COURSE OUTLINE

(1) GENERALLY

SCHOOL	SCHOOL OF SCIENCES		
DEPARTMENT	DEPARTMENT OF CHEMISTRY		
LEVEL OF STUDIES	ISCED level 6 – Bachelor's or equivalent level		
COURSE CODE	YN402	**SEMESTER OF STUDIES**	**4th**
COURSE TITLE	Organic Chemistry III		

TEACHING ACTIVITIES *If the ECTS Credits are distributed in distinct parts of the course e.g. lectures, labs etc. If the ECTS Credits are awarded to the whole course, then please indicate the teaching hours per week and the corresponding ECTS Credits.*	**TEACHING HOURS PER WEEK**	**ECTS CREDITS**
THEORY	4	6

COURSE TYPE *Background, General Knowledge, Scientific Area, Skill Development*	Specific background
PREREQUISITES:	There are no prerequisite courses. To better understand the course, students should have studied the material from Organic Chemistry I and Organic Chemistry II.
TEACHING & EXAMINATION LANGUAGE:	GREEK
COURSE OFFERED TO ERASMUS STUDENTS:	NO
COURSE URL:	https://eclass2.emt.duth.gr/courses/CHEM_E104/

(2) LEARNING OUTCOMES

Learning Outcomes

Please describe the learning outcomes of the course: Knowledge, skills and abilities acquired after the successful completion of the course

The Organic Chemistry III course aims to explore the chemistry of important classes of organic compounds, including carbonyl compounds, carboxylic acids, carboxylic acid derivatives, amines, aromatic and heterocyclic compounds, carbohydrates, biological molecules, and natural products. It also covers organic synthesis and spectroscopic techniques for determining the structure of these compounds.

Specifically, within the context of the course, students will acquire the knowledge and skills to understand:

- ✓ The chemistry of ketones and aldehydes (structure, properties, preparations, reactions)
- ✓ The chemistry of carboxylic acids, including their structure, properties, preparations, and reactions
- ✓ The chemistry of carboxylic derivatives, their reactivity, preparations, and physical and chemical properties of acid chlorides, acid anhydrides, esters, amides, and nitriles, along with synthesis strategies and spectroscopic analysis
- ✓ The chemistry of the α carbon, reactions of enols and enolate ions, the Claisen condensation, alkylation at the α position, conjugate addition reactions, and their applications in synthetic strategies
- ✓ The chemistry of amines, including preparations, physical and chemical properties, Hofmann elimination, diazotization, and aryldiazonium ions, as well as synthesis strategies and spectroscopic analysis

- ✓ Retrosynthetic analysis, chemoselectivity, protecting groups, and asymmetric synthesis
- ✓ The chemistry and stereochemistry of carbohydrates
- ✓ The chemistry of esters, phosphoric esters, phosphoric anhydrides, and compounds with "high energy content'.
- ✓ The chemistry of Aromatic Heterocyclic Compounds, their nomenclature and structure, the basicity and acidity they exhibit.
- ✓ The organic chemistry of life, biological molecules
- ✓ The chemistry of natural products, their classification, their biological activity and their use as therapeutic agents
- ✓ Two-dimensional spectra (2D NMR), applications in biological systems and medicine
- ✓ The study and utilization of organic reactions in the chemical synthesis of natural products, drugs and polymers

- ➢ More generally, upon completing the course, the student will have developed the following key abilities and skills:
- ➢ Expanding their scientific outlook and gaining a better understanding of the behaviour of organic compounds, reaction mechanisms, and synthesis strategies.
- ➢ Applying concepts, reactions, and mechanisms to both simple and complex compounds, as well as solving synthetic problems.
- ➢ Gaining theoretical training and acquiring skills to address interdisciplinary issues.
- ➢ Developing the ability to search for scientific information from international literature, understand it, and present findings.
- ➢ Practising criticism and self-criticism.
- ➢ Encouraging creative and inductive thinking.

General Skills

Taking into account the general competencies that the graduate must have acquired (as listed in the Diploma Supplement and listed below), which of these does the course aim to achieve?

Search, analysis and synthesis of data and information, using the necessary technologies	*Project planning and management*
Adapting to new situations	*Respect for diversity and multiculturalism*
Decision making	*Respect for the natural environment*
Autonomous work	*Demonstrate social, professional and ethical responsibility and sensitivity to gender issues*
Teamwork	*Practicing criticism and self-criticism*
Working in an international environment	*Promoting free, creative and inductive thinking*
Working in an interdisciplinary environment	*……*
Generation of new research ideas	*Other…*
	…….

(3) COURSE CONTENT

1. Review of spectroscopic methods for product identification.
2. Aldehydes and Ketones. Nomenclature. Nucleophilic reactions. Oxygen, Nitrogen, Sulfur, Hydrogen, Carbon nucleophiles. Hydrolysis of acetals, imines and enamines. Synthesis strategies. Spectroscopic analysis.
3. Carboxylic Acids: Nomenclature, structure, properties, preparations, and reactions.
4. The chemistry of carboxylic acid derivatives: reactivity, preparations, and reactions of acid chlorides, acid anhydrides, esters, amides, and nitriles; spectroscopy of carboxylic acids.
5. Chemistry of the α carbon: enols and enol ions, their formation and reactions, including aldol reaction and Claisen condensation. Alkylation of the a position. Conjugate addition reactions. Synthesis strategies.
6. The chemistry of amines: properties, preparations, reactions, including acylation, Hofmann elimination, reactions of aryldiazonium ions. Spectroscopy of amines.
7. Synthetic strategies: retrosynthetic analysis, pericyclic reactions, sigmatropic and electrocyclic reactions. Chemoselectivity and protecting groups; asymmetric synthesis; chiral reagents; enzymes as

catalysts.
8. Synthesis and reactions of carbenes.
9. Chemistry of thiesters, phosphoric esters, and phosphoric anhydrides; compounds of high energy content.
10. Biomolecules: carbohydrates, classification, Fischer projections, stereoisomerism, reactions of monosaccharides, plus complex carbohydrates and derivatives.
11. Amino acids: properties, analysis, peptides, proteins, peptide bonds, and peptide synthesis.
12. Lipids, fats, steroids, terpenes, and alkaloids.
13. The chemistry of aromatic heterocyclic compounds: nomenclature, structure, basicity, acidity, including the chemistry of furan, pyrrole, thiophene, and pyridine.
14. Natural products.
15. Special chapters on NMR, including two-dimensional spectra (2D NMR), applications in biological systems and medicine.

(4) TEACHING AND LEARNING METHODS - EVALUATION

DELIVERY METHOD *Face to face, Distance learning, etc.*	Face-to-face
USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES *Use of ICT in Teaching, Laboratory Education, Communication with students*	The use of ICT, specifically PowerPoint, in teaching involves employing a problem-solving methodology and developing effective teaching strategies. This includes providing exemplary solutions to exercises and administering self-assessment tests. Additionally, the learning process is supported through the electronic platform, e-class. Communication with students occurs via email, facilitating the resolution of any doubts they may have.
TEACHING ORGANIZATION *The ways and methods of teaching are described in detail.* *Lectures, Seminars, Laboratory Exercise, Field Exercise, Bibliographic research & analysis, Tutoring, Internship (Placement), Clinical Exercise, Art Workshop, Interactive learning, Study visits, Study / creation, project, creation, project. Etc.* *The supervised and unsupervised workload per activity is indicated here, so that total workload per semester complies to ECTS standards*	

Activity	***Load Monthly Work***
Lectures (3 hours per week X 13 weeks)	39
Tutorial (1 hour per week X 13 weeks) with solving representative exercises	13
Final exam (3 hours)	3
Literature study and analysis	13
Self-assessment test	13
Student study hours and preparation for the final exam	65
Total course	146 hours (total workload)

	(24 hours of workload per credit unit)	
STUDENT EVALUATION *Description of the evaluation process* *Language of Assessment, Assessment Methods, Formative or Inferential, Multiple Choice Test, Short Answer Questions, Essay Development Questions, Problem Solving, Written Assignment, Report / Report, Oral Examination, Public Presentation, Laboratory Work, Clinical Examination of a Patient, Artistic Interpretation, Other / Others* *Explicitly specified evaluation criteria are mentioned and if and where they are accessible to students.*	Student evaluation is done through a written final exam (in Greek) which includes: ✓ multiple choice questions (formative) ✓ short answer questions (inferential) ✓ answers to critical questions (conclusion) ✓ combinatorial problems (inferential)	

(5) RECOMMENDED BIBLIOGRAPHY

- Recommended Bibliography:

1. Οργανική Χημεία. Αριθμός τόμου: ΙΙ. Έκδοση: 4η αμερικανική-2η ελληνική/2024. Συγγραφείς: David Klein. ISBN: 9786185800147. Τύπος: Σύγγραμμα
Διαθέτης (Εκδότης): UTOPIA ΕΚΔΟΣΕΙΣ Μ. ΕΠΕ.
Κωδικός Βιβλίου στον Εύδοξο: 122094658
2. ΟΡΓΑΝΙΚΗ ΧΗΜΕΙΑ. Συγγραφείς: Loudon Marc, Parise Jim, 2019, ISBN9789925563616. Κωδικός Βιβλίου στον Εύδοξο: 77107206. Διαθέτης (Εκδότης) BROKEN HILL PUBLISHERS LTD
3. ΟΡΓΑΝΙΚΗ ΧΗΜΕΙΑ ΤΟΜΟΣ ΙΙ. Συγγραφείς: Clayden-Greeves-Warren. ISBN-13: 978-618-5173-21-0. Κωδικός στον Εύδοξο: 59384178.
4. Πυρηνικός Μαγνητικός Συντονισμός. Συγγραφείς: Μαυρομούστακος Θ.,Τζάκος Α.,Σπυρούλιας Γ.,Μικρός Ε.,Κολοκούρης Α.,Παπακωνσταντίνου Κ.,Γεροθανάσης Ι.,Ματσούκας Ι. Έκδοση: 1η/2018. ISBN: 9789602665046. Τύπος: Σύγγραμμα. Διαθέτης (Εκδότης): Σ.ΑΘΑΝΑΣΟΠΟΥΛΟΣ & ΣΙΑ Ι.Κ.Ε
Κωδικός Βιβλίου στον Εύδοξο: 77114375

- Relevant Scientific Journals:

Journal of Chemical Education
European Journal of Organic Chemistry
Organic Chemistry Frontiers
Organic Syntheses
Organic Letters