Course Title	**Pharmaceutical Chemistry II**				
Course Code	PHA401				
Course Type	Compulsory				
Level	BSc (Level 1)				
Year / Semester	4th (7th Semester)				
Teacher's Name	Dr C. Triantis, Dr G. Papagiouvannis				
ECTS	6	Lectures / week	3+1*	Laboratories/week	2
Course Purpose	The aim of this course is to teach the students the pharmacochemistry of the vast group of drugs acting on the Centrial Nervous System (CNS), from many points of view: Nomenclature, syntheses, properties, purity control, molecular mode of action, therapeutic uses, fate in the organism, structure-activity relationships. Thus, aims are the knowledge of structure, correlation of structure with drug action, sites of loss, therefore duration of drug action. Another aim is the knowledge of the fate of the drug, i.e. structural changes performed in the body by the drug metabolizing enzymes, mainly of the liver. Aim is also to familiarise the students with relations of molecules acting on CNS and the CNS site of action as well as the involved neurotransmitters. Some of the pharmacomolecules examined are addressed to pathologic conditions of the modern society, e.g. Senile Dementia of Alzheimer Type, Parkinsonism. Furthermore, all agents used illegally, such as opioids, cannabinoids and other drugs of addiction, with special pharmaco-sociologic interest. The knowledge of this subject helps considerably other subjects of Pharmaceutical Sciences, like Pharmacology, Toxicology, Pharmacotherapeutics and Pharmacochemistry of Addiction - Narcotics. *tutorial				
Learning Outcomes	By the end of this course, the students are expected to be able to: • Recognize the basic classification and causes of major diseases and their characteristics • Distinguish differences between diseases and recognize the therapeutic target at the molecular level • Recognize the classification of the main drugs used in the treatment of diseases and other conditions of the Central Nervous System • Explain the synthesis of the important drug molecules used for pathologic conditions concerning CNS • Identify the physical and chemical properties of drugs acting on CNS and ways to handle them				

	• Distinguish the structural changes (i.e. metabolism) and fate of this group of molecules in the organism, the duration of action, the possibility of biodetoxication or biotoxication; • Analyse the relationships between action and structural and physicochemical characteristics; • Understand the complexity of the molecular mechanisms underlying the action of drug molecules to interpret their major adverse reactions. • Analyse characteristic molecules used illegally as narcotic and addictive agents, from the pharmacochemical point of view. • Recognize the features of molecules used in drug detoxification Overall learning outcome Acquire an integrated view of the pharmacochemistry of the most important drugs used in the treatment of diseases of the Central Nervous System or abusively as addictive agents		
Prerequisites	PHA307	Corequisites	None
Course Content	Theory: • General anesthetics. • Hypnotics such as barbiturates • Antiepileptics. • Anxiolytics, benzodiazepines derivatives • Neuroleptics (drugs acting against mania and psychoses), • Antidepressants. • Centrally acting muscle relaxants • Antiparkinsonian drugs. • Drugs acting on neurodegenerative diseases, mainly on Parkinson, Huntington and Alzheimer disease. • Opioids and other centrally acting analgesics. Opioid antagonists. Introduction to addiction. Agents used in detoxication and addiction therapy. Central nervous system stimulants (purines, niketamide). • Drugs acting on migraine, vertigo and emesis, cough, sneezing and hiccups. • Drugs affecting appetite and obesity. • Cycloogygenase inhibitors, anti-inflammatory agents (non-steroidal), analgesics and antipyretics. Lipoxygenase inhibitors. • Psychotoxic and psychedelic drugs. Laboratory experiments/exercises:		

	As part of the course, laboratory exercises are carried out on the course material for a better deepening and consolidation of the theoretical part. Exercise 1-2: Synthesis, purification with recrystallization and identification (with IR, thin layer chromatography and melting point) and quality control of phenytoin Exercise 3-4: Synthesis, purification with recrystallization, identification (with IR, thin layer chromatography and melting point) and quality control of benzocaine Exercise 5: Quantitative determination of compounds with diazotization Exercise 6: Quality and quantity control of Chlorodiazepoxide Exercise 7: Detection of S, N and halogens in organic compounds Exercise 8: Qualitative and quantitative analysis of phenobarbital Exercise 9: Quantitative analysis of haloperidol Exercise 10: Quantitative analysis of topiramate Exercise 11: Computational determination of blood-brain barrier permeability by known opioids. Exercise 12: Design of improved centrally acting analgesic drugs.
Teaching Methodology	The teaching methodology includes lectures offering the theoretical background for a better perception of some concepts of Pharmaceutical Chemistry. Methods such as discussion, questions/answers, pros/cons and case studies are used to enhance student's participation. A debate-focused flipped classroom is used to enhance student engagement, while also improving learning outcomes. Detailed notes with PowerPoint are used in the lesson. Image-rich material and short animations are used to comprehend some biological processes. The laboratory part of the course is conducted in the Pharmaceutical Lab under the supervision of the professor/lab instructor.

Bibliography	(a) Textbooks: • Μαθήματα Φαρμακευτικής Χημείας Ι, Κατασταλτικά ΚΝΣ-ψυχοφάρμακα, αντιισταμινικά, βιταμίνες, αντιβακτηριακά φάρμακα. Ν. Πουλή , Π. Μαράκος. Εκδόσεις Παρισιάνος, 2018 • Pharmaceutical Chemistry. CNS drugs. Rekka E, Kourounakis P. Greek Publisher Chatzipantou, 2015 • Wilson and Gisvold's Textbook of Organic Medicinal and Pharmaceutical Chemistry, Twelfth, North American edition, 12th ed. 2011. (b) References: • "Burger's Medicinal Chemistry and Drug Discovery" vol. 1-8, John Wiley & Sons, 8th ed., 2021. • "An Introduction to Medicinal Chemistry", P. Graham, Oxford, 6th ed, 2017. • "Comprehensive Medicinal Chemistry II", John B. Taylor and David J. Triggle, Elsevier 2007.
Assessment	• Midterm written Exam 20% • Lab Reports 10% • Lab Examination 10% • Final written Examination 60% Course evaluation is done by:

	(a) a written examination during the semester which examines specific modules of the course and it accounts for 20% of the total grade (b) laboratory reports during the semester, in which students present the collected and analysed experimental data as well as their conclusions, derived from theory and the experimental data. Together with lab written exams on the laboratory work, lab reports account for a total of 20% of the total score (60% of this concerns the laboratory reports and 40% the exam results) (c) a final written examination which examines all modules of the course material and it accounts for 60% of the total grade. Students are prepared for the above written exams over the theoretical and practical background in the classroom and with additional exercises given to them for further practice. For the better comprehension of the subject frequent revisions are performed at regular intervals. Questions of gradual difficulty apply to the evaluation of the mid-term and final examination. There may be multiple choice or right/wrong questions with justification of the answers or issue analysis and problem solving questions may be applied in order to evaluate the knowledge and perception of the student on the subject. For the evaluation of laboratory exercise reports, the following criteria shall be taken into account, with ratios varying according to the laboratory exercise: (a) data collection (b) data analysis (c) application of theory to draw conclusions The above criteria and assessment tools, as well as their weight, are communicated to the students, and are formulated in such a way in order to maximize the expected learning outcomes as well as the quality of the course.
Language	Greek, English