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

Course Handout

1. Course Name : Organic Chemistry

2. Course Code : 16CY1103

3. Course Coordinator : Dr. S.Vijaya Laxmi

4. Course Structure(LTP) :

L	T	P
3	1	2

5. Credits : 5

6. Team Members : Dr. E. Hari Krishna.

7. Course Description: 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: To provide an introduction to the shapes of organic molecules and the basic principles and nomenclature of stereogenic elements in organic molecules. Green chemistry embodies the concept of "benign by design" and involves tailoring or modifying chemical processes to minimize or eliminate hazardous waste from being produced during a chemicals generation, use, and eventual degradation. To provide student with the basic concept of Nanochemistry and changes of chemical and physical properties due size reduction

9. Upon completion of the course, students will:

CO	CO	BTL
I	Understand the basics of Stereo Chemistry, Green Synthesis & Substitution reactions. .	2
II	Identify the stereo isomerism in many newly synthesized drugs.	2
III	Understand the concept of NGP, Aromaticity and Nucleophilic substitution reactions.	2

IV	Design the green synthetic approaches to replace conventional synthesis methods	2
V	Knowledge in this course will train the students in scientific research approach. .	2

10. Course outcome Indicators:

CO#	COI-1	COI-2	COI-3
CO-I	Understand the chirality and Stereochemistry of the molecules.	Discuss the stereoisomerism of chiral molecules	Application of optical and Geometrical isomerism for the elucidation of configuration of chiral compounds
CO-II	Understand the mechanism of Nucleophilic substitution reactions.	Understand the Importance of NGP reactions.	Application of NGP reaction mechanism for the synthesis of Richter, Sommelet - Hauser and Smiles rearrangement recations.
CO-III	Explain the importance of Huckel rule and aromaticity.	Understanding the inductive and mesomeric effects of aromatic compounds	Application of Huckel rule for the identification of aromaticity.
CO-IV	Understanding the importance of Green chemistry principles.	Understanding the concepts of Green catalysis and Bio catalysis.	Application of green synthesis of the preparation organic compounds.
CO-V	Perform laboratory experiments.	Ability to design and synthesize the biologically demand compounds.	

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 Out come	**P01**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO-I			1	1	2	1			1	1	3	1
CO-II			1	1	2	1			1	1	3	1
CO-III			1	1	2	1			1	1	2	1
CO-IV									2	2		
CO-V			1	1	1	1			1	1	3	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	Dr.SVL				
Tuesday					
Wednesday		Dr.SVL			Organic Chemistry Lab (Dr. SVL)
Thursday					Organic Chemistry Lab (Dr. EHK)
Friday			Dr.EHK		
Saturday	Dr.EHK				

14. Syllabus:

Organic Chemistry:

UNIT-I: **Stereochemistry** **15 Hrs**

Sereoisomerism-Stereoisomers Classification – Configuration and conformation.

Molecular Three dimensional representations: Wedge, Fischer, Newman and Saw-horse formulae, their description and interconversions.

Molecular Symmetry & Chirality: Symmetry operations and symmetry elements (Cn & Sn). Criteria for Chirality. Dissymmetrization.

Optical isomerism: Molecular Symmetry and Chirality-Cahn-Ingold-Prelog rules R, S-nomenclature, stereoisomerism resulting from more than one chiral center, meso and pseudoasymmetric compounds - **Axial Chirality** - Stereochemistry of allenes spiranes - biphenyl derivatives and atropisomerism - **Planar chirality** - Ansa compounds and trans - Cycloalkenes - **Helicity**. Helically chiral compounds

Geometrical isomerism - E, Z - nomenclature - Physical and Chemical methods of determining the configuration of geometrical isomers-Stereoisomerism in 3, 4 and 5-membered cyclic compounds.

UNIT-II: Substitution Reactions **20 Hrs**

i) Aliphatic Nucleophilic substitutions: The S_N2, S_N1, mixed S_N1 and S_N2, SET mechanisms. Reactivity- effects of substrates, attacking nucleophiles, leaving groups and reaction medium. Common carbocation rearrangements – primary, secondary and tertiary. The neighbouring group participation (NGP) -anchimeric assistance, NGP by σ and π-bonds, phenonium ions, norbornyl and norbornenyl systems, Classical and nonclassical carbocations, NGP by halogens and heteroatoms (O,N,S)

The S_N^i and S_N2' mechanisms. Nucleophilic substitution at an allylic, and vinylic carbons.

ii. Aromatic Nucleophilic Substitution: The S_NAr, S_N1, benzyne and $S_{RN}1$mechanisms. Reactivity - effect of substrate, structure, leaving group and attacking nucleophile. The von Richter, Sommelet - Hauser and Smiles rearrangements.

UNIT-III:

Structure and reactivity: Localized and delocalized covalent bond- Concept of resonance and aromaticity - Huckel's rule for aromaticity in benzenoid and non-benzenoid compounds, anti-aromaticity and homo-aromaticity. Nature of reaction energy and kinetic considerations - types of organic reactions - reagents - reactive intermediates. Their formation and stabilization - inductive and mesomeric effects.

UNIT-IV: Green Chemistry **5 Hrs**

Green Chemistry:

Introduction , Basic principles of Green Chemistry, Atom economy, measuring and controlling Environmental performance, Green catalysis, Bio catalysis , Environmentally benign solutions, renewable resources, green reagents, Examples of Green reactions – Synthesis of ibuprofen, clean Fischer –Indole synthesis comparison of the above with conventional methods.

CO-V: LAB COMPONENT:

List of Regular Experiments

1. Preparation of Iodoform and determination of its melting point
2. Preparation of Nitro Benzene and determination of its melting point
3. Preparation of Di nitro Benzene and determination of its melting point
4. Preparation of Aspirine and determination of its melting point
5. Preparation of Acetanilide and determination of its melting point
6. Preparation of P-Bromo Acetanilide and determination of its melting point

Books Suggested:

1. Advanced Organic Chemistry-Reactions, Mechanism and Structure, Jerry March, John Wiley
2. Organic Chemistry Vol. I (Sixth Edn.) and Vol. II (Fifth Ed.,) by IL finar ELBS. Chemistry (fifth Edn.,) by Morrison and Boyd, PHI, India
3. Organic Chemistry (fifth edition)by Francis A. CareyTata Mc Graw Hill publishing company Limited, New Delhi.
4. Reaction Mechanism in Organic Chemistry by Mukherjee Sirigh, NTerniitarr, India

Green Chemistry: Introductory Text. M. Lancaster Royal Society of Chemistry

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:

Unit	Topic	Source
I	Anomers and Epimers Optical Isomerism.	T-1, R-1
II	The von Richter, Sommelet - Hauser and Smiles rearrangements.	T-2
III	Green synthesis of Aldol Condensation and Enzyme catalysis.	Internet Source

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 Chemistry	Understand the necessity of Organic Chemistry.	Oral	Explanation	Listens and participate	Understand
2	I	2	Basic concepts Isomerism	Understand	Oral	Explanation	Listens and participate	Understand
3	I	3	Types of Isoerism	Understand	Chalk and talk	Explanation	Listen	Understand
4	I	4	Conformational Isomerism and its importance	Apply and use	Chalk and talk	Explanation	Listen and Practice	Understand And apply
5	I	5	Conformational Isomerism of n-Butane its Newman and sawhorse projections	Apply and use	Chalk and talk	Explanation	Listen and Practice	Understand And apply
6	I	6	Conformational Isomerism of Cyclohexane.	Understand various timing issues	Chalk and talk	Explanation	Listen and	Understand
7	I	7	Conformational Isomerism of mono and Bi substituted Cyclohexane	Understand	Chalk and talk	Explanation	Listen	Understand
8	I	8	Introduction to optical Isomerism.	Understand	Chalk and talk	Explanation	Listen	Understand
9	I	9	Discuss the difference between the relative and absolute configuration.	Understand	PPT	Explanation	Listen	Understand
10	I	10	CIP rules for assigning the R/S nomenclature	Understand	PPT	Explanation	Listen	Understand
11	I	11	Practice questions to assign R/S nomenclature.	Apply and use	Chalk and talk	Explanation	Listen and practice	Understand and apply
12	I	12	Discussion of R/S nomenclature for Biphenyls and Spiro compounds.	Understand	Chalk and talk /PPT	Explanation	Listen	Understand
13	I	13	Introduction to Geometrical Isomerism.	Understand	Chalk and talk / PPT	Explanation	Listen and analyze	Explore the mechanism
14	I	14	Discussion on how to assign Cis/ Trans nomenclature for alkenes	Understand	Chalk and talk	Explanation	Listen	Understand
15	I	15	Discussion on how to assign E&Z nomenclature for alkenes.	Understand	Chalk and talk	Explanation	Listen	Understand And remember
16	II	16	Introduction to Nucleophilic substitution reactions.	Apply and use	Chalk and talk	Explanation	Listen	Understand And remember
17	II	17	Discussion about SN^1 and SN^2 reactions.	Analyze	Chalk and talk /PPT	Explanation	Listen and practice	Analyze
18	II	18	Discussion about mixed SN^1 and SN^2 reactions.	Analyze	Chalk and talk	Explanation	Listen and practice	Analyze

19	II	19	Introduction to neighbouring group participation	Understand,	Chalk and talk	Explanation	Listen and practice	Explore the mechanism
20	II	20	NGP by sigma and pi bond participation	Understand,	Chalk and talk	Explanation	Listen and practice	Explore the mechanism
21	II	21	NGP by phenonium ions	Understand	Chalk and talk / PPT	Explanation	Listen	Understand
22	II	22	NGP in norbornyl systems.	Understand	Chalk and talk	Explanation	Listen and practice	Explore the mechanism
23	II	23	NGP in norbornenyl systems	Analyze	Chalk and talk	Explanation	Listen and practice	Understand
24	II	24	Discussion on classical and nonclassical carbocations	Apply and use	Chalk and talk	Explanation	Listen	Explore the mechanism
25	II	25	NGP by halogens and heteroatoms	Apply and use	Chalk and talk / PPT	Explanation	Listen	Understand
26	II	26	Nucleophilic substitution at an allylic, and vinylic carbons	Apply and use	Chalk and talk / PPT	Explanation	Listen	Understand
27	II	27	Aromatic Nucleophilic substitution reaction.	Apply and use	Chalk and talk	Explanation	Listen and participate	Explore the mechanism
28	II	28	Effect of substrate, structure, leaving group and attacking nucleophile on Nucleophilic Substitution reactions.	Apply and use	Chalk and talk	Explanation	Listen and participate	Explore the mechanism
29	II	29	The von Richter, Sommelet - Hauser and Smiles rearrangements.	Apply and use	Chalk and talk	Explanation	Listen	Understand
30	III	30	Concept of Aromaticity.	Apply and use	Chalk and talk	Explanation	Listen and participate	Explore the mechanism
31	III	31	Huckel's rule for aromaticity	Understand	Chalk and talk	Explanation	Listen	Understand
32	III	32	Nature of reaction energy and kinetic considerations	Understand	Chalk and talk	Explanation	Listen	Understand
34	III	34	Types of organic reactions - reagents	Understand	Chalk and talk / PPT	Explanation	Listen	Understand
35	III	35	Reactive intermediates. Their formation and stabilization - inductive and mesomeric effects.	Understand	Chalk and talk	Explanation	Listen	Understand
36	IV	36	Introduction to Green chemistry	Understand	Chalk and talk / PPT	Explanation	Listen	Explore the mechanism
37	IV	37	Basic principles of Green Chemistry	Analyze	PPT	Explanation	Listen	Analyze
38	IV	38	Atom economy, measuring and controlling Environmental performance.	Understand	PPT	Explanation	Listen and participate	Understand
39	IV	39	Green catalysis, Bio catalysis , Environmentally benign solutions, renewable resources, green reagents.	Analyze	Chalk and talk	Explanation	Listen	Analyze
40	IV	40	Synthesis of ibuprofen, clean Fischer –Indole synthesis comparison of the above with conventional methods	Understand	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
	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 PATERN:

1. **Assignment Test**: 6 Questions will be given in advance and any two questions of the Faculty choice have to be answered.

2. **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.**

3. **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.

4. **Quiz:** 20 Objective Questions will be given for 20 marks and to be answered in 20 minutes.

5. **Semester End exam:** Four questions with internal choice 4x15=60

18. Chamber consultation hours:

THU: 2:00 PM- 3:20PM
FRI: 2:00 PM- 3:20PM

19. 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. Reconduction 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.

20. Signature of the Course Coordinator:

21. Signature of the Group Head:

22. Signature of the HOD: