1.- GENERAL INFORMATION				
Learning Unit Organic Chemistry Theory II		**Department** Chemistry		**Format** Lecture
Prerequisites (P) Organic Chemistry Theory I	**Corequisites (CO)** Organic Chemistry Theory Lab II	**Academy** Organic chemistry	**Module** M2: Synthesis, purification and chemical transformation	
Type Basic, particular, mandatory.	**Lecture hours** 68 hrs.	**Practice hours** 0 hrs.	**Total hours** 68 hrs.	**Credits** 9

2.- GENERIC COMPETENCIES
Students perform and relate structural aspects of nomenclature, preparation and reactivity methods of the organic compounds that belong to the following functional groups: alkenes and an alkynes alcohols, ethers, epoxides, and aromatic compounds, highlighting the reaction mechanisms to be able to predict reactions that are more complex.

3.- SPECIFIC CHARACTERISTICS OF THE COMPETENCY	
Knowledge	Structure of matter Stereochemistry Functional groups: synthesis and characteristic reactions Types of reactions
Skills	Students… Distinguish different types of bonds. Predict the Stereochemical product of specific reactions. Identify the different functional groups and relate their synthesis methods and particular characteristics. Know the different types of reactions to predict the product obtained.
Aptitudes	Team work Skills on analysis, synthesis and evaluation. Creativity Critical thinking Work culture
Values	Solidarity Honesty Responsibility Discipline

4.- TRANSVERSAL COMPETENCIES

☑	Foreign Language (English)
☑	Critical, analytical and synthetic thinking.
☑	Oral and written expression
☑	Professional ethics
☐	Administration of human and material resources
☐	Leadership and sustainability
☐	Creativity, innovation and entrepreneurship
☐	Other

5.- COURSE CONTENT OF THE LEARNING UNIT

1.- Alkenes.
2.- Alkynes
3. Alcohols.
4.- Ethers, epoxides and sulphides.
5.- Aromatic compounds .
6.- Reactions of aromatic compounds.

6.- ASSESSMENT

☑	Numeric grade.
☐	
☐	

7.- GRADING CRITERIA OF THE LEARNING UNIT

Indicator of evaluation	Percentage
Departmental exams	25
Partial exam	40
Homework	10
Research activities	10
Practice reports	0
Class participation	0
Other: Activities in Moodle	15

8.- REQUIRED MATERIAL (for students)	
☐	Calculator
☐	Periodic table
☐	Lab coat
☑	Text book
☐	Workbook
☐	

9.-SPECIFIC CONTENT BY LEARNING UNITS

Content unit	Generic competency of the content unit	Topics	Class hours	Student activities	Bibliography
Unit 1 Structure and synthesis of alkenes	Students - are able to distinguish the sigma bond from the pi bond, recognizing the unsaturation degrees. – draw and name all the alkenes from a given molecular formula, using the E and Z and cis trans systems.	1.1 Orbital description of the double bond of alkenes. 1.2 Unsaturation elements. 1.3 Nomenclature of alkenes. 1.4 Nomenclature of cis- trans isomers. 1.5 Stability of alkenes. 1.6 Physical properties of alkenes. 1.7 Alkene synthesis through alkyl halide elimination. 1.8 Alkene synthesis through alcohol dehydration.	6 h	Students **Before:** Identify the learning objectives, and read about the topic. **During**: Listen and take notes, reflect, analyze and carry out the activities. **After:** They do the homework exercises to ensure the learning of the topic. Answer the questionnaire and/or the Moodle	L.G. Wade Jr. *Química Orgánica volume 1.*

				activities in in due time.	
Unit 2. Alkene reactions	Students… -Identify the main characteristics of electrophilic addition reactions of alkenes to predict their addition, oxidation, and reduction products.	2.1 Reactivity of the double bond carbon-carbon. 2.2 Alkene electrophilic addition. 2.3 Hydrogen halide addition to alkenes. 2.4 Water addition: alkene hydration. 2.5 Hydration through oxymercuration and demercuration. 2.6 Alkoxymercuration- Demercuration 2.7 Hydroboration of Alkenes 2.8 Halogen addition to alkenes. 2.9 Halohydrin formation. 2.10 Catalytic hydrogenation of alkenes. 2.11 Carbene addition to alkenes. 2.12 Epoxidation of alkenes 2.13 Epoxide opening catalyzed by acids. 2.14 S*in* Hydroxylation of alkenes. 2.15 Oxidative breaking of alkenes.	10 h		
Unit 3. Alkynes	Students… - draw and name all the alkynes from	3.1 Nomenclature of alkynes 3.2 Physical properties of alkynes. 3.3 Electronic structure of alkynes. 3.4 Acidity of alkynes. Acetylide ion formation.	6 h		

	a given molecular formula, to identify the main characteristics of the electrophilic addition reactions of alkynes and predict the hydration and, reduction products of alkynes and their breaking.	3.5 Synthesis of alkynes through acetylide. 3.6 Synthesis of alkynes through elimination reactions. 3.7 Addition reactions of alkynes. 3.8 Oxidation of alkynes.			
Unit 4. Structure and synthesis of alcohols.	Students… -Identify alcohols and phenols by their name and formula.	4.1 Structure and classification of alcohols. 4.2 Nomenclature of alcohol and phenols. 4.3 Physical properties of alcohols. 4.4 Important commercial alcohols. 4.5 Alcohol and phenol acidity. 4.6 Synthesis of alcohols: introduction and review.	10 h		

	- Know the alcohol preparation reactions from alkyl halides and from carbonyl compounds via reduction or reaction with the Grignard reagent.	4.7 Organometallic reagents for the synthesis of alcohols. 4.8 Organometallic reagent addition to carbonyl compounds. Grignard reagents. 4.9 Secondary reactions of organometallic reagents: Alkyl halide reduction. 4.10 Reduction of the carbonyl group: 1° and 2° alcohol synthesis. Reactions with $LiAlH_4$ and $NaBH_4$ Synthesis of alcohols through nucleophilic additions. 4.11 Thiols (mercaptans)			
Unit 5. Alcohol reactions	Students… -Identify the reactions that alcohols go through in order to predict the products of the dehydration reactions to form alkenes; SN1 and S_N2	5.1 Oxidation states of alcohol and related functional groups. 5.2 Oxidation of alcohols. 5.3 Additional methods for the oxidation of alcohols. 5.4 Alcohols as nucleophiles and electrophiles. Tosylate formation. S_N2 reactions of the tosylate esters. 5.5 Reduction of alcohols. 5.6 Reaction of alcohols with hydrogen halide acids. (alkyl halides) 5.7 Reactions of alcohols with phosphorus halides.	10 h		

	reactions to transform them into alkyl halides. Conversion and use of tosylates.	5.8 Reactions of alcohols with thionyl chloride. 5.9 Reactions of alcohol dehydration. 5.10 Reactions exclusive to diols. 5.11 Alcohol esterification. 5.12 Inorganic acid esters.			
Unit 6. Ethers, epoxides and sulphides.	Students… -Identify ethers, epoxides, thiols and sulphides by their name and formula. –Know the preparation reactions of ethers and epoxides. - Analyze the general characteristics of the ring opening of epoxides	6.1 Physical properties of ethers. 6.2 Nomenclature of ethers. 6.3 Williamson ether synthesis. 6.4 Ether synthesis through alkoxymercuration-demercuration. 6.5 Industrial synthesis: biomolecular dehydration of alcohols. 6.6 Ether cleavage through HBr and HI 6.7 Autoxidation of ethers 6.8 Sulphides 6.9 Synthesis of epoxides. 6.10 Ring opening of epoxides catalyzed through an acid. 6.11 Ring opening of epoxides catalyzed through a base. 6.12 Orientation of the ring opening of the epoxide. 6.13 Epoxide reactions with Grignard and organolithium reagents.	8 h		

	under acid and basic conditions.				
Unit 7. Aromatic compounds	Students -Identify the derivatives of benzene by their name and formula. –Distinguish aromatic and non-aromatic compounds based on their structures and Hückel rule.	7.1 Structure and properties of benzene. 7.2 Molecular orbital of benzene. 7.3 Representation of cyclobutadiene with molecular orbitals. 7.4 Aromatic, antiaromatic, and non-aromatic compounds. 7.5 Hückel rule 7.6 Aromatic ions. 7.7 Heterocyclical aromatic compounds. 7.8 Polynuclear aromatic compounds. 7.9 Aromatic allotropes of carbon. 7.10 Fused heterocyclic compounds. 7.11 Nomenclature of benzene derivatives. 7.12 Physical properties of benzene and its derivatives.	8 h		
8. Reactions of aromatic compounds.	Students… -Know the reactions of aromatic electrophilic	8.1 Aromatic electrophilic substitution. 8.2 Benzene halogenation. 8.3 Benzene nitration. 8.4 Benzene sulfonation. 8.5 Toluene nitration: effect of the alkyl group over the substitution.	10 h		

	substitution of benzene. - Understand the mechanism and the general characteristics of the S_EA reaction. -Identify the lateral chain reactions of aromatic rings. - Use their knowledge to design the synthesis of disubstituted and trisubstituted benzenes.	8.6 Activator substituents, *ortho-para* directors. 8.7 Deactivator substituents, *meta* directors. 8.8 Halogenated substituents. Deactivators but *ortho-para* directors. 8.9 Effects of multiple substituents over the aromatic electrophilic substitution. 8.10 Friedel-Crafs alkylation. 8.11 Friedel-Crafs acylation. 8.12 Nucleophilic aromatic substitution. 8.13 Addition reactions of the benzene derivatives. 8.14 Lateral chain reaction of the benzene derivatives. 8.15 Phenol reactions.			

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