



## TOXICOLOGY

### 1. Information about the program

1.1.	UNIVERSITY: "GRIGORE T. POPA" UNIVERSITY OF MEDICINE AND PHARMACY OF IAȘI
1.2.	FACULTY: PHARMACY SCHOOL / DEPARTMENT: PHARMACEUTICAL SCIENCES II
1.3.	SUBJECT: TOXICOLOGY
1.4.	STUDY FIELD: HEALTH
1.5.	STUDY CYCLE: UNDERGRADUATE
1.6.	STUDY PROGRAMME: PHARMACY

### 2. Subject data

2.1.	SUBJECT: TOXICOLOGY						
2.2.	Module leader: Assoc. Prof. Luminița Agoroaei, PhD						
2.3.	Seminar leader: Assoc. Prof. Luminița Agoroaei, PhD, Lecturer Alexandra Jităreanu, PhD , Lecturer Ioana-Cezara Caba, PhD						
2.4. Year of study	IV	2.5. Semester in which is taught	II	2.6. Evaluation type	E2	2.7. Subject status	Compulsory

### 3. Duration of the course (hours per semester)

3.1. Number of hours / week	5	3.2. Number of hours / week	2	3.3.Seminar / lab	3
3.4.Total number of learning hours	70	3.5.Total number of learning hours	28	3.6. seminar / lab	42
3.7.Distribution of activities in the course					hours
Study based on the manual, printed course, bibliography and notes					30
Additional research in the library, on specialized e-platforms and field study					3
Preparation for seminars, practical courses, portfolios and essays					16
Tutoring					2
Assessment					4
Other activities					-
3.8. Number of hours of individual study				51	
3.9. Number of hours per semester				125	
3.10. Number of ECTS				5	

### 4. Previous Knowledge (if applicable)

4.1. course related	Anatomy, Physiology, Inorganic chemistry, Organic chemistry, Analytical chemistry, Biochemistry, Pharmacology, Pathology.
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4.2. skill related	<ul style="list-style-type: none"> <li>- knowledge of the pathophysiological mechanisms, biochemical and pharmacological mechanisms in correlation with toxicodynamic mechanisms;</li> <li>- knowledge of the the physicochemical properties of gaseous, volatile and mineral compounds (with toxicological implications) studied in previous years;</li> <li>- knowledge of the the general analysis principles;</li> <li>- correct handling of laboratory equipment.</li> </ul>
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## 5. Requirements (if applicable)

5.1. course conditions	Amphitheater with video projector.
5.2. seminar / laboratory conditions	<ul style="list-style-type: none"> <li>- Practical work room equipped with ventilation system (fume hoods).</li> <li>- Laboratory equipment and necessary equipments for practical work: glassware, burettes, air sampling devices, distillation installations, installations for entrainment with water vapor, spectrophotometer, spectroscopes, water baths, sand bath, centrifuge, scales (analytical and technical), distiller.</li> <li>- The obligation to use protective equipment - lab coat.</li> <li>- The obligation to respect the work safety rules and the prevention and fire fighting rules.</li> </ul>

## 6. Specific Skills Acquired

Professional skills displayed by knowledge and skills	<p>At the end of the course and practical laboratories of toxicology, students have knowledge and skills to:</p> <ul style="list-style-type: none"> <li>• detect poisoning cases with gaseous, volatile or mineral toxics, and to suggest an emergency treatment;</li> <li>• activity of poisonings prevention;</li> <li>• perform analysis in toxicology laboratories (isolation of gaseous, volatile or mineral toxics from different samples, toxic identification and dosing, determination of biotoxicological indicators);</li> <li>• the ability to interpret the results of toxicological analysis and to assess the degree of intoxication;</li> <li>• competent activity in pharmacies and toxicology laboratories.</li> </ul>
Transversal skills (role skills, professional and personal skills)	<p>At the end of the course and practical laboratories of toxicology, students are able to:</p> <ul style="list-style-type: none"> <li>• work in a team;</li> <li>• participate in continuous education programs;</li> <li>• take responsibilities in exercising the profession of</li> </ul>

	pharmacist; <ul style="list-style-type: none"> <li>• respect professional ethics;</li> <li>• conduct research in the field of toxicology;</li> <li>• use the concepts of toxicology in the context of current pharmacy.</li> </ul>
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## 7. Course Objectives (confirmed by the grid of specific skills acquired)

<b>7.1. General Objective</b>	Theoretical knowledge and practical skills necessary to conduct activities of Toxicology in pharmaceutical field.
<b>7.2. Specific Objectives</b>	<p>A). Acquiring general theoretical knowledge of toxicology - poisoning etiology, toxicokinetic, toxicodynamic, symptoms, treatment and prevention of poisoning - applied to gaseous, volatile and mineral toxics.</p> <p>Acquiring knowledge on the effects of radiation exposure.</p> <p>B). Acquiring practical knowledge to:</p> <p style="padding-left: 40px;">Performing toxicological analysis of gaseous, volatile, and mineral toxics (isolation from air samples, biological samples, corpus delicti; identification; dosage).</p> <p style="padding-left: 40px;">Determination of some biotoxicological indicators in poisonings with gaseous, volatile or mineral toxics.</p> <p style="padding-left: 40px;">Interpretation of toxicological analysis results an evaluation of poisoning severity.</p> <p style="padding-left: 40px;">Analysis of some poisoning cases with gaseous, volatile or mineral toxics.</p>

## 8. Contents

8.1. Course	Teaching methods	Observations
<b>General Toxicology</b>		
The object of toxicology. Classification of toxics. Parameters of toxicity. Classification of intoxications	lecture, examples, discussions	2 hours
Toxicokinetics.	lecture, examples, discussions	3 hours
Factors which influence the toxicity	lecture, examples, discussions	2 hours
Toxicodynamics: classification of toxic effects; the action of toxics on molecular, cellular and tissues level	lecture, examples, discussions	2 hours
Treatment and prophylaxis of intoxications. Toxicological expertise	lecture, examples, discussions	2 hours
<b>Gaseous toxics</b>		
Halogens, phosgene. Gaseous compounds of sulfur, nitrogen and carbon. Hydrogen arsenate and hydrogen phosphorus	lecture, examples, discussions	5 hours
<b>Volatile toxics</b>		
Ethanol. Methanol. Ethylene glycol	lecture, examples, discussions	2 hours
Phenols. Aldehydes. Acetone	lecture, examples, discussions	1 hour
Aliphatic hydrocarbons. Halogenated	lecture, examples, discussions	3 hours

aliphatic hydrocarbons. Aromatic hydrocarbons Ether. Esters. Nitrobenzene. Aniline. Hydrogen cyanide	lecture, examples, discussions	2 hours
<b>Mineral toxics</b>		
Metals. Corrosive acids, caustic alkali, oxidant minerals.	lecture, examples, discussions	6 hours
<b>Bibliography</b>		
<ol style="list-style-type: none"> <li>1. Dart RC. <i>Medical Toxicology</i>. Third Edition. Philadelphia: Lippincott Williams &amp; Wilkins, 2004.</li> <li>2. Hayes AW. <i>Principles and Methods of Toxicology</i>. 3<sup>rd</sup> Edition. New York: Raven Press 1994.</li> <li>3. Lionte C, Şorodoc L, Bologa C, Şorodoc V, Petriş O, Puha G, Gazzi E. <i>Clinical Toxicology – A comprehensive Guide</i>. Iaşi: “Gr. T. Popa” Publisher, 2013.</li> <li>4. Niesink RJ, De Vries J, Hollinger MA. <i>Toxicology – Principles and Applications</i>. CRS Press, 1996.</li> <li>5. Wexler P. <i>Encyclopedia of Toxicology</i>. Second Edition. Oxford: Elsevier Ltd. 2005.</li> <li>6. <a href="http://www.umfiasi.ro/Facultati/FacultateadeFarmacie/Toxicology_Courses">http://www.umfiasi.ro/Facultati/FacultateadeFarmacie/Toxicology_Courses</a> – IV<sup>th</sup> Year, PowerPoint support.</li> </ol>		
<b>8.2. Seminar / Practical lessons</b>	<b>Teaching Methods</b>	<b>Observations</b>
Work safety rules in the toxicology laboratory. Necessary equipment for air samples' collection.	presentation and discussion of general concepts necessary for practical work; presentation and discussion of the working protocol; seminar activities; laboratory work; presentations of poisoning cases; discussions; analysis, interpretation and evaluation of the results.	3 hours
Expression of toxics concentration from air		12 hours
Toxicological analysis of gaseous toxics: ammonia, nitrogen oxides, carbon monoxide, halogens, sulfur compounds		3 hours
Isolation of volatile organic toxics from biological samples - distillation, isolation with water vapor		9 hours
Toxicological analysis of volatile toxic: ethanol, methanol, ethylene glycol, formaldehyde, acetone, phenol, aniline		
Isolation of mineral toxics from biological samples and corpus delicti		3 hours
Toxicological analysis of mineral toxics: oxidizing salts, mercury, lead, copper, cadmium, chromium		6 hours
Determination of biotoxicological indicators: carboxyhemoglobin, thiocyanates, delta-aminolevulinic acid		6 hours
<b>Bibliografie / Bibliography</b>		
<ol style="list-style-type: none"> <li>1. Moffat AC, Osselton MD, Widdop B (editors). <i>Clarke's Analysis of Drugs and Poisons</i>. Third edition. Pharmaceutical Press, 2004.</li> <li>2. Leikin JB, Paloucek FP. <i>Poisoning &amp; Toxicology Handbook</i>. 3<sup>rd</sup> Edition. Hudson, Ohio: Lexi-Comp, INC, 2002.</li> <li>3. <a href="http://www.umfiasi.ro/Facultati/Facultatea de Farmacie/Practical Laboratories of Toxicology">http://www.umfiasi.ro/Facultati/Facultatea de Farmacie/Practical Laboratories of Toxicology</a>, IV<sup>th</sup> Year–support.</li> </ol>		

## 9. The agreement between the course contents and the expectations of the representatives of the epistemic communities, professional associations and employers in the field related to the program

With the knowledge acquired from courses and laboratories of Toxicology, the graduate is able to have a competent activity in pharmacies or toxicological laboratories in our country or abroad, according with current trends in the profession of a pharmacist.

## 10. Assessment

Activity	10.1. Assessment criteria	10.2. Assessment methods	10.3. Percentage of the final grade
10.4. Course	Knowledge acquired.	Written descriptive exam	50%
	Knowledge of specific terms.		
	Logic of knowledge presentation.		
10.5. Seminar / Practical lessons	Activity during practical laboratory.	Seminars, tests, practical skills evaluation, evaluation of practical work results, evaluation of ability to interpret toxicological analysis results	10%
	Final evaluation of toxicological analysis knowledge (according to the standard).	Exam at the ending of practical activity	40%

### Minimal standard of proficiency:

- final assessment of practical knowledge - the minimum grade 5.
- the final grade for promotion - at least 5.

Knowledge of main types of toxic poisoning and toxics groups.

Knowledge of main parameters of toxicity.

Knowledge of toxicokinetic steps and principle toxicodynamic mechanisms.

Knowledge of treatment options according to the nature of intoxication.

Knowledge of characteristics of the most common poisonings with gaseous, volatile or mineral toxics.

The ability to perform a toxicological analysis of some gaseous, volatile or mineral toxics, following a given protocol, and to interpret the results.