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 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

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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.

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	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.

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

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

R.C.No.12A/A.C./BOS/2024-25, Dated:30-4-2024

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:

13. 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.
14. To discuss and approve the Continuation/Modifications of the syllabus for the Odd & Even Semesters of III & IV for 2024-2025.
15. Grant of Extra credits for Online SWAYAM MOOCs etc.
16. Syllabus, Model Question Papers and Model Blueprints, POs, PSOs & COs mapping for III and IV Semesters.
17. Minimum of 60% integration of ICT into transaction of curriculum.
18. 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.
19. Teaching learning methodology by 75:25 (External: Internal) ratio w.e.f. 2017-18 admitted batches and continued it.
20. Remedial coaching and Assignments for slow learners, project work, research, Conferences and CSIR NET&GATE coaching for advanced learners.
21. Panel of paper setters and examiners.
22. Proposals for project work in fourth semester for the benefit of students.
23. Department action plan for 2024-25. To discuss and resolve the minor modifications/refinement if any.
24. Any Other Proposal with the Permission of the Chairman.

The following paper setters are recommended.

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

10. Dr. D. Jaya Prashanthi Department of Chemistry, Andhra University, Visakhapatnam
11. Dr. S. K. Mustafa, Department of Chemistry, Dr, SKR Govt. College, Yanam.
12. Dr. B. Mallikarjun, Department of Chemistry, GDC(A), Rajamahendravaram.
13. Dr. K. Deepthi, Department of Chemistry, ANUR Rajamahendravaram
14. Dr. B. Jagan Mohan Reddy, Department of Chemistry, ANUR Rajamahendravaram
15. Dr. Ravindra Babu, Department of Chemistry, GDC, Tanuku
16. Dr. A. Chandraleela, Department of Chemistry, Andhra University, Visakhapatnam

ADDITIONS/DELETIONS IN COURSES CHEMISTRY 2024-2025

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

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

S. No	Semester	Title of the Paper	Theory/ Practical / Viva	Internal marks	External Marks	Total Marks	Credits
1	III	Organic Reaction Mechanisms – I & Pericyclic Reactions	T	25	75	100	4
2		Organic Spectroscopy-I	T	25	75	100	4
3		Modern Organic synthesis- I	T	25	75	100	4
4		Chemistry of Natural products-I	T	25	75	100	4
5		Multistep Synthesis of Organic Compounds:	P	25	75	100	4
6		Estimations and Chromatography	P	25	75	100	4
7	IV	Organic Reaction Mechanisms – II & Photo chemistry	T	25	75	100	4
8		Organic Spectroscopy-II	T	25	75	100	4
9		Modern Organic synthesis- II	T	25	75	100	4
10		Bio-organic chemistry	T	25	75	100	4
11		Chromatographic Separation and Isolation & identification of Natural Products	P	25	75	100	4
12		Spectral Identification of Organic Compounds ((UV, IR, ^{1}H- NMR, ^{13}C-NMR and Mass).	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. Organic Chemistry Semester-III**			
Course Code	TITLE OF THE COURSE **ORGANIC REACTION MECHANISMS-I & PERICYCLIC REACTIONS**				
Teaching	**Hours Allocated: 60(Theory)**	**L**	**T**	**P**	**C**
Pre-requisites:	**Migrations, Electron donating groups, Electron with drawing group, electronic effects, and shapes of orbits**	**60**	**10**	**30**	**4+3**

Course Objectives:

Study the basics of peri cyclic reactions and asymmetric synthesis.

On Completion of the course, the students will be able to	
CO1	Students will acquire holistic knowledge in nucleophilic and electrophilic aliphatic substitutions reactions
CO2	Students will get the understanding as well as analyzing skills in asymmetric synthesis.
CO3	Student will acquire knowledge on stability of products & mutual correlation b/w reactants and products of pericyclic reactions.
CO4	Student shall have analyzing and creative skills in applications of pericyclic reactions

Course with focus on employability / entrepreneurship / Skill Development modules

Skill Development		Employability		Entrepreneurship	

SYLLABUS:

UNIT-I

(A) Aliphatic Nucleophilic Substitution:

Neighboring group participation by Bromine, Phenyl group, Non–Classical carbocations, NGP by Pi bond, Sigma bond and Cyclopropyl group, SN at Allylic carbon (allylic rearrangements), SN at Aliphatic trigonal carbon, SN at Vinylic carbon, Ambident nucleophiles, Hydrolysis of esters (BAC2 Ac2, AAC1, AAL1, BAL1), Mechanism of esterification of carboxylic acid with an alcohol using DCC, Mayer's Synthesis of aldehydes, ketones and carboxylic acids, Mitsu Nobu reaction, Von–Braun reaction.

(B) Aliphatic Electrophilic Substitution:

Mechanisms of SE2, SE1, SEi, Hydrogen as electrophile: Hydrogen exchange; Migration of double bonds, Halogen electrophiles. Mechanism of Halogenation of aldehydes and ketones; HVZ reaction; Halogenation of Sulphoxides & Sulphones, Nitrogen Electrophiles: Aliphatic diazo coupling, Diazo transfer reaction, Carbon as Leaving groups: Decarboxylation of Aliphatic Acids; Dakin – West reaction; Haller–Bauer reaction.

UNIT – II

Principles of asymmetric synthesis:

(A) Introduction and terminology: Topicity in molecules Homotopic, stereo heterotopic (enantio topic and di stereo topic) groups and faces, symmetry, substitution and addition criteria. Prochirality nomenclature: Pro-R, Pro-S, Re and Si. Stereoselective reactions: Substrate stereoselectivity, product stereoselectivity, enantioselectivity and diastereo selectivity.

(B) Conditions for stereoselectivity: Methods for inducing enantio and Di stereoselectivity. Analytical methods: % Enantiomeric excess, enantiomeric ratio, optical purity % diastereomeric excess and diastereomeric ratio. Techniques for determination of enantiomeric excess, specific rotation, Chiral NMR; Chiral derivatizing agents, Chiral solvent, Chiral shift reagents and Chiral HPLC.

UNIT – III

Pericyclic Reactions-I

(A) Molecular orbital symmetry, frontier orbitals of ethylene, 1,3 Butadiene, 1,3,5-Hexatriene, allyl system, classification of pericyclic reactions FMO approach, Wood word-Hoffman correlation diagram method and perturbation of molecular (PMO)approach for the explanation of pericyclic reactions under thermal and photochemical conditions.

(B) Electrocyclic Reactions: Conrotatory and dis rotatory motions (4n) and (4n+2), allyl systems Cycloadditions: Antara facial and supra facial additions, notation of cycloadditions, (4n) and (4n+2) systems with a greater emphasis on (2+2) and (4+4) – cycloadditions, (2+2) - additions of ketenes and chelotropic reactions.

UNIT-IV

Pericyclic Reactions-II

(A) FMO approach and perturbation of molecular (PMO) approach for the explanation of sigma tropic rearrangements under thermal and photochemical conditions.

(B) supra facial and Antara facial shifts of H Sigma tropic shift involving carbon moieties, retention and inversion of configurations, (3, 3) and (5, 5) sigma tropic rearrangements detailed treatment of Claisen and Cope rearrangements, aza-Cope rearrangement and Barton reaction.

Unit No	Additions	Deletions	Expected levels of learning as per Blooms Taxonomy for assessment of CO	Percentage added/deleted
1	NIL	NIL	NIL	NIL
2		NIL	NIL	NIL
3		NIL	NIL	NIL
4		NIL	NIL	NIL

K1 = Remembering, K2= Understanding, K3= Applying, K4 = Analyzing, K5 = Evaluating, K6 = Create

Reference Books:

S. No	AUTHOR	TITLE	PUBLISHER
1	Jerry March	Advanced Organic Chemistry: Reactions Mechanisms and Structure	Tata McGraw Hill
2	Charles Dupey and O. Chapman	Molecular reactions and Photochemistry	PrenticeHall
3	T.H. Lowery and K.S. Richardson.	Mechanisms and Theory in Organic Chemistry	
4	L.N. Ferguson	The modern structural theory in Organic Chemistry	Prentice Hall
5	Jack Hine	Physical Organic Chemistry	Tata McGraw Hill
6	Francis A. Carey and Richard J. Sandenburg,	Advanced Organic Synthesis Part-A and Part B	
7	Christine Willis and Martin Willis	Organic Synthesis	Oxford Chemistry primers
8	ROC Norman and JM Coxon	Principles of Organic Synthesis	CBS,Publisher
9	M. B. Smith	Organic Synthesis	Tata McGraw Hill
10	Clayden,, Greeves and Stuwart Warren	Organic Chemistry	Oxford University Press
11	George S.Zweifel and Michael H. Nantz	Modern Organic Synthesis	W. H. Freeman & company
12	Turro	Organic Photochemistry	

Web Links

1. https://youtu.be/Mjck01ao9Mw
2. https://www.youtube.com/watch?v=k9j8e5uzg4&list=PLj_Alq7xw30kL1S84P_SMO2wSfkTeN6n_&index=2
3. https://www.youtube.com/watch?v=k9j8e5uzg4&list=PLj_Alq7xw30kL1S84P_SMO2wSfkTeN6n_&index=2

CO-PO Mapping

On Completion of the course, the students will be able to	
CO1	Students will acquire holistic knowledge in nucleophilic and electrophilic aliphatic substitutions reactions
CO2	Students will get the understanding as well as analysing skills in asymmetric synthesis.
CO3	Student will acquire knowledge in fundamentals of pericyclic reactions.
CO4	Student shall have analysing and creative skills in applications of pericyclic reactions

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

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 synthetic organic chemistry to the solution of simple to complex synthesis of organic molecules.

(PO2) Critical Thinking: Carry out experiments in the area of organic analysis, estimation of stereoselectivity, derivative process 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 synthetic 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 organic compound 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 mechanisms involved in the domain of Organic Chemistry.

PSO2 - Demonstrate the knowledge of asymmetric synthesis and pericyclic reactions in the domain of research, education and perspective entrepreneurship.

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

PITHAPUR RAJAH'S GOVERNMENT COLLEGE, KAKINADA

PG COURSES 2024-25

SYLLABUS FOR SEMESTER – III (MSC- ORGANIC CHEMISTRY)

PAPER I (ORGANIC REACTION MECHANISMS-I & PERICYCLIC REACTIONS)

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

II YEAR MSC ORGANIC CHEMISTRY (EXAMINATION AT THE END OF III SEMESTER)PAPER- I: ORGANIC REACTION MECHANISMS-I & PERICYCLIC REACTIONS MODEL PAPER

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

SECTION: A

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

1. How can you describe BT level-2
   i) Neighboring group participation (NGP) by bromine and phenyl groups. (10M)
   ii) Mitsu Nobu reaction. (5M)

(OR)

Illustrate the following reactions with suitable mechanism. BT level-3
   i) HVZ reaction (8 M)
   ii) Dakin- west reaction (7 M)

2. Discuss the following with relevant examples. BT level-2
   i) Homotopic and Heterotopic groups and faces. (10 M)
   ii) Pro-R and pro-S, Re and Si.

(OR)

   i) Describe Substrate stereo selectivity and product stereo selectivity. BT level-2
   ii) Explain Chiral shift reagents and chiral HPLC. BT level-4

3. a. How would you demonstrate the 1,3,5-hexatriene system by using wood ward Hoffmanncorrelation method (8M). BT level-3

   b) How would you distinguish between the terms DIS rotation and CON rotation with reference to electro cyclic reactions (7 M) BT level-2

(OR)

Apply Wood word Hoffman and correlation methods for 1,3 butadiene and 1,3,5hexatriene systems. (15 M) BT level-3

4. a) Construct a correlation diagram for the conversion of 4+4 system. BT level-3

   b) What can you point out about cope rearrangement? Explain its mechanism. How is Claisen rearrangement related to Cope rearrangement? BT level-4

(OR)

   a) How would you differentiate between (3, 3) and (5, 5) sigma tropic rearrangements? BT level-2

   b) What are the mechanistic steps involved in the Barton Reaction, and how do they lead to the formation of carbon-carbon bonds. BT level-3

SECTION: B

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

5. Discuss about hydrolysis of esters. BT level-2
6. How can you describe the aliphatic diazo coupling. BT level-1
7. Discuss about chiral NMR. BT level-2
8. What explanation do you have for enantiomeric excess and specific rotation.
9. Define pericyclic reaction& write classification of pericyclic reactions. - BT level-1
10. How would you differentiate the ANTRA FACIAL and SUPRA FACIAL. BT level-4
11. Illustrate Aza Cope rearrangement & write any 2 applications. BT level-3
12. Explain Fluxional tautomerism. BT level-4

	Pithapur Rajah's Government College (Autonomous) Kakinada	**Program & Semester II M.Sc. Organic Chemistry Semester-III**			
Course Code	**TITLE OF THE COURSE ORGANIC SPECTROSCOPY-II**				
Teaching	**Hours Allocated: 60(Theory)**	**L**	**T**	**P**	**C**
Pre-requisites:	**EMR, Basics of Organic Spectroscopy**	**60**	**10**	**-**	**4**

Course Objectives:

Study the UV, IR, NMR and Mass Spectroscopic Techniques.

Course Outcomes:

On Completion of the course, the students will be able to	
CO1	Student will be able to identify the conjugated double bonds in compounds
CO2	Will be able to draw the Stereo chemical structure of different molecules
CO3	Know how to solve problems base on H^1 and ^{13}C NMR
CO4	Understand methods of solving combines problem on all spectroscopy techniques

Course with focus on employability / entrepreneurship / Skill Development modules

Skill Development		Employability		Entrepreneurship	

SYLLABUS:

UNIT-I

UV-Visible spectroscopy:

(A) Beer-Lambert's Law-Deviations from Beers Law-Instrumentation-Mechanics of measurement- Energy transitions–Simple chromophores- Auxochrome, Absorption shifts (Bathochromic, Hypsochromic, Hyper chromic and Hypo chromic shifts) UV absorption of Alkenes-Polyenes unsaturated cyclic systems.

(B) UV absorption of carbonyl compounds: α, β-unsaturated carbonyl systems-UV absorption of aromatic systems-solvent effects-geometrical isomerism (Effective conjugation)-acid and base effects-typical examples-calculation of λ max values using Woodward Fisher rules, applications.

UNIT-II

Infrared spectroscopy:

(A) Mechanics of measurement-Fundamental modes of vibrations-stretching and bending vibrations- Factors effecting Vibrational frequency-hydrogen bonding, instrumentation of IR. Fingerprint region and its importance, sampling techniques.

(B) Typical group frequencies for –CH, -OH, N-H, C-C, -C=O and aromatic systems-Application in structural determination–Examples-simple problems.

UNIT-III

Nuclear Magnetic Resonance Spectroscopy (^{1}HNMR):

(A) Introduction: Basic principle of- NMR Nuclear spin- nuclear resonance-saturation-Relaxation- Instrumentation. Shielding and deshielding of magnetic nuclei-chemical shift and its measurements, factors influencing chemical shift –spin-spin interactions- factors influencing –coupling constant J and factors effecting J value.

(B) 13C NMR Spectroscopy: Similarities and Differences between PMR and CMR, general considerations, chemical shift (aliphatic, olefinic, alkyne, aromatic, hetero aromatic, and carbonyl carbon), coupling constants, typical examples of CMR spectroscopy-simple systems.

UNIT-IV

Mass spectrometry

(A) Introduction: Ion production-E1, C1, instrumentation, determination of Molecular weight and formulae-Behaviour of organic compounds in mass spectrometer- factors affecting fragmentation.

(B) Mass spectral fragmentation of organic compounds, Common functional groups, molecular ion peak, base peak, meta stable peak, Mc Lafferty rearrangement, Nitrogen rule. Examples of mass spectral fragmentation of organic compounds with respect of their structure determination.

Unit No	Additions	Deletions	Expected levels of learning as per Blooms Taxonomy for assessment of CO	Percentage added/deleted
1				
2				
3				
4				

K1 = Remembering, K2= Understanding, K3= Applying, K4 = Analyzing, K5 = Evaluating, K6 = Create

Reference Books:

S. No	AUTHOR	TITLE	PUBLISHER
1	W. Kemp	Organic Spectroscopy	ELBS Macmillan
2	D.H. Williams and I. Fleming	Spectroscopic Methods in Organic Chemistry	McGraw Hill
3	J.R.Dyer	Applications of absorption spectroscopy of Organic Compounds	Prentice Hall
4	Atta-Ur-Rehman	Nuclear Magnetic Resonance-Basic principles	, Springer-Verlag
5	G.C.Vassiellr and T.C. Merill	Spectrometric identification of Organic Compounds	Johne Willey,

Web Links

1. https://youtu.be/Mjck01ao9Mw
2. https://www.youtube.com/watch?v=k9j-8e5uzg4&list=PLj_Alq7xw30kL1S84P_SMO2wSfkTeN6n_&index=2
3. https://www.youtube.com/watch?v=k9j-8e5uzg4&list=PLj_Alq7xw30kL1S84P_SMO2wSfkTeN6n_&index=2

CO-PO Mapping

On Completion of the course, the students will be able to	
CO1	Student will be able to identify the conjugated double bonds in compounds
CO2	Will be able to draw the Stereo chemical structure of different molecules
CO3	Know how to solve problems base on H^1 and ^{13}C NMR
CO4	Understand methods of solving combines problem on all spectroscopy techniques

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

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

(PO1) Knowledge: Apply the knowledge of various Spectroscopic techniques to analysis of simple to complex organic molecules.

(PO2) Critical Thinking: Carry out experiments in the area of Spectroscopy to estimate the structure and chemical formula of the different organic compounds 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 Spectroscopic techniques.

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

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

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

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

PROGRAM SPECIFIC OUTCOMES (PSO's)

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

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

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

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

PITHAPUR RAJAH'S GOVERNMENT COLLEGE, KAKINADA

PG COURSES 2024-25

SYLLABUS FOR SEMESTER – III (MSC- ORGANIC CHEMISTRY)

PAPER II (ORGANIC SPECTROSCOPY-II)

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

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

PAPER- II: ORGANIC SPECTROSCOPY

MODEL PAPER

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

SECTION: A

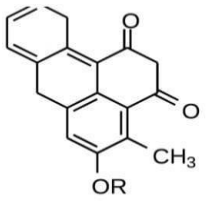
Answer **ALL** questions **4X15=**

1) a. i) Explore the principles 0f beer-lamberts law eloborate on deviation from beers law. Bt-1

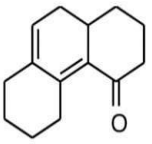
ii) explain briefly about absorption shifts

(OR)

b) Write about the wood-word Fischer rules and apply it for the calculation of λ_{max} of α, β- unsaturated carbonyl compounds? BT-4



AND



2. a) Write a short note about the following. BT-4

i) Analyse the fundamental modes of vibrations in molecular systems, differentiating between stretching and bending vibrations. BT-4

ii) discuss on factors effecting vibrational frequencies. BT-2

(OR)

b) Apply knowledge of vibrational spectroscopy and how to distinguish the following set of molecules. BT-3

i) Cis and Trans-2-butene.

ii) Mono and Di substituted benzene.

iii) Methyl benzoate & Phenylacetate

3. a) Write a note on shielding and deshielding of magnetic nuclei, explaining the 3 concept of chemical shift and its measurement. BT-2

b) illustrate the factors effecting chemical shift.

(OR)

b) Apply knowledge of 13C NMR spectroscopy and Predict the chemical shifts for the following molecules. BT-4

c) i)1-hexene and 1-hexyne.

d) ii) Ortho and Para hydroxy acetophenone.

4. a) i) Analyze the methods of ion production in mass spectrometry, such as El, and C1. BT-1

i) Explain MALDI and FAB

ii) Factors effecting fragmentation

(OR)

b) Write a note on the general mode of fragmentation patterns for the following functional groups i) Alkynes ii) Alcohols iii) Amines. BT-4

SECTION: B

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

5. Describe the concept of energy transitions in UV-Visible spectroscopy and provide an example. BTI
6. Apply the concept of solvent effects to explain the UV absorption of carbonyl compounds.BT3
7. Define the fingerprint region in infrared spectroscopy and explain its significance. BTI
8. Write the IR values of acetophenone,2-Propanol and o-cresol. BT-3
9. Write the ^{13}C chemical shift values of aliphatic, olefinic, alkane, aromatic and heteroaromatic, carbonyl compounds. BT-3
10. Differentiate between PMR & CMR BT-1
11. Explain the significance of molecular ion peaks and meta-stable peaks in mass spectrometry. BT-2
12. Discss about nitrogen rule. BT-2

	Pithapur Rajah's Government College (Autonomous) Kakinada	**Program & Semester II M.Sc. Organic Chemistry Semester-III**			
Course Code	**TITLE OF THE COURSE MODERN ORGANIC SYNTHESIS-I**				
Teaching	**Hours Allocated: 60(Theory)**	**L**	**T**	**P**	**C**
Pre-requisites:	**Basics of Organic Reagents**	**60**	**10**	**30**	**4+3**

Course Objectives:

Study the reactions involving C-C, C=C, protecting groups and about phase transfer catalyst.

Course Outcomes:

On Completion of the course, the students will be able to	
CO1	Students will be able to analyse the difference in the basic types of organic chemistry
CO2	Students will be able to analyse the difference in the coupling reactions
CO3	Students will able to know about Functional group transformations of Organoboranes
CO4	Students will be able to understand, how to protect and de protect the particular functional groups

Course with focus on employability / entrepreneurship / Skill Development modules

Skill Development		Employability		Entrepreneurship	

SYLLABUS:

UNIT-I

Formation of C-C single bonds

(A) Alkylation via enolate, Thermodynamic and kinetic enolate, Asymmetric Aldol reaction: a) Chiral enolate and achiral aldehyde b) Achiral enolate and chiral aldehyde – explanation by Zimmerman Traxler model; stork enamine reaction and its synthetic applications; Organo Sulphur chemistry: Umpolung and its synthetic applications (Corey Seebach Reaction), sulphurylides: dimethyl Sulphonium methylide, dimethyl oxosulphonium methylide preparations and their synthetic applications.

(B) Organo Palladium Chemistry: Heck Reaction, Stille coupling, Suzuki coupling, Sonogashira coupling, Negeshi coupling, Wacker Oxidation; Organo copper chemistry: Gilman's reagent and synthetic applications; Synthetic applications of carbenes and carbenoids; Baylis Hilman reaction. Kulinkovich Reaction

UNIT-II

Formation of Carbon-Carbon double bonds

(A) Stereochemistry of E1 and E2 reactions (Different examples of acyclic and cyclic molecules, Saytzeff rule, Hofmann rules and Bredt's rule); Pyrolytic Syn eliminations (focus should be given on stereochemistry of syn eliminations of amine oxides, xanthates and esters of acyclic and cyclic molecules); Sulphoxide-Sulphenate rearrangement (Mislow-Evans rearrangement)

(B) Wittig reaction, Wittig-Horner reaction and stereo chemistry of Wittig reaction; Shapiro reaction, Claisen rearrangement of allyl vinyl ethers, Julia Lythgoe olefination, Mc Murray coupling, Peterson Olefination, Tebbs reagent and its application, Metathesis: Grubbs 1st and 2nd generation catalysts, Olefin cross coupling (OCM), ring closing (RCM) and ring opening (ROM) metathesis, olefination by Nysted reagent.

UNIT-III

Reactions of Un activated C-H bonds and organoboranes.

(A) The Hoffmann Loeffler- Freytag reaction, Barton reaction and Photolysis of organic hypohalites; Organo boranes: Preparation of Organo boranes viz hydroboration with BH3-THF, dicylohexylborane, disiamylborane, thexylborane, 9- BBN mono isopinocamphlyl borane (IPCBH2) and diisopinocamphenylborane (IPC2BH)

(B) Functional group transformations of Organoboranes-Oxidation, protonolysis and isomerization. Formation of carbon-carbon-bonds viz organoboranes carbonylation and cyanidation.

UNIT-IV

Protecting groups and Synthetic applications of PTC and crown ethers

(A)Protecting Groups

1) Protection of alcohols as ethers [methyl ether (RO-Me), Tertiary butyl ether (ROCMe3), Benzyl ethers (RO-Bn), as Silyl ethers [Trimethyl silyl ether (R-OTMS), tri ethyl silyl ethers (RO-TES), t-butyl dimethyl silyl ether(ROTBDMS in the presence of imidazole), t-butyl diphenyl silyl ether (RO-TBDPS)], as acetals [tetra hydro pyranyl ethers(RO-THP),

2) Protection of 1,2-diols by acetal, ketal and carbonate formation.

3) Protection of amines by acetylation, benzoylation, benzoyloxy carbonyl, FMOC and triphenyl methyl groups.

4) Protection of carbonyl by acetal, ketal and thioacetal (Umpolung) groups.

5) Protection of carboxylic acids by esters and ortho ester formation.

(B) Phase Transfer Catalysts: Synthetic applications of PTC and crown ethers

Unit No	Additions	Deletions	Expected levels of learning as per Blooms Taxonomy for assessment of CO	Percentage added/deleted
1	Kulinkovich Reaction		K3	2%
2				
3				
4				

K1 = Remembering, K2= Understanding, K3= Applying, K4 = Analyzing, K5 = Evaluating, K6 = Create

Reference Books:

S. No	AUTHOR	TITLE	PUBLISHER
1	Francis A. Carey and Richard J. Sandenburg,	Advanced Organic Synthesis Part-A and Part B	
2	Christine Willis and Martin Willis	Organic Synthesis	Oxford Chemistry primers
3	ROC Norman and JM Coxon	Principles of Organic Synthesis	CBS,Publisher
4	M. B. Smith	Organic Synthesis	Tata McGraw Hill
5	Clayden,, Greeves and Stuwart Warren	Organic Chemistry	Oxford University Press

Web Links:

1. https://youtu.be/Mjck01ao9Mw
2. https://www.youtube.com/watch?v=k9j-8e5uzg4&list=PLj_Alq7xw30kL1S84P_SMO2wSfkTeN6n_&index=2
3. https://www.youtube.com/watch?v=k9j-8e5uzg4&list=PLj_Alq7xw30kL1S84P_SMO2wSfkTeN6n_&index=2

CO-PO Mapping

On Completion of the course, the students will be able to	
CO1	Students will be able to analyse the difference in the basic types of organic chemistry
CO2	Students will be able to analyse the difference in the coupling reactions
CO3	Students will able to know about Functional group transformations of Organoboranes
CO4	Students will be able to understand, how to protect and de protect the particular functional groups

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

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

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

(PO2) Critical Thinking: Carry out experiments in the area of organic analysis, estimation, organoboranes and synthetic application of PTC 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 synthetic applications of PTC and synthetic 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 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 mechanisms involved in the domain of organic Chemistry.

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

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

PITHAPUR RAJAH'S GOVERNMENT COLLEGE, KAKINADA
PG COURSES 2024-25
SYLLABUS FOR SEMESTER – III (MSC- ORGANIC CHEMISTRY)
PAPER III (MODERN ORGANIC SYNTHESIS-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 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

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

PAPER- III: MODERN ORGANIC

SYNTHESISMODEL PAPER

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

SECTION: A

All questions carry equal marks. 4x15=60 Marks

1. a) Discuss the synthetic applications of

I) Gilman's Reagent ii) Umpolung. BT-2

(OR)

b) Write a note on the following reactions and their synthetic applications. BT2

i) Stille coupling Reaction.
ii) Sonagashira Reaction.
iii) Negeshi coupling Reaction.

2. a. i) Explain the Sulphoxide-Sulphenate rearrangement (Mislow-Evans rearrangement). Discuss the mechanism and providing examples of its synthetic applications. BT-2
II) Discuss Pyrolytic Syn eliminations & stereochemistry of amine oxides, xanthates.

(OR)

b. i) Define and explain stereochemistry of Wittig reaction. And explain wittig horner reaction

BT-2

ii) explain briefly about Julia-lythgoe reaction with any two applications

3. I) Write a note on the Barton & HLF reaction with a suitable example. And its synthetic applications. BT-4

(OR)

ii) analyze the functionalm group transformations of organo boranes. BT-3

4. a) Explain the protection and deprotection of alcohols as silyl ethers, such as trimethyl silylether, triethyl silyl ethers, and t-butyldimethylsilyl ether. Discuss the conditions, selectivity, and applications of these protecting groups. BT-3

(OR)

b) What is PTC? Write the different types of phase transfer catalysts (PTC) and crown ethers. Discuss the mechanisms and strategic use of these catalysts in organic reactions.

BT-2

SECTION-B

Answer Any **FIVE** Questions (5 x 3 = 15 M)

1. Write about Heck coupling. BT-1
2. Describe the synthetic applications of Gilman's reagent. BT1
3. Discuss Hoffmann & saytzeff rule. BT-2
4. Write about the Olefination by Nysted reagent. BT-1
5. Explain the mechanism and stereochemical outcomes of the photolysis of organic hypohalites. BT2
6. Write a note on hydroboration with mono-isopinocamphyl borane (IPCBH2), and diisopinocamphenyl borane (IPC2BH). BT-2
7. Define and explain the concept of acetals and provide examples of their formation. BT-1
8. Explain the mechanisms and synthetic applications of protecting amines by acetylation BT-2

	Pithapur Rajah's Government College (Autonomous) Kakinada	Program & Semester II M.Sc. Organic Chemistry Semester-III			
Course Code	TITLE OF THE COURSE CHEMISTRY OF NATURAL PRODUCTS				
Teaching	Hours Allocated: 60(Theory)	L	T	P	C
Pre-requisites:	Classification of alkaloids, terpenoids, steroids, flavonoids and iso flavonoids	60	10		4

Course Objectives:

Study the structural illustration and synthesis of Alkaloids, Terpenoids, Steroids, Flavonoids and Isoflavonoids.

Course Outcomes:

On Completion of the course, the students will be able to	
CO1	Understand the alkaloids structures and its synthesis
CO2	Acquire knowledge on terpenoids structures and its synthesis
CO3	Inculcate knowledge on steroids structures and its synthesis
CO4	Acquire knowledge on flavonoids and iso flavonoids structures and its synthesis

Course with focus on employability / entrepreneurship / Skill Development modules

Skill Development		Employability		Entrepreneurship	

SYLLABUSUNIT–

I:

Alkaloids

(A) Introduction, isolation, general methods of structure elucidation and physiological action, classification based on nitrogen hetero cyclic ring, structure, stereochemistry, synthesis and biosynthesis of Morphine, Strychnine Structure, stereochemistry, synthesis and biosynthesis of Colchicine and Reserpine.

UNIT–II:

Terpenoids

(A) Occurrence, isolation, general methods of structure determination, isoprene rule. Structure determination, stereochemistry, biosynthesis and synthesis of Farnesol, Zingiberene, Taxol
(B) Structure determination, stereochemistry, biosynthesis and synthesis of Forskolin, Azadirachtin and β- amyrin.

UNIT–III:

Steroids

(A) Occurrence, nomenclature, basic skeleton, Diel's hydrocarbon and its stereochemistry. Isolation, structure determination and synthesis of cholesterol (total synthesis not expected),
(B) Isolation, structure determination and synthesis of Androsterone, Testosterone and Progesterone.

UNIT–IV:

Flavonoids and Iso flavonoids

(A) Occurrence, nomenclature and general methods of structure determination, Isolation, structure elucidation and synthesis of Quercetin, Cyanidin, Genistein,
(B) Isolation, structure elucidation and synthesis of Kaempferol, Butein and Daidzein. Biosynthesis of Flavonoids and Iso flavonoids.

Unit No	Additions	Deletions	Expected levels of learning as per Blooms Taxonomy for assessment of CO	Percentage added/deleted
1	NIL	NIL	NIL	NIL
2	NIL	NIL	NIL	NIL
3	NIL	NIL	NIL	NIL
4				

K1 = Remembering, K2= Understanding, K3= Applying, K4 = Analyzing, K5 = Evaluating, K6 = Create

Reference Books:

S. No	AUTHOR	TITLE	PUBLISHER
1	P. S. Kalsi	Chemistry of Natural products	Kalyani Publishers
2	O. P. Agrawal	Chemistry of Organic Natural Products	Goel Pubs
3	Atta-ur-Rahman and M.I. Choudhary.	New Trends in Natural Products Chemistry, Atta-ur-Rahman and M.I.Choudhary, Harwood Academic Publisher	Harwood Academic Publisher
4	J. H. Richards & J. R. Hendrieson	Biosynthesis of steroids, terpenes and acetogenins, J. H. Richards & J. R. Hendrieson	Prentice Hall

Web Links:

1. https://youtu.be/Mjck01ao9Mw
2. https://www.youtube.com/watch?v=k9j-8e5uzg4&list=PLj_Alq7xw30kL1S84P_SMO2wSfkTeN6n_&index=2
3. https://www.youtube.com/watch?v=k9j-8e5uzg4&list=PLj_Alq7xw30kL1S84P_SMO2wSfkTeN6n_&index=2

CO-PO Mapping

	On Completion of the course, the students will be able to
CO1	Recognize and draw particular alkaloids structures and its synthesis
CO2	Recognize and draw particular terpenoids structures and its synthesis
CO3	Recognize and draw particular steroids structures and its synthesis
CO4	Recognize and draw particular flavonoids and iso flavonoids structures and its synthesis

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

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

(PO1) Knowledge: Apply the knowledge of chemistry of Natural products to the solution of simple to complex synthesis of alkaloids and terpenoids.

(PO2) Critical Thinking: Carry out experiments in the area of organic analysis, estimation of structural elucidation and spectral analysis of natural products 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 Natural products.

(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 mechanisms involved in the domain of chemistry of Natural Products.

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

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

PITHAPUR RAJAH'S GOVERNMENT COLLEGE, KAKINADA
PG COURSES 2024-25
SYLLABUS FOR SEMESTER – III (MSC- ORGANIC CHEMISTRY)
PAPER IV (CHEMISTRY OF NATURAL PRODUCTS)
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

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

PAPER- IV: CHEMISTRY OF NATURAL PRODUCTS

MODEL PAPER

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

SECTION: A

All questions carry equal marks.

1. a) Apply the principles of stereochemistry in the synthesis and biosynthesis of Colchicine. BT-3

   Or

   b) Recall the structure and synthesis pathways of Morphine? BT-1

2. Analyze the stereochemistry in the biosynthesis of Farnesol and Taxol, elucidating key stereochemical features. BT-2

   Or

   b) analyze the structure and the synthesis of β-Amyrine? BT-2

3. a) Explain the structural elucidation & synthesis of Progesterone? BT-2

   Or

   i) Recall the basic skeleton and stereochemistry of Diel's hydrocarbon in steroids.BT-1

   ii. Analyze the isolation and synthesis methods of Cholesterol, emphasizing stereochemical considerations.BT-3

4. a) Analyze the structural features of Cyanidin and discuss its synthesis method.BT-2

   Or

   b) Apply knowledge of flavonoid biosynthesis to propose a synthetic route for a specific flavonoid.BT-3

SECTION-B

ANSWER ANY FIVE QUETIONS

1. Write the crucial intermediate in the synthesis of Morphine and its significance.BT-1
2. Write about the isolation of alkaloids?BT-1
3. Write synthesis & structure of Zingiberene.BT-1
4. Write the stereochemistry of Azadirectin? BT-1
5. Write about the distinctive structural feature of Androsterone.BT-2?
6. Explain briefly biosynthesis of steroids? BT-2
7. Describe the isolations of flavonoids and isoflavone
8. Briefly explain the nomenclature of Quercetin.Bt-2

SEMESTER-III

Laboratory Course-100 M

Multistep Synthesis of Organic Compounds:

The experiments should illustrate the use of organic reagents and may involve purification of the products by chromatographic techniques.

1. Beckmann rearrangement: Benzanilide from Benzophenone Benzophenone → Benzophenone oxime → Benzanilide

2. Benzilic acid rearrangement: Benzilic acid from benzoin Benzoin → Benzil → Benzilic acid

3. P-Bromo Aniline from Aniline:

Aniline → Acetanilide → P-Bromo Acetanilide → P-Bromo Aniline

4. Symmetrical Tribromo Benzene from aniline:

Aniline → Tribromoaniline→Tribromobenzene

5. 2,4,6-trimethylquinoline from p-toluidine

p-toluidne→ 4-(p-tolylamino) pent-3-ene-2-one → 2,4,6-trimethylquinoline

6. Flavone from o-hydroxy acetophenone

o-hydroxyacetophenone → o-benzoyl acetophenone → o-hydroxy- dibenzoylmethane Flavone

7. 2-phenylindole from phenylhydrazine

Phenylhydrazine →acetophenonephenylhydrazone→ 2-phenylindole

SCHEME OF VALUTION

Record= 10M

Viva= 15M

Chemicals required = 5M

Chemical equation = 15M

Procedure= 20M

Report= 10M

Total= 75M

SEMESTER-III

Laboratory Course-2 Estimations and Chromatography- 100 M

1. Estimation of (a) Glucose (b) Phenol (c) Aniline (d) Acetone (e) Aspirin (f) Ibuprofen (g) Paracetamol

2. Separation by column chromatography: Separation of a mixture of ortho and paranitro anilines using silicagel as adsorbent and chloroform as the eluent. The column chromatography should be monitored by TLC.

Books Suggested:

1. Modern Organic Synthesis in the Laboratory A Collection of Standard Experimental Procedures, Jie Jack Li,

Chris Limberak is, Derek A. Pflum

2. Practical organic chemistry by Mann & Saunders

3. Textbook of practical organic chemistry by Vogel

4. Textbook of practical organic chemistry including qualitative organic analysis by A.I. Vogel (Longman)

SCHEME OF VALUTION

RECORD= 10M

Viva= 15M

Chemicals required = 5M

Chemical equation = 15M

Procedure= 20M

Report= 10M

Total= 75M

PG II YEAR
IV SEMESTER

	Pithapur Rajah's Government College (Autonomous) Kakinada	**Program & Semester II M.Sc. Organic Chemistry Semester-IV**			
Course Code	**Paper – I : Organic Reaction Mechanism-II & Organic photochemistry-II**				
Teaching	**Hours Allocated: 60 (Theory)**	**L**	**T**	**P**	**C**
Pre-requisites:	Free radical reactions, Photo chemistry and asymmetric synthesis	60	10		4

Course Objectives:

1. Study the basics of Free radical reactions
2. Methodologies in Asymmetric Synthesis
3. Photo Chemistry

On Completion of the course, the students will be able to	
CO1	Students will acquire holistic knowledge in Free radical reactions
CO2	Students will get the understanding as well as obtain analyzing skills in the methodologies of asymmetric synthesis
CO3	Student will acquire knowledge on basics of Photochemistry.
CO4	Student shall have analying and creative skills in applications of Photochemistry

Course with focus on employability / entrepreneurship / Skill Development modules

Skill Development		Employability		Entrepreneurship	

SYLLABUS:

UNIT-I:

Free Radical Reactions:

Allylic halogenations using NBS (Wohl – Ziegler bromination); Hydroxylation at aromatic carbon by Fentons reagent; Oxidation of aldehydes to carboxylic acids; Formation of cyclic ethers using Lead tetraacetate; Formation of hydroperoxides (autooxidation);;Arylation of Aromatic compounds by diazonium salts(Gomberg – Bachman reaction); Mechanisms of Sand Meyer reaction, Hunsdiecker reaction, Reed

reaction.

(A) Rearrangements: Wagner – Meerwein Rearrangement, Demjanov Rearrangement, Wittig Rearrangement andStevens Rearrangement. Rearrangements to electron deficient nitrogen: Beckmann, Hofmann, Curtius, Schmidt and Lossen rearrangements.

UNIT– II:

Methodologies in asymmetric synthesis

(A) Strategies in Asymmetric Synthesis: l. Chiral substrate controlled, 2. Chiral reagent controlled and 3. Chiral catalyst controlled.

1. **Chiral Substrate controlled asymmetric synthesis**: Nucleophilic additions to chiral carbonyl compounds. 1, 2-asymmetric induction, Cram's rule and Felkin-Anh model.
2. **Chiral reagent controlled asymmetric synthesis**: Asymmetric reductions using BINAL-H. Asymmetric hydroboration using IPC_2 BH and $IPCBH_2$.

(B) 3. **Chiral catalyst controlled asymmetric synthesis**: Sharpless and Jacobsen asymmetric epoxidations. Sharpless asymmetric dihydroxylation. Asymmetric hydrogenations using chiral Wilkinson biphosphine and Noyoricatalyst. Enzyme mediated enantioselective synthesis.

UNIT – III

Photo Chemistry-I

(A) Photochemical energy, Frank Condon Principle, Types of Electronic Excitation and Molecular orbital view of excitation,Jablonski Diagram, singlet and triplet states, photosensitization, quenching, quantum efficiency and quantum yield. Photo Chemistry of Carbonyl Compounds: Norrish Type I reaction (alpha cleavage reaction), Norrish Type – II reaction.

(B) Paterno- Buchi reaction, Photo reduction & photo enolization ; photochemical Oxidations[Backstrom mechanism],Photooxidation of alkenes with singlet oxygen.

UNIT – IV

Photochemistry-II

(A) Di – Pi methane Rearrangement, Oxa di – Pi methane rearrangement; Aza di – Pi methanerearrangement; Photochemistry of Benzene and substituted benzene, 1, 2 , 1,3 ,& 1, 4- additions; Photo Fries rearrangement of Phenolic acetates and Anilides;Photochemistry of unsaturated systems, Cis- Trans Isomerisation of alkenes (Direct and sensitized) (Photoisomerisation of Stilbene), Photochemistry of Butadiene; Dimerisations of alkenes, Intramolecular dimerisation.

(B) Photochemical rearrangement of Cyclohexadienenones; Photochemistry of alpha, beta Unsaturated ketones (dimerisations and addition across the double bond); Photochemical rearrangement reactions of Cyclohexenone, Photorearrangements of Beta, gamma unsaturatedsystems (Mechanism of 1,2& 1,3 – acyl shifts); Photochemistry of Nitrite esters (Barton reaction).

Unit No	Additions	Deletions	Expected levels of learning as per Blooms Taxonomy for assessment of CO	Percentage added/deleted
1	NIL	NIL	NIL	NIL
2	NIL	NIL	NIL	NIL
3				
4				

K1 = Remembering, K2= Understanding, K3= Applying, K4 = Analyzing, K5 = Evaluating, K6 = Create

Reference Books:

S. No	AUTHOR	TITLE	PUBLISHER
1	Jerry March	Advanced Organic Chemistry: Reactions Mechanisms and Structure	Tata McGraw Hill
2	Charles Dupey and O. Chapman	Molecular reactions and Photochemistry	PrenticeHall
3	T.H. Lowery and K.S. Richardson.	Mechanisms and Theory in Organic Chemistry	
4	L.N. Ferguson	The modern structural theory in Organic Chemistry	Prentice Hall
5	Jack Hine	Physical Organic Chemistry	Tata McGraw Hill
6	Francis A. Carey and Richard J. Sandenburg,	Advanced Organic Synthesis Part-A and Part B	
7	Christine Willis and Martin Willis	Organic Synthesis	Oxford Chemistry primers
8	ROC Norman and JM Coxon	Principles of Organic Synthesis	CBS,Publisher
9	M. B. Smith	Organic Synthesis	Tata McGraw Hill
10	Clayden,, Greeves and Stuwart Warren	Organic Chemistry	Oxford University Press
12	Turro	Organic Photochemistry	

Web Links

4. https://youtu.be/Mjck01ao9Mw
5. https://www.youtube.com/watch?v=k9j-8e5uzg4&list=PLj_Alq7xw30kL1S84P_SMO2wSfkTeN6n_&index=2
6. https://www.youtube.com/watch?v=k9j-8e5uzg4&list=PLj_Alq7xw30kL1S84P_SMO2wSfkTeN6n_&index=2

CO-PO Mapping

On Completion of the course, the students will be able to	
CO1	Students will acquire holistic knowledge in Free radical reactions
CO2	Students will get the understanding as well as obtain analyzing skills in the methodologies of asymmetric synthesis
CO3	Student will acquire knowledge on basics of Photochemistry.
CO4	Student shall have analysing and creative skills in applications of Photochemistry

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

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 methodologies of asymmetric synthesis and photo chemistry to the solution of simple to complex synthesis of organic molecules.

(PO2) Critical Thinking: Carry out experiments in the area of organic analysis, estimation, derivative process, free radical mechanism and photo chemical processes 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 rearrangements and methodologies of asymmetric synthesis.

(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 mechanisms involved in the domain of organic Chemistry.

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

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

PITHAPUR RAJAH'S GOVERNMENT COLLEGE, KAKINADA
PG COURSES 2024-25
SYLLABUS FOR SEMESTER – IV (MSC- ORGANIC CHEMISTRY)
PAPER-I: ORGANIC REACTION MECHANISM-II & ORGANIC PHOTOCHEMISTRY - II
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

II YEAR MSC ORGANIC CHEMISTRY (EXAMINATION AT THE END OF IV SEMESTER)

PAPER-I: ORGANIC REACTION MECHANISM-II & ORGANIC PHOTOCHEMISTRY - II

MODEL PAPER

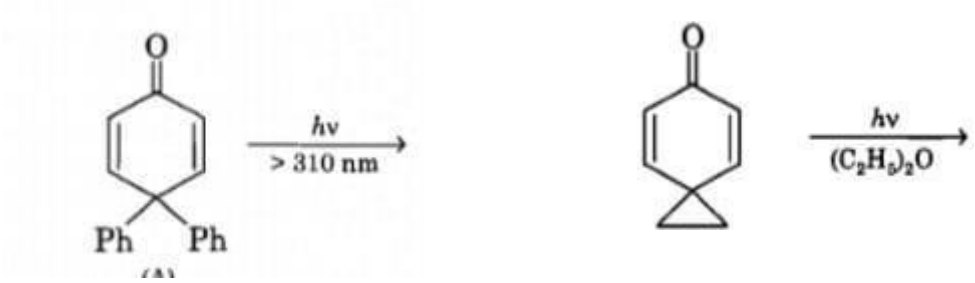
Duration: 3 hrs **Max. Marks: 75**

SECTION: A

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

1. a) Explain the mechanism of
   i) wagner-meerwein rearrangement ii) Hunsdiecker reaction. BT-4
   (Or)
   b) Discuss the following reactions with examples. BT-2
   i) Curtius, smidth and Lossen Rearrangement reactions
   ii) Wittig rearrangement
2. a) Explain the asymmetric hydrogenation using chiral Wilkinson biphosphine
   (Or)
   b) Explain about Crams rule and Felkhin-Anh model. BT-4.
3. a) Discuss in detail about i) Norrish type-I ii) Norrish type-II. Bt-2
   (Or)
   b) Explain the fluorescence, phosphorescence and Jablonski diagram. BT-4

4 a) i) write the reaction mechanism of Aza- di pi methane rearrangement. Bt-1
   ii) Analyze the mechanistic steps involved in the Barton Reaction. BT-5
   (OR)
   write products for the reactions of following reactions.



SECTION: B

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

5. Write about Demjanov rearrangement? BT-1
6. Discuss Gombergs-bachmann reaction. BT-2
7. Define assymetric synthesis and Classify the types? BT-3
8. Explain the use of chiral auxiliaries in Diels alder reaction? BT-4
9. Describe how the Franck-Condon principle explains the relative intensities of electronic transitions in a molecule. BT-2
10. Write a short on types of electronic excitation? BT-1
11. Discuss the photo chemistry of α, β unsaturated ketones? BT-2
12. Explain the mechanism of photo fires rearrangement? BT-4

	Pithapur Rajah's Government College(Autonomous) Kakinada	**Program & Semester II M.Sc. Organic Chemistry Semester-IV**			
Course Code	**TITLE OF THE COURSE ORGANIC SPECTROSCOPY-II**				
Teaching	**Hours Allocated: 60(Theory)**	**L**	**T**	**P**	**C**
Pre-requisites:	**EMR, Basics of Organic Spectroscopy**	**60**	**10**	**-**	**4**

Course Objectives:

Study the UV, IR, NMR and Mass Spectroscopic Techniques.

Course Outcomes:

On Completion of the course, the students will be able to	
CO1	Student will be able to learn about ORD&CD and also octant applications
CO2	Will be able to draw the structure of different molecules by using 2D NMR
CO3	Understand methods of solving combines problem on all spectroscopy techniques
CO4	Understand methods of chromatography

Course with focus on employability / entrepreneurship / Skill Development modules

Skill Development			Employability		Entrepreneurship	

SYLLABUS:

UNIT-I:

Optical Rotatory Dispersion (ORD) and CD spectroscopy:

(A) Optical Rotation, Circular birefringence, Circulardichroism and Cotton effect. Plane curves and Anomalous curves. Empirical and Semi empirical rules – The axial haloketone rule,

(B) The Octant rule and Helicity rule. Application of the rules to the study of absolute configuration andconfirmations of organic molecules.

UNIT-II

(A) Improving the PMR spectrum: Chemical and Magnetic Equivalence. Chemical exchange, First and Non-First OrderSpectra and analysis of AB, AMX and ABX systems. Simplification of complex spectra-: Nuclear Magnetic double resonance, Lanthanide shift reagents, solvent effects,Fourier transforms technique, Nuclear Overhauser Effect (NOE), Deuterium Exchange, spectra at higherfields. HinderedRotations and Rate processes. Resonance of other nuclei-19F and31 P

(B) 2D NMR spectroscopy: Definitions and importance of COSY, DEPT, HOMCOR, HETCOR, INADEQUATE,INDOR INEPT, NOESY.

UNIT-III

Solution of structural problems by joint application of UV, IR, NMR (^{1}H&^{13}C) and mass spectrometry.

UNIT-IV

(A) Separation Techniques: Solvent extraction chromatography-paper-thin layer partition-column chromatography,Electrophoresis.

(B) Instrumentation – Gas Chromatography, High performance Liquid Chromatography, X – Ray diffraction (XRD)

Unit No	Additions	Deletions	Expected levels of learning as per Blooms Taxonomy for assessment of CO	Percentage added/deleted
1	NIL	NIL	NIL	NIL
2				
3				
4				

K1 = Remembering, K2= Understanding, K3= Applying, K4 = Analyzing, K5 = Evaluating, K6 = Create

Reference Books:

S. No	AUTHOR	TITLE	PUBLISHER
1	D.H. Williams and I. Fleming	Spectroscopic Methods in Organic Chemistry- Forth Edition	Tata – McGraw Hill, NewDelhi, 1990.
2	W.Kemp	Organic Spectroscopy- Second Edition	ELBS Macmillan, 1987
3	R.M. Silverstein:G.C.Vassiellr and T.C. Merill	Spectrometric identification of Organic Compounds-Fourth Edition	Johne Willey, Singapore, 1981.
4	D.L.Pavia, G.M.Lampman, G.S.Kriz	Introduction to spectroscopy	Harcourt college publishers
5	H.Kaur	Instrumental methods of chemical analysis	PragatiPrakasan, meerut.

Web Links

https://www.youtube.com/watch?v=6WmWzkprmxI

https://www.youtube.com/watch?v=WTmj_9VT5oE

CO-PO Mapping

On Completion of the course, the students will be able to	
CO1	Student will be able to learn about ORD&CD and also octant applications
CO2	Will be able to draw the structure of different molecules by using 2D NMR
CO3	Understand methods of solving combines problem on all spectroscopy techniques
CO4	Understand methods of chromatography

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

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

(PO1) Knowledge: Apply the knowledge of various Spectroscopic techniques to analysis of simple to complex organic molecules.

(PO2) Critical Thinking: Carry out experiments in the area of Spectroscopy to estimate the structure and chemical formula of the different organic compounds 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 Spectroscopic techniques.

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

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

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

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

PROGRAM SPECIFIC OUTCOMES (PSO's)

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

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

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

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

PITHAPUR RAJAH'S GOVERNMENT COLLEGE, KAKINADA

PG COURSES 2024-25

SYLLABUS FOR SEMESTER – IV (MSC- ORGANIC CHEMISTRY)

PAPER II (ORGANIC SPECTROSCOPY-II)

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

II YEAR MSC ORGANIC CHEMISTRY (EXAMINATION AT THE END OF IV SEMESTER)

PAPER- II: ORGANIC SPECTROSCOPY-II

MODEL PAPER

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

SECTION: A

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

1. a) i) Describe briefly about plane curves and anamalous curves? Bt-2
   ii. Explain application in determining Configuration and confirmational changes? BT-4

   (Or)

   b) Explain octant rule importance and it's applications? BT-3

2. a) Describe the first order and non first order spectra with different examples?

   (Or)

   b) Explain with suitable examples of HECTOR; INDOR; DEPT. BT-4

3. An organic compound gives the following spectral data and find suitable structure with explanation BT-3

   a) MF:C3H7NO IR: cm-1 3580,2990,1690,1580,1400
   'HNMR :(cocl3 TMS) : 1.1(3H,triplet) 2.2(2H,quateret) 6.2 (2H,singlet)
   13CNMR : (cocl3) : 10(q) 30(t) H8(s)
   Mass m/z :73,57,55,44,29

   (OR)

   b) MF:C14H10O2 IR(cm-1) : 3050,1690, 1600-1480, 880 BT-3
   'HNMR (COCL3 TMS) : 7.5(4H ,multiplet) 7.67 (2H,multiplet) 7.9(4H,multiplet)ppm
   13CNMR (COCL3) : 130(d) 132(d) 134(s) 138(d) 195(s)
   mass m/z : 210, 105, 775

4.a) i) Discuss about paper chromatography? BT-2

   ii) How would you adapt column chromatography to separate compounds with similar polarities?

   (Or) BT-3

   c) I) Explain the principle and instrumentation and applications of Gas chromatography?

   ii) Explain the differences between normal-phase and reverse-phase HPLC. BT-4

SECTION: B

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

5. Describe alpha axial halo keto rule with examples. BT-1

6. Distinguish similarities and differences between ORD &CD. BT-2

7. Summarize ABX &AMX Spectral system. BT-2

8. Explain about lanthanoid shifts reagent? Bt-4

9. Predict 'HNMR and Mass spectral data for ethyl benzoate? Bt-3

10. A neutral compound of MF C10H12O gave the following data
    13CNMR signals ppm 22(q) 68(d) 128(d) 129(d) 131(s) 132(d) 166(s) with relative intensities 8:3:6:8:1:3:1 reduce its structure. Bt-3

11. Discuss solvent extraction? Bt-2

12. Write briefly on x- ray diffraction? Bt-1

	Pithapur Rajah's Government College (Autonomous) Kakinada	**Program & Semester II M.Sc. Organic Chemistry Semester-IV**			
Course Code	**TITLE OF THE COURSE Paper – III: Modern Organic Synthesis -II**				
Teaching	**Hours Allocated: 60(Theory)**	**L**	**T**	**P**	**C**
Pre-requisites:	Basics on Synthesis and reduction oxidation	**60**	**10**	**30**	**4+3**

Course Objectives:

Study the reactions involving C-C, C=C, protecting groups and about phase transfer catalyst.

Course Outcomes:

On Completion of the course, the students will be able to	
CO1	Students will be able to know different reactions of organo sillanes
CO2	Students will be able to understand, the importance of oxidation reagents.
CO3	Students will be able to understand, the importance of reduction reagents.
CO4	Student will get in depth in understanding basic and advance d concepts in retero synthetic analysis.

Course with focus on employability / entrepreneurship / Skill Development modules

Skill Development			Employability			Entrepreneurship	

SYLLABUS:

UNIT-I

OrganoSilanes

(A) Synthetic applications of trimethylsilyl chloride dimethyl-t-butylsilyl chloride, trimetthylsilyl cyanide, trimethylsilyl iodideand trimethylsilyltriflate, synthetic applications of α-silylcarbanion and β-silylcarbonium ions. Synthetic applications ofsilylenol ethers.

(B) Preparation and synthetic applications of alkynylsilanes, aryl silanes, allylsilanes and vinyl silanes,Nazarov cyclization, Synthetic conversion of α, β-epoxy silanes, Peterson Olefination, Brook rearrangement and Rubottomoxidation.

UNIT-II

Oxidation

(A) Synthetic applications of the following reagents in the oxidation of functional groups like alkenes, alkynes, alcohols,aldehydes and ketones:

1) $Pb(OAC)_4$ 2) HIO_4 3) SeO_2 4) Collins reagent, Jones reagent, PCC (Coreys reagent), PDC, Bableroxidation) 4) MnO_2 5) $KMnO_4$ 6) OsO_4 7) Swern oxidation.

(B) 8) Oxidations by using IBX, TEMPO 9) Bayer villageroxidation 10) Oxidation of alkenes using Woodward and Prevost rteagents 11) Oxidation by using DDQ 12) Sharplessa symmetric epoxidation and sharpless asymmetric dihydroxylation 13) Thallium nitrate

UNIT-III

Reduction

(A)(1) Catalytic reductions: Homogeneous (Wilkinson's Catalytic reduction) and heterogeneous catalytic reductions and theirsynthetic applications.

(2) Reductions by using electrophilic nucleophilic metal hydrides: $LiAlH_4$ (Various examples ofreductions and cram's rule), related reagents of LAH, $NaBH_4$, $NaBH_3CN$, TrialkylBorohydrides (Super Hydride and Selectride).

(B)(3) Reductions by using electrophilic metal hydrides: BH_3, DIBAL

(4) Reductions by dissolving metals: Clemenson reduction, Acyloin condensation, Bouveault-Blanc reduction, Birchreduction (Various examples should be discussed).

(5) Reductions by using Diimide and Wolf-Kishner Reduction

(6)Reductions by using tri n-butyl tin hydride.

UNIT-IV

Retro Synthetic Analysis

(A) 1. Basic definitions of the following: a) Retro synthetic analysis b) Disconnection c) Target molecule d) Synthon e) Syntheticequivalent f) Functional Group Inter Conversion (FGI) g) Functional Group Addition (FGA)

2. Guidelines for the order of events: One Group C-X disconnections (Carbonyl derivatives, ethers, sulphides and alcohols);

(B) Two group C-X disconnections (1,1-difunctionalised, 1,2-difunctionalised and 1,3-difunctionalised compounds), One groupC-C disconnections (Alcohols and carbonyl compounds, 1,1- C-C, 1,2-C-C and 1,3-C-C).Linear and convergent synthesis.

Unit No	Additions	Deletions	Expected levels of learning as per Blooms Taxonomy for assessment of CO	Percentage added/deleted
1	NIL	NIL	NIL	NIL
2				
3				
4				

K1 = Remembering, K2= Understanding, K3= Applying, K4 = Analyzing, K5 = Evaluating,

K6 = Create

Reference Books:

S. No	AUTHOR	TITLE	PUBLISHER
1	Francis A. Carey and Richard J. Sandenburg,	Advanced Organic Synthesis Part-A and Part B	
2	Christine Willis and Martin Willis	Organic Synthesis	Oxford Chemistry primers
3	ROC Norman and JM Coxon	Principles of Organic Synthesis	CBS,Publisher
4	M. B. Smith	Organic Synthesis	Tata McGraw Hill
5	Clayden,, Greeves and Stuwart Warren	Organic Chemistry	Oxford University Press

Web Links:

1. https://youtu.be/Mjck01ao9Mw
2. https://www.youtube.com/watch?v=k9j-8e5uzg4&list=PLj_Alq7xw30kL1S84P_SMO2wSfkTeN6n_&index=2
3. https://www.youtube.com/watch?v=k9j-8e5uzg4&list=PLj_Alq7xw30kL1S84P_SMO2wSfkTeN6n_&index=2

CO-PO Mapping

On Completion of the course, the students will be able to	
CO1	Students will be able to know different reactions of organo sillanes
CO2	Students will be able to understand, the importance of oxidation reagents.
CO3	Students will be able to understand, the importance of reduction reagents.
CO4	Student will get in depth in understanding basic and advance d concepts in retero synthetic analysis.

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

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

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

(PO2) Critical Thinking: Carry out experiments in the area of retro synthetic analysis and organo silanes 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 synthetic 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 (like UV-Vis, FTIR, NMR, GCMS, Fluorescence, SEM, TEM and XRD) for chemical analysis.

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

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

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

PROGRAM SPECIFIC OUTCOMES (PSO's)

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

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

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

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

PITHAPUR RAJAH'S GOVERNMENT COLLEGE, KAKINADA

PG COURSES 2024-25

SYLLABUS FOR SEMESTER – IV (MSC- ORGANIC CHEMISTRY)

PAPER III (MODERN ORGANIC SYNTHESIS-II)

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

II YEAR MSC ORGANIC CHEMISTRY (EXAMINATION AT THE END OF IV SEMESTER)

PAPER- III: MODERN ORGANIC SYNTHESIS-II

MODEL PAPER

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

SECTION: A

All questions carry equal marks. 4x15=60 Marks

1. a) Discuss synthetic applications of alkyl Silanes aryl Silanes and vinyl Silanes?

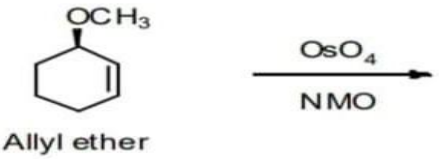
(Or)

b) Explain Peterson's olefination and brook rearrangement with applications?

2. a) Write the synthetic application of I) Pb(OAC)4 ii) Carey's reagent iii)DDQ

(Or)

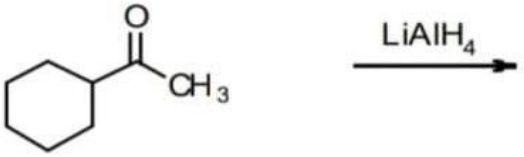
b) b) predict the product and write the suitable mechanism for the following reactions.

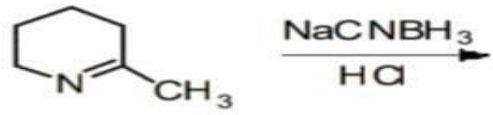


3. a) Compare and contrast the mechanisms of action of homogeneous and heterogeneous catalysts.

(Or)

c) predict the product and write the suitable mechanism for the following reactions.





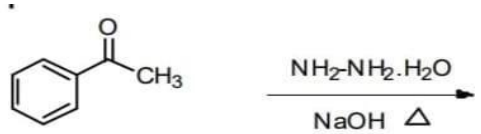
BT-3

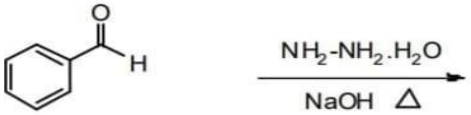
4. a) i) Define linear and convergent synthesis with taking any two molecules?
   ii) Explain functional group conversion and functional group addition with sutiable examples
   (Or)
   b) Describe one group C-C disconnection of Alcohol & carbonyl compounds. BT-2

SECTION-B

Answer Any **FIVE** Questions (5 x 3 = 15 M)

5. Discuss the synthetic application of sillyl enol ether? Bt-2
6. Write about the mechanism of Rubotton oxidation? Bt-1
7. Predict The Products Of the Following Reactions. Bt-3





8. Write about colling reagent? Bt-1
9. Discuss clemmenson reduction with applications? Bt-2
10. Explain the Bouveault- Blanc reduction? Bt-4
11. Write a short note on TM, synthons and synthetic? Bt-1
12. Write about 1,2 C-C disconnection? Bt-1

	Pithapur Rajah's Government College (Autonomous) Kakinada	**Program & Semester II M.Sc. Organic Chemistry Semester-IV**			
Course Code	**TITLE OF THE COURSE Paper – IV: Bio organic chemistry**				
Teaching	**Hours Allocated: 60(Theory)**	**L**	**T**	**P**	**C**
Pre-requisites:	Amino acids, oxytocin, DNA, RNA, peptides	60	10	30	4+4

Course Objectives:

Study the Biopolymers and Enzymes, Antimalarials& Antibiotics, Vitamins, Nucleic Acids.

Course Outcomes:

	On Completion of the course, the students will be able to
CO1	Understand and gain knowledge on biopolymers and Enzymes
CO2	Inculcate knowledge on Antimalarials & Antibiotics structures and its synthesis
CO3	Acquiring knowledge on Vitamins structures and its synthesis
CO4	Application of recombinant DNA technology in production of pharmaceuticals.

Course with focus on employability / entrepreneurship / Skill Development modules

Skill Development			Employability			Entrepreneurship	

SYLLABUS

UNIT-I

Biopolymers and Enzymes

(A) Peptides: α-Amino acids, their general properties and synthesis, Synthesis of peptides by Merrified solid phasesynthesis. Chemistry of oxytocin and dolastain-10.

(B) Enzymes-Oxidoreductases, hydrolases, transferases, synthesis of ATP, Baker's Yeast. Enzyme models.

UNIT-II

Antimalarials & Antibiotics

(A) Antimalarials: Chemotherapy, synthesis and activity of antimalarial drugs-quinoline group-quinine, acridine group quinacrine and guanidine group-paludrine.

(B) Antibiotics: General characteristics, structure- activity relationships, synthesis and activity of antibiotics: Pencillin G,Cephalosphorin-C and streptomycin.

UNIT-III

Vitamins

(A) Definition, occurence, structural formulae, physiological functions and synthesis of Vitamins. Retinol (A), Biotins(H), Nicotininc acid

(B) Structure determination and synthesis of Thiamine (B_1), Riboflavin (B_2), Pyridoxine (B_6) and.

UNIT-IV

Nucleic Acids:

(A) Nucleic acids: Basic concepts of the structures of RNA and DNA and their hydrolysis products, nucleotides, nucleosides and heterocyclic bases, Genetic Code, Finger Print test.

(B) Application of recombinant DNA technology in production of pharmaceuticals, diagnosis of diseases, insect control, improved biological detergents, gene therapy-examples.

Unit No	Additions	Deletions	Expected levels of learning as per Blooms Taxonomy for assessment of CO	Percentage added/deleted
1	NIL	NIL	NIL	NIL
2				
3				
4				

K1 = Remembering, K2= Understanding, K3= Applying, K4 = Analyzing, K5 = Evaluating, K6 = Create

Reference Books:

S. No	AUTHOR	TITLE	PUBLISHER
1	H.Dugas and C. Penney	Bio-organic Chemistry,	springer
2	John Man	Chemical Aspects of Biosynthesis	Oxford University Press
3	AStreitweiser, CH Heathcock and E.M./Kosover	Introduction to Organic Chemistry	Mc.Millan, University Press
4	N. R. Krishnaswamy	Chemistry of Natural Products	Mc.Millan, University Press

Web Links:

1. https://youtu.be/Mjck01ao9Mw
2. https://www.youtube.com/watch?v=k9j-8e5uzg4&list=PLj_Alq7xw30kL1S84P_SMO2wSfkTeN6n_&index=2
3. https://www.youtube.com/watch?v=k9j-8e5uzg4&list=PLj_Alq7xw30kL1S84P_SMO2wSfkTeN6n_&index=2

CO-PO Mapping

On Completion of the course, the students will be able to	
CO1	Recognize and draw particular alkaloids structures and its synthesis
CO2	Recognize and draw particular terpenoids structures and its synthesis
CO3	Recognize and draw particular steroids structures and its synthesis
CO4	Recognize and draw particular flavonoids and iso flavonoids structures and its synthesis

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

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

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

(PO2) Critical Thinking: Carry out experiments in the area of organic analysis, estimation, derivative process and spectral analysis 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 Bio 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 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.

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(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 mechanisms involved in the domain of Bio organic Chemistry.

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

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

PITHAPUR RAJAH'S GOVERNMENT COLLEGE, KAKINADA

PG COURSES 2024-25

SYLLABUS FOR SEMESTER – IV (MSC- ORGANIC CHEMISTRY)

PAPER IV (BIO 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

II YEAR MSC ORGANIC CHEMISTRY (EXAMINATION AT THE END OF IV SEMESTER)

PAPER- IV: BIO ORGANIC CHEMISTRY

MODEL PAPER

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

SECTION: A

All questions carry equal marks. 4x15=60 Marks

1. a) i) Explain Merrified solid phase synthesis of peptides. BT-4
   ii) Write the chemical properties of amino acids?
   (Or)
   b) Explain the structural determination and synthesis of oxytocin? BT-2

2. a) Describe the synthesis and structure activity relation for- pencillin ? BT-1
   (OR)
   Describe the synthesis & structutral activity of cephalosphorin-C? BT-1

3. a) Discuss the structure determination and synthesis of nicotinic acid? BT-2
   (OR)
   B)write a brief note on the Significance of biotin and describe the classification of thiamine? BT-2

4. i) what is genetic code and Explain its importance in protein synthesis? BT-1
   (O R)
   iii) Describe the structure of DNA and RNA molecules.
   iv) List the nitrogenous bases found in DNA and RNA

SECTION-B

Answer Any **FIVE** Questions (5 x 3 = 15 M)

5. write the advantages of merrified peptide synthesis? BT-1
6. Explain the synthesis of ATP? BT-4
7. Discuss the activity of anti- malarial drug? BT-2
8. Explain the general characteristics of penicillin? BT-4
9. Draw the classification of vitamins? BT-2
10. Write the biological activity of vit-B. BT-1
11. write about finger print test? BT-1
12. Define gene therapy?

SEMESTER-IV

Laboratory Course-1 100 M

Chromatographic Separation and Isolation & identification of Natural Products:

1. Thin layer chromatography: Determination of purity of a given sample, monitoring the progress of chemical reactions, identification of unknown organic compounds by comparing the Rf values of known standards.

2. Isolation and identification of Natural Products:

   (a) Isolation of caffeine from tea leaves
   (b) Isolation of euginol from cloves
   (c) Isolation of casein and lactose from milk
   (d) Isolation of limonene from lemon peel
   (e) Isolation of piperines from black pepper
   (f) Isolation of lycopene from tomatoes
   (g) Isolation of β-carotene from carrots

SCHEME OF VALUTION

RECORD= 10M
Viva= 15M
principle = 5M
Chemical equation = 5M
Procedure= 10M
Tables= 5M
Calculation= 10M
Chromatography= 10M
Report= 10M
Internals = 25M

Total= 75M + 25M= 100M

SEMESTER-IV

Laboratory Course-2

Spectral Identification of Organic Compounds

(UV, IR, ^{1}H- NMR, ^{13}C- NMR and MASS).

A minimum of 40 representative examples should be studied

Books Suggested:

1. Ikan, R. Natural Products, A Laboratory Guide, 2nd ed.; Academic Press: New York, 1991.
2. Adapted from Introduction to Organic Laboratory Techniques: A Microscale Approach. Pavia, Lampman, Kriz andEngel.(1999) Saunders College Publishing.
3. Pharmaceutical drug analysis by Ashutoshkar
4. Quantitative analysis of drugs in pharmaceutical formulations by P D Sethi
5. Practical pharmaceutical chemistry part-1 and part-2 by A H Beekett and J B Stenlake
6. Practical organic chemistry by Mann & Saunders.
7. Spectrometric Identification of organic compounds, R.M. Silverstein, F.X. Webster and D.J. Kiemle, 7th Ed.,(Wiley).

SCHEME OF VALUTION

RECORD= 10M
Viva= 15M
UV ANALYSIS=5M
IR ANALYSIS=5M
NMR ANALYSIS=5M
MASS ANALYSIS=5M
2 SPECTRAS=2X20=40M
REPORT =10M
Internals = 25M

Total= 75M + 25M= 100M

THANK YOU