anti-aromaticity and Homo-aromaticity. Expalinaromaticity in benzenoid and non-benzenoid compounds.

2. a) How do you classify organic compounds into cis-trans, E-Z and Syn-antinomenclature. Discuss the stability of disubstituted cyclohexanes.

(OR)

b) Write an account of stereoisomerism in allenes and spiranes.

3. a) Write notes on i) Pyridazine ii) Pyrimidine and Pyrazine

(OR)

b) Describe the synthesis and reactivity of the Quinoline and Indole systems.

4. a) Outline the isolation, structure elucidation and synthesis of Atropine

(OR)

b) Outline the isolation, structure elucidation and synthesis of α-Pinene.

PART-B

Answer any Five questions **(5 ×3 = 15M)**

5. Which is more basic among methyl amine, dimethyl amine and trimethylamine?Explain.
6. State and explain the Huckle's rule.
7. What are Nitrenes? Explain their reactivity with any two suitable examples.
8. Define terms invertomer, Homomer, Epimer and Anomer.
9. Write any three differences between conformation and configuration.
10. What is meant by atropisomerism? Illustrate.
11. Write the structure of Imidazole. What is the expected product(s) when this isbrominated with bromine in acetic acid?
12. Depict the stereo structure of Nicotine. How many numbers of tertiary nitrogenexist in Nicotine?

LABORATORY COURSE

Practical Paper – II :: Organic Chemistry

(at the end of semester I) 6hr/week 75Marks

Learning Outcomes:

On successful completion of this practical course, student shall be able to:

Prepare the Aspirin, Nerolin, Chalcone, P- Nitro acetanilide, 2,4,6 – Tri bromoaniline, M-Dinitrobenzene, Phthalimide, Diels- Alder Adduct and they can determine their melting points.

Practical (Laboratory) Syllabus:

Preparation, recrystallization, and determination of melting point & yield of the following compounds:

i. Aspirin,
ii. Nerolin,
iii. Chalcone,
iv. p-Nitro acetanilide,
v. 2,4,6- Tri bromoaniline,
vi. m-Dinitrobenzene,
vii. Phthalimide,
viii. Diels-Alder adduct

Lab References:

S. No	Author	Title	Publisher
1	J. Mendham, R. C. Denney, J. D. Barnesand M. J. Thomas	Vogel's Text Book of Quantitative Chemical Analysis	Pearson Education Asia.
2	B.S. Furniss, A.J. Hannaford, P.W.G. Smith, A.R. Tatchell	Vogel's Text Book of Practical Organic Chemistry	Longman Scientific & Technical .
3	Ahluwalia & Aggarwal R	Comprehensive Practical Organic Chemistry	University press. Delhi
4	Mann F.G and Saunders B.C	Practical Organic Chemistry	Pearson Education

Scheme of valuation

Record:	10M
Viva:	15M
Chemicals required;	5M
Chemical equations:	15M
Lab technique and procedure:	20M
Report:	10M
Total =	**75M**

Co-Curricular Activities

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

For Teacher: Training of students by the teacher in laboratory and field for not less than15 hourson the field techniques/skills of preparation of Aspirin, Nerolin, Chalcone, p-Nitro acetanilide, 2,4,6- Tri bromoaniline, m-Dinitrobenzene, Phthalimide, Diels-Alder adduct and the determination of melting point of organic compound.

For Students: Student shall visit a related industry/chemistry laboratory in universities/research organizations/private sector facility and observes the synthetic reactions. Write their observations and submit a hand-written fieldwork/project work report not exceeding 10 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).

Suggested Co-Curricular Activities

Training of students by related industrial experts.

Assignments, Seminars and Quiz (on related topics), collection of relevant videos andmaterial.

Visits of abilities, firms, research organizations etc.

Invited lectures and presentations on related topics by field/industrial experts

	P R Govt College (A)Kakinada	Program & Semester			
Course Code CHE-7A	TITLE OF THE COURSE **PHYSICAL CHEMISTRY-I**	I M Sc (I Semester)			
Teaching	Hours Allocated: 60 (**Theory**)	L	T	P	C
Pre-requisites	Basics on thermodynamics, chemical kinetics, Photochemistry	60	10	30	4+3

Course Objectives: Study the thermodynamics and polymer chemistry and photo

1. Thermodynamics
2. Micelles and Macro molecules
3. Chemical Kinetics
4. Photochemistry

Course Outcomes:

On Completion of the course, the students will be able to	
CO1	Determination of partial molar volume: Derivation of phase rule from the conceptof chemical potential. Vapour pressure- Rault's law;
CO2	molecular weight determination
CO3	studying fast reactions
CO4	Quantum yield and its determination

Course with focus on employability / entrepreneurship / Skill Development modules

Skill Development		Employability		Entrepreneurship	

Syllabus:

UNIT-I:

Thermodynamics-I:

(A) Concepts of partial molar properties – partial molar volume and its significance volume method. Partial molar free energy, chemical potential, Variation of chemical potential with T a; Determination of partial molar volume: Graphical method, intercept method and apparent molar v nd P. Gibbs- Duhem equation-derivation and significance. Phase equilibrium - Derivation of phase rule from the concept of

chemical potential.

(B) Ideal solutions - Thermodynamic properties of ideal solutions mixing quantities; Vapour pressure- Raults law; Thermodynamic properties of ideally dilute solutions. Vapour pressure- Henry's law, Trouton's Law. Non-ideal systems -Concept of fugacity, fugacity coefficient. Determination of fugacity; Non ideal solutions.

Activities and activity coefficients; Standard-state conventions for non ideal solutions; Determination of activity coefficients from vapour pressure measurements. Activity coefficients of non-volatile solutes using Gibbs- Duhem equation. Chemical equilibrium effect of temperature on equilibrium constant- Van'tHoff equation

UNIT-II:

Micelles and Macro molecules:

(A) Surface active agents, classification of surface active agents, micellization, hydro phobic interaction, critical micellar concentration (CMC), factors affecting the CMC of surfactants, counter ion binding to micelles, thermodynamics of micellization- phase separation and mass action models, Solubilization, micro emulsion, reverse micelles.

(B) Polymer- definition, types of polymers, electrically conducting, fire resistant, liquid crystal polymers, kinetics of free radical polymerization. Molecular mass- Number and mass average molecular weight, molecular weight determination-End group analysis, Osmometry, viscometry, ultracentrifugation and light scattering methods.

UNIT-III:

Chemical Kinetics:

(A) Theories of reaction rates- Collision theory- Limitations, Transition state theory. Effect of ionic strength - Debye Huckel Theory-Primary and secondary salt effects; Effect of dielectric constant, effect of substituent, Hammett equation-limitations, Taft equation;

(B) Prediction of rate constants- Consecutive reactions, parallel reactions ,opposing reactions Uni molecular steps only, no derivation). Specific and general acid-base catalysis; Skrabal diagram; Fast reactions- different methods of studying fast reactions- flow methods, relaxation methods- temperature jump and pressure jump methods.

UNIT-IV:

Photochemistry:

(A) Electronic transitions in molecules, Franck-Condon principle. Electronically excited molecules- singlet and triplet states, spin-orbit interaction. Quantum yield and its determination; Actinometry - ferrioxalate and uranyl oxalate actinometers-problems.

(B) Quenching effect- Stern Volmer equation. Photochemical equilibrium and delayed fluorescence - E

type and P type. Photochemical primary processes, types of photochemical reactions-photo dissocoation, addition and isomerisation reactions with examples.

Unit no	Additions	Deletions	Expected levels of learning as per Blooms Taxonomy for assessment of CO	Percentage added/added
1	Trounton's law	-	K_2	2%
2	-	-	-	-
3	-	-	-	-
4	-	-	-	-

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

Reference books

S.No	AUTHOR	TITLE	PUBLISHER
1	Peter Atkins and Julio de Paula	Physical chemisry	Oxford university Press
2	G.W. Castellon	Physical chemistry	Narosha Publishing House
3	W.J.Moore	Physical chemistry	Prentice Hall
4	Samuel Glasstone	Thermodynamics for chemists	Prentice Hall
5	K.J.Laidler	Chemical kinetics	McGraw Hill publications
6	Puri sharma and pathania	Principles of Physical chemistry	Vishal publishing Co.
7	Sabastian Koltzenburg, Michael Maskos, Oskar Nuyken	Polymer chemistry	Springer
8	V.R. Gowriker, N.V.V. Iswanadhan and J. Sreedhar	Introduction to polymer science	Wiley Publications
9	V. Morol	Micelles, Theoretical and applied aspects	Plenum Publishers

Web Links:

1 https://youtu.be/75uFuS1j59o

2 https://youtu.be/CgZDTuE3vn0

3 https://youtu.be/DHPXKASQ7LE

CO-PO Mapping:

	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO9	PO 10	PSO1	PSO2	PSO3
CO1	3	3	3	3	2	1	1	1	1	3	3	2	3
CO2	3	3	3	1	1	1	3	1	1	3	3	2	3
CO3	3	3	3	2	2	1	2	1	1	3	3	2	2
CO4	3	2	2	2	1	1	3	1	1	3	3	2	3

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

(**PO1) Knowledge:** Apply the knowledge of Physical Chemistry to the solution of simple to complex synthesis of organic compounds.

(PO2) Critical Thinking: Carry out experiments in the area of thermodynamics and chemical kinetics for maintaining optimum conditions and applying the domain of critical thinking.

(PO3) Problem Solving: Identify, formulate, review research literature, and analyze simple to complex problems reaching substantiated conclusions using fundamental principles of polymer chemistry.

(PO4): Usage of modern tools: Create data using modern chemical tools and ICT for modeling and analyze the photo chemical procesesses data obtained from sophisticated instruments for chemical kinetics 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 Post-graduation, our Post graduates would be able to:

PSO 1- Evaluate, analyse, interpret, and effectively apply the basic laws, principles, phenomena, processes and Experiments involved in the domain of Physical Chemistry.

PSO2 - Demonstrate the knowledge of thermodynamics and chemical kinetics in the domain of research, education and perspective entrepreneurship.

PSO3 - Evaluate distinct problems in the field of polymer chemistry, scientific interpretation, and derivations with an understanding on basic tools to be employed.

Weightage to contentSemester -I Paper-IV

S.No	Course Content	Long Answer	Short Answer	Total marks	As per Blooms Taxonomy
1	**Thermodynamics-I:**	2	2	36	Understanding, Application
2	**Micelles and Macro molecules:**	2	2	36	Remembering, Understanding
3	**Chemical Kinetics:**	2	2	36	Application & Creation
4	**Photochemistry:**	2	2	36	Remembering, Understanding
	TOTAL	**8**	**8**	**144**	

P.R. COLLEGE (A), KAKINADA

I YEAR M Sc (Examination at the end of V semester)Paper-IV PHYSICAL CHEMISTRY-I

MODEL PAPER

Duration: 3hrs **Max. Marks:75**

PART-A

Answer all questions **(4 × 15 = 60M)**

1. a) i) Describe the different methods of fugacity.

   ii) Write a note on Henry's law.

   (OR)

   b) What is chemical potential? Write the influence of temperature and pressureon chemical potential.

2. a) i) Give a brief account on factor affecting critical micellar concentrations.

   ii) Write a note on thermodynamic misallocation.

   (OR)

   b) i) Write a note on free radical polymerization.

   ii) Give a brief account on light scattering method.

3. a) i) Write a note of Hammet equations.

   ii) Write the kinetics of parallel reactions.

   (OR)

   b) i) Describe the kinetics of fast reactions explain the pressure jump method andtemperature jump method.

   ii) Wrtie a note on transitions state theory.

4. a) i) Derive stern – Volmer equations.

   ii) Write about delayed fluorescence.

   (OR)

   b) What is quantum yield? Explain the experimental determinations of quantumyield. Also write the low and high quantum yield.

PART-B

(5 ×3 = 15M)

Answer any Five questions

5. Derive Phase Rule.
6. Determinations of partial molar volume by intercept method.
7. Classifications of surfactants.
8. Write a note on mass average molecular weight.
9. Write a note on taft equation.
10. Write a note on kinetics of consecutive reactions.
11. Write a note on photo stationery state.
12. Write about internal conversion and intersystem crossing.

LABORATORY COURSE

Practical Paper – III :: Physical Chemistry

(at the end of semester I) 6hr/week 75Marks

Learning Outcomes:

On successful completion of this practical course, student shall be able to: Acquire skills of handling the conductometer, potentiometer and the estimation of critical solution temperature of the two immiscible liquids.

Practical (Laboratory) Syllabus

1. Determination of critical solution temperature of phenol-water system.
2. Effect of added electrolyte on the CST of phenol-water system.
3. Conductometric titration of Strong acid versus Strong base
4. Dissociation constant of weak acid (CH_3COOH) by conductometric method.
5. Conductometric titration of Weak acid vs Strong base.
6. Determination of cell constant
7. Adsorption of acetic acid on animal charcoal or silica gel.
8. Acid-catalyzed hydrolysis of methyl acetate
9. Determination of partial molar volume of solute –H_2O system by apparent molar volume method.

Scheme of valuation

Record:	10M
Viva:	15M
Chemicals and apparatus:	4M
Principle:	3M
Chemical equation:	3M
Theory and procedure:	10M
Tables:	10M
Calculation, Graphs	10M
Report:	10M
TOTAL	**75M**

Co-Curricular Activities

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

For Teacher: Training of students by the teacher in laboratory and field for not less than 15 hours on the field techniques/skills of handling the conductometer, potentiometer and the estimation of critical solution temperature of the two immiscible liquids.

For Students: Student shall visit a related industry/chemistry laboratory in universities/research organizations/private sector facility and observes the instrumentation. Write their observations and submit a hand-written fieldwork/project work report not exceeding 10 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).

Suggested Co-Curricular Activities

Training of students by related industrial experts.

Assignments, Seminars and Quiz (on related topics), collection of relevant videos andmaterial.

Visits of abilities, firms, research organizations etc.

Invited lectures and presentations on related topics by field/industrial experts.

SEMESTER-II

	Pithapur Rajah's Government College (Autonomous) Kakinada	Program &SemesterI M.Sc. Chemistry Semester-II Paper-I			
Course Code	TITLE OF THE COURSE **GENERAL CHEMISTRY – II**				
Teaching	**Hours Allocated: 60(Theory)**	**L**	**T**	**P**	**C**
Pre-requisites:	Operators, wave mechanics	**60**	**10**	**----**	**4**

Course Objective

Study the quantum chemistry and molecular spectroscopy

Course Outcomes:

	On Completion of the course, the students will be able to
CO1	Determination of energy and wave function for one electron and many electron systems
CO2	Learning of molecular symmetry, classifying the varies molecules into point groups basing onsymmetry
CO3	Study of errors and learning of significant figures
CO4	Learning of FORTRAN language By using FORTRAN LANGUAAGE can solve chemistry problems

Course with focus on employability / entrepreneurship / Skill Development modules

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

Syllabus

UNIT-1

Basic Quantum Chemistry-III:

(A) Hydrogen atom- solution of R(r), Φ (ϕ) and Θ (θ) equations. Probability density in orbitals- shapes of orbitals- Perturbation theory- Time independent perturbation theory (only first order perturbation is to be dealt with)- application to ground state energy of Helium atom.

(B) Variation principle- applications- calculation of zero-point energy of harmonic oscillator- many electrons atom- Hartee-Fock self-consistent field method (qualitative treatment only).

UNIT-II

Molecular symmetry and Group Theory in chemistry:

(A) Basic concepts of symmetry and Group theory-Symmetry elements, symmetry operations and point groups- Schoen flies symbols- Classification of molecules into

point groups-Axioms of Group theory- Group multiplication tables for C2v and C3v point groups.

(B) Similarity transformations- and classes-Representations- reducible and irreducible representations, Mullikan symbols, Orthogonality theorem and its implications ,Character table and its anatomy.

UNIT-III

Treatment of analytical data:

(A) Accuracy and precision- Classification of errors- Determinate and Indeterminate errors- Minimization of errors- Absolute and Relative errors, propagation of errors- Distribution of Indeterminate errors- Gaussian distribution- Measures of central tendency-Measures of precision.

(B) Standard deviation- Standard error of mean- student's test-Confidence interval of mean- Testing forsignificance- Comparison of two means- F-test- Criteria of rejection of an observation- Significant figures and computation rules.

UNIT- IV

Introduction to computer programming- FORTRAN 77:

(A) Basic structures and functioning of computer with P.C. as an illustrative example- Main Memory-Secondary storage memory- input/output devices- computer languages- operating systems- principles of algorithms-and flow charts-constants and variables- Arithmetic expressions- Arithmetic Statements-Replacement statement- IF statement- logical IF and BLOCK IF statements- GOTO statements- subscripted variable and DIMENSION statement. DO statement- Rules for DO statement- Functions and subroutines- Development of FORTRAN statements for simple formulae in chemistry such as Vander Waals equation- pH of a solution- First order rate equation- Cell Constant-Electrode potential.

(B) Flowcharts and computer programs for

i) Program for the calculation of Cell Constant, Specific Conductance and Equivalence.
ii) Rate Constant of First order reaction or Beer's law by linear least square method.
iii) Hydrogen ion concentration of a strong acid solution/Quadratic equation
iv) Solution for Vander Waals equation or Hydrogen ion concentration of a monoprotic weak acid
v) Standard deviation and Variance of univariant data.

Unit No	Additions	Deletions	Expected levels of learning as per Blooms taxonomy assessment of CO	Percentage added/deleted
I	--	--		
II	--	--		
III	--	--		
IV	--	--		

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

Text Books/Reference Books

S. No	AUTHOR	TITLE	PUBLISHER
1	A. K. Chandra	Introductory Quantum chemistry	Tata McGraw-Hill
2	A.K. Bhattacharya	Group theory for chemistry	
3	F. A. Cotton	Chemical Applications of Group Theory 3rd Edition	CVWiley India Pvt.Ltd
4	Vogel	Vogels Textbook of Quantitative analysis	
5	Skog and West	Fundamentals of Analytical chemistry	Cengage learning
6	V. Rajaraman	Principles of computer programming (FORTRAN IBM PC)	Prentice Hall
7	P. C. Jurs	Basics of computer for chemists	
8	C.N. Banwell	Fundamentals of Molecular spectroscopy	Mc Graw Hill
9	B. K. Sharma	Molecular Spectroscopy	Krishna Prakashan
10	Aruldas	Molecular spectroscopy	
11	R. K. Prasad	Introduction to Quantum Mechanics	New age International Publications

Web Links

1. https://youtu.be/Yf_4Qv-A55Q
2. https://youtu.be/g2sqX3FkcRo
3. https://youtu.be/e4VHMSO5eqM
4. https://youtu.be/5VZm7IsT1xM

CO-PO Mapping

	On Completion of the course, the students will be able to
CO1	Determination of energy and wave function for one electron and many electron systems
CO2	Learning of molecular symmetry, classifying the varies molecules into point groups basing onsymmetry
CO3	Study of errors and learning of significant figures
CO4	Learning of FORTRAN language By using FORTRAN LANGUAAGE can solve chemistry problems

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	1	3	3	3	1	1	1	2	2	3	3	1
CO2	3	1	3	3	3	1	1	1	2	2	3	3	1
CO3	3	2	3	3	2	1	1	1	1	2	3	2	1
CO4	3	2	3	3	2	1	1	1	1	2	3	2	1
Avg.	3	1.5	3	3	2.5	1	1	1	1.5	2	3	2.5	1

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

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

(**PO1) Knowledge:** Apply the knowledge of Quantum Chemistry and Treatment of analytical data to the solution of simple to complex compounds.

(PO2) Critical Thinking: Carry out experiments in the area of Quantum Chemistry and Treatment of analytical data for maintaining optimum conditions and applying the domain of critical thinking.

(PO3) Problem Solving: Identify, formulate, review research literature, and analyze simple to complex problems reaching substantiated conclusions using fundamental principles of Group theory.

(PO4): Usage of modern tools: Create data using modern chemical tools and ICT for modelling and analyze the data obtained from FORTRAN 77.

(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 Post-graduation, our Post graduates would be able to:

PSO 1- Evaluate, analyse, interpret, and effectively apply the basic laws, principles, phenomena, processes and Experiments involved in the domain of Quantum Chemistry.

PSO2 - Demonstrate the knowledge of Analytical data and Group Theory in the domain of research, education and perspective entrepreneurship.

PSO3 - Evaluate distinct problems in the field of Quantum Chemistry, scientific interpretation, and derivations with an understanding on basic tools to be employed.

PITHAPUR RAJAH'S GOVERNMENT COLLEGE, KAKINADA

PG Courses 2023-24

SYLLABUS FOR SEMESTER – II (MSC- CHEMISTRY)

Paper I (General Chemistry)

Weightage to Content

S. No.	Course Content	Essay Questions (15M)	Short Answer Questions (5M)	Total No. Of Questions from each Unit	Total No. of Marks allotted to each Unit
1	Unit – I	2	2	4	40
2	Unit – II	2	2	4	40
3	Unit – III	2	2	4	40
4	Unit – IV	2	2	4	40
	TOTAL	**8**	**8**	**16**	**160**

PITHAPUR RAJAH'S COLLEGE (A), KAKINADA

I YEAR MSC (EXAMINATION AT THE END OF II SEMESTER)

PAPER- I: GENERAL CHEMISTRY

MODEL PAPER

Duration: 3 hrs **Max. Marks: 75**

SECTION: A

Answer ALL questions. **4X15=60**

1. (a) Explain Hartree – Folk self-consistent field.

(OR)

(b) Derive wave function and energy for many electron atom.

2. (a) Write a note on great orthogonal theorem and construct a character able for C3V

(OR)

(b) Write a note on similarity transformation and group multiplication table for C3V point group.

3. (a) Write a brief note on classifications of errors and write short note on Q – test.

(OR)

(b) Write note on calibrations methods.

4. (a) Write FORTRON program and flow chart for the variance and standard deviation.

(OR)

(b) Write a brief note on FORTRON constants and variables.

SECTION - B

Answer any FIVE questions **5X3=15**

1. Write a short note on $2P_z$ orbital.
2. Write a short note on variation theorem.
3. Write group multiplication table of C_2V point group.
4. What is the point group of SO_4^{2-}?
5. The titre values of A and B are 10.4, 10.5 and 10.8, 9.3, 9.5 and 9.6 respectively. Ther calculate the F and T test values.
6. Write a short note on random errors.
7. Write the flow chart diagram for concentrations of H^+ ion of strong acid solutions.
8. Write algrouth for $(a+b)^2$ equation.

*** *** ***

	Pithapur Rajah's Government College(Autonomous) Kakinada	**Program &SemesterI M.Sc. Chemistry Semester-II Paper-II**			
Course Code	TITLE OF THE COURSE **INORGANIC CHEMISTRY – II**				
Teaching	**Hours Allocated: 60(Theory)**	**L**	**T**	**P**	**C**
Pre-requisites:	Electronic configurations, calculation of oxidation states, trends in periodic table, shape of the orbitals, theories in bonding	**60**	**10**	**30**	**4+3**

Course Objectives:

Study of bonding theories, inorganic rings, and coordination compounds

Course Outcomes:

	On Completion of the course, the students will be able to
CO1	Analyze and predict the stability and reactivity of metal cluster
CO2	Understand the bonding and electronic structure of organometallic compounds
CO3	Understand the principles of metal-ligand complex formation and their reactivity
CO4	Understand the role of metal ions in biological systems.

Course with focus on employability / entrepreneurship / Skill Development modules

Skill Development			Employability		Entrepreneurship

Syllabus

UNIT-I

Metal cluster compounds:

(A) Definition – evidences for existence of M-M bonds - conditions favorable for formation of M-M bonds – preparation, structure, and bonding of the following metal cluster compounds. $Re_2Cl_8^{2-}$, $Mo_2Cl_8^{4-}$

(B) $Re_2(RCOO)_4X_2$, $Mo_2(RCOO)_4(H_2O)_2$, $Cr_2(RCOO)_4(H_2O)_2$, $Cu_2(RCOO)_4$ $(H_2O)_2$, $Cr_2Cl_9^{3-}$, $Mo_2Cl_9^{3-}$, $W_2Cl_9^{3-}$, Re_3Cl_9, $Re_3Cl_{12}^{3-}$, $Mo_6Cl_8^{4+}$, $Nb_6X_{12}^{2+}$ and $Ta_6X_{12}^{2+}$. Polyatomic clusters – Zintle ions, Chevrel phases

UNIT-II

Organometallic compounds:

(A) 16 and 18 electron rules. Isoelectronic relationship - Synthesis, structure, bonding and reactions of carbon monoxide, dinitrogen, and nitric oxide complexes. Isolobal relationship – H, Cl, CH3, Mn $(CO)_5$; CH_2, $Fe(CO)_4$; P, CH, $Co(CO)_3$.

(B) Synthesis, structure, bonding and reactions of metallocenes with special reference to ferrocene. Catalysis byOrganometallic compounds – Homogeneous Catalysis – Alkene hydrogenation – Wilkinson's catalyst, Hydroformylation.

UNIT-III

Metal Ligand equilibria in solution:

(A) Stepwise and overall formation constants and their interaction– trends in stepwise constants – factors affecting the stability of metal complexes–Pearson's theory of hard and soft acids and bases (HSAB),chelate effect and its thermodynamic origin.

(B) Determination of stability constants of complexes–spectrophotometric method and pH–metric method.Reactivity of metal complexes–inert and labile complexes. Explanation of lability on the basis ofVBT & CFT.

Bio-Inorganic Chemistry:

Metalloporphyrins with special reference to Hemoglobin & Myoglobin. Biological role of alkali and alkaline earth metal ions with special reference to Na^+ , Mg^{+2}, Co^{+3} Zn^{+2} Ca^{2+}.

UNIT- IV

Inorganic Reaction Mechanisms:

(A) Substitution reactions of metal complexes – D, Id, Ia and A mechanisms – Ligand replacement reactions ofoctahedral complexes – Acid hydrolysis – factors affecting acid hydrolysis – Anation and Base hydrolysis of Cobalt (III) complexes.

(B) Ligand displacement reactions of square planar complexes of platinum (II). Factors affecting square planar substitution – trans effect (theories). Electron transfer reactions of complexes – concept of complementary and non-complementary reactions with examples. Inner and outer sphere mechanisms.

Unit No	Additions	Deletions	Expected levels of learning as per Blooms taxonomy assessment of CO	Percentage added/deleted
III	Na+ , Mg+2, Co+3 Zn+2	Biological and biological Nitrogen Fixation	K_3 and K_5	

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

Reference Books/Text Books

S.NO	AUTHOR	TITLE	PUBLISHER
1	F.A.Cotton and R.G.Wilkinson	Advanced Inorganic Chemistry,IV Edition	John Wiley and Sons
2	J.E.Huheey	Inorganic Chemistry III Edition	Haper International Edition
3	A.Singh and R.C.Mehrotra	Organometallic chemistry –A Unified Approach	Wiley Eastren Ltd
4	Shriver and Atkins	Inorganic chemistry	Oxford University press
5	M.C.Day and J.Selbin	Theoretical Inorganic Chemistry	Affilated East West press Pvt Ltd
6	D.Benson	Mechanisms of Inorganic reactions in solutions	Mc Graw Hill,London
7	K.F.Purcell and J.C.Kotz	Inorganic chemistry	W.B.Saunders company,Newyork
8	G.N.Mukerjee and Arabinda das	Elements of Bio inorganic chemistry	U.N.Dhar and sons pvt ltd

CO-PO Mapping

On Completion of the course, the students will be able to	
CO1	Analyze and predict the stability and reactivity of metal cluster
CO2	Understand the bonding and electronic structure of organometallic compounds
CO3	Understand the principles of metal-ligand complex formation and their reactivity
CO4	Understand the role of metal ions in biological systems.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	3	1	3	1	1	1	1	2	1	3	3	3
CO2	3	2	2	2	3	1	1	1	2	3	3	3	3
CO3	3	3	1	3	1	1	1	1	1	3	3	3	3
CO4	3	3	1	3	1	1	1	1	1	3	3	3	3
Avg.	3	2.75	1.25	2.75	1.5	1	1	1	1.5	2.5	3	3	3

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

Programme Outcomes

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

(**PO1) Knowledge:** Apply the knowledge of Organometallic Chemistry to the solution of simple to complex compounds.

(PO2) Critical Thinking: Carry out experiments in the area of Organometallic Chemistry for maintaining optimum conditions and applying the domain of critical thinking.

(PO3) Problem Solving: Identify, formulate, review research literature, and analyze simple to complex problems in bio chemistry.

(PO4): Usage of modern tools: Create data using modern chemical tools and ICT for modelling and analyzing the inorganic reaction mechanism.

(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 Post-graduation, our Post graduates would be able to:

PSO 1- Evaluate, analyse, interpret, and effectively apply the basic laws, principles, phenomena, processes and Experiments involved in the domain of Organometallic Chemistry.

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

PSO3 - Evaluate distinct problems in the field of Biological Chemistry ,with an understanding on bio tools to be employed

PITHAPUR RAJAH'S GOVERNMENT COLLEGE, KAKINADA

PG COURSES 2023-24

SYLLABUS FOR SEMESTER – II (MSC- CHEMISTRY)

PAPER II (INORGANIC CHEMISTRY)

S. No.	Course Content	Essay Questions (15M)	Short Answer Questions (5M)	Total No. Of Questions from each Unit	Total No. of Marks allotted to each Unit
1	Unit – I	2	2	4	40
2	Unit – II	2	2	4	40
3	Unit – III	2	2	4	40
4	Unit – IV	2	2	4	40
	TOTAL	**8**	**8**	**16**	**160**

WEIGHTAGE TO CONTENT

PITHAPUR RAJAH'S COLLEGE (A), KAKINADA

I YEAR MSC (EXAMINATION AT THE END OF II SEMESTER)

PAPER- II: INORGANIC CHEMISTRY

MODEL PAPER

Duration: 3 hrs **Max. Marks: 75**

SECTION: A

Answer **ALL** questions **4X15=60**

1. a) Discuss the structure and bonding of the metal clusters. $Re_2Cl_8^{-2}$ and $Mo_2Cl_8^{-4}$

(OR)

(b) Describe the structures of Trinuclear metal clusters.

2. (a) Explain the synthesis, structure and reactions of Dinitrogen complexes.

(OR)

(b) Write the preparation, structure and bonding in ferrocene.

3. (a) Describe a spectrophotometric method for the determination of stability constant of a complex.

(OR)

(b) Explain Person's concept of Hard and Soft acid and bases give examples.

4. (a) Discuss the mechanism of acid and base hydrolysis of Co(III) complex.

(OR)

(b) Explain trans effects with suitable examples. Discuss the polarization and Pi bonding theories of trans effect.

SECTION: B

Answer any **FIVE** questions **5X3=15**

1. Explain the structure and magnetic property of $Re_2(RCOO)_4X_2$
2. What are the favorable conditions for the formation of metal clusters?
3. What is 16 electron rule? Illustrate with suitable examples.
4. Explain Isolobal relationship with suitable examples.
5. What is meant by Chelate effect.
6. Giving suitable examples explain the liability and inertness of complexe.
7. Explain the inner sphere electron transfer mechanism.
8. What are complementary and non-complementary reactions? Explain.

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PITHAPUR RAJAH'S GOVERNMENT COLLEGE, KAKINADA
SYLLABUS FOR SEMESTER – II (MSC- CHEMISTRY)
PAPER II (INORGANIC CHEMISTRY)
PRACTICALS

Quantitative analysis:

(A) Volumetric:

1. Determination of Ferric iron by photochemical reduction
2. Determination of Nickel by EDTA
3. Determination of Calcium and Magnesium in a mixture by EDTA
4. Determination of Ferrocyanide by Ceric sulphate
5. Determination of Copper (II) in presence of Iron (III)

(B) Gravimetric:

6. Determination of Zinc as Zinc pyrophosphate
7. Determination of Nickel from a mixture of Copper and Nickel

(C) Volumetric:

1. Determination of Ferric iron by photochemical reduction
2. Determination of Nickel by EDTA
3. Determination of Calcium and Magnesium in a mixture by EDTA
4. Determination of Ferrocyanide by Ceric sulphate
5. Determination of Copper (II) in presence of Iron (III)

(D) Gravimetric:

8. Determination of Zinc as Zinc pyrophosphate
9. Determination of Nickel from a mixture of Copper and Nickel.

Reference Books/Text Books

S.NO	AUTHOR	TITLE	PUBLISHER
1	J. Mendham R. C. Denny J.D.Barnes M.J.K.Thomas	Vogel Text book of Quantitative Chemical Analysis	Pearson Education

Schem Scheme of valuation

1. Record	**10 Marks**
2. Viva- Voce	**15 Marks**
3. Practical (Quantitative analysis)	**50 Marks**
i. Principle with Chemical Reaction	10 Marks
ii. Brief Procedure	10 Marks
iii. Formula & Tabular forms	5 Marks
iv. Calculation	5 Marks
v. Report	
< 2% Error	20 Marks
>2% Error	15 Marks
>5% Error	10 Marks
Total	**75 Marks**

Cocurricular 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 Quantitative analysis-Determination of amount of solute present in given solution.

For Student: Student shall visit a related industry/chemistry laboratory in universities/research organizations/private sector facility and observe the techniques used for Determination of amount of solute present in given solution. Write their observations and submit a hand written 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 &SemesterI M.Sc. Chemistry Semester-II Paper-III			
Course Code	TITLE OF THE COURSE **ORGANIC CHEMISTRY – II**				
Teaching	**Hours Allocated: 60(Theory)**	**L**	**T**	**P**	**C**
Pre-requisites:	**Different types of reactions and mechanisms, formation of alkenes& new C-C bonds.**	**60**	**10**	**30**	**4+3**

Course Objectives:

Study the aromaticity, stereochemistry of organic compounds, heterocyclic compounds, and natural products

Course Outcomes:

On Completion of the course, the students will be able to	
CO1	Mechanisms of the substitution and elimination reactions, formation of alkenes.
CO2	Formation of Carbon hetero bonds through reaction mechanism and synthetic applications of the reactions.
CO3	Apply knowledge of rearrangement reactions to synthetic organic chemistry.
CO4	Structural illustration of compounds.

Syllabus:

UNIT – I

Reaction Mechanism:

(A) Aliphatic Nucleophilic Substitution and Nucleophilic Aromatic substitution:

Stereochemistry of SN2 and SN1mechanisms, Neighboring Group Participation (Anchimeric assistance), NGP by O, S, N: Aromatic Nucleophilic substitution: SN2 (Ar) (Addition – Elimination), SN1(Ar) and benzyne mechanisms (Elimination - Addition); evidence for the structure of benzyne. Von Richter, Sommelet-Hauser rearrangements.

(B) Elimination Reactions:

Type of elimination reactions, mechanisms, Stereochemistry and Orientation, Hofmann and Saytzeff rules, Syn elimination versus anti-elimination, competition between elimination and substitution, dehydration, dehydrogenation, dehalogenation, decarboxylative eliminations, E1cB mechanism and pyrolytic eliminations

UNIT – II

Addition Reactions

Addition to Carbon – Carbon Multiple Bonds:

Mechanistic and stereo chemical aspects of addition reactions involving electrophiles, nucleophiles and free radicals, regio and chemo selectivity, orientation and reactivity,

Hydrogenation of double and triple bonds, hydrogenation of aromatic rings, Hydroboration.

Addition to Carbon-Hetero Multiple Bonds:

Steric course of addition reactions to C=O and C=N, Aldol, Cannizzaro, Perkin, Knoevenagel, Claisen- Schmidt, Claisen, Dieckman, Benzoin and Stobbe condensations, Reformatsky reaction, Tollen's reaction, Prin's reaction, Wittig, Grignard, Mannich, and Michael reaction.

UNIT – III

Molecular Rearrangements

Types of molecular rearrangements, migratory aptitude;

Rearrangements to electron deficient carbon: Pinacol-pinacolone, Dienone-Phenol, Arndt-Eistert synthesis. Neighboring group assistance in free radical reactions; Reactivity for aliphatic substrates; Reactivity in aromatic substrates; Reactivity at bridge head.

Rearrangements to electron deficient oxygen: Baeyer-villiger, Hydro peroxide rearrangement and Dakin rearrangements; Neber rearrangement, Benzil-Benzilic acid and Favorskii rearrangements.

UNIT - IV

Spectroscopy and Protecting Groups

(A) Spectroscopy

i) U.V. Visible absorption laws, electronic excitations, and absorption shifts

ii) I.R.: Fundamental modes of vibrations in IR Spectroscopy, Finger Print Region and its importance.

iii) NMR: Chemical shift and its importance, coupling constant and its importance, Factors affecting chemical shift and coupling constant, Deuteration-deuterium exchange and Deuterium Labeling.

iv) Mass: Some useful terms used in Mass spectrometry: Molecular ion, Fragmentation, Cleavage,

v) Rearrangement, Loss of small molecules, Isotope Abundance, Metastable ions, Even-electron rule, Nitrogen

vi) rule, Mc Lafferty Rearrangement.

(B). Protection of carbonyl, Hydroxyl, carboxylic and Amine groups.

Unit No	Additions	Deletions	Expected levels of learning as per Blooms taxonomy assessment of CO	Percentage added/deleted
I	E1cB mechanism	--	K_1, K_2	

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

Text Books/ Reference Books

S. No	AUTHOR	TITLE	PUBLISHER
1	Jerry March	Advanced Organic Chemistry: Reactions Mechanisms and Structure	John Wiley and Sons
2	Peter Sykes	A Guide book to Mechanism in Organic chemistry	Longmann
3	P.S.Kalsi.	Reaction Mechanism in Organic chemistry	New Age international
4	R.T.Morrison and R,T,Boyd	Organic chemistry	Prentice Hall
5	E.L.Eliel	Stereochemistry to Organic compounds	John Wiley
6	P.S.Kalsi	Stereochemistry	New Age International
7	Raj K.Bansal	Heterocyclic chemistry	
8	R.M.Acheson ,john Wiley	An Introduction to Heterocyclic compounds	John Wiley
9	K.W.Bentley	Chemistry of Natural Products	
10	D.Nasipuri	Stereochemistry to Organic compounds	New age International
11	R.S.Kalsi	Chemistry of Natural products	Kalyani Publications

CO-PO Mapping

On Completion of the course, the students will be able to	
CO1	Mechanisms of the substitution and elimination reactions, formation of alkenes.
CO2	Formation of Carbon hetero bonds through reaction mechanism and synthetic applications of the reactions.
CO3	Apply knowledge of rearrangement reactions to synthetic organic chemistry.
CO4	Structural illustration of compounds.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	3	1	3	2	1	1	1	2	1	3	3	1
CO2	3	3	3	3	3	1	1	1	2	1	3	3	1
CO3	3	3	3	2	2	1	1	1	2	1	3	3	1
CO4	3	2	2	3	1	2	3	1	3	1	3	3	1
Avg.	3	2.75	2.25	2.75	2	1.25	1.5	1	2.25	1	3	3	1

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

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

(**PO1) Knowledge:** Apply the knowledge of Mechanistic chemistry to the solution of simple to complex organic reactions.

(PO2) Critical Thinking: Carry out experiments in the area of Chemical Kinetics for reaction mechanism analysis for Organic reactions.

(PO3) Problem Solving: Identify, formulate, review research literature, and analyze simple to complex problems reaching substantiated conclusions using fundamental principles of Organic Spectroscopy techniques.

(PO4): Usage of modern tools: Create data using modern chemical tools and ICT for modeling and analyze the data obtained from sophisticated instruments for protecting groups in Organic Chemistry.

(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 Post-graduation, our Post graduates would be able to:

PSO 1- Evaluate, analyse, interpret, and effectively apply the basic laws, principles, phenomena, processes and Experiments involved in the Reaction mechanism of Organic reactions.

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

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

PITHAPUR RAJAH'S GOVERNMENT COLLEGE, KAKINADA

PG COURSES 2023-24

SYLLABUS FOR SEMESTER – II (MSC- CHEMISTRY)

PAPER III (ORGANIC CHEMISTRY)

WEIGHTAGE TO CONTENT

S. No.	Course Content	Essay Questions (15M)	Short Answer Questions (5M)	Total No. Of Questions from each Unit	Total No. of Marks allotted to each Unit
1	Unit – I	2	2	4	40
2	Unit – II	2	2	4	40
3	Unit – III	2	2	4	40
4	Unit – IV	2	2	4	40
	TOTAL	**8**	**8**	**16**	**160**

PITHAPUR RAJAH'S COLLEGE (A), KAKINADA

I YEAR MSC (EXAMINATION AT THE END OF II SEMESTER)

PAPER- III: ORGANIC CHEMISTRY

MODEL PAPER

Duration: 3 hrs **Max. Marks: 75**

SECTION: A

Answer **ALL** questions **4X15=60**

1. a) Explain the reaction mechanism and synthetic applications of Vonritcher, sommelet – Hauser and smiles rearrangement.

(OR)

b) Write short notes on E1, E2, E1CB mechanisms

2. a) Explain the mech and applications following reactions

i) Micheal ii) wittig . Iii) Claisen

(OR)

b) i) Aldol condensation ii) Reformatsky iii) Perkin

3. a) Explain the following rearrangements with mechanism.

i) Benzil- Benzillic acid ii) Beckmann iii) Bayer – Villiger.

(OR)

b) i) Wagner Merwin ii) Hoffmann. iii) Favorskii

4. a) Protection of Carbonyl, Amine, Hydroxyl groups.

(OR)

b) i) Write note on chromophore, Auxochrome, Bathochromic, Hypso effects.

ii) Discuss Base peak, MC-Lafferty rearrangement, and molecular ion.

SECTION : B

Answer any **FIVE** questions 5 X 3 = 15

1. Explain NGP in substitution reactions
2. Explain Walden Inversion
3. Explain Markovnikov's rule
4. Describe the mechanism and applications of Cannizzaro. Reaction.
5. Explain the reaction mechanism and synthetic applications of Tiffeneau – Demjanov
6. Explain the reaction mechanism and synthetic applications of Neber
7. Give the all bond frequencies in IR.
8. Write principle and importance of NMR spectroscopy.

PITHAPUR RAJAH'S COLLEGE (A), KAKINADA

I YEAR MSC (EXAMINATION AT THE END OF II SEMESTER)

PAPER- III: ORGANIC CHEMISTRY

PRACTICALS

Course Outcomes

CO1: Develops the separation techniques for binary organic mixtures.

CO2: Analyze and identifies the functional groups of a given unknown organic compound.
CO3: Predicts the nature of organic molecules by their reactions.
CO4: Determines the physical constants accurately and precisely.
CO5: Identify the different elements present in an organic compound.

Syllabus

Systematic qualitative analysis of an organic mixture containing two compounds Identification of method of separation and the functional group(s) present in each of them and preparation of one solid derivative for the conformation of each of the functional group(s).

Reference Books/Text Books

S.NO	AUTHOR	TITLE	PUBLISHER
1	J. Mendham R. C. Denny J.D.Barnes M.J.K.Thomas	Vogel Text book of Quantitative Chemical Analysis	Pearson Education
2	B.S. Furniss, A.J. Hannaford, P.W.G. Smith	Vogel's Text Book of Practical Organic Chemistry	A.R. Tatchell, 5 Ed.

Scheme of Evaluation

1.	**Record**	**10 Marks**
2.	**Viva- Voce**	**15 Marks**
3.	**Practical (Qualitative analysis)**	**50Marks**
i.	Method of Separation	10 Marks
ii.	Preliminary Tests (7+7) State (1+1) Ignition test (1+1) Solubility (2+2) Test for Unsaturation (1+1) Extra element (2+2))	14 Marks
iii.	Identification Test (3+3)	6 Marks
iv.	Confirmation Test (5+5)	10 Marks
v.	Derivatives (3+3)	6 Marks
vi.	Report (2+2)	4 Marks
	Total	**75 Marks**

Cocurricular 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 Separation of organic compounds & Identification of functional groups present in organic compounds in a mixture, Preparation of their derivatives.

For Student: Student shall visit a related industry/chemistry laboratory in universities/research organizations/private sector facility and observe the techniques used for Separation of organic compounds & Identification of functional groups present in organic compounds in a mixture, Preparation of their derivatives. Write their observations and submit a hand written 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 &SemesterI M.Sc. Chemistry Semester-II Paper-IV**			
Course Code	TITLE OF THE COURSE **PHYSICAL CHEMISTRY – II**				
Teaching	**Hours Allocated: 60(Theory)**	**L**	**T**	**P**	**C**
Pre-requisites:	**Basics on thermodynamics, chemical kinetics, Photochemistry**	**60**	**10**	**30**	**4+3**

Course Objectives:

Study the thermodynamics and polymer chemistry and photo chemical effects.

Course Outcomes:

On Completion of the course, the students will be able to	
CO1	Structural illustration of compounds through NMR Learning of instrumentation of NMR and ESR Study of applications of ESR spectroscopy
CO2	Study of statistical thermodynamics Study of relation between micro and macro thermodynamic properties of matter
CO3	Study of complexation effect on EMF of the cells Study of Fuel cells
CO4	Study of electrical double layer of colloidal systems Study of over voltage

Course with focus on employability / entrepreneurship / Skill Development modules

Skill Development			Employability			Entrepreneurship	

Syllabus

UNIT-I:

Physical methods of molecular structural elucidation:

(A) NMR: Principle and theory, Nature of spinning particle and its interaction with magnetic field. Chemical shift and its origin. Spin-Spin interaction, Application of NMR to structural elucidation- Structure of ethanol, dimethylformamide, styrene and acetophenone.

(B) Electron Spin Resonance: Principle and experimental technique- g-factor, line shapes and line widths- hyperfine interactions- applications of ESR studies.

UNIT -II:

(A) Thermodynamics-II

Brief review on entropy; entropy changes accompanying specific process – expansion, phase transition, heating, measurement of entropy. Nernst heat theorem; Third law of thermodynamics- Determination of the absolute entropy- Apparent exceptions to Third law of thermodynamics.

(B) Statistical Thermodynamics: Objectives of statistical thermodynamics, Concept of distributions, Types of ensembles. Thermodynamic probability, Most probable distribution Law – Partition Function, (Definition and significance): Molar and molecular partitions-translational, rotational, vibrational, and electronic partition functions-Relation between thermodynamic functions (E, H, S, G and C_v) and the partition functions

UNIT-III:

Electrochemistry I:

(A) Electrochemical cell- Galvanic and electrolytic cell. Concentration cell with and without transference, Effect of complexation on redox potential- ferricyanide/ ferrocyanide couple, Iron (III) phenanthroline / Iron(II) phenanthroline couple. Determination of standard potential, solubility product equilibrium constant and activity coefficients from EMF data. Bjerrum theory of ion association (elementary treatment) Concept of activity and activity coefficients in electrolytic solutions. The mean ionic activity coefficient.

(B) Debye-Huckel theory of electrolytic solutions. Debye-Huckel limiting law (derivation not required), Calculation of mean ionic activity coefficient; Limitations of Debye-Huckel theory. Effect of dilution on equivalent conductance of electrolytes - Anomalous behavior of strong electrolytes. Debye Huckel- Onsagar equation – verification and limitations, Fuel Cells.

UNIT-IV:

Electrochemistry II:

(A) The electrode-electrolyte interface. The electric double layer. The Helmholtz-Perrin parallel-plate model, the Gouy-Chapman diffuse-charge model and the Stern model.
(B) Electrodics: Charge transfer reactions at the electrode-electrolyte interface. Exchange current density and over-potential. Derivation of Butler-Volmer equation. High field approximation, Tafel equation, Low field equilibrium, Nernst equation. Voltammetry- Concentration polarization, experimental techniques.

Unit No	Additions	Deletions	Expected levels of learning as per Blooms taxonomy assessment of CO	Percentage added/deleted

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

Text Books/ Reference Books

S. No	AUTHOR	TITLE	PUBLISHER
1	Samuel Glasstone	Text book of Physical chemistry	McMillan Pub
2	W.J. Moore	Physical chemistry	Prentice Hall
3	G.W. Castellon	Physical chemistry	N Narosha Publishing house
4	Peter Atkins and Julio, de Paula	Physical chemistry	Oxford university press
5	JOM Bockris &K.N. Reddy	Modern electrochemistry	Plenum publications
6	S. Glassstone	Introduction to Electrochemistry	East West Press
7	Banwell	Fundamentals of molecular spectroscopy	Mc Graw Hill
8	Straw and Walker	Spectroscopy	Chapman and hall
9	M.C. Gupta	Statistical thermodynamics	New Age International
10	M. Dole	Statistical thermodynamics	Prentice Hall

Weblinks

1 https://youtu.be/75uFuS1j59o
2 https://youtu.be/CgZDTuE3vn0
3 https://youtu.be/75uFuS1j59o
4 https://youtu.be/CgZDTuE3vn0
5 https://youtu.be/DHPXKASQ7LE

CO-PO Mapping

On Completion of the course, the students will be able to	
CO1	Structural illustration of compounds through NMR Learning of instrumentation of NMR and ESR Study of applications of ESR spectroscopy
CO2	Study of statistical thermodynamics Study of relation between micro and macro thermodynamic properties of matter

CO3	Study of complexation effect on EMF of the cells Study of Fuel cells
CO4	Study of electrical double layer of colloidal systems Study of over voltage

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

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

(**PO1) Knowledge:** Apply the knowledge of Thermodynamics and Electrochemistry to the solution of simple to complex problems in chemistry.

(PO2) Critical Thinking: Carry out experiments in the area of Thermodynamics and Electrochemistry for maintaining optimum conditions and applying the domain of critical thinking.

(PO3) Problem Solving: Identify, formulate, review research literature, and analyze simple to complex problems in Thermodynamics and electrochemistry.

(PO4): Usage of modern tools: Create data using modern chemical tools and ICT for modelling and analyzing the NMR analysis of Organic Compounds.

(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 Post-graduation, our Post graduates would be able to:

PSO 1- Evaluate, analyse, interpret, and effectively apply the basic laws, principles, phenomena, processes and Experiments involved in the domain of Thermodynamics and Electrochemistry.

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

PSO3 - Evaluate distinct problems in the field of Spectroscopy with special reference to NMR spectroscopy with an understanding on bio tools to be employed

PITHAPUR RAJAH'S GOVERNMENT COLLEGE, KAKINADA
PG COURSES 2023-24
SYLLABUS FOR SEMESTER – II (MSC- CHEMISTRY)

PAPER IV (PHYSICAL CHEMISTRY)
WEIGHTAGE TO CONTENT

S. No.	Course Content	Essay Questions (15M)	Short Answer Questions (5M)	Total No. Of Questions from each Unit	Total No. of Marks allotted to each Unit
1	Unit - I	2	2	4	40
2	Unit - II	2	2	4	40
3	Unit - III	2	2	4	40
4	Unit - IV	2	2	4	40
	TOTAL	**8**	**8**	**16**	**160**

PAPER IV (PHYSICAL CHEMISTRY)
WEIGHTAGE TO CONTENT

S. No.	Course Content	Essay Questions (15M)	Short Answer Questions (5M)	Total No. Of Questions from each Unit	Total No. of Marks allotted to each Unit
1	Unit - I	2	2	4	40
2	Unit - II	2	2	4	40
3	Unit - III	2	2	4	40
4	Unit - IV	2	2	4	40
	TOTAL	**8**	**8**	**16**	**160**

PITHAPUR RAJAH'S COLLEGE (A), KAKINADA

I YEAR MSC (EXAMINATION AT THE END OF II SEMESTER)

PAPER- IV: PHYSICAL CHEMISTRY

MODEL PAPER

Duration: 3 hrs **Max. Marks: 75**

SECTION: A

Answer **ALL** questions **4X15=60**

1. What is chemical shift? Write about factors influencing chemical shift. Write NMR spectra of styrene.

   (OR)

   Write about principle involved in ESR spectroscopy. Write NMR spectra of Acetophenone.
2. Write a note on 3rd law of thermodynamics. Variation of entropy with pressure and volume at constant temperature.

   (OR)

   Derive an equation for translational partition functions. Relation between partition function and internal energy.

3. i) Write a note on concentration cell without transference.
   ii) Derive standard potential from emf.

   (OR)

   i) Write a note on Debye – Huckel limiting law
   ii) Write a note on fuel cells.
4. i) Discuss Helm holtz – Perrin and gouy chapmann theory.
   ii) Derive Tafel equation

   (OR)

   i) Write a note on over Voltage
   ii) Write a note on concentration polarization.

SECTION: B

Answer any **FIVE** questions 5 X 3 = 15

5. Write ESR spectra of CH_3.
6. Discuss about coupling constants.
7. The enthalpy of function of water is 25.74 KJ note at its normal function point is O^0C calculate the entropy of function.
8. Write a short note on partition function.
9. Write a note on electrochemical cell.
10. Calculate the emf of concentration cell Ag/AgCl (a=0.1) AgCl / Ag at 25^0C of the transport number of Ag is 0.45.
7. What is cyclic voltammetry?
8. Calculate the ionic strength and mean activity coefficient of 1.0 m mole log^{-1} $CaCl_2$ at 25^o

PITHAPUR RAJAH'S COLLEGE (A), KAKINADA

I YEAR MSC (EXAMINATION AT THE END OF II SEMESTER)

PAPER- IV: PHYSICALC CHEMISTRY

PRACTICALS

1. Distribution of iodine between $CHCl_3$ and water
2. Distribution of I_2 between $CHCl_3$ and aq.KI solution- calculation of equilibrium constant.
3. Determination of Coordination number of cuprammonium cation.
4. Titration of mixture Strong acid and weak acid versus Strong base by conductometry.
5. Titration of Strong acid Vs Strong Base – pH – metry.
6. Titration of mixture of ($NaHCO_3$ + Na_2CO_3) Vs HCl – pH- metry.
7. Titration of Strong acid Vs Strong Base using Quinhydrone electrode.
8. Titration of Fe^{+2} Vs $K_2Cr_2O_7$ – potentiometry.
9. Verification of Beer-Lambert's law by Iron-thiocyanate system –colorimetry.
10. Determination of single electrode potential of Cu^{2+} /Cu and estimate the given unknown concentration.
11. Adsorption of acetic acid on animal charcoal or silica gel.
12. Acid-catalyzed hydrolysis of methyl acetate.

    Determination of partial molar volume of solute –H2O system by apparent molar volume meth

.

Reference Books/Text Books

S.NO	AUTHOR	TITLE	PUBLISHER
1			
2			

Schem Scheme of valuation

1. Record	**10 Marks**
2. Viva- Voce	**15 Marks**
3. Practical	**50 Marks**
i. Principle with Chemical Reaction	10 Marks
ii. Brief Procedure	5 Marks
iii. Formula & Tabular forms	5 Marks
iv. Calculation	5 Marks
v. Graph	5 Marks
vi. Report	
< 2% Error	20 Marks
>2% Error	15 Marks
>5% Error	10 Marks
Total	**75 Marks**

Cocurricular 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 Various instrumentation techniques like Potentiometry, pH Metry, Spectrophotometer, and other laboratory techniques.

For Student: Student shall visit a related industry/chemistry laboratory in universities/research organizations/private sector facility and observe the techniques used for Various instrumentation techniques like Potentiometry, pH Metry, Spectrophotometer, and other laboratory techniques. Write their observations and submit a hand written 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.

THANK YOU

PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS)

KAKINADA - 533 001,

EAST GODAVARI, A.P.

Affiliated to Adikavi Nannaya University

NAAC Accredited with "A" Grade (3.17 CGPA)

BOARD OF STUDIES OF CHEMISTRY

M. Sc ANAIYTICAL CHEMISTRY Under CBCS

Convened on 30th APRIL 2024

AY 2024-2025

DEPARTMENT OF CHEMISTRY

P. R. GOVT. COLLEGE (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, PITHAPUR RAJAHS GOVERNMENT COLLEGE(A), KAKINADA-A. P

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

R.C.No.12A/A.C./BOS/2023-24, Dated: _____.

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

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

ORDERS:

The Principal, Pithapur Rajahs Government College(A), Kakinada is pleased to constitute P G Boards of Studies in Chemistry for framing the syllabi in Analytical Chemistry Subject for III & IV Semesters duly following the norms of the UGC Autonomous guidelines.

S. No	Name of the Nominee	Designation
1	V. Sanjeeva Kumar	Chairman& Lecturer In charge.
2	Dr. K. Deepthi	University Nominee Associate ProfessorDepartment of Chemistry Adikavi Nannaya University, Rajamahendravaram.
3	Dr. T. Satyanarayana	Subject Expert Principal Ideal college of Arts & sciences, Kakinada.
4	T. Narasimhamurthy	Subject Expert Lecturer in chemistry, GDC (A) Rajamahendravaram.
5	Dr. G. Chandrasekhar Reddy Managing Director HIQ Pharma Pvt. Ltd Hyderabad	Representative from Industry
6	T.V.V. Satya Narayana	Member
7	P. Vijay Kumar	Member
8	V. Rambabu	Member
9	G. Pavani	Member
10	Dr. N. Bujji Babu	Member
11	Dr. Ch. Praveen	Member
12	V. Venkateswara Rao	Member
13	U.S.N. Prasad	Member
14	T. Pavan Kumar	Member
15	P.RT. Ravi varma	Member
16	K. Srilekha	Member
17	P. Sirisha	Member
18	R. Ramya Sri	Member
19	G. Chandrika	Student Alumni Member
20	A Naga Devi	Student Member
21	B Madhav Rao	Student Member

22	S. Venkateswara rao	Student Member
23	Ch. Surya Swamy	Student Member

The above members are requested to attend the BoS meeting on 30th APRIL 2024 and share their valuable reviews, and suggestions on the following functionaries.

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

PRINCIPAL
P.R. Govt. College (A)
KAKINADA

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

PITHAPUR RAJAH'S GOVERNMENT COLLEGE (A), KAKINADA-A.P
DEPARTMENT OF CHEMISTRY
MINUTES OF BOARD OF STUDIES (BOS) MEETING

2024-25 on 30th APRIL2024 Meeting of Board of Studies in M. Sc Analytical Chemistry is convened on 30th APRIL 2024 through offline at Pithapur Rajah's Government College (A), Kakinada.

Venue: JKC Dt: 30th APRIL2024

The Principal Dr. B.V. Tirupanyam, Chairman, Sri. V. Sanjeeva Kumar, Chairman and lecturer in charge, University Nominee, Dr. K. Deepthi, Industrialist Dr. G. Chandrasekhar Reddy Managing Director HIQ Pharma Pvt. Ltd Hyderabad, Subject Expert, Dr.T. Satyanarayana, subject expert T. Narasimhamurthy, All the faculty members ofChemistry Department and student alumni attended the meeting.

Agenda:

1. To discuss the Semester System and revised Choice Based Credit System (CBCS) being implemented for the past 03 years, i.e., w.e.f. 2020-21.
2. To discuss and approve the Continuation/Modifications of the syllabus for the Odd & Even Semesters of III & IV for 2024-2025.
3. Grant of Extra credits for Online SWAYAM MOOCs etc.
4. Syllabus, Model Question Papers and Model Blueprints, POs, PSOs & COs mapping for III and IV Semesters.
5. Minimum of 60% integration of ICT into transaction of curriculum.
6. Minimum attendance of 75% for both I mid-term examination, and II mid- term examination under CIA component shall be the benchmark for attendance and it shall be approved in the BOS.
7. Teaching learning methodology by 75:25 (External: Internal) ratio w.e.f. 2017-18 admitted batches and continued it.
8. Remedial coaching for slow learners and project work, research, Conferences, etc.,CSIR NET & GATE coaching for advanced learners.
9. Panel of paper setters and examiners.
10. Proposals for project work in fourth semester for the benefit of students.
11. Department action plan for 2024-25. To discuss and resolve the minor modifications/refinement if any.
12. Any Other Proposal with the Permission of the Chairman

The following paper setters are recommended.

1. Dr. V. Siddaiah Department of Chemistry, Andhra University, Visakhapatnam

2. Dr. D. Jaya Prashanthi Department of Chemistry, Andhra University, Visakhapatnam
3. Dr. S. K. Mustafa, Department of Chemistry, Dr, SKR Govt. College, Yanam.
4. Dr. B. Mallikarjun, Department of Chemistry, GDC(A), Rajamahendravaram.
5. Dr. K. Deepthi, Department of Chemistry, ANUR Rajamahendravaram
6. Dr. B. Jagan Mohan Reddy, Department of Chemistry, ANUR Rajamahendravaram
7. Dr. Ravindra Babu, Department of Chemistry, GDC, Tanuku
8. Dr. A. Chandraleela, Department of Chemistry, Andhra University, Visakhapatnam

ADDITIONS/DELETION IN COURSES CHEMISTRY 2024-25

Year	Semester& Paper	Additions	Deletions
II	**III & IV**	-	--
II	**III & IV**	**-**	**-**
II	**III & IV**	-	
II	**III & IV**	**-**	**-**

Course structure of M. Sc Analytical Chemistry (Final Year)

S. No	Semester	Title of the Paper	Theory/ Practical / Viva	Internal marks	External Marks	Total Marks	Credits
1	III	Separation Methods -I	T	25	75	100	4
2		Quality control and Traditional methods of analysis	T	25	75	100	4
3		Applied analysis - I	T	25	75	100	4
4		Instrumental methods of analysis-I	T	25	75	100	4
5		Classical methods of analysis - I	P	25	75	100	4
6		Instrumental methods of analysis - I	P	25	75	100	4
7	IV	Separation methods-II	T	25	75	100	4
8		Quality control and Traditional methods of analysis-II	T	25	75	100	4
9		Applied analysis -II	T	25	75	100	4
10		Instrumental methods of analysis-II	T	25	75	100	4
11		Classical methods of analysis - II	P	25	75	100	4
12		Instrumental methods of analysis - II	p	25	75	100	4
13		Comprehensive	V	---	50	50	4
		Viva- voce					
Total Credits							

	Pithapur Rajah's Government College (Autonomous) Kakinada	Program &Semester II M.Sc. Chemistry Semester-III Paper-I			
Course Code	TITLE OF THE COURSE **SEPARATION METHODS-I**				
Teaching	**Hours Allocated: 60(Theory)**	**L**	**T**	**P**	**C**
Pre-requisites:	Adsorption, absorption, partition coefficient, polarity of the solvents.	**60**	**10**	**----**	**4**

Course Objective

Students will gain knowledge on principle, instrumentation and applications of different chromatographic techniques.

Course Outcomes:

	On Completion of the course, the students will be able to
CO1	Students will be able to know the chromatography introduction, Principles and development methods
CO2	Students will acquire knowledge on column chromatography, Gel exclusion Chromatography and Capillary electrophoresis
CO3	**Understand the gas chromatography, GC-MS and Inorganic molecular sieves**
CO4	**Acquire knowledge on Liquid-liquid partition chromatography, LC-MS,HPLC**

Course with focus on employability / entrepreneurship / Skill Development

Skill Development		Employability		Entrepreneurship	

modules

Syllabus

UNIT-1

CHROMATOGRAPHY–1

Chromatography: classification of different chromatographic methods, methods of development-Elution development, Gradient elution development, displacement development, and frontal analysis.

Principles of chromatography, adsorption phenomena, partition, adsorption coefficient, retardation factor, retention time and

volume, column
capacity, temperature effects, partition isotherm.

Dynamics of chromatography-efficiency of chromatographic column, High Equivalent Theoretical Plate (HETP), Van Deempter equation, resolution, choice of column, length and flow velocity, qualitative and quantitative analysis.

UNIT-II
CHROMATOGRAPHY-2

Column chromatography (adsorption chromatography): principles, general aspects, adsorption isotherms, chromatographic media, nature of forces between adsorbent and solutes, eluents (mobile phase), column chromatography without detectors and liquid chromatography with detectors and applications.
Gel Exclusion chromatography or Gel filtration chromatography: principles, properties of xerogels, apparatus and detectors, resolution of gel type, applications to organic compounds.
Capillary Electrophoresis: Principle, Details of the Instrument, Applications to Inorganic and Organic compounds.

UNIT-III
CHROMATOGRAPHY-3

Gas chromatography: Theory, Instrument description of equipment and different parts, columns (packed and capillary columns), detector specifications-thermal Conductivity detector, flame ionization detector, electron capture detector, nitrogen phosphorus detector, photo ionization detector, programmed temperature gas Chromatography; applications in the analysis of gases, petroleum products etc., other detectors used their Principles and Applications.
Inorganic molecular sieves: structure of zeolites, crystals, types of sieves, hydro carbons application in the separation of gases including, ion exclusion principles and applications, Counter current chromatography-principles and application,
Affinity chromatography-principles and applications
GC-MS–Introduction

Instrumentation – GC – MS interface – Mass spectrometer (MS) Instrument operation, processing GC – MS data –ion chromatogram Library searching –Quantitative measurement – sample preparation Selected ion monitoring –Application of GC-MS for Trace constituents. Drugs analysis, Environmental analysis and others

UNIT- IV
CHROMATOGRAPHY-3

Liquid-liquid partition chromatography: principle, supports, partitioning liquids, eluents, reverse phase chromatography, apparatus, applications
High performance liquid chromatography: Theory, Instrument description of the different parts of the equipment, columns, detectors-UV detector, refracto metric detector, Fluorescence detector, Diode Array detector, applications in the separation of organic compounds, names of other detectors used their Principles and Applications.
LC-MS – Introduction – Instrumentation– liquid chromatograph – Mass spectrometer Interface – Instrumental details – Processing LC-MS data– ion chromatograms – Library searching – Quantitative measurements.
Sample preparation – selected ion monitoring. Application of LC-MS for Druganalysis, Environmental samples and others.

Unit No	Additions	Deletions	Expected levels of learning as per Blooms taxonomy assessment of CO	Percentage added/deleted
I	--	--	K_1,K_2	5%
II	--	--	--	
III	--	--	--	
IV	--	--	K_1, K_2	5%

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

Text Books/Reference Books

S. No	AUTHOR	TITLE	PUBLISHER
1	R.P.W Scott	Techniques and practice of Chromatography	Marel Dekker Inc.,NewYork
2	M.N.Sastri	Separation methods	HimalayaPublishingCompany,Mumbai

3	E.Helfman	Chromatography	VanNostrand, Reinhold,NewYork
4	E.Lederer and M.Lederer	Chromatography	Elsevier,Amsterdam.
5	John A Dean	Chemical separation methods	Von Nostrand Reinhold, NewYork
6	H.M Mc Nair and J. M. Miller	Basic Gas Chromatography	John Wiley, NewYork
7	W.Jeumings	Analytical Gas chromatography	AcademicPress,New York
8	H.Eugelhardt(ed)	Practice of HPLC	SpringerVerrag,Berrin
9	R.P.W Scott	Techniques and practice of Chromatography	Marel Dekker Inc.,NewYork
10	M.N.Sastri	Separation methods	HimalayaPublishingCompany,Mumbai
11	E.Helfman	Chromatography	VanNostrand, Reinhold,NewYork

Web Links

1. https://youtu.be/XMtmSz_9umk
2. https://youtu.be/ZN7euA1fS4Y
3. https://youtu.be/cdRp8rTc75o?si=0LTebCrkHFKc6XQ
4. https://youtu.be/ZN7euA1fS4Y

CO-PO Mapping

	On Completion of the course, the students will be able to
CO1	Students will be able to know the chromatography introduction, Principles and development methods
CO2	Students will acquire knowledge on column chromatography, Gel exclusion Chromatography and Capillary electrophoresis
CO3	**Understand the gas chromatography, GC-MS and Inorganic molecular sieves**
CO4	**Acquire knowledge on Liquid-liquid partition chromatography, LC-MS,HPLC**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	1	2	1	2	1	1	1	2	2	3	3	1
CO2	3	1	1	2	1	1	1	1	2	2	3	3	1
CO3	3	2	2	2	2	1	1	1	1	2	3	2	1
CO4	3	2	2	1	2	1	1	1	1	2	3	2	1
Avg.	3	2	1.75	1.5	1.75	1	1	1	1.5	2	3	2.5	1

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

At the completion of the M.Sc. Chemistry program, the students of our department will be able to

PO1: Knowledge in Chemistry: Apply the knowledge of structural elucidation techniques to the solutionof simple to complex molecules.

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

PO3: Design/development of solutions: Design separation techniques for simple to complex molecules.

PO4: Conduct investigations of complex problems: Use fundamental research-based knowledge andavailable structural elucidation methods for analysis and interpretation of structural data of the molecules.

PO5: Modern tool usage: Create IT & AI enabled structural elucidation techniques, for modeling andoptimization of simple to complex molecules.

PO6: Society: Applying the contextual knowledge to assess societal, health, safety, legal and culturalissues.

PO7: Environment and sustainability: Understand the importance of analysis of compounds for various solutions in societal and environmental context and demonstrate the knowledge and need for sustainable development.
PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms ofthe science-based practice.
PO9: Communication: Communicate effectively on issues related to analysis of compounds with the chemistry community, being able to write the effective reports and documentation, 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.

PSO-1: To have a firm foundation in the fundamentals/concepts/theories and its applications in analysis of compounds.

PSO-2: To understand the structure and properties of molecules.
PSO-3: To acquaint with safety measures in laboratory and develop skills in proper handling of chemicals and apparatus/instruments and carry out experiments, record the observations and present theinference/results.

PITHAPUR RAJAH'S GOVERNMENT COLLEGE, KAKINADA
PG Courses 2023-24
SYLLABUS FOR SEMESTER – III(MSC- CHEMISTRY)
Paper I (Separation methods-I)
Weightage to Content

S. No.	Course Content	Essay Questions (15M)	Short Answer Questions (5M)	Total No. Of Questions from each Unit	Total No. of Marks allotted toeach Unit
1	Unit - I	2	2	4	40
2	Unit - II	2	2	4	40
3	Unit - III	2	2	4	40
4	Unit - IV	2	2	4	40
	TOTAL	**8**	**8**	**16**	**160**

PITHAPUR RAJAH'S COLLEGE (A), KAKINADA

II YEAR MSC ANALYTICAL CHEMISTRY IMPORTANT QUESTIONS

PAPER- I: SEPARATION METHODS-I

UNIT-1: ESSAYS

1.Explain about different methods of development in chromatography.

2. Write a note on a) HETP b) Van dempter equation .

3. Explain the different types of chromatography techniques with example.

4. Write a short note on the following a) Resolution b) Retention time c)Retention volume and d) Column capacity.

SHORTS:

1. **Define frontal analysis.**
2. **Explain Rf value of chromatography.**
3. **Write a brief note on adsorption phenomena.**
4. **Write about temperature effect in chromatography.**

UNIT-2: ESSAYS

1. **Explain basic principles, instrumentation and applications of capillary electrophoresis.**
2. **Explain the principle and applications of Column chromatography.**
3. **Discuss in detail Gel filtration chromatography.**
4. **Write the principle, properties of xerogels and applications of organic compounds.**

SHORTS:

1. **Define Adsorption isotherm.**
2. **Explain about elution(mobile phase).**
3. **Write a short note on capillary electrophoresis.**
4. **Write about column chromatography principle and applications.**

UNIT-3: ESSAYS

1. **What is the principle of GC and explain detailed detectors in GC.**
2. **Explain about Instrumentation, Interface and data processing of GC-MS.**
3. **Discuss the gas chromatography principle, instrumentation and applications.**
4. **Write about the following a) Inorganic molecular sieves b) Affinity chromatography.**

SHORTS:

1. **Discuss about nitrogen phosphorous detector.**
2. **Explain the applications of GC-MS for Environmental analysis.**
3. **Write the difference between packed column and capillary column.**
4. **Write about thermal conductivity detector in GC.**

UNIT-4: ESSAYS

1. **Explain about the HPLC principle , instrumentation and applications.**
2. **Explain the instrumentation and applications of LC-MS.**
3. **Write a brief note on various detectors used in HPLC.**
4. **Write a brief note on reverse phase liquid-liquid chromatography.**

SHORTS:

1. **Applications of LC-MS in environmental samples.**
2. **Write about fluorescence detector.**
3. **Explain the sample preparation method of LC-MS.**
4. **Define and explain UV detector in liquid chromatography.**

PITHAPUR RAJAH'S COLLEGE (A), KAKINADA

II YEAR MSC (EXAMINATION AT THE END OF III SEMESTER)

PAPER- I: SEPARATION METHODS-I

MODEL PAPER

Duration: 3 hrs **Max. Marks: 75**

SECTION: A

Answer ALL questions. **4X15=60**

1. (a) Explain the different types of Chromatography techniques with examples . (B4-Level)

OR

(b) Write about the following 1)Van Deempter equation 2)Resolution 3)Elution development. (B1 – Level)

2. (a) Discuss about the principles of Electrophoresis. (B2 – Level)

OR

(b) Explain the principle and applications of Column chromatography. (B4-Level)

3. (a) Discuss the Gas chromatography principle and applications. (B2 – Level)

OR

(b) Explain the importance and application of GC-Ms in drug analysis. (B4-Level)

4. (a) Discuss about the HPLC principle and applications. (B2 – Level)

OR

(b) Describe the Instrumention and applications of LC-MS . (B5 -Level)

SECTION -B

Answer any FIVE Questions. 5x3=15M

5. Define frontal analysis. (B1 – Level)

6.Define and explain Rf value of chromatography. (B4 – Level)

7. Write a short note on Absorption isotherm (B1 – Level)

8. Describe Gel filtration chromatography (B5 – Level)

9. Discusses the nitrogen phosphorus detector. (B2 – Level)

10. Explain the applications of GC-MS for Environmental analysis. (B4 – Level)

11. Discuss about the Fluorescence detector. (B2 – Level)

12. Explain the sample preparation method of LC-MS. (B4 – Level)

	Pithapur Rajah's Government College(Autonomous) Kakinada	**Program &Semester II M.Sc. Chemistry Semester-III Paper-II**			
Course Code	TITLE OF THE COURSE **QUALITY CONTROL AND TRADITIONAL METHODS OF ANALYISY-I**				
Teaching	**Hours Allocated: 60(Theory)**	**L**	**T**	**P**	**C**
Pre-requisites:	Statistical analysis, ISO, GLP, analysis techniques of organic and inorganic compounds	**60**	**10**	**30**	**4+3**

Course Objectives:

Student will acquire knowledge on various types of analysis techniques

Course Outcomes:

On Completion of the course, the students will be able to	
CO1	Students will be able to know the characteristics of ananalysis, Evaluation and reliability of analytical data, Statistical analysis, Quality assurance and management systems and ICH guidelines
CO2	Students will understand the Decomposition techniques of Inorganic Compounds and Organic Compounds
CO3	Acquire the knowledge on Oxidant system of Inorganic Systems and Organic Systems analysis
CO4	Acquire Organic Functional group analysis

Course with focus on employability / entrepreneurship / Skill Development modules

Skill Development			Employability			Entrepreneurship	

Syllabus

UNIT-I

(a) QUALITY CONTROL IN ANALYTICAL CHEMISTRY

(b) Characteristics of an analysis: quality of an analytical procedure, limit of detection, sensitivity, safety, cost measurability, selectivity and specificity, quality control principles of Ruggedness test, control charts, Youden plot, and ranking test.

(c) Evaluation and reliability of analytical data: limitation of analytical methods, accuracy, precision, errors in chemical analysis, classification of errors, minimization of errors, significant figures, computations and propagation of errors.

(d) Statistical analysis: Mean deviation, Standard deviation, F test, T test, rejection of results, presentation of data.

(e) Quality assurance and management systems: elements of quality assurance, quality assurance in design, development, production and services, quality and quantity management system, **ISO 9000**and **ISO 14000** series-meaning of quality, quality process model, customer requirement of quality calibration and testing, statistical process control, process control tools, control chart, statistical quality control, acceptance sampling.

Good laboratory practices(GLP)–need for GLP, GLP implementation and organization, GLP status in India

(f) Brief outline of ICH guidelines on drug substances and products.

UNIT-II

DECOMPOSITION TECHNIQUES OF ANALYSIS

(a) Inorganic Compounds

Principle of decomposition and Dissolution. Difference between dissolution / decomposition of Organic and Inorganic substances. Importance of Decomposition

Techniques in Analysis.

Principle of Dissolution of an inorganic substance.

Decomposition of samples with acids – H_2O, HCl, HF, HNO_3, H_2SO_4 and $HClO_4$ Decomposition of samples by fusion, Principle and with two examples each Alkali Fusion--- Na_2CO_3,NaOH,

Acidic Fusion--- Sodium Hydro Sulphate, Sodium Pyro Sulphate

Oxidation Fusion---Na_2O_2, Sodium Chlorate

Reductive Fusion Na_2CO_3+ Na_4BO_4

What is Sintering process, How is it different from Fusion.

Fusion with alkali carbonates, alkali hydroxides, Sodium Peroxide Decomposition of samples by sintering with sodium peroxide, sodium carbonate.

Principles of decomposition at high temperatures,high pressures.

Principles of Microwave and ultra sonic decomposition techniques.

(b) Organic Compounds

Principles of solubility of organic compounds, non polar, polar solvents. Re crystallisation methods and application of solubility and Re crystallisation.

UNIT-III

OXIDANT SYSTEMS-PRINCIPLES AND APPLICATIONS IN ANALYSIS

Analytical chemistry of some selected oxidant systems – formal, standard and normal potentials in various media, species responsible for the oxidation properties, stability of the solutions, standardization, requirement for the selections of the oxidants, selection of suitable indicators for Oxidant systems.

a) Inorganic Systems Mn (III), Mn (VII), Ce (IV), Cr (VI), V (V), periodate, iodate

b)Organic Systemschloramine-T.

UNIT- IV

ORGANIC FUNCTIONAL GROUP ANALYSIS

Classification of functional groups with suitable examples.

Determination of:

1) Functional groups imparting acidic nature – thiol, enediol, phenolic hydroxyl

.2) Functional groups imparting basic nature – Aliphatic and Aromatic primary,secondaryandtertiaryamines– hydrazine derivatives.

3) Functional groups which impart neither acidic nor basic nature – Aldehydes, Ketones,Nitro,Methoxy, Olifinic

Unit No	Additions	Deletions	Expected levels of learning as per Blooms taxonomy assessment of CO	Percentage added/deleted
I	--	--	K_2, K_3	5%
II	--	--	--	
III	--	--	--	
IV	--	--	--	

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

Reference Books/Text Books

S.NO	AUTHOR	TITLE	PUBLISHER
1	Griffin	Technical methods of analysis	Mc Graw Hill Book Co.
2	D.GPeterseti	Chemical Separation and measurements	John M.Haves SandersCo.
3	H.ALaitina	Chemical analysis	McGrawHillBookCo.

4	I.M Kolthoff and R. Belcher	Volumetric Analysis, Vol III	Interscience public, new york
5	J.Bassettetal	Vogel's Text Book of Inorganic Quantitative Analysis	ELBS
6	D.A Skoog, D.M West and F.J Holler	Analytical Chemistry	SandersCollege Publishing, NewYork
7	Prof. Y. Anjaneyulu	Quality Assurance and Good Laboratory Practices	In NowPublication,NewYork
8	J.Dolezal,P.Povondra	Decomposition Techniques in Inorganic Analysis	JohnWileyandSons, NewYork

Web links

https://youtu.be/KxhVj4NsaKs

https://youtu.be/YfRqtzkX6Kk

https://youtu.be /BAOITNYOPSA?si=v4wyEtuW5xpu4

https://youtu.be/yjesFiq_Oc4?si=Yb9pgrpyINODUM3f

CO-PO Mapping

On Completion of the course, the students will be able to	
CO1	Students will be able to know the characteristics of ananalysis, Evaluation and reliability of analytical data, Statistical analysis, Quality assurance and management systems and ICH guidelines
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CO3	Acquire the knowledge on Oxidant system of Inorganic Systems and Organic Systems analysis
CO4	Acquire Organic Functional group analysis

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	2	1	1	1	1	1	1	2	1	3	3	3
CO2	3	2	1	2	1	1	1	1	2	3	3	3	3
CO3	3	2	1	2	1	1	1	1	1	3	3	3	3
CO4	3	3	1	1	1	1	1	1	1	3	3	3	3
Avg.	3	2.75	1	1.5	1	1	1	1	1.5	2.5	3	3	3

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

Programme Outcomes

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

PO1: Knowledge in Chemistry: Apply the knowledge of structural elucidation techniques to the solutionof simple to complex molecules.

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handling of chemicals and apparatus/instruments and carry out experiments, record the observations and present theinference/results.

PITHAPUR RAJAH'S GOVERNMENT COLLEGE, KAKINADA
PG COURSES 2023-24
SYLLABUS FOR SEMESTER – III(MSC- CHEMISTRY)
PAPER II (QUALITY CONTROL AND TRADITIONAL METHODS OF ANALYSIS-I)
WEIGHTAGE TO CONTENT

S. No.	Course Content	Essay Questions (15M)	Short Answer Questions (5M)	Total No. Of Questions from each Unit	Total No. of Marks allotted toeach Unit
1	Unit - I	2	2	4	40
2	Unit - II	2	2	4	40
3	Unit - III	2	2	4	40
4	Unit - IV	2	2	4	40
	TOTAL	**8**	**8**	**16**	**160**

PITHAPUR RAJAH'S COLLEGE (A), KAKINADA

II YEAR MSC IMPORTANT QUESTIONS

PAPER- II: QUALITY CONTROL AND TRADITIONAL METHODS OF ANALYSIS-I

UNIT-1: ESSAYS

1. Write a note on the following a) Principles of ruggedness test b)Control charts c) Accuracy and precision.
2. Discuss the various statistical parameters relevant to data processing.
3. Write a note on ICH guide lines on drug and their products.
4. Explain about ISO 9000 and ISO 14000
5. Give a detailed account on classification of errors and also write minimization of errors.

SHORTS:

1. Write a brief note on youden plot.
2. What is the GLP status in india.
3. Write about F-test.
4. Define selectivity and sensitivity.
5. Explain the Q-test for rejection of data.

UNIT-2: ESSAYS

1. Discuss about the principles of decomposition and dissolution for inorganic substances.
2. Explain the principles of solubility of organic compounds in non-polar and polar solvents.
3. Decomposition of samples by fusion a) Alkali fusion of Na_2CO_3, NaOH b) Oxidation fusion of Na_2O_2,$NaClO_3$.
4. Write about the following a) Sintering process and principles of microwave technique b) Recrystallization methods and application of recrystallization.

SHORTS:

1. Write about acidic and reduction fusion.
2. Explain the principle of decomposition of sample by H_2SO_4.
3. Write about principles of microwave and ultra sonic decomposition techniques.
4. Write the principle of decomposition.

UNIT-3: ESSAYS

1. Explain about the following oxidants a) Mn(VII) b) Ce(IV) c) Iodate
2. Write about the analytical chemistry of organic system of Chloramine-T and Chromium (VI).
3. Write a brief note on the following a) Mn(III) b) Per iodate c) V(V).

SHORTS:

1. Explain the classification of redox indicators.

2. Explain the requirements of reductants standardization.
3. Explain about standard and normal potentials in various media.
4. Write about the principles of oxidants in analytical chemistry.

UNIT-4: ESSAYS

1. How can you determine primary, secondary and tertiary amines?
2. Explain about the following a) Thiol b) enediols c) phenolic hydroxyls
3. Write about the functional group analysis of Aldehydes, ketones and methoxy functional groups.
4. Write about amines and hydrazine derivatives.

SHORTS

1. How can you separate aldehydes and ketones
2. Explain the principle involved in estimation of nitro group.
3. How can you analyze olefinic functional group.

PITHAPUR RAJAH'S COLLEGE (A), KAKINADA

II YEAR MSC (EXAMINATION AT THE END OF III SEMESTER)

PAPER- II: QUALITY CONTROL AND TRADITIONAL

METHODS OF ANALYSIS-I

MODEL PAPER

Duration: 3 hrs **Max. Marks: 75**

SECTION: A

Answer **ALL** questions **4X15=60**

1. a) Discusses the various statistical parameter relevant to data processing. (B2 -Level)

(OR)

(b) Write a note on ICH guidelines on drug and their products (B1-Level)

2. (a) Explain about the principles of solubility of organic compounds in non-polar and polar solvents. (B4-Level)

(OR)

(b) Discuss the principles of Decomposition and Dissolution for inorganic substances. (B2 -Level)

3. (a) Discuss the stability & standardization solutions of Ceric ammonium sulphate and Mn(III) explain experimental details (B2 -Level)

(OR)

(b) Explain the standardization mechanism and applications of Chloramine-T (B4-Level)

4. (a) Write about the following functional group analysis 1) Aromatic secondary amines 2)Aliphatic primary amines. (B1 – Level)

(OR)

(b) Explain the functional determination of Nitro, Methoxy and Olifinic groups. (B4-Level)

SECTION: B

Answer any **FIVE** questions **5X3=15**

1. Define selectivity and sensitivity. (B1 – Level)
2. Explain the Q-Test for rejection of data. (B4 -Level)
3. Discuss about acidic and reduction fusion. (B2 -Level)
4. Explain the principle of decomposition of sample by sulfuric acid. (B4-Level)
5. Discuss the requirements of reductants standardization. (B2 -Level)
6. Write about the classification of redox indicators. (B1- Level)
7. Explain the general functional classification. (B4-Level)
8. Explain the principle involved estimation of aldehyde group. (B4-Level)

PITHAPUR RAJAH'S GOVERNMENT COLLEGE, KAKINADA
SYLLABUS FOR SEMESTER – III (MSC- CHEMISTRY)
CLASSICAL METHOD OF ANALYSIS-I
PRACTICALS

1. Water analysis
(i) Determination of total hardness (Ca2+ and Mg2+) of water samples
(ii) Determination of chloride (Cl-)present in water samples
(iii) Determination of dissolved oxygen (DO) of drinking water and sewage water
2. Complexometric titrations
(i) Determination of the concentration of calcium in milk powder by complexometric titration (EDTA)
(ii) Determination of Calcium and Magnesium in limestone or dolomite samples using EDTA.
3. Fertilizer analysis
(i) Determination of ammonia from ammonia containing fertilizer
(ii) Determination of phosphate from fertilizer
4. Analysis of iron ore
(i) Complete analysis of iron ore
(ii) Determination of percentages of Fe (II) and Fe (III) present in iron ore sample
5. Analysis of Coal
(i) Determination of moisture content of coal sample
(ii) Determination of volatile matter of coal sample
(iii)Determination of fixed carbon of coal sample
(iv) Determination of ash content of coal sample.

Reference Books/Text Books

S.NO	AUTHOR	TITLE	PUBLISHER
1	J. Mendham R. C. Denny J.D.Barnes M.J.K.Thomas	Vogel Text book of Quantitative Chemical Analysis	Pearson Education

Schem Scheme of valuation

1. Record **10 Marks**
2. Viva- Voce **15 Marks**
3. Practical (Quantitative analysis) **50 Marks**
i. Principle with Chemical Reaction 10 Marks
ii. Brief Procedure 10 Marks
iii. Formula & Tabular forms 5 Marks
iv. Calculation 5 Marks
v. Report
< 2% Error 20 Marks
>2% Error 15 Marks
>5% Error 10 Marks

TOTAL **75marks**

Cocurricular 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 Quantitative analysis - Determination of amount of solute present in given solution.

For Student: Student shall visit a related industry/chemistry laboratory in universities/research organizations/private sector facility and observe the techniques used for Determination of amount of solute present in given solution. Write their observations and submit a hand written 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 &SemesterIIM.Sc. Chemistry Semester-III Paper-III**			
Course Code	TITLE OF THE COURSE **APPLIED ANALYSIS-I**				
Teaching	**Hours Allocated: 60(Theory)**	**L**	**T**	**P**	**C**
Pre-requisites:	Analysis of iron ore and water analysis.	**60**	**10**	**30**	**4+3**

Course Objectives:

Student will be able to know the various metals and its analysis

Course Outcomes:

On Completion of the course, the students will be able to	
CO1	Scope of metallurgical analysis, Analysis of iron ores, Manganese ore, Chromite ore and phosphate rock ore
CO2	Analysis of steel, Refractory materials and fluxes
CO3	Analysis of soap, oils, paints and cements
CO4	Determination of DO, COD, BOD and Ions in water

Course with focus on employability / entrepreneurship / Skill Development modules

Skill Development			Employability			Entrepreneurship	

Syllabus:

UNIT-I : ANALYSIS OF ORES

(a) General techniques of analysis applied to complex materials-Scope of metallurgical analysis -

General methods of dissolution of complex materials -

Various chemical methods for the effective separation of the

constituents in the complex materials.

(b) Analysis of ores: Iron ore- Analysis of the Constituents – Moisture , loss of ignition, Total Iron, ferrous Iron ,Ferric Iron, alumina, silica, Titania, Lime, Magnesia, Sulphur, phosphrous, manganese, alkalies, combined water, Carbon in blast furnace, flue dust and sinter.

(c) Manganese Ore-Analysis of the Constituents –Total Manganese, MnO_2, SiO_2, BaO, Fe_2O_3, Al_2O_3 ,CaO ,P and S

(d) Chromite Ore - Analysis of the Constituents – Chromium, SiO_2, FeO, Al_2O_3, CaO, & MgO.

(e) Phosphate rock Ore - Analysis of the Constituents - CaO, P_2O_5, F, SiO_2, CO_2 ,S, Na_2O ,Al_2O_3,Fe_2O_3 ,Mgo,K_2O,Cl,MnO.Organic carbon, Moisture, Loss of ignition.

(f) Aluminium Ore (Bauxite) - Analysis of the Constituents – Silica, Alumina, Fe_2O_3, Titania, MnO, P_2O_5, CaO , MgO, vanadium, zirconium, and alkalies.

UNIT – II : **ANALYSIS OF FINISHED PRODUCTS-I**

(a) Analysis of steel for C, Si, S, P, Mn, Ni, Cr; Mg and analysis of blast furnace slag.

(b) Analysis of refractory materials : fireclay ,flour spar, and magnesite

(c) Analysis of fluxes –limestone and dolomite.

UNIT – III: **ANALYSIS OF FINISHED PRODUCTS-II**

(a) Chemical Analysis of cement-silica, NH_4OH group, ferric oxide, alumina, lime, magnesia, Sulphide, Sulphur , K_2O, Na_2O, free CaO in Cement and Clinker, SO_3 and loss on ignition.

(b) Analysis of oils-saponification number, iodine number, and acid number.

(c) Analysis of soaps - moisture, volatile matter, total alkali, total fatty matter, free caustic alkali or free fatty acids, sodium silicate ,chloride.

(d) Analysis of paints-vehicle and pigment, ,$BaSO_4$,total lead and lead chromate

UNIT – IV: ASSESSMENT OF WATER QUALITY

Sources of water, classification of water for different uses,
types of water pollutants and their effects,
Analytical methods for the determination of the
following ions in water: Anions: CO_3^{2-}, HCO_3^-, F^-, Cl^-
, SO_4^{2-}, PO_4^{2-}, NO_3^-, NO_2^-, CN^-, S^{2-}

Cations:Fe^{2+},Fe^{3+},Ca^{2+},Mg^{2+},Cr^{3+},As^{5+},Pb^{2+},Hg^{2+},Cu^{2+},Zn^{2+},Cd^{2+},Co^{2+}
Determination of Dissolved oxygen (D.O), Biochemical Oxygen
Demand (BOD) and Chemical Oxygen Demand (COD),
standards for drinking water

Unit No	Additions	Deletions	Expected levels of learning as per Blooms taxonomy assessment of CO	Percentage added/deleted
I	--	---	K_2, K_3	5%
II	--	--	--	
III	--	--	--	
IV	--	--	--	

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

Text Books/ Reference Books

S. No	AUTHOR	TITLE	PUBLISHER
1	Harrison John, Weily1979	Handbook of Analytical Control of Iron and Steel Production	Mc Graw Hill
2	Foster Dee Sneel and Frank M	Commercial Methods of Analysis	Mc Graw Hill
3	Lalude	Water Pollution	Mc Graw Hill
4	AnilKumarDe	Environmental Chemistry	Wiley Eastern Ltd.
5	S.M. Khopkar	Environmental Analysis	S.M. Khopkar(IIT Bombay
6	Griffin	Technical Methods of Analysis	Mc Graw Hill

WebLinks:

https://youtu.be/XV609o_o9kg

https://youtu.be/9S11FizrS7I

https://youtu.be/7rWy8zvWfW4?si=Pvkwpa6BfJrPy-Et

https://youtu.be/mAcXLbiXIhA?si=L4zg7vKv4K393KbW

CO-PO Mapping

On Completion of the course, the students will be able to	
CO1	Scope of metallurgical analysis, Analysis of iron ores, Manganese ore, Chromite ore and phosphate rock ore
CO2	Analysis of steel, Refractory materials and fluxes
CO3	Analysis of soap, oils, paints and cements
CO4	Determination of DO, COD, BOD and Ions in water

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	3	1	3	2	1	1	1	2	1	3	3	1
CO2	3	3	3	3	3	1	1	1	2	1	3	3	1
CO3	3	3	3	2	2	1	1	1	2	1	3	3	1
CO4	3	2	2	3	1	2	3	1	3	1	3	3	1
Avg.	3	2.75	2.25	2.75	2	1.25	1.5	1	2.25	1	3	3	1

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

Programme Outcomes

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

PO1: Knowledge in Chemistry: Apply the knowledge of structural elucidation techniques to the solutionof simple to complex molecules.

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

PO3: Design/development of solutions: Design separation techniques for simple to complex molecules.

PO4: Conduct investigations of complex problems: Use fundamental research-based knowledge andavailable structural elucidation methods for analysis and interpretation of structural data of the molecules.

PO5: Modern tool usage: Create IT & AI enabled structural elucidation techniques, for modeling andoptimization of simple to complex molecules.

PO6: Society: Applying the contextual knowledge to assess societal, health, safety, legal and culturalissues.
PO7: Environment and sustainability: Understand the importance of analysis of compounds for various solutions in societal and environmental context and demonstrate the knowledge and need for sustainable development.
PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms ofthe science-based practice.
PO9: Communication: Communicate effectively on issues related to analysis of compounds with the chemistry community, being able to write the effective reports and documentation, 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.
PSO-1: To have a firm foundation in the fundamentals/concepts/theories and its applications in analysis of compounds.
PSO-2: To understand the structure and properties of molecules.
PSO-3: To acquaint with safety measures in laboratory and develop skills in proper handling of chemicals and apparatus/instruments and carry out experiments, record the observations and present theinference/results.

PITHAPUR RAJAH'S GOVERNMENT COLLEGE, KAKINADA
PG COURSES 2023-24
SYLLABUS FOR SEMESTER – II (MSC- CHEMISTRY)
PAPER III (ORGANIC CHEMISTRY)
WEIGHTAGE TO CONTENT

S. No.	Course Content	Essay Questions (15M)	Short Answer Questions (5M)	Total No. Of Questions from each Unit	Total No. of Marks allotted toeach Unit
1	Unit - I	2	2	4	40
2	Unit - II	2	2	4	40
3	Unit - III	2	2	4	40
4	Unit - IV	2	2	4	40
	TOTAL	**8**	**8**	**16**	**160**

PITHAPUR RAJAH'S COLLEGE (A), KAKINADA

II YEAR MSC IMPORTANT QUESTIONS

PAPER- II: APPLIED ANALYSIS-I

UNIT:1 ESSAYS

1. **Write the total iron, ferrous and ferric iron in iron ore?**
2. **How do you determine Mn in manganese ore, Cr in chromate ore?**
3. **Write about the various chemical methods for the effective separation of constituents in complex materials.**
4. **Write about the following a) Analysis of Bauxite ore b) Analysis of phosphate rock ore.**

SHORTS:

1. **Write about Carbon in blast furnace.**
2. **Determination of moisture in iron ore**
3. **Write a brief note on Aluminium ore.**
4. **Determination of Silica in bauxite ore**

UNIT-2: ESSAYS

1. **Write the analysis of any four constituents of steel**
2. **Write detailed explanation of Refractory materials.**
3. **Explain about analysis of fluxes-Limestone & dolomite.**

SHORTS

1. **Discuss about analysis of Nickel in steel.**
2. **Explain about magnesite.**
3. **Explain the mechanism of blast furnace.**
4. **Write the analysis of carbon in steel.**

UNIT-3 ESSAYS

1. **Write the analysis of saponification number, iodine number and acid number of oils.**
2. **Determination of total lead, lead chromate and barium sulfate of paints.**
3. **Write about the chemical analysis of Cement.**

4. **Discuss about the following a) Total fatty matter b) volatile matter c) sodium silicate**

SHORTS:

1. **Write a short note on iodine number.**
2. **Write the analysis of free caustic alkali in soaps.**
3. **Determination of total lead in paints.**
4. **How do you analyze vehicle and pigments in paints.**

UNIT-4: ESSAYS

1. **Explain the determination of carbonate , bicarbonate and calcium, magnesium in water.**
2. **Write the analysis of DO, BOD and COD of water.**
3. **How do you determine the following ion in water a) NO_3^- b) Ca^{2+} c) Cr^{2+}**
4. **Write about types of water pollutants.**

SHORTS:

1. **What is meant by BOD.**
2. **Define water pollutants.**
3. **What are the standards for drinking water.**
4. **Write about types of water.**

PITHAPUR RAJAH'S COLLEGE (A), KAKINADA

I IYEAR MSC (EXAMINATION AT THE END OF II SEMESTER)

PAPER- III: APPLIED ANALYSIS-I

MODEL PAPER

Duration: 3 hrs **Max. Marks: 75**

SECTION: A

Answer **ALL** questions **4X15=60**

1. a) Explain the suitable methods for determination of manganese in manganese ore. (B4-Level)

(OR)

b) Discuss the analysis of CO_2 in phosphate rock ore (B2-Level)

2. a) Explain the procedure for analysis of C, Mn and Cr in steel (B3-Level)

(OR)

b) Describe the chemical analysis of limestone (B2-Level)

3. a) Write the analysis of the Saponification number, Iodine number and acid number of oils? (B1-Level)

(OR)

b) How can determine the total lead, lead chromate and $BaSO_4$ of Paints? (B5-Level)

4.a) Explain the determination of carbonate and bicarbonate & Arsenic and Lead ions of water? (B4-Level)

(OR)

b) Write the analysis of DO, BOD and COD of water? (B1-Level)

SECTION :B

Answer any **FIVE** questions 5 X 3 = 15

1. Explain the determination of moisture of iron ore? (B4-Level)
2. Explain the determination of silica present in bauxite ore (B4-Level)
3. Explain the mechanism of blast Furnance. (B4-Level)
4. Write the analysis of carbon in steel. (B1-Level)
5. How can determine Al in cement analysis. (B5-Level)
6. Discuss the analysis of TFM of soaps. (B2-Level)
7. Define water pollutants (B1-Level)
8. What are the standards of drinking water. (B6-Level) .

	Pithapur Rajah's Government College(Autonomous) Kakinada	**Program &SemesterII M.Sc. Chemistry Semester-III Paper-IV**			
Course Code	TITLE OF THE COURSE **INSTRUMENTAL METHODS OF ANALYSIS-I**				
Teaching	**Hours Allocated: 60(Theory)**	**L**	**T**	**P**	**C**
Pre-requisites:	Types of spectroscopy and its principles ,Instrumentation and applications	**60**	**10**	**30**	**4+3**

Course Objectives:

Student will be able to know the types of spectroscopy and its principles ,instrumentation and applications

Course Outcomes:

	On Completion of the course, the students will be able to
CO1	UV-Visible Spectroscopy, Spectro fluorimetry
CO2	Infrared spectroscopy, Raman Spectroscopy
CO3	NMR Spectroscopy, ESR Spectroscopy
CO4	Mass Spectroscopy, X-ray Spectroscopy

Course with focus on employability / entrepreneurship / Skill Development modules

Skill Development			Employability			Entrepreneurship	

Syllabus

UNIT-I: SPECTROSCOPIC METHODS-I

(a) UV-Visible Spectroscopy: laws of absorption, deviation from Beer's law, single and double beam spectrophotometers-instrumentation, sources of radiation, detectors, qualitative analysis by absorption measurements, general precautions in Colorimetric determinations, determination of certain metal ions by using ligands –Fe^{2+}, Fe^{3+}, Al^{3+}, NH_4 Cr^{3+}, Cr^{6+}, Co^{3+}, Cu^{2+},Ni^{2+}andanions– NO_2, -, PO_4^{3-} using suitable reagents, simultaneous determinations of dichromate and permanganate in a mixture, spectro photomeric titrations, principle of diode array spectrophotometers.

(b) Spectro fluorimetry: Theory of fluorescence, phosphorescence, factors affecting the above, quenching, relation between intensity of fluorescence and concentration, instrumentation, application with reference to Al^{3+}, chromium salts, fluorescence, thiamin(B1) and riboflavin (B2) in drug samples

UNIT -II: SPECTROSCOPIC METHODS-II

(a) ***Infrared spectroscopy:*** units of frequency, wavelength and wave number molecular vibrations, factors influencing vibrational frequencies, instrumentation, sampling techniques, detectors, characteristic frequencies of organic molecules, qualitative and quantitative analysis with reference to (petroleum refinery and polymer industry), selected molecules like CO, CO_2, non-destructive IR method for the analysis of CO and other organic compounds, principles of Fourier transform IR.

(b)***Raman Spectroscopy:*** Raman effect and spectra, differences between Raman spectra and IR spectra, instrumentation, Raman spectra of CO, CO_2, N_2O, H_2O.

UNIT-III:

SPECTROSCOPIC METHODS-II

NMR Spectroscopy: resonance condition, origin of NMR spectra, instrumentation, chemical shift, factors affecting chemical shift, shielding, spin-spin splitting, mechanism for spin-spin coupling, interpretation of NMR spectra of typical organic compounds factors influencing NMR spectra,fastchemical reactions,magnitude of I, nuclei with quadrupole moments, FT NMR, study of isotopes otherthanproton-$_{13}C$,$_{15}N$,$_{19}F$,$_{31}P$,$_{11}B$, double resonance, spin tickling, shift reagents, applications.

(a) ESR Spectroscopy: principle, g value, hyper fine splitting, qualitative analysis, Krammers degeneracy, fine splitting, instrumentation, introduction to double resonance technique, difference between ESR and NMR spectra, quantitative analysis, application to study of free radicals and other analytical applications.

UNIT-IV: SPECTROSCOPIC METHODS-III

(a) Mass Spectroscopy: Principle, basic instrumentation, energetics of ion formation, types of peaks observed, resolution, qualitative analysis, molecular weight determination, quantitative analysis, advantages

(b) X-ray Spectroscopy (XRF): chemical analysis by X-ray spectrometers, energy dispersive and wavelength dispersive techniques, evaluation methods, instrumentation, applications.

Unit No	Additions	Deletions	Expected levels of learning as per Blooms taxonomy assessment of CO	Percentage added/deleted
I	--	--	--	
II	--	--	--	
III	--	--	--	
IV	--	Matrix effect	K_1, K_2	5%

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

Text Books/ Reference Books

S. No	AUTHOR	TITLE	PUBLISHER
1	H.H Willard, Meritt Jr. And J. ADean	Instrumental methods of analysis	Goel Publishing House ,Meerut
2	Skoog and West	Principles of instrumental analysis	Goel Publishing House, Meerut
3	B.K Sarma	Instrumental methods of analysis	Goel Publishing House, Meerut
4	Chatwal and Anand	Instrumental methods of Analysis	London
5	A.R Date and A.L Glay	Applications of ICP-MS	London (EDS), Blackie, London.
6	A. Moutaser and D.W Gologhtly (Eds)	ICP in Analytical Atomic Spectrometry	VeH Publisher, NewYork
7	G.I Moore	Introduction to ICP emission Spectrometry in Analytical	London

Weblinks

1 https://youtu.be/1mrUHrZ-0zk?si=Hsu2iw0uIc0REZy_
2. https://youtu.be/zslQtSF5-TU?si=DGRw0DKXJga2ivc1
3. https://youtu.be/w3LS22E10Zc?si=ruxEk6Dlf2STmMzo
4. https://youtu.be/SBir5wUS3Bo?si=MY0d6epJDwsHk0Hw

CO-PO Mapping

On Completion of the course, the students will be able to	
CO1	UV-Visible Spectroscopy, Spectro fluorimetry
CO2	Infrared spectroscopy, Raman Spectroscopy
CO3	NMR Spectroscopy, ESR Spectroscopy
CO4	Mass Spectroscopy, X-ray Spectroscopy

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	3	1	3	2	1	1	1	2	1	3	3	1
CO2	3	2	2	3	2	1	1	1	2	1	3	3	1
CO3	3	3	1	3	3	1	2	1	2	1	3	3	1
CO4	3	2	2	3	3	1	2	1	3	1	3	3	1
Avg.	3	2.5	1.5	3	2.5	1	1.5	1	2.25	1	3	3	1

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

Programme Outcomes

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

PO1: Knowledge in Chemistry: Apply the knowledge of structural elucidation techniques to the solutionof simple to complex molecules.

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

PO3: Design/development of solutions: Design separation techniques for simple to complex molecules.

PO4: Conduct investigations of complex problems: Use fundamental research-based knowledge andavailable structural elucidation methods for analysis and interpretation of structural data of the molecules.

PO5: Modern tool usage: Create IT & AI enabled structural elucidation techniques, for modeling andoptimization of simple to complex molecules.

PO6: Society: Applying the contextual knowledge to assess societal, health, safety, legal and culturalissues.

PO7: Environment and sustainability: Understand the importance of analysis of compounds for various solutions in societal and environmental context and demonstrate the knowledge and need for sustainable development.

PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms ofthe science-based practice.

PO9: Communication: Communicate effectively on issues related to analysis of compounds with the chemistry community, being able to write the effective reports and documentation, 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.

PSO-1: To have a firm foundation in the fundamentals/concepts/theories and its applications in analysis of compounds.

PSO-2: To understand the structure and properties of molecules.

PSO-3: To acquaint with safety measures in laboratory and develop skills in proper handling of chemicals and apparatus/instruments and carry out experiments, record the observations and present theinference/results.

PITHAPUR RAJAH'S GOVERNMENT COLLEGE, KAKINADA

PG COURSES 2023-24

SYLLABUS FOR SEMESTER – II (MSC- CHEMISTRY)

PAPER IV (PHYSICAL CHEMISTRY)

WEIGHTAGE TO CONTENT

S. No.	Course Content	Essay Questions (15M)	Short Answer Questions (5M)	Total No. Of Questions from each Unit	Total No. of Marks allotted toeach Unit
1	Unit - I	2	2	4	40
2	Unit - II	2	2	4	40
3	Unit - III	2	2	4	40
4	Unit - IV	2	2	4	40
	TOTAL	**8**	**8**	**16**	**160**

PITHAPUR RAJAH'S COLLEGE (A), KAKINADA

II YEAR MSC IMPORTANT QUESTIONS

PAPER- IV: INSTRUMENTAL METHODS OF ANALYSIS-I

UNIT-1: ESSAYS

1. Write the principle, instrumentation and applications of Uv- visible spectroscopy.
2. Explain the principle and applications with reference of spectroflorimetry.
3. Discuss about the following. a) Riboflavin b) Thiamin c) Quenching.
4. Write a short note on simultaneous determination of dichromate and permanganate in a mixture.

SHORTS:

1. Define laws of absorption .
2. Define fluorescence.
3. Determine NO_2^-, PO_4^{-3} by using UV- Visible spectra.
4. Write about Diode array spectrophotometer.

UNIT-2: ESSAYS

1. Explain the principle and applications of IR Spectroscopy.
2. Describe the Principle and instrumentation of Raman Spectroscopy.
3. Discuss about the factors affecting vibrational frequency.
4. Are you separate by using IR, Raman spectras in the following molecules.

   I. CO. ii. CO_2 iii. H_20

SHORTS :

1. Brief note on Raman effect .
2. What is the difference between IR and Raman.
3. Write the principle of Fourier transform IR.
4. Write notes on molecular vibrations .

UNIT - 3 : ESSAYS

1. Explain the principle and instrumentation of NMR Spectroscopy ?
2. Describe the theory and working mechanism of ESR Spectroscopy .
3. Define chemical shift. What are the factors affecting chemical shift ?
4. Write about the following a) Hyper fine splitting b) Kramer's degeneracy C) g - value.

SHORTS :

1. Explain the differences between NMR and ESR.
2. Explain about double resonance technique ?
3. Write note on spin spin splitting and spin - spin coupling ?
4. Short note on FT - NMR .

UNIT - 4 : ESSAYS

1. Discuss about principle of mass spectroscopy , instrumentation and it's applications .
2. Write about the chemical analysis by using X- Ray spectrophotometry .
3. Explain the principle , instrumentation and applications of X-Ray fluorescence spectroscopy ?

SHORTS :

1. What are the peaks observed in mass spectra.
2. Write a note on matrix effects.
3. Write the applications of XRF
4. Write the utility of mass spectroscopy in qualitative analysis.

PITHAPUR RAJAH'S COLLEGE (A), KAKINADA

II YEAR MSC (EXAMINATION AT THE END OF II SEMESTER)

PAPER- IV: INSTRUMENTAL METHODS OF ANALYSIS-I

MODEL PAPER

Duration: 3 hrs **Max. Marks: 75**

SECTION: A

Answer **ALL** questions **4X15=60**

1. (a) Write the principle, Instrumentation and applications of UV-Visible spectroscopy? (B1-Level)

   (OR)

   (b) Explain the principle and applications with reference(any three) of spectro flourimetry? (B4-Level)

2. (a) Discuss the principle and applications of IR spectroscopy. (B2-Level)

   (OR)

   (b)Describe the principle and instrumentation of Raman spectroscopy. (B3 -Level)

3. (a) Write the mechanism for spin-spin coupling and factors effecting on chemical shift of NMR spectroscopy? (B1-Level)

   (OR)

   (b) Describe the theory and working mechanism of ESR spectroscopy?(B2-Level)

4. (a) Write the basic principle, instrumentation and peaks observed in mass spectroscopy . (B1-Level)

   (OR)

   (b) Explain principle, instrumentation and applications of XRF spectroscopy. (B4 -Level)

SECTION: B

Answer any **FIVE** questions 5 X 3 = 15

5. Define laws of absorption. (B1-Level)
6. Discuss about fluorescence? (B2-Level)
7. What is IR analysis of CO2. (B6-Level)
8. Write note on molecular vibrations. (B1-Level)
9. What is FT-NMR? (B1-Level)
10. How can you differentiate NMR and ESR? (B2-Level)
11. Define Molecular ion in MS. (B1-Level)
12. Explain Matrix effects of XRF. (B4 -Level)

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PITHAPUR RAJAH'S COLLEGE (A), KAKINADA

IIYEAR MSC (EXAMINATION AT THE END OF III SEMESTER)

INSTRUMENTAL METHODS OF ANALYSIS

PRACTICALS

1. pH metry

(i) Determination of alkalinity of a coloured effluent using pH metric titration.

(ii) Determination of purity of commercial HCl using pH metric titration.

(iii)Determination of purity of commercial H_2SO_4 using pH metric titration.

2. Potentiometry

(i) Determination of Cr (VI) with Fe (II) using potentiometric end point

(ii) Determination of Fe (II) using ceric sulphate by potentiometric end point

(iii)Determination of a mixture of Ce (IV) and V(V) with Fe (II) by potentiometric end point

(iv)Determination of KSCN with $AgNO_3$ by potentiometric end point.

3. Spectrophotometry

(i) Determination of Fe (III) using potassium thiocyanate

(ii) Determination of Iron (II) using Orthophenanthroline

(iii)Determination of phosphate in fertilizer and cola drinks by Molybdenum blue method

(iv)Determination of Manganese (II) -periodate method

4. Flame photometry

(i) Determination of sodium present in bread samples

(ii) Determination of sodium and potassium in a given sample of fertilizer

5. Thin layer chromatography:

Determination of Rf values and identification of organic compounds in a given mixture by TLC

(i) Separation of mixture of Benzil and 2-nitrophenol

(ii) Mixture of benzophenone and naphthalene

(iii) Mixture of 2-nitrophenol and 4-nitrophenol

Reference Books/Text Books

S.NO	AUTHOR	TITLE	PUBLISHER
1	A.I VOGEL	A Text Book of Quantitative In organic Analysis (3rd Edition)	London

Schem Scheme of valuation

1. Record	**10 Marks**
2. Viva- Voce	**15 Marks**
3. Practical	**50 Marks**
i. Principle with Chemical Reaction	10 Marks
ii. Brief Procedure	5 Marks
iii. Formula & Tabular forms	5 Marks
iv. Calculation	5 Marks
v. Graph	5 Marks
vi. Report	
< 2% Error	20 Marks
>2% Error	15 Marks
>5% Error	10 Marks
Total	**75 Marks**

Cocurricular 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 Various instrumentation techniques like Potentiometry, pH Metry, Spectrophotometer, and other laboratory techniques.

For Student: Student shall visit a related industry/chemistry laboratory in universities/research organizations/private sector facility and observe the techniques used for Various instrumentation techniques like Potentiometry, pH Metry, Spectrophotometer, and other laboratory techniques. Write their observations and submit a hand written 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 - 533 001,

EAST GODAVARI, A.P.

Affiliated to Adikavi Nannaya University

NAAC Accredited with "A" Grade (3.17 CGPA)

BOARD OF STUDIES OF CHEMISTRY

M. Sc ANAIYTICAL CHEMISTRY Under CBCS

Convened on 30th APRIL 2024

AY 2024-2025

DEPARTMENT OF CHEMISTRY

P. R. GOVT. COLLEGE (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, PITHAPUR RAJAHS GOVERNMENT COLLEGE(A), KAKINADA-A. P

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

R.C.No.12A/A.C./BOS/2023-24, Dated: _____.

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

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

ORDERS:

The Principal, Pithapur Rajahs Government College(A), Kakinada is pleased to constitute P G Boards of Studies in Chemistry for framing the syllabi in Analytical Chemistry Subject for III & IV Semesters duly following the norms of the UGC Autonomous guidelines.

S. No	Name of the Nominee	Designation
1	V. Sanjeeva Kumar	Chairman& Lecturer In charge.
2	Dr. B. Jagan Mohan Reddy	University Nominee Associate ProfessorDepartment of Chemistry Adikavi Nannaya University, Rajamahendravaram.
3	Dr. T. Satyanarayana	Subject Expert Principal Ideal college of Arts & sciences, Kakinada.
4	T. Narasimhamurthy	Subject Expert Lecturer in chemistry, GDC (A) Rajamahendravaram.
5	Dr. G. Chandrasekhar Reddy Managing Director HIQ Pharma Pvt. Ltd Hyderabad	Representative from Industry
6	T.V.V. Satya Narayana	Member
7	P. Vijay Kumar	Member
8	V. Rambabu	Member
9	G. Pavani	Member
10	Dr. N. Bujji Babu	Member
11	Dr. Ch. Praveen	Member
12	V. Venkateswara Rao	Member
13	U.S.N. Prasad	Member
14	T. Pavan Kumar	Member
15	P.R. Ravi varma	Member
16	K. Srilekha	Member
17	P. Sirisha	Member
18	R. Ramya Sri	Member
19	G. Chandrika	Student Alumni Member
20	A Naga Devi	Student Member
21	B Madhav Rao	Student Member
22	S. Venkateswara rao	Student Member

23	Ch. Surya Swamy	Student Member

The above members are requested to attend the BoS meeting on 30TH APRIL 2024 and share their valuable reviews, and suggestions on the following functionaries.

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

PRINCIPAL
P.R. Govt. College (A)
KAKINADA

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

PITHAPUR RAJAH'S GOVERNMENT COLLEGE (A), KAKINADA
DEPARTMENT OF CHEMISTRY
MINUTES OF BOARD OF STUDIES (BOS) MEETING

2024-25 on 30th APRIL2024 Meeting of Board of Studies in M. Sc Analytical Chemistry is convened on 30th APRIL 2024 through offline at Pithapur Rajah's Government College (A), Kakinada.

Venue: JKC Dt: 30th APRIL2024

The Principal Dr. B.V. Tirupanyam, Chairman, Sri. V. Sanjeeva Kumar, Chairman and lecturer in charge University Nominee, Dr. K. Deepthi, Industrialist Dr. G. Chandrasekhar Reddy Managing Director HIQ Pharma Pvt. Ltd Hyderabad, Subject Expert, Dr .T. Satyanarayana, subject expert T. Narasimhamurthy, All the faculty members ofChemistry Department and student alumni attended the meeting.

Agenda:

1. To discuss the Semester System and revised Choice Based Credit System (CBCS) being implemented for the past 03 years, i.e., w.e.f. 2020-21.
2. To discuss and approve the Continuation/Modifications of the syllabus for the Odd & Even Semesters of III & IV for 2024-2025.
3. Grant of Extra credits for Online SWAYAM MOOCs etc.
4. Syllabus, Model Question Papers and Model Blueprints, POs, PSOs & COs mapping for III and IV Semesters.
5. Minimum of 60% integration of ICT into transaction of curriculum.
6. Minimum attendance of 75% for both I mid-term examination, and II mid- term examination under CIA component shall be the benchmark for attendance and it shall be approved in the BOS.
7. Teaching learning methodology by 75:25 (External: Internal) ratio w.e.f. 2017-18 admitted batches and continued it.
8. Remedial coaching for slow learners and project work, research, Conferences, etc., for advanced learners.
9. Panel of paper setters and examiners.
10. Proposals for project work in fourth semester for the benefit of students.
11. Department action plan for 2024-25. To discuss and resolve the minor modifications/refinement if any.
12. Any Other Proposal with the Permission of the Chairman

The following paper setters are recommended.

1. Dr. V. Siddaiah Department of Chemistry, Andhra University, Visakhapatnam

2. Dr. D. Jaya Prashanthi Department of Chemistry, Andhra University, Visakhapatnam
3. Dr. S. K. Mustafa, Department of Chemistry, Dr, SKR Govt. College, Yanam.
4. Dr. B. Mallikarjun, Department of Chemistry, GDC(A), Rajamahendravaram.
5. Dr. K. Deepthi, Department of Chemistry, ANUR Rajamahendravaram
6. Dr. B. Jagan Mohan Reddy, Department of Chemistry, ANUR Rajamahendravaram
7. Dr. Ravindra Babu, Department of Chemistry, GDC, Tanuku
8. Dr. A. Chandraleela, Department of Chemistry, Andhra University, Visakhapatnam

Resolution:

It is resolved to introduce the following new courses in the programme M. Sc Organic Chemistry from the AY 2023-24

S. No	Course Code	Title of the new course	Programme in which it is introduced
1		Nil	Nil

ADDITIONS/DELETIONS IN COURSES CHEMISTRY 2023-24

Year	Semester& Paper	Additions	Deletions
II	III&I	-	-
II	III&II	-	-
II	III&III	-	
II	III&IV	-	-
II	IV&I	-	-
II	IV&II		
II	IV&III	-	-
II	IV&IV	-	-

Course structure of M. Sc ANALYTICAL Chemistry
(Final Year)

S. No	Semester	Title of the Paper	Theory/ Practical / Viva	Internal marks	External Marks	Total Marks	Credits
1	III	*Separation Methods-I*	T	25	75	100	4
2		*Quality Control and Traditional methods of Analysis-I*	T	25	75	100	4
3		*Applied Analysis-I*	T	25	75	100	4
4		*Instrumental Methods of Analysis-I*	T	25	75	100	4
5		*Classical methods of Analysis-I*	P	25	75	100	4
6		*Instrumental methods of Analysis-I*	P	25	75	100	4
7	IV	*Separation Methods-II*	T	25	75	100	4
8		*Quality Control and Traditional methods of Analysis-II*	T	25	75	100	4
9		*Applied Analysis-II*	T	25	75	100	4
10		*Instrumental Methods of Analysis-II*	T	25	75	100	4
11		*Classical methods of Analysis-II*	P	25	75	100	4
12		*Instrumental methods of Analysis-II*	P	25	75	100	4
13		*Comprehensive Viva-voce*	V	---	50	50	4
Total Credits							

	Pithapur Rajah's Government College (Autonomous) Kakinada	Program & Semester II M.Sc. Analytical Chemistry Semester-IV
Course Code	**PAPER -1** **SEPARATION METHODS - II**	
Teaching	*Hours Allocated: 60 (Theory)*	*L* *T* *P* *C*
Pre-requisites	*Chromatography techniques, sampling techniques, importance of analytical chemistry in industry*	*60* *10* *--* *4*

Course Objectives:

Study the techniques of chromatography and sampling

On Completion of the course,the students will be able to	
CO1	*Students will acquire holistic knowledge in paper and TLC techniques*
CO2	*Students will be able to know the ion exchange chromatography*
CO3	*Student will acquire knowledge in sampling of solids, liquids and gases*
CO4	*Students will know about importance of analytical chemistry in industry and solvent extraction*

Course with focus on employability / entrepreneurship / Skill Development modules

Skill Development		*Employability*		*Entrepreneurship*

Syllabus:

Unit – I Chromatography – 5

(a) Paper chromatography: *principle, papers as a chromatographic medium, modified papers, solvent systems mechanism of paper chromatography, experimental technique, different development methods- ascending, descending, horizontal, circular spreading, multiple development, two dimensional development, reverse phase paper chromatographic technique-visualization and evaluation of chromatograms, applications.*

(b) Thin layer chromatography: *principle, chromatographic media-coating materials, applications, activation of adsorbent, sample development, solvent systems, development of chromatoplate types of development, visualization methods, documentation, applications in the separation, HPTLC-principle, technique, applications.*

Unit – II Chromatography – 6

(a) Ion Exchange: *principles of ion-exchange systems, synthetic ion-exchange resins, properties of anion and cation exchange resins, ion-exchange mechanism, ion-exchange equilibria, selectivity, ion-exchange capacity applications of ion-exchange in different fields.*

(b) Ion exchange chromatography: *Principle, equipment, application specifically separations of lanthanides, actinides, amino acids.*

Unit – III Sampling of Solids, Liquids and Gases

(c) Ion chromatography: *principles of separation, instrumentation, detectors, separation of cations and anions, applications in the analysis of water and air pollutants*

Sampling: *Basis of sampling, purpose of sampling, homogeneous and heterogeneous samples, statistical criteria for good sampling, sample size, sampling unit, gross sample, laboratory sample.*

Sampling of Solids: Cone and Quartering method, Long pile and alternative shovel method, precautions and preservation of solid samples, sampling of metals and other solids rods, wires, sheets, plates, especially gold, silver, Iron and other metals.

Sampling of different types of liquids: Different sampling techniques, sampling of drinking water, industrial effluents, precautions in sampling and preservation of collected liquid samples.

Sampling of gases: sampling and pre-concentration by adsorption or absorption method, instantaneous monitoring, sampling in samples and subsequent monitoring, different types of gas samplers, precautions in preservation of samples, systematic sampling and random sampling.

Unit – IV Importance of Analytical chemistry & Solvent Extraction

(a)Importance of Analytical Chemistry to Industrial Research: *Importance of Qualitative and Quantitative analysis in research and development, industries and other branches of science.*
Development and validation of an analytical method, units, concentrations, calculations, standards, chemical reactions, expressions of concentrations, importance of separation methods with examples.

(b)Solvent Extraction: *principles and processes of solvent extraction, Distribution Law and Partition coefficient, nature of partition forces, different types of solvent extraction systems – Batch extraction, Continuous extraction, Counter current extraction, solvent extraction systems, applications in metallurgy, general applications in analysis and pre-concentration, special extraction systems like crown ethers, super fluid and surfactant extractions-examples.*

Reference Books:

1. *E. Helfman, Chromatography, VanNostrand, Reinhold, New York*
2. *E. Lederer and M. Lederer, Chromatography, Elsevier, Amsterdam.*
3. *Chemical separation methods, John Dean, Von Nostra and Reinhold, New York*
4. *R.P. W Scott, Techniques and practice of Chromatography, Marel DekkerInc New York*
5. *E. Stahl, Thin layer chromatography, Academic Press, New York James, G. Tartor (Ion chromatography)*
6. *R.P.W Scott, Techniques and practice of Chromatography, Marel DekkerInc, Newyork*

Web Links:

1. *https://youtu.be/TdJ5/SQ6GAQ*
2. *https://youtu.be/VOSkyj1dtbc*
3. *https://youtu.be/e3lRt9XdV0s*
4. *https://youtu.be/ulb0IF-ECRM*

Weightage to content
semester IV
PAPER -1

S. No	Course Content	Long Answer	Short Answer	Total marks	As per Blooms Taxonomy
1	*Paper and TLC chromatography*	*2*	*2*	*36*	*Understanding, Application*
2	*Ion exchange chromatography*	*2*	*2*	*36*	*Creative, Analyzing*
3	*Sampling techniques*	*2*	*2*	*36*	*Application Creation*
4	*Importance of analytical chemistry and solvent extraction*	*2*	*2*	*36*	*Remembering, Evaluation*
	TOTAL	**8**	**8**	**144**	

PRGC (A) KAKINADA

PAPER -1 SEPARATION METHODS -II

SEMESTER-IV

IMPORTANT QUESTIONS

Unit-1:

EASSYS:

1. Write a brief note on paper chromatography and different types development methods
2. Explain briefly about reverse phase paper chromatography technique and evaluate the chromatograms
3. Explain the brief account on thin layer chromatography and also explain the type of development
4. Write a brief account on HPTLC principle, technique, application

SHORTS:

1. Discuss the ascending and descending development
2. Write the application of paper chromatography
3. Give a short note on visualization method
4. Write a short note on activation of adsorbent

Unit -2:

EASSYS:

1. Give a detailed account on synthetic ion-exchange resins and write the properties of cation and anion exchange resins
2. Write a brief note on ion-exchange chromatography with applications
3. Write a brief note on ion chromatography principle, instrumentation, detector and application
4. Explain the ion-exchange terms:
   a) Ion exchange equilibria.
   b) Ion exchange capacity.
   c) Selectivity of ion exchange.

SHORTS:

1. Write a note on application of ion-exchange in different fields
2. Write a note on separation of cations and anions in ion chromatography
3. Write a short note on ion-exchange mechanism
4. Define separation of amino acids by ion-exchange chromatography

Unit -3:

EASSYS:

1. Explain the sampling of solids:
   a) Cone and Quartering method.
   b) Long pile and alternative shovel method.
   c) Precautions and Preservation of solid samples.
2. Write a brief note on the 4 different sampling techniques, precautions and preservation of sampling o liquids
3. Explain the sampling of liquids, sampling of drinking water and sampling of industrial effluents
4. Give a brief detailed account on sampling of gases

SHORTS:

1. Write a short note on homogeneous and heterogeneous samples
2. Explain the statistical criteria for good sampling
3. Write a note on purpose of sampling
4. Write a short note on laboratory sample

Unit-4:

EASSYS:

1. Write a brief note on importance of Qualitative and Quantitative analysis in research and development
2. Write a brief note on method development and validation of an analytical method and its importance
3. Explain about the different types of solvent extraction systems and its applications
4. Explain briefly about the special extraction systems and its applications

SHORTS:

1. Discuss the partition coefficient
2. Write the note on nature of partition forces?
3. Write the importance of separation methods with examples
4. Write a note on distribution law

PITHAPUR RAJAH'S COLLEGE (A), KAKINADA

II YEAR MSC ANALYTICAL CHEMISTRY

(EXAMINATION AT THE END OF IV SEMESTER)

PAPER- I: SEPARATION METHODS – II

MODEL PAPER

Duration: 3 hrs Max. Marks: 75

SECTION: A

Answer **ALL** questions **4X15=60**

1. *write a brief note on paper chromatography and explain the different development methods. (B1-level)*

(OR)

2. *write a brief note on HPTLC Principle, techniques and applications (B1-level)*
3. *Give a detailed account on synthetic ion exchange resins and write the properties of cation and anion exchange resins (B2-level)*

(OR)

4. *Explain briefly note on ion chromatography principle, instrumentation, detector and its applications (B4-level)*

5. *Explain the 4 different types of sampling techniques, and their precautions and preservation of sampling of liquids (B4-level)*

(OR)

6. *Explain the sampling of solids:*
   a) Cone and Quartering method.
   b) Long pile and alternative shovel method.
   c) Precautions and Preservation of solid samples (B4-level)

7. *Write a brief note on importance of Qualitative and Quantitative analysis in research and development (B1-level)*

(OR)

8. *Explain about the different types of solvent extraction systems and its applications (B4-level)*

SECTION: B

Answer **ANY FIVE** questions **5X3=15**

9. *Discuss the ascending and descending development (B2-level)*
10. *Write a short note on activation of adsorbent (B1-level)*
11. *Write a note on application of ion-exchange in different fields (B3-level)*
12. *Write a short note on ion-exchange mechanism (B1-level)*
13. *Write a short note on homogeneous and heterogeneous samples (B1-level)*
14. *Explain the statistical criteria for good sampling (B4-level)*
15. *Write the note on nature of partition forces (B1-level)*
16. *Discuss the partition coefficient (B2-level)*

Co-Curricular Activities:

a) Mandatory:(

1. **For Teacher**: *Training of students by teacher in laboratory and field for not less than15 hours on the field techniques/skills of preparation of acetanilide, preparation of azo dye, 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/researchorganizations/privatesectorfacilityandobservethetechniques used for the separation of organic compounds. Write their observations and submit a handwritten fieldwork/project work report not exceeding 10 pages in the given format to the teacher.*
3. *Max marks for Field work/project work Report:05.*
4. *Suggested Format for Fieldwork/project work*
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 other material.*
3. *Visits of facilities, firms, research organizations etc.*
4. *Invited lectures and presentations on related topics by field/industrial experts*

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO/	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	1	1	2	3	1	1	1	2	1	3	3	1
CO2	3	2	1	3	3	2	2	1	1	3	3	3	1
CO3	3	2	2	1	3	1	1	1	1	1	3	2	1
CO4	3	2	2	1	3	1	1	1	1	1	3	2	1
Avg.	3	1./5	1.5	1./5	3	1.25	1.25	1	1.25	1.5	3	2.5	1

PO1: Knowledge in Chemistry: Apply the knowledge of structural elucidation techniques to the solution of simple to complex organic molecules.

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

PO3: Design/development of solutions: Design separation techniques for simple to complex molecules.

PO4: Conduct investigations of complex problems: Use fundamental research- based knowledge and available structural elucidation methods for analysis and interpretation of structural data of the organic molecules.

PO5: Modern tool usage: Create enabled structural elucidation techniques, for modeling and optimization of simple to complex organic molecules.

PO6: Society: Applying the contextual knowledge to assess societal, health, safety, legal and cultural issues

PO7: Environment and sustainability: Understand the importance of analysis of organic compounds for various solutions in societal and environmental context and demonstrate the knowledge and need for sustain able development.

PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the science-based practice.

PO9: Communication: Communicate effectively on issues related to analysis of organic compounds with the chemistry community, being able to write the effective reports and documentation, 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.

PSO-1: To have a firm foundation in the fundamentals/concepts/theories and its applications in analysis of organic compounds.

PSO-2: To understand the structure and properties of organic molecules.

PSO-3: To acquaint with safety measures in laboratory and develop skills in proper handling of chemicals and apparatus/instruments and carry out experiments, record the observations and present the inference/results

	Pithapur Rajah's Government College(Autonomous) Kakinada	Program &Semester II M.Sc. Analytical Chemistry Semester-IV			
Course Code	PAPER -II QUALITY CONTROL AND TRADITIONAL METHODS -II				
Teaching	Hours Allocated: 60 (Theory)	L	T	P	C
Pre-requisites	Precipitation methods and analysis of drugs	60	10	---	4

Course Objectives:

Study the analysis of precipitation methods and drugs

On Completion of the course,the students will be able to	
CO1	Student will be able to identify the precipitation and mechanism
CO2	Student have knowledge on PFHS and electro gravimetric
CO3	Student will be able to understand reductant system
CO4	Understanding the analysis of some selected drugs

Course with focus on employability / entrepreneurship / Skill Development modules

Skill development		Employability		Enterpreneur ship	

Syllabus:

Unit–I:

Precipitation methods-1:

(a). Crystal habit and super saturation, nucleation and crystal growth, homogeneous and heterogeneous nucleation, solubility and particle size, colloids, completeness of precipitation, effect of excess precipitant, pH, complex formation, temperature, purity of precipitates, aging.

Co-precipitation and post precipitation : theory of adsorption of salts having an ion in common with the main precipitate, co-precipitation in colloidal precipitates ,adsorption of solvents, mixed crystal formation by occlusion and entrapment, re- precipitation with examples, Post-precipitation – theory of post-precipitation, examples of post-precipitation, conditions for obtaining pure and quantitative precipitates.

Precipitation Titrations:Principle, Indicators for precipitation titrations, determination of halides.

Unit–II :

Precipitation methods-2:

Precipitation from Homogeneous Solution (PFHS): theory of PFHS, methods of PFHS–increase in pH, decrease in pH, cation release, anion release, reagent synthesis, change in oxidation state, photochemical reactions, precipitation from mixed solvents. Applications of PFHS methods.

Gravimetric determinations: nature of species, preparation of solutions, limitations, interferences, inorganic b. precipitants-chlorideand sulphate, organic precipitants dimethylglyoxime (DMG), oxine, benzidine, salicylaldoxime, benzoinoxime, sodium tetraphenyl boron, tetraphenyl arsonium chloride.

Electro-gravimetric analysis: principle, important terms in electrogravimetry, decomposition voltage or decomposition potential, overvoltage and their importance, instrumentation, electrolysis at constant current, determination of Cu2+ by constant current electrolysis, electrolysis at controlled potentials, determination of Cu, Pb, Sn in brass and bronze by controlled potential electrolysis.

Unit–III:

Reductantsystem–Principles and applications in analysis

Analytical chemistry of some selected reductant systems–formal, standard and normal potentials in various Media, stability of the solution,

Species responsible for the reduction properties, standardization, requirement for the selection of the reductants, selection of suitable indicators for various reductant systems,
Inorganic Systems –Cr (II),V(II),Ti(III),Sn(II),Fe(II)in H3PO4 and hydrazine

ORGANIC Systems–hydroquinone and Ascorbic acid.

Unit – IV Analysis of some selected Drugs:

Basic considerations of drugs – Classification Determination of the following Drugs: Acetyl salicylic acid (Antipyretic–Analgesic)

Testosterone, progesterone and cortisone (Steroids and corticoids

Sulphadiazine (sulpha drugs) Phenobarbitone (Barbituric acid derivatives)

Chloramphenicol, Benzylpenicillin and Tetracycline (Antibiotics)

Thiamine(B1), Riboflavin(B2) and ascorbic acid(c)[Vitamins] Isoniazid (Anti micro bacterial agents)
Methly dopa (Antihypertensive agents) Metronidazole (Anti amoebic agents)

Reference Books

1. *Technical methods of analysis–Griffin, Mc Graw Hill Book Co.*
2. *Chemical Separation and measurements–D. G Peter seti, John M. Haves Sanders Co.*
3. *Chemical analysis–H. A Laitinan, Mc Graw Hill Book Co.*
4. *Newer redox titrants–Berka, Zykaand Vulterin, Pergamon Press*
5. *Volumetric Analysis, Vol III – I.M Kolthoffand R. Belvher, Inter science Public, New York*
6. *Vogel's Text Book of organic Quantitative Analysis –J. Bassettetal, ELBS*
7. *Pharmaceutical analysis–T. Higuchi, Brochmannhausfen*
8. *D.ASkoog,D.MWestandF.JHoller, Analytical Chemistry, An Introduction, Sanders College Publishing, New York*
9. *Quantitative Chemical Analysis–I. M Kolthoff, E. B Sandel, E. J Meehan, S. Brucken stein, Macmillan Company, London*

Web Links:

https://youtu.be/j9jvimqm8eYhttps://youtu.be/Nk_wupeeb6Ehttps://youtu.be/8NspLCYVb6c

WEIGHTAGE TO CONTENT SEMESTER -IV

PAPER -II

S. No	Course Content	Long Answer	Short Answer	Total marks	As per Blooms Taxonomy
1	Precipitation method-1	*2*	*2*	*36*	*Understanding, Application*
2	Precipitation method-2	*2*	*2*	*36*	*Remembering, Understanding*
3	Reductantsystem	*2*	*2*	*36*	*Application Creation*
4	Analysis of some selected drugs	*2*	*2*	*36*	*Remembering, Understanding*
	TOTAL	**8**	**8**	**144**	

PRGC (A) KAKINADA

PAPER-II

QUALITY CONTROL AND TRADITIONAL METHODS OF ANALYSIS – II

SEMESTER-IV

IMPORTANT QUESTIONS

UNIT - 1

ESSAYS:

1. Explain about Homogeneous nucleation and Heterogeneous nucleation in precipitation Methods
2. Write a detailed note on theory of post precipitation with examples
3. Explain the principle of precipitation. Give a brief note on indicators that are used in precipitation titrations
4. Write a brief note on theory of Co- precipitation and also about adsorption of solvents

SHORTS:

1. Write a brief note on Colloids.
2. Write a short note on mixed crystal formation by occlusion and entrapment.
3. Write the effect of pH and temperature on precipitation.
4. What is the basic principle of precipitation.

UNIT - 2

ESSAYS:

1. Discuss about any five methods of PFHS and its applications.
2. Explain about DMG and its significance in gravimetric analysis.
3. Discuss the theory of precipitation from Homogeneous solution.
4. Give a detailed account on decomposition potential and over voltage of electro gravimetric analysis.

SHORTS:

1. What is the basic principles of electro gravimetric analysis.
2. Write a short note on Benzoin Oxime.
3. Explain the determination of cu and Pb in brass by controlled potential electrolysis.
4. Write a short note on benzidine.

UNIT - 3

ESSAYS:

1. Give a detailed account on In-organic reductant systems - Cr(ll), V(V), and Sn (ll).
2. Discuss the significance of suitable indicators for reductant systems with examples.
3. Write a detailed note on Hydroquinone and Ascorbic acid.
4. Write a brief note on formal, standard and normal potentials in various media.

SHORTS:

1. What is meant by Standardization. Justify its importance.
2. Write a short note on Standard potential.
3. Write a brief note on selective reductant systems.
4. Write a note on in organic reductant system Fe (ll) in Phosphoric acid.

UNIT - 4

ESSAYS:

1. Give the procedure for the analysis of following drugs.
   (a) Acetyl salicylic acid. (b) Isoniazid. (C) Methyl Dopa.
2. Discuss about the determination of Sulphadiazine.
3. Explain the determinations of the following drugs
   (a) Phenobarbitone. (b) Chloramphenicol. (C) Progesterone

SHORTS:

1. Explain the classification of drugs.
2. Write a brief note on Riboflavin.
3. Write a short note on antihypertensive agents.
4. Write the determination of Benzyl penicillin.

PITHAPUR RAJAH'S COLLEGE (A), KAKINADA

II YEAR MSC ANALYTICAL CHEMISTRY

(EXAMINATION AT THE END OF IV SEMESTER)

PAPER- II: QUALITY CONTROL AND TRADITIONAL METHOD OF ANALYSIS-II

MODEL PAPER

Duration: 3 hrs. **Max. Marks: 75**

SECTION: A

Answer **ALL** questions **4X15=60**

1. Explain about homogeneous and heterogeneous nucleation in precipitation methods. (B2-level)

(OR)

2. What is the principle note on Indicators that are used in precipitation titration. (B1 -level)

3. Discuss the theory of precipitations from homogeneous solutions (B2 – Level)

(OR)

4. Describe the precipitation from mixed solvents and applications of precipitations from homogeneous solution(B2-level)

5. Discuss the significance of suitable indicators for reductant system with examples (B2-level)

(OR)

6. Give a detailed account on Inorganic reductant systems-Cr (2), V (5) and Sn (2) (B1- level)

7. How do you analyze the Sulphadiazine drug (B4- Level)

(OR)

8. Explain the determination of Tetracycline (B2- Level)

SECTION: B

Answer **ANY FIVE** questions **5X3=15M**

9.Write a brief note on colloids. (B1 - Level)

10.Write the effect of pH and temperature on precipitations. (B1 - Level)

11.Explain about the Benzoin oxime. (B2 - Level)

12.Write a short note on Dimethyl Glyoxime (DMG)

13.Write a note on selective reductant systems. (B1 - Level)

14.Define formal potential. (B1 - Level)

15.How do you analyze the Riboflavin drug. (B4 - Level)

16.Explain the determination of chloramphenicol. (B2 - Level)

PITHAPUR RAJAH'S COLLEGE (A) KAKINADA

II YEAR M.Sc (EXAMINATION AT THE END OF IV SEMESTER)

CLASSICAL METHODS OF ANALYSIS -II

PRACTICAL

1. *Water analysis:*

   (i) Determination of alkalinity (CO_3^{2-}, HCO_3^-) of water samples.
   (ii) Determination of chemical oxygen demand (COD) of drinking water and sewage water
   (iii) Determination of biological oxygen demand (BOD)of drinking water and sewage water

2. *Redox titrations:*

   (i) Determination of oxalate in kidney stones by permanganometric titration.
   (ii) Determination of Fe (II)presentinanIrontabletusing$KMnO_4$

3. *Fertilizer analysis:*

   (i) Determination of nitrate from fertilizer
   (ii) Determination of sulfur (as sulfate) from sulfur containing fertilizer.

4. *Analysis of oils and soaps:*
   (i) Determination of saponification value, acid value and iodine value of oil sample
   (ii) Determination of moisture content and total alkali of soaps

5. *Separation and determination of ions by ion-exchanger resins:*
   (i) Determination of Na^+ by cation exchanger resin
   (ii) Determination of Na^+ and K^+ in a mixture by cation exchanger resin
   (iii)Determination of $Cl^-$and Br^- in a mixture by anion exchanger resin

Co-Curricular Activities:

b) **Mandatory:(**

4. **For Teacher**: *Training of students by teacher in laboratory and field for not less than15 hours on the field techniques/skills of preparation of acetanilide, preparation of azo dye, use of separating funnel for solvent extraction, separation of organic compounds in a mixture.*
5. **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 handwritten fieldwork/project work report not exceeding10 pages in the given format to the teacher.*
6. *Max marks for Fieldwork/projectworkReport:05.*

7. Suggested Format for Fieldwork/project work

8. Unit tests (IE).

Suggested Co-Curricular Activities

6. *Training of students' by related industrial experts.*
7. *Assignments, Seminars and Quiz (on related topics), collection of videos and other material.*
8. *Visits of facilities, firms, research organizations etc.*
9. *Invitedlecturesandpresentationsonrelatedtopicsbyfield/industrialexp*

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO/	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	3	3	2	3	3	3	1	1	3	3	2	2
CO2	3	3	3	2	3	3	3	1	1	3	3	2	2
CO3	3	3	3	2	3	3	3	1	1	3	3	2	2
CO4	3	3	3	2	3	3	3	1	1	3	3	2	2
Avg.	3	3	3	2	3	3	3	1	1	3	3	2	2

PO1:

Knowledge in Chemistry: Apply the knowledge of structural elucidation techniques to the solution of simple to complex organic molecules.

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

PO3: Design/development of solutions: Design separation techniques for simple to complex molecules.

PO4: Conduct investigations of complex problems: Use fundamental research-based knowledge and availablestructuralelucidationmethodsforanalysisandinterpretationofstructuraldataofthe organic molecules.

PO5: Modern tool usage: Create ITCAI enabled structural elucidation techniques, for modeling and optimization of simple to complex organic molecules.

PO6: Society: Applying the contextual knowledge to assess societal, health, safety, legal and cultural issues.

PO7: Environment and sustainability: Understand the importance of analysis of organic compounds for various solutions in societal and environmental context and demonstrate the knowledge and need for sustainable development.

PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the science-based practice

PO9: Communication: Communicate effectively on issues related to analysis of organic compounds

With the chemistry community, being able to write the effective reports and documentation, presentations.

PO10: Life-long learning: Recognize the need for, and have the preparation and abilitytoengageinindependentandlifelonglearninginthebroadestcontextoftechnologicalchange.

PSO-1: Tohaveafirmfoundationinthefundamentals/concepts/theoriesanditsapplicationsinanalysis of organic compounds.

PSO-2: To understand the structure and properties of organic molecules.

PSO-3: To acquaint with safety measures in laboratory and develop skills in proper handling of chemicals and apparatus/instruments and carry out experiments, record the observations and present the inference/results

	Pithapur Rajah's Government College(Autonomous) Kakinada	Program & Semester II M.Sc. Analytical Chemistry Semester-IV			
Course Code	**PAPER -III** **APPLIED ANALYSIS -II**				
Teaching	*HoursAllocated:60(Theory)*	*L*	*T*	*P*	*C*
Pre-requisites	*Analysis of raw material, soils, fuels, air and fertilizers*	*60*	*10*	*-*	*4+4*

Course Objectives:

Study the Analysis of raw materials, soils, fuels, and fertilizers

Course Outcomes:

On Completion of the course,the students will be able to	
CO1	Students will be able to analyze the raw materials
CO2	Students will be able to know about analysis of soils, fuels and fertilizers
CO3	Students will able to know about assessment of air quality
CO4	Students will be able to understand kinetic methods of analysis

Course with focus on employability / entrepreneurship / Skill Development modules								
Skill Development			Employability			Entrepreneurship		

Syllabus

Unit – I Analysis of raw materials

(a) Analysis of non-ferrous alloys:

(i) Brass-Analysis of the constituents-Cu, Zn, Sn, Pb and Fe.

(ii) Bronze-Analysis of the constituents–Cu, Sn, Zn, Pb and Fe.

(iii) Solder-Analysis of the constituents–Sn, Pb and Sb.

(b) Analysis of Ferroalloys:

(i) Ferro silicon-Analysis of the constituents–Si, C, P, S

(ii) Ferro vanadium-Analysis of the constituents–V, C, P, S, Si, Al.

(iii) Ferro manganese-Analysis of the constituents–Mn, S, C, P, Si

(iv) Silico manganese-Analysis of the constituents–Mn, S, C, P, Si

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Unit – II Analysis of Soil, Fertilizer and Fuel

(a) Analysis of soils: sampling, determination of moisture, total N, P, Si, lime, humus nitrogen, alkali salts, soil absorption ratio.

(b) Analysis of fertilizers: ammonical fertilizers, Phosphate fertilizers, Nitrate fertilizers.

(c) Analysis of fuels: solid fuels-coal, proximate analysis, ultimate analysis, heating value, grading of coal based on Ultimate Heat Value (UHV).

Unit – III Assessmentof Air Quality

Composition of pure air, classification of air pollutants, toxic elements present in dust and their sources – collection of air samples.

Sources, effects, control of pollution and chemical analysis for the following.

(a) Primary pollutants:

(i) Carbon compounds – Carbon monoxide (CO) and Carbon dioxide (CO_2).

(i) Sulphur compounds- sulphur dioxide (SO_2), Sulphur trioxide (SO_3) and Hydrogen Sulphide(H_2S).

(ii) Nitrogen compounds-nitric oxide (NO), and nitrogen dioxide (NO_2),

(iii) Hydrocarbons - Aliphatic hydrocarbons and polycyclic aromatic hydrocarbons (PAH).

(iv) Particulate matter - Repairable and Suspended particulate matter, Inorganic and Organic particulate

b)Secondary pollutants-ozone(O_3), peroxyacetyl nitrate(PAN), per-oxy benzyl nitrate(PBN)

c) Standards for ambient air quality.

UNIT-IV

Kinetic Methods of Analysis & Non aqueous Titrimetry

(a) *Kinetic methods of analysis: introduction, slow reactions, catalyzed reactions, methods of determination of catalyst concentration, extrapolation method for the determination of catalyst, variable time method, fixed time method, examples for the determination of toxic metals and anions using some typical kinetic reactions.*

b) Non aqueous titrimetry : Classification of solvents and titrations for non-aqueous titrmetry-Types of reactions - Indicators.

(i) Determination of acids

(ii) Determination of bases

(iii)Karl-Fisher reagent for the determination of moisture content in drugs and other samples.

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ReferenceBooks:

1. *Chemical analysis–H. A Laitinan, Mc Graw Hill Book Co*
2. *Standard methods of Chemical Analysis, Welcher*
2. *Technical Methods of Analysis, Griffin, Mc Graw Hill*
3. *Commercial Methods of Analysis, Foster Dee Sneel and Frank M. Griffin, Mc Graw Hill Book Co.*
4. *Environmental Chemistry, Anil Kumar De, Wiley Eastern Ltd.*
5. *Environmental Analysis, S. M Khopkar (IIT Bombay)*
6. *Environmental Air Analysis, Trivedi and Kudesia, Akashdeep Pub.*

Web Links:

https://youtu.be/HMU9aVmcDWQhttps://youtu.be/lJb_FKEkLxU

https://youtu.be/TpcvHkfyXps

WEIGHTAGE CONTENT TO SEMESTER -IV

PAPER-III

S. No	Course Content	Long Answer	Short Answer	Total marks	As per Blooms Taxonomy
1	*Analysis of raw materials*	2	2	36	*Understanding, Application*
2	*Analysis of soils, fuels, fertilizer*	2	2	36	*Remembering, Understanding*
3	*Assessment of air quality*	2	2	36	*Application Creation*
4	*Kinetic methods of analysis*	2	2	36	*Remembering, Understanding*
	TOTAL	8	8	144	

PRGC (A) KAKINADA

PAPER - 3 APPLIED ANALYSIS-II

SEMESTER-IV

IMPORTANT QUESTIONS

UNIT - 1

ESSAYS:

1. Explain about the Complete analysis of Bronze.
2. Discuss the detail the analysis of Silico manganese alloy Mn, S, P, and Si.
3. What are Ferro alloys and how can you analyze Ferro vanadium.
4. Explain the detailed analysis of few of the chief constituents of Brass - Cu, Zn, Sn and Fe

SHORTS:

1. Write a short note on analysis of Solder.
2. Write the analysis of Ferro Manganese.
3. Discuss short notes on Non-Ferro alloys.

UNIT - 2

ESSAYS:

1. Explain the various types of Fertilizers and discuss the analysis of phosphate and ammonical fertilizers
2. How can you determine total nitrogen, Humus nitrogen and P in Soil.
3. Explain in detail about Proximate analysis and ultimate analysis.

SHORTS:

1. Explain Soil absorption ratio.
2. Explain UHV
3. Write the analysis of N, P, Si in Soil
4. Write notes on proximate analysis in solid fuels.

UNIT - 3

ESSAYS:

1. Give chemical analysis for the following analysis
   (a) NO and NO2. (b) Hydrocarbons
2. Write the chemical analysis of Ozone, PAN, and PBN in air.
3. Write about the following pollutants
   (a) Carbon monoxide. (b) Hydrogen sulphide
4. Explain the following
   (a) Monitoring of sulphur compounds SO2 and H2S
   (b) Secondary pollutants - Ozone and PAN.

SHORTS:

1. What are standards for ambient air quality.
2. Give the methods to collect air samples.
3. Discuss the role of particulate matter in air pollution
4. Write a short note on polycyclic aromatic hydrocarbons

UNIT - 4

ESSAYS:

1. Explain the determination of toxic metals using kinetic methods of analysis.
2. Determine moisture content in drugs using Karl - Fischer Reagent.
3. Write a brief note on the following
   (a) Methods of determination of catalyst concentration
   (b) Extrapolation method for the determination of catalyst.
4. Explain the determination of bases in non aqueous titrations.

SHORTS:

1. Write short notes on solvents in non aqueous titrations.
2. Write a short note on catalyst variable time method.
3. Give a brief note on determination of toxic metals.
4. Classify the solvents using in non aqueous titrations.

PITHAPUR RAJAH'S COLLEGE (A), KAKINADA

II YEAR MSC ANALYTICAL CHEMISTRY

(EXAMINATION AT THE END OF IV SEMESTER)

PAPER- III: APPLIED ANALYSIS-II

MODEL PAPER

Duration: 3 hrs Max. Marks: 75

SECTION: A

Answer **ALL** questions **4X15=60**

1. *Explain detailed analysis of few of the chief constituents of Brass-Cu, Zn, Sn and Fe (B4-level)*

(OR)

2. *Explain the detail the analysis Ferro chromium alloy Cr, C and Si (B4-level)*

3. *Explain various types of fertilizers and discuss the analysis of phosphate and ammonical fertilizer (B4-level)*

(OR)

4. *Analysis of soil-moisture content Si and P (B4-level)*

5. *Explain the following*

   a. *Monitoring of Sulphur compounds So2 and H2S*
   b. *Secondary pollutants O3 and PAN (B4-level)*

(OR)

6. *Write a brief note on air pollutants*

   a) Poly cyclic aromatic hydrocarbons
   b) particulate matter-inorganic and organic pollutants (B1-level)

7. *Explain the determination of toxic metals using kinetic methods of analysis (B4-level)*

(OR)

8. *Write a brief note on KARL-FISHER reagent for the determination of moisture content in drugs and other samples. (B1-level)*

SECTION-B

*Answer Any **FIVE** Questions* *(5 x 3 = 15)*

9.Discuss short note on ferrous alloy (B2-level)

10.Write a short note on Silico manganese -P, Si (B1-level)

11.Write a short note on proximate analysis in solid fuels. (B1-level)

12.Write the analysis of N, P, Si in soil (B1-level)

13.Discuss the role of particulate matter in air pollution (B2-level)

14.Write a short note on poly cyclic aromatic hydro carbons (B1-level)

15.How to determine catalyst by extra polation method (B5-level)

16.Write a Short note on determination of toxic metal (B1-level;)

Co-Curricular Activities:

e) Mandatory:(

11. **For Teacher**:*Training of students by teacher in laboratory and field for not less than15 hours on the field techniques/skills of preparation of acetanilide, preparation of azo dye, use of separating funnel for solvent extraction, separation of organic compounds in a mixture.*
12. **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 and written fieldwork/project work report not exceeding10 pages in the given format to the teacher.*
13. *Max marks for Fieldwork/projectworkReport:05.*
14. *Suggested Format for Fieldwork/project work*
15. *Unit tests (IE).*

f)*Suggested Co-Curricular Activities*

10. *Training of students' by related industrial experts.*
11. *Assignments, Seminars and Quiz (on related topics), collection of videos and other material.*
12. *Visits of facilities, firms, research organizations etc.*
13. *Invited lectures and presentations on related topics by field/industrial experts*

CO-PO Mapping:													
	PO1	PO2	PO3	PO4	PO5	PO6	PO/	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	1	1	2	3	1	1	1	2	1	3	3	1
CO2	3	2	1	3	3	2	2	1	1	3	3	3	1
CO3	3	2	2	1	3	1	1	1	1	1	3	2	1
CO4	3	2	2	1	3	1	1	1	1	1	3	2	1
Avg.	3	1./5	1.5	1./5	3	1.25	1.25	1	1.25	1.5	3	2.5	1

PO1: Knowledge in Chemistry: Apply the knowledge of synthetic organic chemistry to the solution of simple to complex synthesis of organic molecules

PO2: Problem analysis: Identify, formulate, review research literature, and analyze simple to complex problems reaching substantiated conclusions using fundamental principles of synthetic organic 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 of complex problems: Use fundamental research-based knowledge and available research methods including design of experiments, analysis and interpretation of data, and synthesis of the organic molecules.

PO5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and IT toolsformodelingandinterpretationofsimpletocomplexorganicmolecules.

PO6: Society: Applying the contextual knowledge to assess societal, health, safety, legal and cultural issues.

PO7: Environment and sustainability: Understand the importance of synthetic organic chemistry for various solutions in societal and environmental context and demonstrate the knowledge and need for sustainable development.

PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the science-based practice.

PO9: Communication: Communicate effectively on issues related to synthetic organic chemistry with the chemistry community, being able to write the effective reports and documentation, presentations.

PO10: Life-long learning: Recognize the need for, and have the preparation and abilitytoengageinindependentandlifelonglearninginthebroadestcontextoftechnologicalchange.

PSO-1: To have a firm foundation in the fundamentals/concepts/theoriesanditsapplicationsinsyntheticorganicchemistry.

PSO-2: To understand the structure and properties of reagents, Characteristics mechanisms of chemical reactions and their synthetic utility.

PSO-3: To acquaint with safety measures in laboratory and develop skills in proper handling of chemicals and apparatus/instruments and carry out experiments, record the observations and present the inference/results

	Pithapur Rajah's Government College (Autonomous) Kakinada	Program &Semester II M.Sc. Analytical Chemistry Semester-IV			
Course Code	**PAPER – IV** **INSTRUMENTAL METHOD OF ANALYSIS-II**				
Teaching	**Hours Allocated: 60(Theory)**	*L*	*T*	*P*	*C*
Pre-requisites	*Instrumental analysis*	*60*	*10*	*30*	*4+4*

Course Objectives:

Studytheinstrumentationofatomicspectroscopyandelectroanalyticalmethods

Course Outcomes:

On Completion of the course,the students will be able to	
CO1	*Students will be able to know about atomic spectroscopy*
CO2	*To understand the analysis TG, DTA and DSC*
CO3	*Students will gain knowledge one elector analytical methods*
CO4	*To understand the analysis of radio chemical methods*

Skill Development		*Employability*		*Entrepreneurship*	

SYLLABUS:

Unit 1: Spectro-analytical Methods of Analysis

(a) Flame photometry: *theory. instrumentation, combustion flames, detectors, and analysis of Na. K. Ca. Mg*

(b) Atomic Absorption Spectrometer*: theory, instrumentation. flame and non-flame techniques, resonance line sources, hollow cathode lamp, instrumentation, chemical and spectral interferences, applications with special reference to analysis of trace metals in oils, alloys and toxic metals in drinking water and effluents*

(c) Inductively coupled plasma spectrometer(ICP-AES, ICP-MS): *principles, instrumentation, plasma, AES detectors, quadrupole mass spectrometers, differencebetweenthe two detectors, analysis methods for liquids and solids, applications in the analysis oftraceand toxic metals in water, geological and industrial samples.*

(d) Arc and Spark spectrographic Direct analysis of solid for metals.

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Unit - II Thermal methods of Analysis

(a) *Thermogravimetry-theory, instrumentation, applications with special reference to* $CuSO_4.5H_2O$, $CaC_2O_4.2H_2O$, $CaCO_3$, $(COOH)_2.2H_2O$

(b) *Differential thermal analysis-principle, instrumentation, difference between TG and DTA -applications with special reference to the clays and minerals, coals (fuels) Differential scanning calorimetry-*

(c) *principle, instrumentation, applications to inorganic materials like chlorates and per chlorates, ammonium nitrate, organic compounds and Drugs.*

Unit- III : Electro analytical Methods of Analysis - 1

(a)Voltametry and polarographic analysis: *principle of polarography, residual current, migration current, diffusion current, half-wave potential, Ilkovic equation, instrumentation, Dropping mercury electrode (DME), advantages and disadvantages of DME, qualitative and quantitative analysis of inorganic ions-Cu, Bi, Pb, Cd, Zn, AC polarography, pulse polarography*

(b)Anode stripping voiltametry:

principle, instrumentation, Hanging mercury drop electrode, application in the analysis of Pb and Cd in environmental samples, principle of cathode stripping voltametry.

(c) Coulometric analysis: *principles of coulometric analysis with constant current, coulometric analysis with controlled potential, applications of coulometric methods for the analysis of cations-As (III), Fe (II) and I^- and S^{2-} by using I_2 liberations and Ce^{4+} liberation in solution*

Unit – IV Electro Analytical and Radio chemical methods of analysis – 2

(a)Ion Selective Electrodes: *reference electrodes – hydrogen electrode, calomel electrode, silver chloride electrode ;indicator electrodes – hydrogen and glass electrodes, theory of membrane potentials and liquid junction potentials, types of ion selective electrodes, basic properties, potentials and construction, calibrationofionselectiveelectrodes,ionselectiveelectrodeswithfixedmembranesites,silver,lead, cadmium, sulfide, fluoride, cyanide and glass electrodes, applications in the analysis of air and water pollutants,principlesofliquidmembrane,gassensingandenzymebasedelectrode*

(b) Radio chemical methods of analysis: *detection and measurement of radioactivity, introduction to radioactive tracers, applications of tracer technique, isotope dilution analysis-applications, activation analysis–application, advantages and disadvantages, radio carbon dating technique*

Reference Books:

1. *Instrumental methods of analysis–H. H Willard, Meritt Jr. and J. ADean*
2. *Principles of instrumental analysis–Skoog and West*
3. *Vogels Text book of Quantitative Inorganic analysis– J. Basset, R. C Denney, G. H Jefferey and J. Madhan*
1. *Instrumental methods of analysis–B. K Sarma, Goel Publishing House, Meerut*
2. *Instrumental methods of Analysis–Chatwal and Anand*
3. *Instrumental methods of Analysis–Ewing*

Web Links:

https://youtu.be/-xYHKME72

https://youtu.be/0QEaYsQKsjc

https://youtu.be/pQdoH6WEfes

WEIGHTAGE TO CONTENT SEMESTER -IV

PAPER -IV

S. No	Course Content	Long Answer	Short Answer	Total marks	As per Blooms Taxonomy
1	*Atomic emission spectroscopy*	*2*	*2*	*36*	*Understanding, Application*
2	*Thermal methods of analysis*	*2*	*2*	*36*	*Remembering, Understanding*
3	*Electro analytical methods-I*	*2*	*2*	*36*	*Application Creation*
4	*Radio chemical methods*	*2*	*2*	*36*	*Remembering, Understanding*
	TOTAL	**8**	**8**	**144**	

PRGC (A) KAKINADA

PAPER -IV INSTRUMENTAL METHODS OF ANALYSIS -II

SEMESTER-IV

IMPORTANT QUESTIONS

Unit -1:

EASSYS:

1. Explain the basic principle of flame photometry with illustration
2. Write a detailed note on theoretical explanation of ICP-AES with examples
3. Write a brief note on atomic absorption spectrometer and also explain flame and non-flame technique
4. Write a detailed notes on theoretical explanation of ICP-MS with examples

SHORTS:

1. Write a brief note on detector of flame photometry
2. Mention brief application of ICP-AES
3. Determination of mg and ca by flame photometry
4. Determine the toxic metals in drinking water and effluents

Unit -2:

EASSYS:

1. Discuss about the thermogravimetry analysis and its applications
2. Write a detailed note on chlorate and per chlorate
3. Write a brief note on differential thermal analysis and its applications
4. Give a detailed account on differential scanning calorimetry and its applications

SHORTS:

1. Write a short note on CUSO4. 5H2O in thermogravimetry analysis
2. Write the difference between thermodynamics gravimetry and differential thermal analysis
3. Determine the purity of pharmaceutical drugs by differential scanning calorimetry
4. Write the application of differential thermal analysis

Unit -3:

EASSYS:

1. Discuss briefly about the polarographic analysis with applications
2. Write the theoretical explanation of cathode stripping voltametry and its applications
3. Write the theoretical explanation of anode stripping voltametry and its applications
4. Explain briefly about the coulometric analysis with examples

SHORTS:

1. What is meant by half - wave potential in polarographic analysis
2. Write a short note on dropping mercury electrode
3. Write applications in coulometric analysis
4. Write the short note on pulse polarography

Unit-4:

EASSYS:

1. Explain the 5 types of ion selective electrode
2. Explain about the liquid junction potential and reference electrodes
3. Discuss briefly about the radio carbon dating technique and its advantages
4. Write a brief account on radio activity and its applications

SHORTS:

1. What is meant by glass electrode
2. Write a note on isotope dilution analysis
3. Write a note on radioactive tracer
4. What is ion selective electrode

PITHAPUR RAJAH'S COLLEGE (A), KAKINADA

II YEAR MSC ANALYTICAL CHEMISTRY

(EXAMINATION AT THE END OF IV SEMESTER)

PAPER- IV: INSTRUMENTAL METHOD OF ANALYSIS-II

MODEL PAPER

Duration: 3 hrs. **Max. Marks: 75**

SECTION: A

Answer **ALL** questions **4X15=60**

1. *Explain the basic principle of flame photometry with illustration (B4-level)*

OR

2. *Write a brief note on atomic absorption spectrometer and also explain flame and non- flame technique (B1-level)*

3. *Discuss the principle of thermogravimetric analysis (B2-level)*

OR

4. *Give a detailed account on differential scanning Calorimetry and its applications (B1-level)*
5. *Give a brief account on Anode stripping of voltametry and analysis of Pb and Cd in environmental samples(B1-level)*

OR

6. *Explain briefly about the coulometric analysis with examples (B4-level)*

7. *Explain the 5 types of ion selective electrode ((B4-level)*

OR

8. *Discuss briefly about the radio carbon dating technique and its advantages (B2-level)*

SECTION-B

*Answer Any **FIVE** Questions* *(5 x 3 = 15)*

9. *Write a brief note on detector of flame photometry*
10. *Determine the toxic metals in drinking water and effluents*
11. *Write the difference between thermodynamics gravimetry and differential thermal analysis*
12. *Determine the purity of pharmaceutical drugs by differential scanning calorimetry*
13. *What is meant by half - wave potential in polarographic analysis*
14. *Write the short note on pulse polarography*
15. *What is meant by glass electrode*
16. *Write a note on isotope dilution analysis*

PITHAPUR RAJAH'S COLLEGE (A), KAKINADA

II YEAR M.Sc (EXAMINATION AT THE OF IV SEMESTER)

INSTRUMENTAL METHODS OF ANALYSIS – II

PRACTICALS

1. *pH metry*

(i) Determination of purity of commercial H_3PO_4 by pH metric titration

(ii) Determination of CH_3COOH by pH metric titration.

(iii)Determination of stability constant of copper glycinate

2. *Potentiometry*

(iii) Determination of Fe (II) using Mn (VII) of by potentiometric titration

(iv) Determination of Fe (II) using V(V) of by potentiometric titration

(iii)Determination of a mixture of Mn (VII) and V(V) with Fe (II) using potentiometric end point

(iv)Determination of a mixture of bromide and chloride with $AgNO_3$ usingpotentiometric end point

3. *Spectrophotometry*

(v) Determination of nitrite in drinking water samples by diazotization method

(vi) Determination of nitrate -phenol di sulphonic acid method

(vii) Simultaneous Determination of Cr(VI) and Mn(VII) in a mixture without separation

(viii) Determination of Cu(II) using EDTA – Photometric titration method.

4. *. Flame photometry*

(ix) Determination of Lithium by flame photometry

(x) Determination of calcium from milk samples using flame photometry

5. *Thin layer chromatography*

(xi) Separation and identification of the given mixture of colorless compounds (Diphenylamine, Benzophenone and Naphthalene)

(xii) Separation and identification of the given mixture of colored compounds(azobenzene, hydroxy azo benzene, p-amino azo benzene).

Co-Curricular Activities:

g) Mandatory:(

16.**For Teacher**:*Trainingofstudentsbyteacherinlaboratoryandfieldfornotlessthan15hours on the field techniques/skills of preparation of acetanilide, preparation of azo dye, use of separating funnel for solvent extraction, separation of organic compounds in a mixture.*

1/.**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 handwritten fieldwork/project work report not exceeding10 pages in the given format to the teacher.*

18.*Max marks for Field work/project work Report:05.*

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO/	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	3	3	2	3	3	3	1	1	3	3	2	2
CO2	3	3	3	2	3	3	3	1	1	3	3	2	2
CO3	3	3	3	2	3	3	3	1	1	3	3	2	2
CO4	3	3	3	2	3	3	3	1	1	3	3	2	2
Avg.	3	3	3	2	3	3	3	1	1	3	3	2	2

PO1: Knowledgein Chemistry: Apply the knowledge of synthetic organic chemistry to the solution of simple to complex synthesis of organic molecules

PO2: Problem analysis: Identify, formulate, review research literature, and analyze simple to complex problems reaching substantiated conclusions using fundamental principles of synthetic organic 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 of complex problems: Use fundamental research-based knowledge and available research methods including design of experiments, analysis and interpretation of data, and synthesis of the organic molecules.

PO5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and IT tools for modeling and interpretation of simple to complex organic molecules.

PO6: Society: Applying the contextual knowledge to assess societal, health, safety, legal and cultural issues.

PO/: Environment and sustainability: Understand the importance of synthetic organic chemistry for various solutions in societal and environmental context and demonstrate the knowledge and need for sustainable development.

PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the science-based practice.

PO9: Communication: Communicate effectively on issues related to synthetic organic chemistry

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

PSO-2: To understand the structure and properties of reagents, Characteristics mechanisms of chemical reactions and their synthetic utility.

PSO-3: To acquaint with safety measures in laboratory and develop skills in proper handling of chemicals and apparatus/instruments and carry out experiments, record the observations and presentthe inference/results

THANK YOU