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 18 December 2023

AY 2023-24

DEPARTMENT OF CHEMISTRY

P. R. GOVT. COLLEGE (Autonomous)

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

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

PROCEEDINGS OF THE PRINCIPAL, PITHAPUR RAJAHS GOVERNMENT COLLEGE(A), KAKINADA-A. P

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

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

SUB: P.R. Government College(A), Kakinada-PG Board of Studies (BOS)-Program/Course-M.Sc. 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 P G Boards of Studies in Chemistry for framing the syllabi in Organic Chemistry Subject for I, II 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 Professor Department of Chemistry Adikavi Nannaya University, Rajamahendravaram
3	Dr.S.K.Mustafa	Subject Expert Assistant Professor Dr.S.R.K. Govt. Arts College Yanam Govt. of Puducherry.
4	Dr. G. Chandrasekhar Reddy Managing Director HIQ Pharma Pvt. Ltd Hyderabad	Representative from Industry
5	T.V.V. Satya Narayana	Member
6	P. Vijay Kumar	Member
7	V. Rambabu	Member
8	G. Pavani	Member
9	Dr. N. Bujji Babu	Member
10	Dr. Ch. Praveen	Member
11	V. Venkateswara Rao	Member
12	U.S.N. Prasad	Member
13	T. Pavan Kumar	Member
14	S. Abhisha	Member
15	S. Sirisha	Member
16	R. Ramya Sri	Member
17		Student Alumni Member
18		Student Member
19		Student Member

The above members are requested to attend the BoS meeting on 18 December 2023 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 theDepartment of the college.

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

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

2023-24 on 18 December 2023 Meeting of Board of Studies in M. Sc Organic Chemistry is convened on 18 December 2023 through offline at Pithapur Rajah's Government College (A), Kakinada.

Venue: LCD Hall-I, Dt: 18 December 2023.

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. G. Chandra Sekhar 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 I &II for 2023-24.
3. Grant of Extra credits for Online SWAYAM MOOCs etc.
4. Syllabus, Model Question Papers and Model Blueprints, POs, PSOs & COs mappingfor I and V 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 itshall be approved in the BOS.
7. Teaching learning methodology by 75:25 (External: Internal) ratio w.e.f. 2017-18 admitted batches and continued it.
8. Remedial coaching for slow learners and project work, research, Conferences, etc., for advanced learners.
9. Panel of paper setters and examiners.
10. Proposals for project work in fourth semester for the benefit of students.
11. Department action plan for 2023-24. To discuss and resolve the minor modifications/refinement if any.
12. Any Other Proposal with the Permission of the Chairman.

The following paper setters are recommended.

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

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

Resolution:

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

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

ADDITIONS/DELETIONS IN COURSES CHEMISTRY 2023-24

Year	Semester& Paper	Additions	Deletions
II	**III&I**	Appel Reaction	--
II	**III&II**	**-**	**-**
II	**III&III**	Kulinkovich Reaction	
II	**III&IV**	**-**	**-**
II	**IV&I**	Coupling of alkynes (Eglinton reaction and Glacer reaction) photochemical Oxidations [Backstrom mechanism]	**-**
II	**IV&II**		
II	**IV&III**		
II	**IV&IV**		

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 analysing 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 analysing 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:

Neighbouring 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	Appel 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	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 2023-24
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
   i) Neighbouring group participation (NGP) by bromine and phenyl groups. (10M)
   ii) Mitsu Nobu reaction. (5M)

(OR)

How would you express
   i) HVZ reaction (8 M)
   ii) Dakin- west reaction (7 M)

2. What explanation do you have for
   i) Homotopic and Heterotopic groups and faces. (10 M)
   ii) Pro-R and pro-S, Re and Si. (5 M)

(OR)

What explantion do you have for
   i) Substrate stereo selectivity and product stereo selectivity.
   ii) Chiral shift reagents and chiral HPLC

3. a. How would you demonstrate the 1,3,5-hexatriene system by using wood ward Hoffmann correlation method (10 M)

b) How would you differentiate between the terms DIS rotation and CON rotation with reference to electro cyclic reactions (5 M)

(OR)

H 1,3 butadiene and 1,3,5hexatriene systems by using Wood word Hoffman and correlation method. (15 M)

4. a) Construct a correlation diagram for the conversion of 4+4 system.

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

(OR)

a) How would you differentiate between (3, 3) and (5, 5) sigma tropic rearrangements?
b) How would you express the Barton reaction.

SECTION: B

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

5. i) How would you express about hydrolysis of esters.
(ii) How can you describe the aliphatic diazo coupling.
(iii) How would you express the chiral NMR.
iv) What explanation do you have for enantiomeric excess and specific rotation.
v) How would you demonstrate the classification of pericyclic reactions with suitable examples.

vi) How would you differentiate the ANTRA FACIAL and SUPRA FACIAL.
vii) How would you express the Aza Cope rearrangement.
viii) What did you observe Fluxional tautomerism.

	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 2023-24

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=60**

1. a) Write about the following
   i) Bathochromic shift
   ii) Beer-lamberts law
   iii) Auxochrome

(OR)

b) Write about the wood-word Fischer rules and apply it for the calculation of Λmax of α, β- unsaturated carbonyl compounds?

2. a) Write a short note about the following
   i) Factors effecting vibrational frequency
   ii) Stretching and bending vibrations.

(OR)

b) Write a short note about the following
   i) Fingerprint region and its importance.
   ii) Write typical group frequencies for CH, OH, NH, CO, and aromatic systems.

3. a) Write the basic principle of NMR spectroscopy and explain about nuclear spin and nuclear resonance

(OR)

b) Write about the following
   i) Factors influencing chemical shift.
   ii) Coupling constant J and factors affecting J value.

5. a) Write a short note on the following
   i) MALDI and FAB
   ii) Factors effecting fragmentation

(OR)

b) Write a short note on the following.
   i) Mc Lafferty rearrangement
   ii) Nitrogen rule

SECTION: B

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

i) What is Hypochromic shift?

ii) Write the UV absorption values of carbonyl compounds.

iii) Write about bending vibrations.

iv) Write the IR values of acetophenone,2-Propanol and o-cresol.

v) What is shielding and deshielding.

vi) Write the ^{13}C chemical shift values of aliphatic, olefinic, alkane, aromatic and hetero aromatic, carbonyl compounds.

vii) What is the difference between molecular ion peak and metastable peak?

viii) Differentiate ion analysis and ion abundance.

	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 2023-24
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 SYNTHESIS

MODEL 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.

   Or

   b) Write a short note on the following.

   i) Baylis Hillman reaction

   ii) Stille coupling and Suzuki coupling

2. a) Write a short note on the following

   i) Bredt's rule

   ii) Wittig reaction and Wittig–Horner reaction

   Or

   b) Write a short note about the following

   i) Mc Murray coupling

   ii) Olefin cross coupling metathesis and ring opening metathesis

3. a) Write a short note on the following

   i) HLF reaction

   ii) BARTON reaction

   Or

   b) Predict the products and explain the mechanism for the following reactions

4. a) What is PTC? Write the types of Phase Transfer Catalyst, mechanism, and advantages of PTC method.

   Or

   b) Write the protection and deprotection of the following

   i) Alcohols ii) Amines iii) Carbonyl compounds

SECTION-B

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

1. Write about Negeshi coupling.
2. Write the formation of enolates and enamines.
3. What is Hoffmann rule.
4. Write about the Olefination by Nysted reagent.
5. Write about the stereochemistry of the hydroboration.
6. Write about the protonolysis of organoboranes.
7. What is Fries rearrangement.
8. Write about Click chemistry.

	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	

SYLLABUS

UNIT–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				
2				
3				
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 2023-24
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) Write the structural elucidation of Strychinine?

   Or

   b) Write the synthesis of Morphine?
2. a) Write the structural elucidation of Taxol?

   Or

   b) Write the synthesis of β-Amyrine?
3. a) Write the structural elucidation of Progesterone?

   Or

   b) Write the synthesis of Cholesterol?
4. a) Write the structural elucidation of Quercetin?

   Or

   b) Write about the following
5. i) Write the bio synthesis of flavonoids and isoflavonoids?

   ii) Write about acetate pathway and skhimitic pathway?

SECTION-B

ANSWER ANY FIVE QUETIONS

1. Write the physiological action of Camptothecin?
2. Write about the isolation of alkaloids?
3. Write the occurrence of terepinoids?
4. Write the stereochemistry of Azadirecthin?
5. Write about basic skeleton deals hydrocarbon?
6. Write about the biosynthesis of steroids?
7. Write about the isolation of flavonoids and isoflavonoids?
8. Write about the stereochemistry of Cyanadine and Genestine

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

	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 analysing 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 aromaticcarbonby Fentons reagent; Oxidation of aldehydes to carboxylic acids; Formation of cyclicethers using Leadtetraacetate; Formation of hydroperoxides (autooxidation);;Arylation ofAromatic compounds by diazoinum salts(Gomberg – Bachman reaction); Mechanisms of Sand Meyer reaction, Hunsdieckerreaction, 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 hydro boration 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 – IIreaction.

(B) Paterno- Buchireaction , Photo reduction & photo enolisation; 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	-	Coupling of alkynes (Eglinton reaction and Glacer reaction)	K1, K2	5%
2	-	-	-	-
3	-	photochemical Oxidations [Backstrom mechanism]	K1, K2	5%
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 2023-24
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) Huns diecker reaction

   (Or)

   b) write about the following
   i) Neighbouring group assistance in free radical reaction
   ii) Wittig rearrangement
2. a) Explain the assymetric hydrogenation using chiral Wilkins biphosphine

   (Or)

   b) Explain the briefly cram's rule and it's type?
3. a) Discuss in detail about norrish type-I and norrish type-II reactions

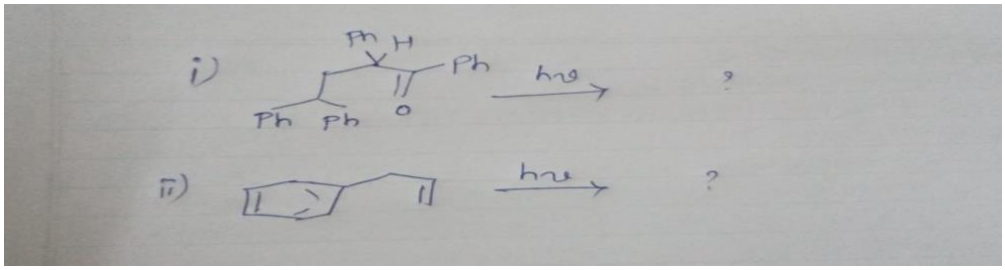
   (Or)

   b) Explain the flourscence and phosphorscence and jablanski diagram

4 a)i) Explain the reaction mechanism of Aza- di pie methane rearrangement
ii) Write about Barton reaction.

(OR)

write products for the reactions of



SECTION: B

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

5.Write about Wittig rearrangement?
6.Write Gombers-bacgmann reaction (Arylation of aromatic compounds by diazonium salt)
7.What is assymetric synthesis and different types?
8.Explain the use of chiral auxiliaries in diels alder reaction?
9.Explain Franck Condon principle?
10.Write a short on types of electronic excitation?
11.Discuss the photo chemistry of unsaturated ketones?
12.Explain photo fires rearrangement?

	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				
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 2023-24

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?
   ii)Explain application in determining Configuration and confirmational changes?

   (Or)

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

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

   (Or)

   b) Explain with suitable examples of HECTOR; INDOR; DEPT

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

   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

   b) MF:C14H10O2 IR(cm-1) : 3050,1690, 1600-1480, 880
   '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)Write a note on i) paper chromatography
   ii) column chromatography

   (Or)

   b)Write about I) gas chromatography
   ii)HPLC

SECTION: B

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

5.Briefly explain on alpha axial halo keto rule with examples

6. Explain the similarities and differences between ORD &CD

7. What the ABX &AMX Spectral system

8. Explain about lanthaloid shifts reagent?

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

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

11. Explain about solvent extraction?

12. Write briefly on x- ray diffraction?

	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) Sharplessasymmetric 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				
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.

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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 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 2023-24

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) Write the synthetic application of alkyl Silanes aryl Silanes and vinyl Silanes?

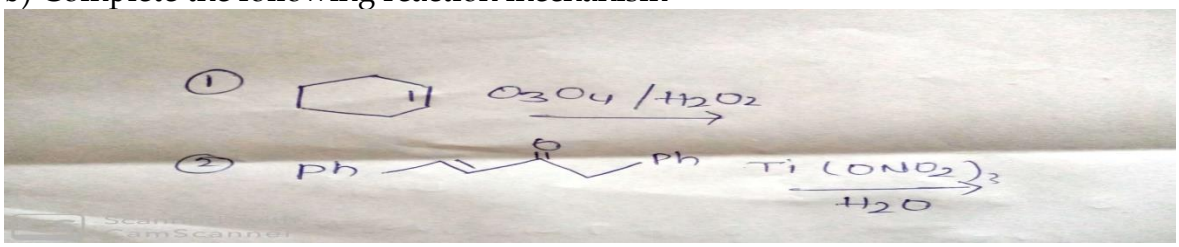
(Or)

b) Write Peterson olification and book rearrangement?

2) a) Write the synthetic applicationof I)pb(OAC)4 ii) Carey's reagent iii)DDQ

(Or)

b) Complete the following reaction mechanism



3) a) Explain homogeneous and heterogeneous catalytic reduction?

(Or)

b) Briefly explain on i) LiAlH4 ii) DIBAL iii) NABH3CN

4) a)i)Explain the linear and convergent synthesis?

ii)Explain functional group conversion and functional group addition

(Or)

b) Explain the one group C-C disconnection. (Alcohol & carbonyl compounds)

SECTION-B

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

5)Discuss the synthetic application of sillyl enol ether?

6)Write about the mechanism of Rubotton oxidation?

7)Write a short note on wolf- kishner reduction?

8)Write about colling reagent?

9)Write about clemmenson reduction with applications?

10)Explain the Baveault- Blane reduction?

11)Write a short note on TM, synthons and synthetic

12)Write about 1,2 C-C disconnection?

	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				
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.

(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 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 2023-24

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) write the advantages of mortified synthesis?
   ii)Write the chemical properties of amino acids?
   (Or)
   b) explain the chemistry oxytocin and it's physiological functions ?

2. a) write the structural elucidation about pencilin?
   (Or)
   b)Write the synthesis of cephalosphorin-C?

3. a) Discuss the structure determination and synthesis of niofinic acid?
   (Or)
   b) write a brief note on the Significance of biotine and discribe the classification of thiamine?

4. a)what is genetic code and Explain its importance in protein synthesis?
   (Or)
   b)Write the concepts of the structure of RNA &DNA

SECTION-B

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

5.write the advantages of merrified peptide synthesis?

6.write the synthesis of ATP?

7.Write the activity of anti- malarial drug?

8. Explain the general characteristics of antibioticm?

9.write a short note on vitamins?

10.Write structure determination of Riboflavin &thiamine?

11. write about finger print test?

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