

K.L.University
Vaddeswaram- 522502
M.Sc., ORGANIC Chemistry, II-Semester, 2016-17

Course Handout

1. Course Name : Organic Chemistry

2. Course Code : 16CY 1207

3. Course Coordinator : Dr. S. Nareshvarma

4. Course Structure(LTP) :

L	T	P
4	0	6

5. Credits : 7

6. Team Members : Prof. Dr. K. R. S. Prasad

7. Course Description: This course aims at enabling the students who are looking at the field of organic chemistry, spatial orientation of the organic molecules, mechanisms involved in organic synthesis and the structure elucidation of organic moieties. Moreover this course is to provide an intellectually stimulating and satisfying experience of learning and studying modern aspects of organic chemistry. This course blends a theoretical knowledge of advanced concepts in organic synthesis and stereo chemistry with industrial applications but, unlike many Masters level courses of this type, does not focus students on one particular application of organic chemistry eg, medicinal chemistry. Instead it provides training, knowledge and a perspective of a broad range of chemical industries reliant upon organic chemistry.

8. Course Objectives:

Provide in-depth knowledge on the synthesis of Organic molecules and their reaction mechanisms in order to develop novel and stable bio engineering tools. It is required for students to understand various technologies and is suitable to pursue their career in both research and industry.

9. Upon completion of the course, students will:

CO	CO	BTL
I	Derive the Electrophilic addition reaction mechanisms of C=C compounds.	2
II	Describe the relationship among aromatic substitution and addition reactions.	2
III	Apply various reaction pathways to develop new and notable organic compounds.	2
IV	Differentiate the Alkaloids and Terpenoids by their unique properties.	2
V	An ability to analyze, generate experimental skills towards the industrial applications.	2

10. Course outcome Indicators:

CO#	COI-1	COI-2	COI-3
CO-I	Understand the electrophilic substitution reaction.	Discuss the stereo selective addition reactions	Describe the elimination reactions and mechanisms
CO-II	Apply the aromatic reaction mechanism.	Describe the nucleophilic and elimination reaction mechanisms	Explain the factors influencing elimination reactions.
CO-III	Describe the various notable named reactions with mechanism	Explain the conditions to be followed for organic synthesis	Apply the named reactions to various needs.
CO-IV	Explain the unique properties of alkaloids and terpenoids.	Demonstrate the synthetic methods of alkaloids.	Describe the synthetic methods of terpenoids
CO-V	Perform laboratory experiments Demonstrating safe and proper use of highly reactive chemicals.	Ability to design and conduct experiments, as well as to organize, analyze and interpret data.	

11. Program Outcomes (Pos):

PO1. Apply knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the conceptualization of engineering models.

PO2. Identify, formulate, research literature and solve complex engineering problems reaching sustained conclusions using first principles of mathematics and engineering sciences.

PO3. Design solutions for complex engineering problems and design systems, components or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal and environmental considerations.

PO4. Conduct investigations of complex problems including design of experiments, analysis and interpretation of data and synthesis of information to provide valid conclusions.

PO5. Create, select and apply appropriate techniques, resources and modern engineering tools including predictions and modeling, to complex engineering activities, with an understanding of the limitations.

PO6. Function effectively as an individual, and as a member or leader in diverse teams and in multi disciplinary settings.

PO7. Communicate effectively on complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective report and design documentation, make effective presentation, give and receive clear instructions.

PO8. Demonstrate understanding of societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to engineering practice.

PO9. Understand and commit to professional ethics and responsibilities and norms of engineering practice.

PO10. Understand impact of engineering solutions in a societal context and demonstrate knowledge of and need for sustainable development.

PO11. Demonstrate a knowledge and understanding of management and business practice, such as risk and change management, and understand their limitations.

PO12. Recognize the need for, and have the ability to engage in independent and lifelong learning.

12. Mapping of Course Objectives with Programme Outcomes:

1. Highest

2. Moderate

3. Use

Programme Outcomes (Pos)												
Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO-I		1	1	1	2	1	2		1		3	1
CO-II		1	1	1	2	1	2		1		3	1
CO-III		1	1	1	2	1	2		1		2	1
CO-IV		2							2			
CO-V			1	1	1	1						

13. Time Table:

Day/Time	9.00-9.50	9.50-10.40	10.50-11.40	11.50-12.40	01:00 -04:00
Monday		Prof. KRSP			
Tuesday					
Wednesday			Dr. SNV		
Thursday			Prof. KRSP		
Friday					Organic Chemistry Lab (Dr. I V Kasi Viswanath)
Saturday			Dr. SNV		Organic Chemistry Lab (Dr. I V Kasi Viswanath)

14. Syllabus:

Organic Chemistry:

CO-I: Reaction mechanism-I

Electrophilic addition to carbon carbon double bond: Stereoselective addition to carbon carbon double bond; anti addition- Bromination and epoxidation followed by ring opening. Syn addition of OsO₄ and KMnO₄.

Elimination reactions Elimination reactions E₂, E₁, E_{1CB} mechanisms. Orientation and stereoselectivity in E₂ eliminations. Pyrolytic syn elimination and α-elimination, elimination Vs substitution. Factors influencing the elimination reactions

CO-II:

Aromatic substitution reactions- electrophilic, nucleophilic and through benzyne - radical substitution of arenes - orientation of nucleophilic substitution at a saturated, carbon, SN1, SN2, SNi reactions-effect of structure, nucleophile, leaving group, solvent. Additions involving electrophiles, nucleophiles and free radicals. Elimination reactions - E1, E1CB, E2 reactions – elimination versus substitution reactions.

CO-III:

Mechanism of some name reactions: Aldol, Perkin, Benzoin, Cannizzaro, Wittig, Grignard, Reformatsky - Meerwein, Hoffmann Claisen and Favorsky rearrangements. Hydroboration - Openauer oxidation, Clemmensen reduction - Meerwein - Ponnordorf and Verley and Birch reductions. Stork enamine reactions, Michael addition, Mannich Reaction, Diels -Alder reaction, Ene - reaction, Bayer - Villiger Reaction.

CO-IV: Alkaloids & Terpenoids

Alkaloids

Occurrence, isolation, general methods of structure elucidation and physiological action, degradation, classification based on nitrogen heterocyclic ring, structure elucidation and synthesis of the following: Atropine, Papaverine and Quinine.

Terpenoids

Classification of terpenoids, occurrence, isolation, general methods of structure determination. Isoprene and special isoprene rule. Structure determination and synthesis of the following representative molecules: Farnesol, Zingiberene, Camphor and Abietic acid.

CO-V: LAB COMPONENT:

Preparations: i) Iodoform ii) n-Dinitroderivative iii) Aspirin iv) p-Nitroaniline v) Benzophenone vi) Benzoic acid vii) p-Bromo Acetanilide viii) Acetanilide

1. Identification of given two compounds with preparation of two solid derivatives and reporting of the melting points for derivatives
2. One preparation – Yield of crude and crystallized sample and reporting of the melting point.

Books Suggested:

1. Advanced Organic Chemistry-Reactions, Mechanism and Structure, Jerry March, John Wiley.
2. Advanced Organic Chemistry, F.A. Carey and R.J Sundberg, Plenum.
3. Structure and Mechanism in Organic Chemistry C.K.Inglod, Cornell University Press.
4. Organic Chemistry, R.T Morrison and R.N. Boyd, Prentice - Hall.
5. Modern Organic Reactions, H.O. House, Benjamin.
6. Principles of Organic Synthesis, R.O.C Norman and J. M. Coxon, Blackie Academic.
7. Stereochemistry, P.S.Kalsi, Wiley Eastern.
8. Text book of Organic Chemistry, M.C. Murry
9. Organic Chemistry Vol. I (Sixth Edn.) and Vol. II (Fifth Ed.,) by IL finar ELBS.

REFERENCE BOOKS:

1. Advanced organic chemistry by Jerry March (4th Edition) Wiley Eastern.
2. Chemistry of Natural Products, K.W.Bentley by stereochemistry of carbon compounds by E.Eliel, John Wiley & Sons, Inc. Stereochemistry of Organic compounds by D. Nasipuri Chemistry of Natural products by P.S. Kalsi Kalyani Publishers. 1983

15. Self Learning Topics:

CO	Topic	Source
I	elimination Vs substitution	T-1
II	Elimination reactions - E1, E1CB, E2 reactions	T-1
III	Mannich Reaction, Diels -Alder reaction	T-1
IV	Structure determination	Internet Sources
V	Basic lab procedure	Internet Sources

16. Session / Lesson Plan

S. No	CO	Session	Content and Source	Learning objective, End of the session student will	Teaching Methodology	Faculty Approach	Student Approach	Cognitive level expected
1	I	1	Introduction to organic reactions	Understand the necessity	Oral	Explanation	Listens and participate	Understand
2	I	2	Electrophilic addition reactions.	Understand	Oral	Explanation	Listens and participate	Understand
3	I	3	Electrophilic addition to carbon carbon double bond	Understand	Chalk and talk	Explanation	Listen	Understand
4	I	4	Stereoselective addition to carbon carbon double bond.	Apply and use	Chalk and talk	Explanation	Listen and Practice	Understand And apply

5	I	5	Anti-addition- Bromination	Apply and use	Chalk and talk	Explanation	Listen and Practice	Understand And apply
6	I	6	Epoxidation followed by ring opening. Syn addition of OsO ₄ and KMnO ₄ .	Understand various timing issues	Chalk and talk	Explanation	Listen and	Understand
7	I	7	Introduction to Elimination reactions.	Understand	Chalk and talk	Explanation	Listen	Understand
8	I	8	E ₂ , E ₁ , E _{1CB} mechanisms.	Understand	Chalk and talk	Explanation	Listen	Understand
9	I	9	Orientation and stereoselectivity in E ₂ eliminations.	Understand	PPT	Explanation	Listen	Understand
10	I	10	Pyrolytic syn elimination and α -elimination,	Understand	PPT	Explanation	Listen	Understand
11	I	11	Elimination Vs substitution.	Apply and use	Chalk and talk	Explanation	Listen and practice	Understand and apply
12	I	12	Factors influencing the elimination reactions	Understand	Chalk and talk /PPT	Explanation	Listen	Understand
13	II	13	Aromatic substitution reactions.	Understand	Chalk and talk / PPT	Explanation	Listen and analyze	Explore the mechanism
14	II	14	electrophilic, nucleophilic and through benzyne.	Understand	Chalk and talk	Explanation	Listen	Understand
15	II	15	radical substitution of arenes	Understand the synthesis of three-state devices	Chalk and talk	Explanation	Listen	Understand And remember
16	II	16	-orientation of nucleophilic substitution at a saturated, carbon, SN1, SN2, SNi.	Apply and use	Chalk and talk	Explanation	Listen	Understand And remember
17	II	17	Reactions-effect of structure, nucleophile, leaving group, solvent.	Analyze	Chalk and talk /PPT	Explanation	Listen and practice	Analyze
18	II	18	Additions involving electrophiles, nucleophiles and free radicals.	Analyze the importance of registers	Chalk and talk	Explanation	Listen and practice	Analyze
19	II	19	Elimination reactions - E ₁ , E _{1CB} , E ₂ reactions..	Understand, Analyze	Chalk and talk	Explanation	Listen and practice	Explore the mechanism
20	II	20	elimination versus substitution reactions	Understand, Analyze	Chalk and talk	Explanation	Listen and practice	Explore the mechanism
21	III	21	Mechanism of Aldol condensation	Understand	Chalk and talk / PPT	Explanation	Listen	Understand
22	III	22	Perkin and Benzoin reactions	Understand	Chalk and talk	Explanation	Listen and practice	Explore the mechanism
23	III	23	Cannizzaro and Wittig reactions	Analyze	Chalk and talk	Explanation	Listen and practice	Understand
24	III	24	Grignard, Reformatsky - Meerwein reactions	Apply and use	Chalk and talk	Explanation	Listen	Explore the mechanism
25	III	25	Hoffmann, Claisen and Favorsky rearrangements.	Apply and use	Chalk and talk / PPT	Explanation	Listen	Understand

26	III	26	Hydroboration - Oppenauer oxidation, Clemmensen reduction	Apply and use	Chalk and talk / PPT	Explanation	Listen	Understand
27	III	27	Meerwein-Ponndorf and Verley and Birch reductions.	Apply and use	Chalk and talk	Explanation	Listen and participate	Explore the mechanism
28	III	28	Stork enamine reactions, Michael addition and Mannich Reaction.	Apply and use	Chalk and talk	Explanation	Listen and participate	Explore the mechanism
29	III	29	Diels -Alder reaction, Ene - reaction,	Apply and use	Chalk and talk	Explanation	Listen	Understand
30	III	30	Bayer - Villiger Reaction.	Apply and use	Chalk and talk	Explanation	Listen and participate	Explore the mechanism
31	IV	31	Alkaloids-introduction Occurrence.	Understand	Chalk and talk	Explanation	Listen	Understand
32	IV	32	Isolation, general methods of structure elucidation and physiological action of Alkaloids	Analyze	Chalk and talk	Explanation	Listen	Understand
33	IV	33	Degradation, classification based on nitrogen heterocyclic ring.	Understand	Chalk and talk	Explanation	Listen	Understand
34	IV	34	Structure elucidation and synthesis of the Atropine,	Understand	Chalk and talk / PPT	Explanation	Listen	Understand
35	IV	35	Synthesis of Papaverine and Quinine.	Understand	Chalk and talk	Explanation	Listen	Understand
36	IV	36	Terpenoids Classification, occurrence.	Understand	Chalk and talk / PPT	Explanation	Listen	Explore the mechanism
37	IV	37	Isolation, general methods of structure determination of Terpenoids.	Analyze	PPT	Explanation	Listen	Understand
38	IV	38	Isoprene and special isoprene rule.	Understand	PPT	Explanation	Listen and participate	Understand
39	IV	39	Structure determination and synthesis of the Farnesol and Zingiberene,	Analyze	Chalk and talk	Explanation	Listen	Understand
40	IV	40	Structure determination and synthesis of the Cadinene and Abietic acid.	Analyze	PPT	Explanation	Listen	Understand

17. Evaluation scheme:

EVALUATION PLAN FOR COURSES (16CY110-organic chemistry)

Evaluation Component	Marks	Weightage	Date	Duration (Hours)	CO 1		CO 2		CO 3		CO 4		CO-5
					1	2	1	2	1	2	1	2	
	Course Outcome Indicator Number				1	2	1	2	1	2	1	2	
	Blooms Taxonomy Level				1	2	2	2	2	2	1	2	
Assignment Test	20	2.5 %		1 ½	10	10							
Test 1	20	15%*		1 ½			10	10					
Test 2	20			1 ½					10	10			
Home Assignment	20	2.5%		-							10	10	
Quiz	20	2.5%		20 min	5		5		5		5		
Lab	50	12.5%		3 Hrs Continuous Evaluation-15 marks, Viva-vove-10, Test -25. Total marks will be scaled to 5%.									
Attendance	5	5%	----		75% of Theory+25% of lab attendance.								
Semester End Exam	60	35%		3	2	10.5	2	10.5	2	10.5	2	10.5	
	Question Number				3	12	3	12	3	12	3	12	
End-Lab Exam	60	25%			Lab exam will be conducted for 60 marks and scaled to 10%. Initial rubrics for evaluation are: [Record (10) + Write up (10) + Experimentation (25) + Viva-voce(15)].								

* 75 % of the Best and 25% of other test together will be taken for 20 marks, internal.

TEST PATTERN:

- Assignment Test:** 6 Questions will be given in advance and any two questions of the Faculty choice have to be answered.
- TEST1 & 2:** It comprises two sections: **Section-1:** 6 short answer question of 1 mark each are to be answered (no choice). **Section-2:** 2 questions of 7 marks each out of 3 questions have to be answered, totaling to 20 marks. **75 % of the Best and 25% of other test together will be taken for 15 marks, internal.**
- Home Assignment:** Two Questions will be given for 20 marks each and to be submitted on or before submission date announced by the faculty in the class.
- Quiz:** 20 Objective Questions will be given for 20 marks and to be answered in 20 minutes.
- Semester End exam:** Four questions with internal choice 4x15=60

Chamber consultation hours: Fri: 12:40 PM- 2:20PM

Mon: 12:40 PM- 2:20PM

18. Notices:

All notices regarding course matters will be displayed in e-learning site & copy of it in department notice board.

Note:

- a. Each student is required to attend all classes regularly with calculator and is required to complete all the work assigned for the course.
- b. Instructors of courses are not obligated to provide make-up opportunities for students who are absent, unless the absence has been officially approved. An officially approved absence, however, merely gives the individual who missed the class an opportunity to make up the work and in no way excuses him from the work.
- c. Reconduct of tests will not be entertained, whatever may be the reason. Submission of home assignments after the deadline will not be either accepted or awarded any marks.
- d. All students in the class must treat others with civility and respect and conduct themselves during class sessions in a way that does not unreasonably interfere with the opportunity of other students to learn. Failure to comply with this requirement may result in points being deducted from a student's final numerical average / soft skills.

19. Signature of the Course Coordinator:

20. Signature of the Group Head:

21. Signature of the HOD: