UNIVERSIDAD DE CASTILLA - LA MANCHA

GUÍA DOCENTE

1. General information

Course: PHARMACEUTICAL CHEMISTRY II
Type: CORE COURSE
Degree: 376 - UNDERGRADUATE DEGREE PROGRAMME IN PHARMACY
Center: 14 - FACULTY OF PHARMACY
Year: 3
Main language: Spanish
Use of additional languages:
Web site:

Code: 14324
ECTS credits: 6
Academic year: 2023-24
Group(s): 10
Duration: C2
Second language: English
English Friendly: Y
Bilingual: N

Lecturer: **MARÍA DEL PILAR ELÍAS RODRÍGUEZ** - Group(s): **10**

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2. Pre-Requisites

No prerequisites are established for this subject although it is recommended that the student has previously passed the subjects of Organic Chemistry I and II, Biochemistry I and II, Physical Chemistry I and II and Pharmaceutical Chemistry I.

3. Justification in the curriculum, relation to other subjects and to the profession

Pharmaceutical Chemistry is the discipline responsible for the design, synthesis and development of molecules with biological activity and drugs for therapeutic purposes. In this sense, this subject is very important in the training of graduates in pharmacy. This is a subject that requires a solid previous knowledge of organic chemistry, biochemistry and physico-chemistry, and the knowledge acquired from it will be used in subjects such as pharmacology, bioinformatics, biopharmacy and pharmacokinetics, among others.

4. Degree competences achieved in this course

Course competences

Code	Description
B01	Proficiency in a second foreign language at level B1 of the Common European Framework of Reference for Languages.
B02	Knowledge of Information and Communication Technologies (ICT).
B03	A correct oral and written communication
B04	Ethical commitment and professional deontology.
B05	Ability to develop those learning skills necessary to undertake further studies.
EQ01	Identify, design, prepare, analyse and produce active principles, drugs and other materials and products of sanitary interest.
EQ03	Complete standard laboratory processes including the employment of scientific equipment related to synthesis and analysis.
EQ04	Evaluate risks/hazards associated to the use of chemical substances and lab processes.
G01	Identify, design, obtain, analyze, control and produce drugs and medicines, as well as other products and raw materials of sanitary interest for human or veterinary use.
G02	Evaluate the therapeutic and toxic effects of substances with pharmacological activity.
G03	Know how to apply the scientific method and acquire skills in the handling of legislation, sources of information, bibliography, elaboration of protocols and other aspects considered necessary for the design and critical evaluation of preclinical and clinical trials.
G04	Design, prepare, supply and dispense medicines and other products of health interest.
G05	Provide therapeutic advice in pharmacotherapy and dietotherapy, as well as in the nutritional and food field in the establishments where they provide services.
G06	Promote the rational use of medicines and medical devices, as well as to acquire basic knowledge in clinical management, health economics and the efficient use of health resources.
G07	Identify, evaluate and assess problems related to drugs and medicines, as well as participate in pharmacovigilance activities.
G08	Conducting clinical and social pharmacy activities, following the pharmaceutical care cycle.
G09	Intervene in health promotion and disease prevention activities at the individual, family and community levels, with an integral and multi-professional vision of the health-disease process.

G10	Design, apply and evaluate clinical reagents, methods and analytical techniques, knowing the basic principles of clinical analysis and the characteristics and contents of laboratory diagnostic reports.
G11	Evaluate the toxicological effects of substances and design and apply appropriate tests and trials.
G12	Develop hygienic-sanitary analyses, especially those related to food and environment.
G13	Develop communication and information skills, both oral and written, to deal with patients and users of the centre where they carry out their professional activity. Promote the capacity to work and collaborate with multidisciplinary teams and those related to other health professionals.
G14	Know the ethical and deontological principles according to the legislative, regulatory and administrative provisions governing professional practice, understanding the ethical implications of health in a changing social context.
G15	Recognise own limitations and the need to maintain and update professional competence, with particular emphasis on self-learning of new knowledge based on scientific evidence.
T01	Critical thinking skills based on the application of the scientific method
T02	Ability to manage quality scientific information, bibliography, specialized databases and resources accessible through the Internet.
T03	Handling of basic and specific software for the treatment of information and experimental results.
T04	Motivation for quality, safety at work and awareness of environmental issues, with knowledge of the internationally recognised systems for the correct management of these aspects.
T05	Organizational, planning and implementation skills.
T06	Ability to address human resources decision-making and management.
T07	Ability to work as a team and, where appropriate, exercise leadership functions, encouraging entrepreneurship.
T08	Develop interpersonal skills and the ability to function in an international and multicultural context.

5. Objectives or Learning Outcomes

Course learning outcomes

Description

Acquisition of basic skills in synthesis and analytical characterization of drugs in a practical level.

Ability to find and analyze scientific information regarding the chemical aspects of drugs.

ability to associate the structure of drugs with their mechanism of action and their therapeutic activity at the molecular level.

ability to define the pharmacophore group of a set of active molecules.

ability to design synthetic routes to prepare drugs

ability to propose chemical transformations of drugs aimed at optimizing their pharmacokinetic properties and their biological activity.

ability to predict the metabolic transformations suffered by drugs inside the body.

ability to name drugs and to represent their structure from the systematic nomenclature

6. Units / Contents

Unit 1: Chemotherapy enzyme inhibitors I

- **Unit 1.1** Inhibitors related with folic acid
- **Unit 1.2** Inhibitors of purines and pyrimidines synthesis
- **Unit 1.3** Inhibitors related with polymeration of nucleic acid
- **Unit 1.4** Inhibitors of neuraminidase
- **Unit 1.5** Synthesis

Unit 2: Chemotherapy enzyme inhibitors II. Penicillin and Cephalosporins

- **Unit 2.1** Inhibitors of Biosynthesis of UDP-N-Acetylmuramoil pentapeptide
- **Unit 2.2** Inhibitors of 2nd and 3er stage of synthesis of peptidoglycan
- **Unit 2.3** Inhibitors of 4th stage of synthesis os peptidoglycan
- **Unit 2.4** Synthesis

Unit 3: Pharmacodinamic enzime Inhibitors

- **Unit 3.1** Inhibitors of Angiotensin-converting enzyme
- **Unit 3.2** Inhibitors of GABA-T
- **Unit 3.3** Inhibitos of carbonic anhydrases
- **Unit 3.4** Inhibitors of cyclooxigenase
- **Unit 3.5** Synthesis

Unit 4: Drugs related to transport through the membrane

- **Unit 4.1** Drug that acts on Na+ channels
- **Unit 4.2** Drugs regulators of Ca+ channels
- **Unit 4.3** Drugs that acts on K+ channes
- **Unit 4.4** Inhibitors of H+/K+ ATPase
- **Unit 4.5** Synthesis

Unit 5: Drugs related to the activity of noradrenaline, dopamine, and serotonin

- **Unit 5.1** Adrenalergic drugs
- **Unit 5.2** Dopaminergic drugs
- **Unit 5.3** Serotoninergic drugs
- **Unit 5.4** Synthesis

Unit 6: Drugs related to the activity of acetylcholine

- **Unit 6.1** Cholinergic Receptors and supramolecular interactions
- **Unit 6.2** Clinic used of acetylcholine drugs
- **Unit 6.3** Synthesis

Unit 7: Drugs related to peptides and aminoacid receptors

- **Unit 7.1** GABA-receptors related drugs
- **Unit 7.2** Glutamic receptors related drugs
- **Unit 7.3** Peptides receptors related drugs
- **Unit 7.4** Synthesis

Unit 8: Drugs that acts on histamine receptors

Unit 8.1 H1 Antagonist

Unit 8.2 H2 Antagonist

Unit 8.3 synthesis

Unit 9: Drugs related to the activation of steroid hormons

Unit 10: Drugs related to nucleic acid

Unit 10.1 Alkylanting, intercalating, and non-covalent DNA union agents

Unit 10.2 Tetracyclines

Unit 11: Laboratory Practices

7. Activities, Units/Modules and Methodology

Training Activity	Methodology	Related Competences (only degrees before RD 822/2021)	ECTS	Hours	As	Com	Description
Class Attendance (theory) [ON-SITE]	Combination of methods	B01 B02 B03 B04 B05 G01 G02 G03 G04 G05 G06 G07 G08 G09 G10 G11 G12 G13 G14 G15 T01 T02 T03 T04 T05 T06 T07 T08	0.92	23	Y	N	The teaching resources will be available on the Moodle platform before the beginning of the activities. In addition, students will have access to complementary bibliographic and audiovisual material on this platform. On the other hand, the recommended bibliography is available in the university library of the Albacete campus. After the exposition of the topics in class (expository method) by the professor, the active participation of the student through cooperative work, both in the classroom and outside it, and in the resolution of problems and seminars that will be carried out actively during the course will be taken into account in the final evaluation of the student's participation in the subject. This participation will consist of the elaboration of seminars and case studies, and activities consisting of short review questions, which will be distributed throughout the different theoretical expositions, complemented with examples or specific cases from the recent bibliography that put in context the current relevance of each topic. Another aspect to consider in this assessment will be the preparation of a non-compulsory evaluable work whose deadline for delivery will be the day of the exam of the ordinary call.
Class Attendance (practical) [ON-SITE]	Practical or hands-on activities	B01 B02 B03 B04 B05 EQ01 EQ03 EQ04 G01 G02 G03 G04 G05 G06 G07 G08 G09 G10 G11 G12 G13 G14 G15 T01 T02 T03 T04 T05 T06 T07 T08	0.8	20	Y	Y	Practical teaching will be given in small groups within periods established in the academic calendar that do not coincide with other teaching activities. They will be carried out in the laboratories, all of them equipped with the appropriate means to achieve the proposed objectives. These activities are MANDATORY and NOT RECOVERABLE so the student will not be able to pass the course if they are not carried out properly.
Workshops or seminars [ON-SITE]	Combination of methods	B01 B02 B03 B04 B05 G01 G02 G03 G04 G05 G06 G07 G08 G09 G10 G11 G12 G13 G14 G15 T01 T02 T03 T04 T05 T06 T07 T08	0.52	13	Y	N	The resolution of these seminars and the participation in them with proposals, questions, or examples, will constitute an important part of the PARTICIPATION block.
Study and Exam Preparation [OFF-SITE]	Self-study	B01 B02 B03 B04 B05 G01 G02 G03 G04 G05 G06 G07 G08 G09 G10 G11 G12 G13 G14 G15 T01 T02 T03 T04 T05 T06 T07 T08	2.07	51.75	Y	N	The student may request personal tutoring on the contents of the course by previously arranging a meeting with the professor.
Study and Exam Preparation [OFF-SITE]	Problem solving and exercises	B01 B02 B03 B04 B05 G01 G02 G03 G04 G05 G06 G07 G08 G09 G10 G11 G12 G13 G14 G15 T01 T02 T03 T04 T05 T06 T07 T08	1.53	38.25	Y	N	The student may request personal tutoring on the contents of the course by previously arranging a meeting with the professor.

Formative Assessment [ON-SITE]	Assessment tests	B01 B02 B03 B04 B05 G01 G02 G03 G04 G05 G06 G07 G08 G09 G10 G11 G12 G13 G14 G15 T01 T02 T03 T04 T05 T06 T07 T08	0.16	4	Y	Y	Specific dates have been set aside in the academic calendar for evaluation tests that do not coincide with other academic activities.
Total:			**6**	**150**			
Total credits of in-class work: 2.4			**Total class time hours: 60**				
Total credits of out of class work: 3.6			**Total hours of out of class work: 90**				

As: Assessable training activity
Com: Training activity of compulsory overcoming (It will be essential to overcome both continuous and non-continuous assessment).

8. Evaluation criteria and Grading System

Evaluation System	Continuous assessment	Non-continuous evaluation*	Description
Assessment of active participation	10.00%	10.00%	
Test	70.00%	70.00%	
Laboratory sessions	20.00%	20.00%	
Total:	**100.00%**	**100.00%**	

According to art. 4 of the UCLM Student Evaluation Regulations, it must be provided to students who cannot regularly attend face-to-face training activities the passing of the subject, having the right (art. 12.2) to be globally graded, in 2 annual calls per subject , an ordinary and an extraordinary one (evaluating 100% of the competences).

Evaluation criteria for the final exam:

Continuous assessment:

The course has two blocks, a theoretical block, and a practical block. Once the theoretical and practical blocks have been evaluated, the final grade of the course will be calculated based on the following percentages: Theoretical evaluation: 70%, Practical evaluation: 20%, Other activities: 10%. The course will be passed when the grade equals or exceeds 5. The grades of both blocks above 5 can be kept for the following two courses.

The theoretical block will consist of 2 partial exams, the second one coinciding with the final exam of the ordinary exam, or this same final exam in the ordinary exam. The 2 partial tests will have a weight of 40% in the first one and 60% in the second one of the final grade of theory. Students who do not pass the first partial exam with more than a 4 will have to take and pass the final exam in the ordinary exam. Students with a grade of 4 or higher in the first exam will take the second partial exam coinciding with the ordinary final exam unless they expressly inform the professor in charge of their decision to take the final exam. The second partial exam will not have a minimum grade for its weighting together with the first one.

In the practical block will be valued the application in the laboratory of the previously learned knowledge, the acquired skill in the handling of chemical substances as well as of the laboratory material, the attitude of the student, the understanding of the experiments carried out, and the adequate elaboration of the laboratory notebook.

The student's participation in class will be valued by asking questions, solving problems, doing proposed works, and participating in the discussions that take place in class.

Non-continuous evaluation:

The course has two blocks, a theoretical block, and a practical block. Once the theoretical and practical blocks have been evaluated, the final grade of the course will be calculated based on the following percentages: Theoretical evaluation: 70%, Practical evaluation: 20%, Other activities: 10%. The course will be passed when the grade equals or exceeds 5. The grades of both blocks above 5 can be kept for the following two courses.

Each of the parts will be specified in a single final test where these aspects will be evaluated. In the practical block, the application of knowledge associated with the performance of tasks in the laboratory will be assessed. Any student may change to the non-continuous evaluation mode if he/she has not completed at least 50% of all evaluable activities or if the class period has ended. Any student may change to the non-continuous evaluation modality if he/she has not completed at least 50% of all the evaluable activities or if the class period has ended.

Specifications for the resit/retake exam:

The theory grades of the theoretical block and the practical block will be kept by default for the resit/retake evaluation after the final exam in case of being above 4 in both modalities (continuous and non-continuous). In these cases, the student will be able to request not to keep any of his/her grades if he/she considers it appropriate. There will be a single global evaluation test in which the theoretical and practical blocks will be included. Students will have to complete the blocks not passed (theoretical, practical, or both). The resit/retake grade will follow the distribution criteria applied in the final exam.

After this call, the grades of the theoretical and practical blocks that are above 5 can be kept for the following two courses.

Specifications for the second resit / retake exam:

Only students who meet the requirements set forth in the Student Evaluation Regulations of the University of Castilla-La Mancha will be eligible for this call. They will be evaluated according to the criteria applied in the resit/retake call.

9. Assignments, course calendar and important dates

Not related to the syllabus/contents

Hours	hours
Class Attendance (theory) [PRESENCIAL][Combination of methods]	23
Class Attendance (practical) [PRESENCIAL][Practical or hands-on activities]	20
Workshops or seminars [PRESENCIAL][Combination of methods]	13
Study and Exam Preparation [AUTÓNOMA][Self-study]	51.75
Study and Exam Preparation [AUTÓNOMA][Problem solving and exercises]	38.25
Formative Assessment [PRESENCIAL][Assessment tests]	4

Global activity

Activities	hours
Class Attendance (practical) [PRESENCIAL][Practical or hands-on activities]	20
Class Attendance (theory) [PRESENCIAL][Combination of methods]	23
Workshops or seminars [PRESENCIAL][Combination of methods]	13

Study and Exam Preparation [AUTÓNOMA][Self-study]	51.75
Study and Exam Preparation [AUTÓNOMA][Problem solving and exercises]	38.25
Formative Assessment [PRESENCIAL][Assessment tests]	4
Total horas:	150

10. Bibliography and Sources

Author(s)	Title/Link	Publishing house	Citv	ISBN	Year	Description
A. Korolkovas	Fundamentos de la Química Farmacéutica	Ed. Reverté			1978	
C. Avendaño	Introducción a la Química Farmacéutica	Ed. Interamericana-McGraw-Hill.			2001	
D. Lednicer	Organic Chemistry of Drug Synthesis	Ed. Wiley			1999	
G. L. Patrick	An Introduction to Medicinal Chemistry	Oxford University Press			2001	
March, Jerry	Advanced organic chemistry : reactions, mechanisms and struc	John Wiley & Sons		0-471-60180-2	1992	
R. B. Silverman	The Organic Chemistry of Drug Design and Drug Action	Academic Press,			1992	
Vollhardt, K. Peter C.	Química orgánica : estructura y función	Omega		978-84-282-1431-5	2007	
W. O. Foye	Principios de Química Farmacéutica	Ed. Reverté			1988	