

**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**

**Meeting Minutes/Resolutions**



*Convened on 03 November 2022*

**DEPARTMENT OF CHEMISTRY**

**P. R. GOVT. COLLEGE (Autonomous)**

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

**[www.prgc.ac.in](http://www.prgc.ac.in); e-mail: [chemistry\\_dept@prgc.ac.in](mailto:chemistry_dept@prgc.ac.in)**

**PROCEEDINGS OF THE PRINCIPAL,  
P.R. GOVERNMENT COLLEGE(A),KAKINADA-A.P**

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

**R.C.No.12A/A.C./BOS/2022-23, Dated: 24.09.2022**

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

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

**ORDERS:**

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

S.No	Name of the Nominee	Designation
1	Dr. D. Chenna Rao	Chairman& Lecturer Incharge.
2	Dr. K. Deepthi	University Nominee Associate Professor Department of Chemistry Adikavi Nannaya University, Rajamahendravaram
3	Dr. V. Siddaiah	Subject Expert Associate Professor Department of Chemistry Andhra University, Visakhapatnam
4	Dr. B. Ramesh Babu	Representative from Industry Founder & M.D., BogaR laboratories, Peddapuram. Ph: 9701712028.
5	V. Sanjeeva Kumar	Member
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	S. Vijaya Lakshmi	Member
14	Y.Devi	Member
15	D. Bhavya Sri	Member
16	S. Abhisha	Member
17	G. Sandhya	Student Alumni Member
18	S. Venkateswar rao	Student Member
19	K. Subrahmanya swamy	Student Member

The above members are requested to attend the BoS meeting on 03-11-2022 and share their valuable reviews, and suggestions on the following functionaries.

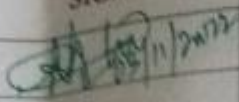
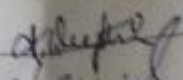
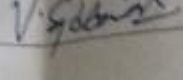
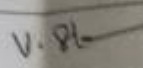
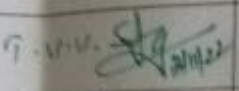
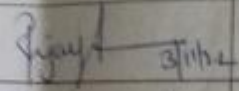
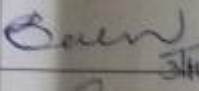
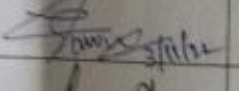
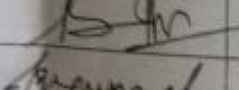
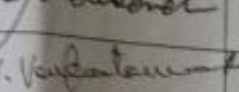

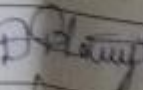
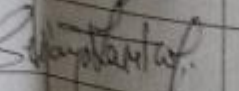


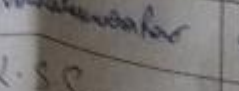
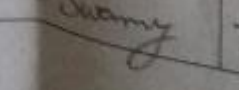
- Prepare syllabi for the subject keeping in view the objectives of the college, interest of the stake holders and National requirement for consideration and approval of the IQAC and Academic Council.
- Suggested methodologies for innovative teaching and evaluation techniques.
- Suggest the panel of 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. Government College(A),  
Kakinada

Signatures of the members who attended the Board of studies in M.Sc. - Organic & Analytical Chemistry held on 03.11.2022 at 11.00 am.

Mode of Conduct of meeting: Offline/ Online

NAME	SIGNATURE	CONTACT NO.
Dr. D. Chenna Rao		9560740108
Dr. K. Deepthi		9985469607
Dr. V. Siddaiah		9440754164
Dr. B. Ramesh Babu		
V. Sanjeeva Kumar		9849324266
T.V.V. Satya Narayana		9490876913
P. Vijay Kumar		9652023082
V. Rambabu		9948485537
G. Pavani		9912526493
Dr. N. Bujji Babu		944394792
Dr. Ch. Praveen		9491185518
V. Venkateswara Rao		9885165588
Y. Devi		9553267198
D. Bhavya Sri		6302865286
S. Vijaya Lakshmi		9133941966
S. Abhisha		
Ms. G. Sandhya		
S. Venkateswara Rao		9848217864
K. Subrahmanya Swamy		7993374608

## **VISION AND MISSION OF THE COLLEGE**

### **Vision**

To provide the right academic environment paving way for intellectual excellence, humane feelings and social commitment. The college believes in providing quality education for the socially disadvantaged, economically weaker sections of the society and thereby help them move up the ladder of success and social order.

### **Mission**

- ➔ To impart holistic education with special emphasis on character, culture, updated knowledge and skill-oriented learning.
- ➔ To make the students enjoy the fruits of globalization without prejudice to their local and cultural environment.
- ➔ To impart necessary life skills so as to make them face any challenge in the bigger world – Social, ethical, psychological or professional.

# **P.R. GOVT.COLLEGE (A), KAKINADA**

## **DEPARTMENT OF CHEMISTRY**

### **Minutes of board of studies (BOS) meeting 2022-23 on 03-11-2022**

Meeting of Board of Studies in Petro Chemicals is convened on 03-11-2022 through offline/Online at P.R. Govt. College (A), Kakinada.

**Venue:**

Conference Hall, Dt: 03-11-2022

The Principal Dr. B.V. Tirupanyam,

Chairman: Dr. D. Chenna Rao

Chairman and lecturer in charge,

Department of Chemistry

University Nominee: Dr. K. Deepthi

Associate Professor

Department of Chemistry

Adikavi Nannaya University, Rajamahendravaram

Industrialist: Dr. B. Ramesh Babu,

Founder & M.D., BogaR laboratories, Peddapuram,

Subject Expert: Dr.V.Siddaiah,

Associate Professor

Department of Chemistry

Andhra University, Visakhapatnam

All the faculty members of Chemistry Department and student alumni attended the meeting.

## **Agenda:**

- To discuss the Semester System and Choice Based Credit System (CBCS) being implemented for the past 06 years, i.e., w.e.f. 2015-16.
- To discuss and approve the Continuation/Modifications of the syllabus for the Odd & Even Semesters of I, III Years for 2022-23.
- Syllabus, Model Question Papers and Model Blue Prints for I, III Semesters.
- Teaching learning methodology by 75:25 (External: Internal).
- Panel of paper setters and examiners.
- Proposals for Community Service Projects/Extension activities for the benefit of the society.
- Department action plan for 2022-23.

To discuss and resolve the minor modifications/refinement if Any Other Proposal with the Permission of the Chairman.

## **Resolutions:**

The following agenda items are discussed and resolutions are made.

- It is resolved to continue choice based credit system in the chemistry as per the directions of the CCE, Vijayawada and University to the Previous year and Final year student's w.e.f. 2018-19.
- It is resolved to approve the Continuation/Modifications of the syllabus for the Odd Semesters of I, III Years for 2021-22.
- It is resolved to encourage students to active participation in various activities and give extra credits for students after successful completion of a particular activity such as SWAYAM, MOOCS etc., (Annexure -II)
- It is Resolved to follow 75%-25% external and internal w.e.f. 2017-2018 admitted batches and it continued.
- It is resolved that every student should maintain 75% attendance for both theory and practical's in order to attend the Mid and Semester examination.
- It is resolved to conduct departmental activities such as OZONE DAY, CHEM FEST, CHEMISTRY DAY and SCIENCE DAY. (Annexure-I)
- It is resolved to implement the recommended pedagogy for the first semester 2022-23

9. Resolved to conduct practical examinations semester wise.

- It is resolved to organize guest lectures by eminent professors.

Resolved to implement pass minimum for internal assessment for CBSE pattern students as the pattern is learner oriented.

- It is resolved to maintain status quo for same question paper pattern in I, II years. The following paper setters are recommended.

1. Dr.V. Siddaiah, Department of Chemistry, Andhra University.
2. Dr.V/Christapher, Department of Chemistry, Andhra University.
3. Dr.K. Deepthi, Department of Chemistry, ANUR Rajamahendravaram
4. Dr. B. Jagan Mohan Reddy, Department of Chemistry, ANUR Rajamahendravaram
5. Dr. Ravindrababu, Department of Chemistry, Arts College (A) Rajamahendravaram.
6. Dr M. Manoranjani, H O D Dept of PG Chemistry, PB Siddhartha arts and science College, Vijayawada.



## Course structure of MSc Organic Chemistry

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
15	III	Organic Reaction Mechanisms - I & Pericyclic Reactions	T	25	75	100	4
16		Organic Spectroscopy-I	T	25	75	100	4
17		Modern Organic synthesis- I	T	25	75	100	4
18		Chemistry of Natural products -I	T	25	75	100	4
19		Multistep Synthesis of Organic Compounds:	P	25	75	100	4

20		Estimations and Chromatography	P	25	75	100	4
21	IV	Organic Reaction Mechanisms - II & Photo chemistry	T	25	75	100	4
22		Organic Spectroscopy-II	T	25	75	100	4
23		Modern Organic synthesis- II	T	25	75	100	4
24		Bio-organic chemistry	T	25	75	100	4
25		Chromatographic Separation and Isolation & identification of Natural Products	P	25	75	100	4
26		Spectral Identification of Organic Compounds ((UV, IR, <sup>1</sup> H- NMR, <sup>13</sup> C- NMR and Mass).	P	25	75	100	4
27		Comprehensive Viva- voce	V	---	50	50	4
<b>Total Credits</b>							<b>100</b>

## Course structure of M. Sc Analytical Chemistry

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
15	III	Separation Methods-I	T	25	75	100	4
16		Quality Control and Traditional methods of Analysis-I	T	25	75	100	4
17		Applied Analysis-I	T	25	75	100	4
18		Instrumental Methods of Analysis-I	T	25	75	100	4
19		Classical methods of Analysis-I	P	25	75	100	4
20		Instrumental methods of Analysis-I	P	25	75	100	4
21	IV	Separation Methods-II	T	25	75	100	4
22		Quality Control and Traditional methods of Analysis-II	T	25	75	100	4
23		Applied Analysis-II	T	25	75	100	4

24		Instrumental Methods of Analysis- II	T	25	75	100	4
25		Classical methods of Analysis-II	P	25	75	100	4
26		Instrumental methods of Analysis- II	P	25	75	100	4
27		Comprehensive Viva-voce	V	---	50	50	4
<b>Total credits</b>							<b>100</b>

	<b>P R Govt College (A)Kakinada</b>	<b>Program &amp; Semester</b>  II M Sc organic chemistry (III Semester)			
Course Code	<b>Organic Reaction Mechanisms – I &amp; Pericyclic Reactions</b>				
Teaching	Hours Allocated: 60 ( <b>Theory</b> )	L	T	P	C
Pre-requisites	Migrations, Electron donating groups, Electron withdrawing group, electronic effects and shapes of orbitals	60	10	--	4

### Course Objectives:

Study the basics of pericyclic 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 in fundamentals 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	
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### 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 (BAC<sub>2</sub> Ac<sub>2</sub>, AAC<sub>1</sub>, AAL<sub>1</sub>, BAL<sub>1</sub>), 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 SE<sub>2</sub>, SE<sub>1</sub>, SE<sub>i</sub>**, 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, Woodward-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 disrotatory 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 Sigmatropic shift involving carbon moieties,** retention and inversion of configurations, (3, 3) and (5, 5) sigmatropic rearrangements detailed treatment of Claisen and Cope rearrangements, aza-Cope rearrangement and Barton reaction.

### Reference books:

- 1) Some Modern Methods of Organic Synthesis W. Carruthers, Third & Fourth Edition, Cambridge University Press, Cambridge, 1988.
- 2) Modern Organic Synthesis-an introduction by George S.Zweifel and Michael H. Nantz, W. H. Freeman & company, New York.
- 3) Advanced Organic Synthesis, Part B-Reactions and Synthesis, Francis A. Carey and Richard J. Sudenburg, Fourth edition, Kluwer academic publishers, New York
- 4) Organic Synthesis, Christine Willis and Martin Willis, Oxford Chemistry primers.
- 5) Principles of Organic Synthesis, ROC Norman and JM Coxon, third edition, CBS, Publisher, Delhi. 6) Organic Synthesis, M. B. Smith, McGraw Hill, International Edition.
- 7) Organic Chemistry, Clayden, Greeves and Stuart Warren.
- 8) Guide Book to Organic Synthesis (3rd edition), R. Mackie, D. M. Smith and Aitken. 9) Organo Boranes and Silanes, Thomson, Oxford Chemistry primers.
- 10) Strategic applications of named reactions in organic synthesis, Laszlo Kurti and Barbara Czako.
- 11) Modern Synthetic Reactions, Herbert O. House, Second Edition, W.A. Benzamine Inc. Menio Park, California, 1972.
- 12) Organic Synthesis viz Boranes, Herbert C. Brown Gray, W. Kramer Alan B. Levy and M. Mark Midland John Wiley & Sons, New York, 1975.
- 13) Organic Synthesis: Special Techniques, V. K. Ahluwalia and Renu Agarwal.
- 14) Organic Synthesis, Jagadamba Singh and Dr. A. Yadav, Pragati Edition.

### Additional Inputs:

Unit No	Additions	Deletions	justification	Percentage of Addition /Deletion
1		Chelotropic reaction	In ug course. Hence deleted	2 %

**Web Links:**

1. <https://youtu.be/Mjck01ao9Mw>
2. [https://www.youtube.com/watch?v=k9j-8e5uzg4&list=PLj\\_Alq7xw30kL1S84P\\_SMO2wSfkTeN6n\\_&index=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](https://www.youtube.com/watch?v=k9j-8e5uzg4&list=PLj_Alq7xw30kL1S84P_SMO2wSfkTeN6n_&index=2)

**Weightage to content****Semester -III****Paper-I**

S.No	Course Content	Long Answer	Short Answer	Total marks	As per Blooms Taxonomy
1	Aliphatic Nucleophilic Substitution:	2	2	36	Understanding, Application
2	Principles of asymmetric synthesis	2	2	36	Creative, Analyzing
3	Pericyclic Reactions-I	2	2	36	Application & Creation
4	Pericyclic Reactions-II	2	2	36	Remembering, Evaluation
	<b>TOTAL</b>	<b>8</b>	<b>8</b>	<b>144</b>	



**P.R. COLLEGE (A), KAKINADA**

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

**(General chemistry)**

**Paper- I MODEL PAPER**

**Time 3 hours**

**Max Marks: 75**

**Answer ALL Questions**

**All questions carry equal marks**

**(4x15=60 Marks)**

1. How can you describe

- i) Neighbouring group participation (NGP) by bromine and phenyl groups. (10 M)
- ii) Mitsunobu reaction. (5 M)

Or

b) 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

b) What explanation do you have for

- i) Substrate stereo selectivity and product stereo selectivity.
- ii) Chiral shift reagents and chiral HPLC

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

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

Or

c) H 1,3-butadiene and 1,3,5-hexatriene systems by using Woodward-Hoffmann 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

- c) How would you differentiate between (3, 3) and (5, 5) sigma tropic rearrangements
- D] How would you express the Barton reaction.

**SECTION-B**

**(5 x 3 = 15 M)**

**ANSWER ANY FIVE QUESTIONS**

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

### Co-Curricular Activities:

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

1. **For Teacher:** Training of students by teacher in laboratory and field for not less than 15 hours on the field techniques/skills of preparation of acetanilide, preparation of azodye, use of separating funnel for solvent extraction, separation of organic compounds in a mixture.
2. **For Student:** Student shall visit a related industry/chemistry laboratory in universities/research organizations/private sector facility and observe the techniques used for the separation of organic compounds. Write their observations and submit a handwritten fieldwork/project work report not exceeding 10 pages in the given format to the teacher.
3. Max marks for Fieldwork/project work Report: 05.
4. Suggested Format for Fieldwork/project work: *Title page, student details, index page, details of place visited, observations, findings, and acknowledgements.*
5. Unit tests (IE).

### b) Suggested Co-Curricular Activities

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

### CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	1	1	2	3	1	1	1	2	1	3	3	1
CO2	3	2	1	3	3	2	2	1	1	3	3	3	1
CO3	3	2	2	1	3	1	1	1	1	1	3	2	1
CO4	3	2	2	1	3	1	1	1	1	1	3	2	1
Avg.	3	1.75	1.5	1.75	3	1.25	1.25	1	1.25	1.5	3	2.5	1

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

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

compounds.

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

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

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

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

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

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

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

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

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

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

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

	<b>P R Govt College (A) Kakinada</b>	<b>Program &amp; Semester</b>  II M Sc organic chemistry (III Semester)			
Course Code	<b>Paper – II :Organic Spectroscopy-II</b>				
Teaching	Hours Allocated: 60 ( <b>Theory</b> )	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 H1 and C13 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	
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### 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, Hyperchromic and Hypo chromic shifts) UV absorption of Alkenes-Polyenes unsaturated cyclic systems.

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

## 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 . **Finger print 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 ( $^1\text{H}$ NMR):

(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) $^{13}\text{C}$  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-**Behavior 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.**

### References books:

1. Spectroscopic Methods in Organic Chemistry- Forth Edition, D.H. Williams and I.Fleming Tata McGraw Hill, New Delhi, 1990.
2. Organic Spectroscopy- Second Edition, W.Kemp, ELBS Macmillan, 1987.
3. Applications of absorption spectroscopy of Organic Compounds J.R.Dyer, Prentice Hall of India, New Delhi, 1984.
4. Spectrometric identification of Organic Compounds-Fourth Edition, R.M. Silverstein:

G.C.Vassiellr and T.C. Merill, John Wiley, Singapore, 1981.

5. Introduction to spectroscopy-D.L.Pavia, G.M.Lampman, G.S.Kriz, 3rdEd (Harcourt college publishers).

6. Absorption spectroscopy of organic molecules-V.M.Parkih.

7. Nuclear Magnetic Resonance-Basic principles-Atta-Ur-Rehman, Springer-Verlag, 1986.

**Additional Inputs:**

Unit No	Additions	Deletions	justification	Percentage of addition/deletion
1		Ionization techniques of FAB, MALDI, ES	In ug course. Hence deleted	2%

**Web Links:**

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

5. [https://www.youtube.com/watch?v=WTmj\\_9VT5oE](https://www.youtube.com/watch?v=WTmj_9VT5oE)

**Weightage to content**

**Semester -III**

**Paper-II**

S.No	Course Content	Long Answer	Short Answer	Total marks	As per Blooms Taxonomy
1	UV-Visible spectroscopy:	2	2	36	Understanding, Application
2	Infrared spectroscopy:	2	2	36	Remembering, Understanding
3	Nuclear Magnetic Resonance Spectroscopy ( <sup>1</sup> HNMR):	2	2	36	Application & Creation
4	Mass spectrometry	2	2	36	Remembering, Understanding
	<b>TOTAL</b>	<b>8</b>	<b>8</b>	<b>144</b>	

**P.R. COLLEGE (A), KAKINADA**

**II YEAR MSc (Examination at the end of III semester)**

**ORGANIC SPECTROSCOPY**

**Paper- II MODEL PAPER**

**Time 3 hours**

**Answer ALL Questions**

**Max Marks: 75**

**PART-A**

**All questions carry equal marks**

**(4x15=60 Marks)**

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  $\lambda_{\text{max}}$  of  $\alpha$ ,  $\beta$ -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) Finger print region and its importance.
- ii) Write typical group frequencies for CH, OH, NH, CO and aromatic systems.

3. a) Write the basic principal 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 effecting 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) MCLAFFATERAY rearrangement
- ii) Nitrogen rule

SECTION-B

(5 x 3 = 15 M)

ANSWER ANY FIVE QUESTIONS

1. What is Hypochromic shift?
2. Write the UV absorption values of carbonyl compounds.
3. Write about bending vibrations
4. Write the IR values of acetophenone, 2-Propanol and o-cresol
5. What is shielding and deshielding.
6. Write the C13 chemical shift values of aliphatic, olefinic, alkyne, aromatic and hetero aromatic, carbonyl compounds.
7. What is the difference between molecular ion peak and metastable peak?
- 8) Differentiate ion analysis and ion abundance

### Co-Curricular Activities:

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

6. **For Teacher:** Training of students by teacher in laboratory and field for not less than 15 hours on the field techniques/skills of preparation of acetanilide, preparation of azodye, use of separating funnel for solvent extraction, separation of organic compounds in a mixture.
7. **For Student:** Student shall visit a related industry/chemistry laboratory in universities/research organizations/private sector facility and observe the techniques used for the separation of organic compounds. Write their observations and submit a handwritten fieldwork/project work report not exceeding 10 pages in the given format to the teacher.
8. Max marks for Fieldwork/project work Report: 05.
9. Suggested Format for Fieldwork/project work: *Title page, student details, index page, details of place visited, observations, findings, and acknowledgements.*
10. Unit tests (IE).

### d) Suggested Co-Curricular Activities

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

### CO-PO Mapping:

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

PO1 :

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

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

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

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

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

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

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

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

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

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

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

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

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

	<b>P R Govt College (A)Kakinada</b>	<b>Program &amp; Semester</b>  II M Sc organic chemistry (III Semester)			
Course Code CHE-7A	<b>Paper – III: Modern Organic Synthesis -I</b>				
Teaching	Hours Allocated: 60 ( <b>Theory</b> )	L	T	P	C
Pre-requisites	Basics on organic reagents	60	10	30	4+4

### 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 analyze the difference in the basic types of organic chemistry
CO2	Students will be able to analyze the difference in the coupling reactions
CO3	Students will be 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	
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## Syllabus

### UNIT-I

#### Formation of C-C single bonds

(A) Alkylations 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, Negishi coupling, Wacker Oxidation; Organo copper chemistry: Gilman's reagent and synthetic applications; Synthetic applications of carbenes and carbenoids; BaylisHilman 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 hypothalites; Organo boranes: Preparation of Organo boranes viz hydroboration with  $\text{BH}_3\text{-THF}$ , dicyclohexylborane, disiamylborane, tetrylborane, 9-BBN mono isopinocampheyl borane ( $\text{IPC}_2\text{BH}_2$ ) and diisopinocampheylborane ( $\text{IPC}_2\text{BH}$ )

(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 ( $\text{RO-Me}$ ), Tertiary butyl ether ( $\text{ROCM}_3$ ), Benzyl ethers ( $\text{RO-Bn}$ ), as Silyl ethers [Trimethyl silyl ether ( $\text{R-OTMS}$ ), tri ethyl silyl ethers ( $\text{RO-TEs}$ ), t-butyl dimethyl silyl ether ( $\text{RO-TBDMS}$  in the presence of imidazole), t-butyl diphenyl silyl ether ( $\text{RO-TBDPS}$ )], as acetals [tetra hydro pyranyl ethers ( $\text{RO-THP}$ ),

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**

#### **Text books:**

1. Text book of Vogel's Quantitative Chemical Analysis, Sixth edition, Pearson
2. Fundamentals of Analytical Chemistry by F. James Holler, Stanley R Crouch, Donald M. West and Douglas A. Skoog, Ninth edition, Cengage.
3. Organic Spectroscopy by William Kemp, Third Edition, Palgrave USA

#### **Reference books:**

- 1) Some Modern Methods of Organic Synthesis W. Carruthers, Third & Fourth Edition, Cambridge University Press, Cambridge, 1988.
- 2) Modern Organic Synthesis-an introduction by George S. Zweifel and Michael H. Nantz, W. H. Freeman & company, New York.
- 3) Advanced Organic Synthesis, Part B-Reactions and Synthesis, Francis A. Carey and Richard J. Sudenburg, Fourth edition, Kluwer academic publishers, New York
- 4) Organic Synthesis, Christine Willis and Martin Willis, Oxford Chemistry primers.
- 5) Principles of Organic Synthesis, R.C. Norman and J.M. Coxon, third edition, CBS, Publisher, Delhi. 6) Organic Synthesis, M. B. Smith, McGraw Hill, International Edition.
- 7) Organic Chemistry, Clayden, Greeves and Stuart Warren.
- 8) Guide Book to Organic Synthesis (3rd edition), R. Mackie, D. M. Smith and Aitken. 9) Organo Boranes and Silanes, Thomson, Oxford Chemistry primers.
- 10) Strategic applications of named reactions in organic synthesis, Laszlo Kurti and Barbara Czako.
- 11) Modern Synthetic Reactions, Herbert O. House, Second Edition, W.A. Benjamin Inc. Menlo Park, California, 1972.
- 12) Organic Synthesis via Boranes, Herbert C. Brown Gray, W. Kramer Alan B. Levy and M. Mark Midland John Wiley & Sons, New York, 1975.
- 13) Organic Synthesis: Special Techniques, V. K. Ahluwalia and Renu Agarwal.
- 14) Organic Synthesis, Jagadamba Singh and Dr. A. Yadav, Pragati Edition.

**Weightage to content**

**Semester -III**

**Paper-3**

<b>S.No</b>	<b>Course Content</b>	<b>Long Answer</b>	<b>Short Answer</b>	<b>Total marks</b>	<b>As per Blooms Taxonomy</b>
1	Formation of C-C single bonds	2	2	36	Understanding, Application
2	Formation of Carbon-Carbon double bonds	2	2	36	Remembering, Understanding
3	Reactions of Un activated C-H bonds and organoboranes	2	2	36	Application & Creation
4	Protecting groups and Synthetic applications of PTC and crown ethers	2	2	36	Remembering, Understanding
	<b>TOTAL</b>	<b>8</b>	<b>8</b>	<b>144</b>	

**Web Links:**

1. <https://www.youtube.com/watch?v=ZMcCXt5zPi4>
2. <https://www.youtube.com/watch?v=fDPQrwCHq3w>

**P.R. COLLEGE (A), KAKINADA**

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

**(General chemistry)**

**PAPER-III: MODERN ORGANIC SYNTHESIS-I**

**Time 3 hours**

**Max Marks: 75**

**PART-A**

**All questions carry equal marks**

**(4x15=60 Marks)**

1. a) Discuss the synthetic applications of

i) Gilmanns Reagent

ii) Umpolung.

Or

b) Write a short note on the following.

i) Baylis Hiltmann 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

(5 x 3 = 15 M)

ANSWER ANY FIVE QUESTIONS

1. Write about Negishi 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.

### Co-Curricular Activities:

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

- 11. For Teacher:** Training of students by teacher in laboratory and field for not less than 15 hours on the field techniques/skills of preparation of acetanilide, preparation of azodye, use of separating funnel for solvent extraction, separation of organic compounds in a mixture.
- 12. For Student:** Student shall visit a related industry/chemistry laboratory in universities/research organizations/private sector facility and observe the techniques used for the separation of organic compounds. Write their observations and submit a handwritten fieldwork/project work report not exceeding 10 pages in the given format to the teacher.
- 13.** Max marks for Fieldwork/project work Report: 05.
- 14.** Suggested Format for Fieldwork/project work: *Title page, student details, index page, details of place visited, observations, findings, and acknowledgements.*
- 15.** Unit tests (IE).

### f) Suggested Co-Curricular Activities

10. Training of students' by related industrial experts.
11. Assignments, Seminars and Quiz (on related topics), collection of videos and other material.
12. Visits of facilities, firms, research organizations etc.
13. Invited lectures and presentations on related topics by field/industrial experts

### CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	1	1	2	3	1	1	1	2	1	3	3	1
CO2	3	2	1	3	3	2	2	1	1	3	3	3	1
CO3	3	2	2	1	3	1	1	1	1	1	3	2	1
CO4	3	2	2	1	3	1	1	1	1	1	3	2	1
<b>Avg.</b>	3	1.75	1.5	1.75	3	1.25	1.25	1	1.25	1.5	3	2.5	1

**PO1 : Knowledge in Chemistry** : Apply the knowledge of synthetic organic chemistry to the solution of simple to complex synthesis of organic molecules

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

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

**PO4: Conduct investigations of complex problems:** Use fundamental research-based knowledge and available research methods including design of experiments, analysis and interpretation of data, and synthesis of the organic molecules.

**PO5 : Modern tool usage:** Create, select, and apply appropriate techniques, resources, and IT tools for modeling and interpretation of simple to complex organic molecules.

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

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

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

**PO9 : Communication:** Communicate effectively on issues related to synthetic organic chemistry with the chemistry community, being able to write the effective reports and documentation, presentations.

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

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

**PSO-2:** To understand the structure and properties of reagents, Characteristics mechanisms of chemical reactions and their synthetic utility.

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

	<b>P R Govt College (A) Kakinada</b>	<b>Program &amp; Semester</b>  II M Sc organic chemistry (III Semester)			
Course Code	<b>Paper – IV : Chemistry of Natural Products –I</b>				
Teaching	Hours Allocated: 60 ( <b>Theory</b> )	L	T	P	C
Pre-requisites	Classification of alkaloids, terpenoids, steroids, flavonoids and iso flavonoids	60	10	30	4+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	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

### Course with focus on employability / entrepreneurship / Skill Development modules

Skill Development		Employability		Entrepreneurship	
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### 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

**(B)** 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 Forskolol, Azadirachtin and  $\beta$ -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, Genestein,

**(B)** Isolation, **structure elucidation** and **synthesis** of Kaempferol, Butein and Daidzein. Biosynthesis of Flavonoids and Iso flavonoids.

### Reference books:

1. Natural Products: Chemistry and Biological Significance, J. Mann, R.S. Davidson, J. B. Hobbs, D. V. Banthrope and J. B. Hatrbnome, Longman, Essex.
2. Organic Chemistry, Vol. 2, I. L. Finar, ELBS.
3. Chemistry of Organic Natural Products, O. P. Agrawal, Vols. 1 & 2, Goel Pubs.
4. Natural Products Chemistry K. B. G. torsell, John Wiley, 1983
5. New Trends in Natural Products Chemistry, Atta-ur-Rahman and M.I. Choudhary, Harwood Academic Publisher.
6. Chemistry of Natural products P. S. Kalsi, Kalyani Publishers
7. Biosynthesis of steroids, terpenes and acetogenins, J. H. Richards & J. R. Hendrierson
8. The biosynthesis of secondary metabolites, R. D. Herbert, Chapman & Hall

9. The Biosynthesis of Secondary Metabolite, R. D. Herbert, Second edn, Chapman and Hall

**Web Links:**

1. <https://www.youtube.com/watch?v=xQDhXoJwSEI>
2. <https://www.youtube.com/watch?v=l2LymcI096Q>

**Weightage to content**

**Semester -III**

**Paper-IV**

S.No	Course Content	Long Answer	Short Answer	Total marks	As per Blooms Taxonomy
1	Alkaloids	2	2	36	Understanding, Application
2	Terpenoids	2	2	36	Remembering, Understanding
3	Steroids	2	2	36	Application & Creation
4	Flavonoids and Isoflavonoids	2	2	36	Remembering, Understanding
	<b>TOTAL</b>	<b>8</b>	<b>8</b>	<b>144</b>	

**P.R. COLLEGE (A), KAKINADA**

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

**(General chemistry)**

**PAPER-IV: NATURAL PRODUCTS**

**Time 3 hours**

**Answer ALL Questions**

**PART-A**

**All questions carry equal marks**

1 a) Write the structural elucidation of Strychnine?

Or

b) Write the synthesis of Morphine?

2. a) Write the structural elucidation of Taxol?

Or

b) Write the synthesis of  $\beta$ -Amyrine?

3. a) Write the structural elucidation of Progesterone?

Or

b) Write the synthesis of the Cholesterol?

4. a) Write the structural elucidation of Quercetin?

Or

b) Write about the following

i) Write the bio synthesis of flavonoids and isoflavonoids?

ii) Write about acetate pathway and shikimic pathway?

**SECTION-B**

**ANSWER ANY FIVE QUESTIONS**

1. Write the physiological action of Camptothecin?

2. Write about the isolation of alkaloids?

3. Write the occurrence of terpenoids?

4. Write the stereochemistry of Azadirachtin?

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 Ggenestine

**Co-Curricular Activities:**

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

16. **For Teacher:** Training of students by teacher in laboratory and field for not less than 15 hours on the field techniques/skills of preparation of acetanilide, preparation of azodye, use of separating funnel for solvent extraction, separation of organic compounds in a mixture.
17. **For Student:** Student shall visit a related industry/chemistry laboratory in universities/research organizations/private sector facility and observe the techniques used for the separation of organic compounds. Write their observations and submit a handwritten fieldwork/project work report not exceeding 10 pages in the given format to the teacher.
18. Max marks for Fieldwork/project work Report: 05.
19. Suggested Format for Fieldwork/project work: *Title page, student details, index page, details of place visited, observations, findings, and acknowledgements.*
20. Unit tests (IE).



## CO-PO Mapping:

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

**PO1 : Knowledge in Chemistry :** Apply the knowledge of synthetic organic chemistry to the solution of simple to complex synthesis of organic molecules

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

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

**PO4: Conduct investigations of complex problems:** Use fundamental research-based knowledge and available research methods including design of experiments, analysis and interpretation of data, and synthesis of the organic molecules.

**PO5 : Modern tool usage:** Create, select, and apply appropriate techniques, resources, and IT tools for modeling and interpretation of simple to complex organic molecules.

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

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

**PO8 : Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and

norms of the science-based practice.

**PO9 : Communication:** Communicate effectively on issues related to synthetic organic chemistry with the chemistry community, being able to write the effective reports and documentation, presentations.

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

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

**PSO-2:** To understand the structure and properties of reagents, Characteristics mechanisms of chemical reactions and their synthetic utility.

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

**III SEMESTER**  
**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 → Benzophenoneoxime → 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-toluidine → 4-(p-tolylamino) pent-3-ene-2-one → 2,4,6-trimethylquinoline
6. Flavone from o-hydroxyacetophenone  
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

**III SEMESTER**  
**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 para nitroanilines using silica gel 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 Limberakis, Derek A. Pflum
2. Practical organic chemistry by Mann & Saunders
3. Text book of practical organic chemistry by Vogel
4. Text book of practical organic chemistry including qualitative organic analysis by A.I. Vogel (Longman)

**SCHEME OF VALUTION**

RECORD= 10M  
Viva= 15M  
principle = 5M  
Chemical equation = 5M  
Procedure= 10M  
Tables= 5M  
Calculation= 10M  
Chromatography= 10M  
Report= 10M  
Total= 75M