

**COURSE DATA****Data Subject**

Code	36312
Name	Toxicology
Cycle	Grade
ECTS Credits	10.5
Academic year	2021 - 2022

Study (s)

Degree	Center	Acad. Period year
1211 - D.D. in Pharmacy-Human Nutrition and Dietetics	Faculty of Pharmacy and Food Sciences	4 Annual

Subject-matter

Degree	Subject-matter	Character
1211 - D.D. in Pharmacy-Human Nutrition and Dietetics	1 - Asignaturas obligatorias del PDG Farmacia-Nutrición Humana y Dietética	Obligatory

Coordination

Name	Department
FERNÁNDEZ FRANZÓN, MÓNICA	265 - Prev. Medicine, Public Health, Food Sc.,Toxic. and For. Med.
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SUMMARY

Toxicology course (36312) is an obligatory subject on the third year of the Degree of the double degree program Pharmacy-Human Nutrition and Dietetics Pharmacy, which is taught in the Faculty of Pharmacy, University of Valencia. This course has a total of 10,5 ECTS taught during a year. The main objective of this subject is to obtain a toxicological training that allows to interpret scientific data relative to drugs and the presence of toxins in food. Thanks to this interpretation the pharmacist and nutritionist-dietitian can take the most appropriate measures for each situation. The knowledge will be provided to the students on basic toxicology, mechanisms of toxicity, evaluation of toxicity, and the toxicity of drugs as potential agents with adverse effects when used in a correct therapeutic guideline or as responsible for acute intoxication, toxicity and food safety. As well as the knowledge on the methodologies that allow to decrease toxic concentrations in biological samples, environmental foods and samples, to assure levels



that provide a well-being to the population.

PREVIOUS KNOWLEDGE

Relationship to other subjects of the same degree

There are no specified enrollment restrictions with other subjects of the curriculum.

Other requirements

To study toxicology, the knowledge of a number of basic concepts of biology, physiology, chemistry and biochemistry are needed. These concepts are part of the contents of the subjects taught during the previous courses in the Graduate.

OUTCOMES

LEARNING OUTCOMES

During this course, students should acquire the following abilities and skills:

- Knowledge on basic toxicology
- Ability to raise and solve basic toxicological problems, relating to chemical properties and structures of drugs and sanitarian products.
- Skill and ability to solve toxicological problems
- Knowledge of the toxicological aspects through the possibilities that Internet provides
- Capacity of relation of the presence of toxics in food and drugs in the organism with the adverse effects that they can cause.
- Ability to perform experimental work and to encourage students to continue the scientific and research activity.

DESCRIPTION OF CONTENTS

1. Introduction to toxicology

Toxicology. Introduction. Historic evolution of toxicology. Related sciences. Related disciplines of toxicology. References. Toxicological concepts. Types of intoxications. Dose-response and dose-effect relationships. Selectivity, sensibility and security margin.



2. Toxicokinetics

Phases of toxic action. Exposure phase. Pathways for xenobiotics. Transport mechanisms of toxins through biological membranes. Absorption. Distribution, fixation and excretion of toxins. Toxicokinetics. Compartmental models. Toxicokinetic parameters. Biotransformations of toxins. Phase 1 reaction: oxidation, reduction, hydrolysis and hydration. Reactions Phase 2: Sulfation, glucuronidation, acetylation, methylation, conjugation with glutathione and amino acids. Mechanisms of toxicity. Apoptosis and necrosis. Nonspecific toxicity. Reversible and irreversible specific toxicity. Immune reactions. Immune mechanisms. Types of allergies. Inhibition, activation and enzyme induction. Factors that modify toxicity. Factors that depend on the individual. Genetic factors. Environmental factors and social factors.

3. Assessment of Toxicology

Methods in toxicology testing. Alternative methods. In vitro test systems. Biological substrates and toxicity endpoints. Studies of general effects: acute toxicity and repeated doses toxicity. Tests of specific effects: Antagonism or synergism studies, and skin, eyes and behaviour tests. Carcinogenicity, mutagenicity, teratogenicity, Reproductive and Developmental Toxicity. Risk assessment and security estimation.

4. Side effects of drugs

Adverse drug reactions. Criteria to determine an adverse reaction. Studies of pharmacovigilance. Methodology in pharmacotherapy follow-up. Introduction to the Dáder method. Classification of negative outcomes of the pharmacotherapy /drug treatment. Clinical case.

5. Side effects of drugs in organs and systems

Adverse drug reaction on the central and peripheral nervous system. Adverse drug reaction on arteries and pulmonary capillaries. Pulmonary veno-occlusive disorders. Bronchial tube and lower tract. Adverse drug reaction on the cardiovascular system. Hypertension, peripheral vasoconstriction and low blood pressure. Adverse drug reaction on the digestive system. Adverse drug reaction and mechanisms of toxic action on the liver. Adverse drug reaction and mechanisms of toxic action on the kidney. Adverse drug reaction on blood and hematopoietic organs. Anaemia, Neutropenia, agranulocytosis and thrombocytopenia. Secondary haematological tumours. Disorders of Haemostasis. Drug adverse reaction of the medicaments on the skin. Cutaneous elementary injuries. Adverse drug reaction on the endocrine system. Adverse reactions on the hypophysis, adrenal glands, thyroid and pancreas. Adverse drug reaction on the locomotor system. Adverse drug reaction on the sense organs: toxic effects on the organs of the vision, organ of hearing and balance, on taste and smell organ.



6. Clinical toxicology

Epidemiology of acute intoxications. Antagonists and Antidotes. Assistance and treatment of acute intoxication. Acute drug intoxication. Acute intoxication of domestic use products: Caustics and Pesticides. Drug addiction.

7. Food safety

Origin and sources of toxics in food, mechanisms of action, toxic effects and preventive measures. Food and toxic substances of natural origin. Biological and chemical contaminants. Food additives and supplements. Toxic derivatives. Food carcinogens. Risks assessment of food.

8. Analytical toxicology

Chemical - toxicological analysis. Sample collection and different toxicological analyses. Chain of custody. Immunochemical tests.

9. Laboratory

There will be 4 hours / session. Practices are of obligatory assistance. Practice manual will be made available to students through the Moodle platform and the students will take it to the laboratory. Students will have to overcome a written exam on the last day of practice.

The scheduled practices are as follows:

1. Pharmaceutical toxicology and databases
 - 1.1. Safe handling of chemical products
 - 1.2. Toxicological data bases in Internet
2. Extraction of drugs from biological fluids
 - 2.1. Identification of toxics
 - 2.2. Determination of salicylates
3. Determination of alcohol in bloody by gas chromatography (GC)
4. Determination of trazodone in plasm by colorimetry
5. Phenothiazines determination in urine by spectrophotometry
6. Determination of theophylline in serum by liquid chromatography (LC)
7. Determination of paracetamol in plasma by LC
8. Determination of atmospheric SO₂. Tetrachloromercurate method (TCM) and p-rosaniline
9. Determination of fluoride in urine

**WORKLOAD**

ACTIVITY	Hours	% To be attended
Theory classes	64,00	100
Laboratory practices	28,00	100
Seminars	6,00	100
Tutorials	3,00	100
Development of group work	15,00	0
Development of individual work	10,00	0
Study and independent work	15,00	0
Readings supplementary material	10,00	0
Preparation of evaluation activities	20,00	0
Preparing lectures	64,00	0
Preparation of practical classes and problem	13,50	0
Resolution of case studies	10,00	0
TOTAL	258,50	

TEACHING METHODOLOGY

The development of the course is structured as follows:

Theoretical classes: 2-3 hours per weeks in which the professor provides students with an overview of the topic, and the information necessary to understand the contents of the subject. The students are encouraged to search supplementary information. It is recommended to review the material before going to the classroom.

Specialized tutoring (sessions in group). Small groups of students are ideal for students to raise questions or issues that they arise throughout the development of the theoretical classes.

Laboratory classes: small groups of students work with the laboratory manual and resolve the problems that are raised. Class attendance is mandatory. Each student group shows their results and discusses their toxicological interpretation. Laboratory classes include toxicological information from internet and databases in Toxicology.

Seminars: a small working group is directed by a professor. The group works according to a basic guides and rules. The results are exposed and critical analysis should be made in class with all the students. The group is supervised by the professor periodically and guides them in the search of bibliographic sources and in their critical analysis. The professor advises about the general approach to work, in a way that promotes the student's capacity for work, synthesis and research



In both theoretical and practical sessions, examples of the applications of the contents of the course in relation to the Sustainable Development Goals (SDGs) will be indicated, as well as in the proposals of topics for the expository seminars. This is intended to integrate the application of the SDGs in the teaching of toxicology in order to provide students with the related knowledge and skills, as well as to promote reflection and critique. Of the 17 SDGs, special emphasis will be placed on the following toxicology-related goals: SDG3, SDG4, SDG5, SDG12, SDG13 and SDG17.

EVALUATION

In order to sit for the final written exam, it is mandatory to have completed the laboratory practices.

Percentages of each section in the evaluation: 65% theory mark (20% first partial mark and 45% second partial mark), 10% seminar mark, 25% practical mark.

The **10%** of the grade will be obtained as a result of the preparation and presentation of **seminars and tutorials**. Mark of this section will be kept two consecutive years (for those students who do not pass the subject in the first enrollment). Lack of regular attendance to class or tutoring will be reflected negatively on the score for this section.

About **25%** of the grade corresponds to **laboratory practices** which attendance is mandatory. It includes the participation and preparation of laboratory practical classes, which are assessed by a written exam during the last day of the laboratory practices and will represent 5% of the mark, which will be kept two years (for those students who do not pass the subject in the first enrollment). The other 20% of the mark corresponds to questions and a practice case which will be evaluated on the written final exam.

To evaluate the **theoretical contents**, there will be a midterm exam, corresponding to the first part of the program, in which they could eliminate contents from 5 out of 10 and that represent **20%** of the final grade. The grade of the mild-term exam is kept for the examination of the first and second round (June-July). Students who have removed contents in the first midterm exam will be assessed only on the final exam of the second part of the theoretical contents, those who have failed the midterm exam go with all the theoretical contents to the final exam.

The other **45%** of the grade will be obtained from the results obtained in the exam corresponding to the **theoretical contents** of the second part of the program (second semester), which 15% correspond to food toxicology contents. To pass the theoretical contents you must have 4 out of 10.

It is mandatory to have passed the theoretical exam and have completed the laboratory practice to add seminars to the grade. To pass the subject, you must obtain a grade of 5 or higher in the final exam.

Those students who fail the course in the first call, they keep the grade of seminars for the second round (June-July).

The student who does not take the theoretical exam and has conducted seminars or practices during the academic year, in the first call will be considered "Not Submitted", and in the second call as "Suspended".



The student who does not take the theoretical exam and has conducted seminars or practices during the academic year, in the first and second call will be considered "Not Submitted".

REFERENCES

Basic

- El manual Merck de diagnóstico y tratamiento. 2007. Elsevier España, Madrid
- Gil Hernández F, Pla Martínez A, Hernández Jerez A. 2019. Manual de toxicología. 2 ed. Editorial técnica Avicam
- Nogué Xarau, X. 2019. Toxicología clínica. Ed. Elsevier España, SLU
- Repetto Jiménez M, Repetto Kuhn G. 2009. Toxicología Fundamental. 4 ed. Díaz de Santos, Madrid
- Lee A. 2007. Reacciones adversas a los medicamentos. 1 ed. Pharma Editores, Barcelona

Additional

- R e v i s t a d e l C o m i t é C i e n t í f i c o
https://www.aesan.gob.es/AECOSAN/web/publicaciones/aecosan_comite_cientifico.htm
Agencia Española de Medicamentos y Productos Sanitarios, <http://aemps.es/>
- European Medicines Agency, www.ema.europa.eu/
- International Vademecum, www.vademecum.es/
- Catálogo de especialidades farmacéuticas. Consejo General de Colegios Oficiales de Farmacéuticos
- Blot plus 2.0) 2013:, <http://www.portalfarma.com/>
- e-libros disponibles a través del Servicio de Biblioteca y Documentación de la Universidad de Valencia, <http://trobes.uv.es/>
- Revista de Toxicología <https://rev.aetox.es/wp/>
Asociación Española de Toxicología, <http://www.aetox.es>
- Portal de búsqueda de información toxicológica, <http://busca-tox.com>

ADDENDUM COVID-19

This addendum will only be activated if the health situation requires so and with the prior agreement of the Governing Council

1. General concepts



All the contents initially programmed in the teaching guide are maintained. Thus, 100% of the curriculum is covered, guaranteeing the achievement of the learning objectives. The student will organize his autonomous learning with the materials uploaded to the virtual classroom.

2. Volume of work and temporary planning of teaching

The teaching guide establishes 64 hours of theory classes in the classroom, 28 hours of practical classes in the laboratory, 6 hours of seminars and 3 hours of tutorials.

The weight of the different activities that add up to the hours of dedication in ECTS credits marked in the original teaching guide is maintained.

Teaching timetables are maintained, both in terms of days and hours for theory, seminars, tutorials and practices.

*The first **theory** classes of the course will take place in the classroom. The rest of the class schedules will be maintained by synchronous videoconferences or voice-over videos. The students will have to do autonomous work with the materials uploaded to the virtual classroom.*

*The **laboratory practices** will be carried out in a face-to-face way, respecting the capacity of the students in the laboratory. The computer practices will be done through synchronous videoconferences.*

*The **seminars** will be presented in class either in person or by synchronous video conference.*

*The system of virtual **tutorials** is maintained through e-mail (attention of the professor within 48 hours), for the resolution of specific doubts. Tutorials will take place in the classroom, as the small groups have the capacity allowed by the UV.*

3. Teaching methodology

***Theory:** The materials for these sessions will have been previously uploaded to the virtual classroom: the same materials provided in the original guide for face-to-face teaching but adapted by incorporating explanatory notes and locutions so that the student can access them at any time. Synchronous video conferences will be held to explain concepts that need to be clarified, using the virtual classroom forum to answer questions.*

For the continuous evaluation, the tool will be used in the virtual classroom and Kahoot questionnaires at established times.

***Seminars:** The seminars will be presented in class in a face-to-face manner or by synchronous video conference so that all the students on the course can access them.*

***Tutorials:** the virtual tutorial system is maintained via e-mail (attention of the teaching staff within 48 hours), for the resolution of specific doubts.*

Tutorials will take place in the classroom, as the small groups meet the capacity allowed by the UV.



Practices: there will be classroom practices respecting the capacity of the students in the laboratory. In order to carry out the practices, the materials for these sessions will be previously uploaded to the virtual classroom (practice booklet, presentations with explanations or locutions, links and videos explaining the techniques/methods used) adapted to the non-presential modality, as well as problems solved together with proposed problems that must be solved and handed in through the virtual classroom "task" option. The resolution of doubts will be carried out by means of synchronous videoconference.

4. Evaluation

In order to pass the course, it is essential to attend the laboratory practices.

The percentage of each section in the evaluation is maintained: 65% of the theory mark (20% of the first partial mark and 45% of the second partial mark), 10% of the seminar mark, 25% of the practice mark.

The **theory** mark and its percentage (65%) are maintained. In this section, continuous assessment activity is incorporated with a percentage of 10% that was not contemplated in the original guide. The weight of the theory exam is reduced from 65% to 55%.

The **seminar** mark and its percentage (10%) are maintained. To get the maximum from this section is a prerequisite for 100% attendance of the scheduled activity, which will be recorded in the classroom (face to face) or in the Blackboard Collaborate platform on the day of the activity through synchronous video conferencing.

The **laboratory practice** mark and its percentage (25%) are maintained. To get the maximum from this section is a prerequisite for 100% attendance of the scheduled activity which will be recorded in the classroom (face to face) or in the Blackboard Collaborate platform on the day of the synchronous video conference.

If a person does not have the means to establish this connection and access the virtual classroom, they should contact the professor by e-mail at the time of publication of this annex to the teaching guide.

The exam will be held in person.

5. Bibliography

The recommended readings available in UV subscribed databases (requiring VPN in some cases) and those recommended by teachers are maintained.