Code: QO421								
Name: Química Orgânica II								
Name in English: Organic Chemistry II								
Name in Spanish: Química Orgánica								
Subject type: Organic Chemistry								
Approval Type: Exams								
Characteristic: Regular								
Frequency: Attendance of a minimum of 75% of the classes								
Period Type / Offering period: Semester/every period								
Requires Final Exam: Yes								
Vectors								
T	L	P	O	PE	OE	SL	WEEKS	CREDITS
4	-	-	-	--		4	15	4
Occurrence in curriculum: 63								
Pre-requirement: QO321 ou QO325								

Summary: Aldehydes and ketones. Carboxylic acids. Derivatives of carboxylic acids. Conjugation, allylic systems, dienes and polyenes, unsaturated carbonyl compounds, Diels-Alder type reactions. Benzene and the aromatic ring. Electrophilic aromatic substitution. Aryl halides and nucleophilic aromatic substitution. Phenols. Amines. Other nitrogenous functions.

Program:

1. Aldehydes and Ketones.

a) Structure and Properties.

b) Occurrence and use.

c) Description of the carbonyl group by valence theory and molecular orbital theory.

d) General methods for preparing aldehydes and ketones.

e) Addition of oxygen and nitrogen nucleophiles to aldehydes and ketones: formation of hydrates, ketals and hemiketals, imines, enamines and related compounds.

f) Addition of carbon nucleophiles: hydrocyanic acid, organometallic reagents (Grignard reaction), phosphorus ylides (Wittig reaction) and phosphonates.

g) The influence of substituents on the reactivity of aldehydes and ketones.

h) Stereochemical aspects of the addition of nucleophiles to aldehydes and ketones.

i) Methods for reducing and oxidizing aldehydes and ketones: Baeyer-Villiger oxidation, oxidation by Cr(VI) compounds, reduction by metal hydrides, catalytic hydrogenation, Clemmensen reaction, Wolff-Kischner reaction.

2. Enolization of aldehydes and ketones.

a) The basicity of the carbonyl group and the acidity of the hydrogen in the alpha position.

b) Description by valence bond theory and molecular orbital theory.

c) Nucleophilic vs. nucleophilic addition enolate formation.

d) Racemizations.

e) Halogenation reaction of aldehydes and ketones.

f) The aldol reaction: acid or basic catalysis.

g) Cross and intramolecular aldol reaction.

h) Aldol reaction with pre-formed enolates.

3. Carboxylic acids.

a) Structure and properties.

b) Occurrence and use.

c) Acidity.

d) Inductive and electronic effects on the acidity of carboxylic acids.

e) Formation of salts, soaps, detergents and surfactants.

f) Esterification reactions.

g) Formation of acyl halides and amides.

h) Reduction of the carboxylic group.

4. Carboxylic acid derivatives: esters, amides, acyl halides, carboxylic acid anhydrides and thioesters.

a) Structure and properties.

b) Occurrence and use.

c) Description by valence bond theory and molecular orbital theory.

d) The basic character of the carbonyl group.

e) General mechanism of the addition of nucleophiles to carboxylic acids and derivatives.

f) The hydrolysis reaction.

g) Addition of heteronucleophiles: formation of esters, amides, thioesters and carboxylic acid anhydrides.

h) The acidity of alpha hydrogen in carboxylic acids and derivatives.

i) The formation of enolates, alkylation reaction and aldol reaction.

j) The addition of organometallics to carboxylic acids and derivatives.

k) The Reformatzky reaction.

5. Electronic conjugation and reactivity.

a) The allylic system.

b) Description by valence bond theory and molecular orbital theory.

c) Dienes.

d) Structure and reactivity.

e) Alpha, beta-unsaturated carbonyl compounds.

f) Structure and properties.

g) Conjugated addition.

h) The Diels-Alder reaction.

6 Benzene and aromaticity.

a) Historical aspects.

b) Structure, nomenclature and properties.

c) Resonance energy.

d) Description by valence bond theory and molecular orbital theory.

e) Hückel's rule.

f) Reactions in the side chain: SN2, SN1, hydrogenolysis, oxidation.

g) Birch reduction.

h) The phenomenon of hyperconjugation.

i) Ultraviolet spectroscopy and photochemical reactions.

7. Electrophilic aromatic substitution reactions.

a) Protonation, halogenation, and nitration reactions. Friedel-Crafts reaction.

b) Orientation effects in SEAr.

c) Effects of multiple substituents.

8. Amines.

a) Structure and properties.

b) Sources and use.

c) Basicity and formation of salts.

d) Formation of imines and enamines.

e) Preparation methods: alkylation, reduction of nitro compounds, nitriles, azides, imines and oximes.

f) Reductive amination.

g) Hofmann, Curtius and Schmidt rearrangements.

h) Formation of diazonium salts.

i) The elimination of Cope and Hofmann.

9. Other nitrogenated organic functions.

a) Nitrocompounds.

b) Structure and properties.

c) Isocyanates, carbamates and ureas.

d) Diazocompounds.

e) The Sandmeyer reaction.

f) Azo compounds.

Basic Bibliography

1) SOLOMONS, G.; FRYHLE, C. Organic Chemistry, 7th Ed., John Wiley & Sons, 2000.

2) STREITWIESER, A.; HEATHCOCK, C. H.; KOSOWER, E. M. Introduction to Organic Chemistry, 4th Ed., McMillan Publishing Co, 1992.

3) COSTA, P.; PILLI, R.; PINHEIRO, S.; VASCONCELLOS, M. Substâncias Carboniladas e Derivados, Editora da Sociedade Brasileira de Química, 2019.

Supplementary Bibliography: None