

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

<b>Code</b>	36312
<b>Name</b>	Toxicology
<b>Cycle</b>	Grade
<b>ECTS Credits</b>	10.5
<b>Academic year</b>	2023 - 2024

**Study (s)**

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

**Subject-matter**

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

**Coordination**

<b>Name</b>	<b>Department</b>
FERNÁNDEZ FRANZÓN, MÓNICA	265 - Prev. Medicine, Public Health, Food Sc.,Toxic. and For. Med.
RUIZ LEAL, MARIA JOSE	265 - Prev. Medicine, Public Health, Food Sc.,Toxic. and For. Med.

**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. 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 SO<sub>2</sub>. 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
<b>TOTAL</b>	<b>258,50</b>	

**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 midterm 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".

**Evidence of copying or plagiarism** in any of the assessable tasks will result in failure to pass the subject and in appropriate disciplinary action being taken. Please note that, in accordance with article 13. d) of the Statute of the University Student (RD 1791/2010, of 30 December), it is the duty of students to refrain from using or participating in dishonest means in assessment tests, assignments or university official documents.

In the event of fraudulent practices, the “**Action Protocol for fraudulent practices at the University of Valencia**” will be applied (ACGUV 123/2020):

<https://www.uv.es/sgeneral/Protocols/C83sp.pdf>

## 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](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/](http://www.ema.europa.eu/)
- International Vademecum, [www.vademecum.es/](http://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>

