1. COURSE DECRIPTION – GENERAL INFORMATION			
1.1. Course teacher	Associate Professor Irena Žuntar, PhD	1.6. Year of study	4th
1.2. Name of the course	**Analytical toxicology**	1.7. Credit value (ECTS)	5
1.3. Associate teachers	Associates on demonstration exercises from Dr. Andrija Štampar Institute of Public Health and Croatian National Institute of Public Health	1.8. Type of instruction (number of hours L+E+S+e-learning)	30+15+15
1.4. Study programme (undergraduate, graduate, integrated)	Integrated study of Pharmacy	1.9. Expected enrolment in the course	130
1.5. Status of the course	Compulsory	1.10. Level of use of e-learning (1, 2, 3 level), percentage of instruction in the course on line (20% maximum)	2nd
2. COURSE DESCRIPTION			
2.1. Course objectives	Students will be introduced into basic toxicological topics, terms and basic principles of interactions of poisons (toxins and toxicants) and human organism (absorption, distribution, metabolism and elimination of poisons from organism). But, also effects of chemicals on ecosystem. Students will understand biochemical mechanisms of poison toxicity, know different types of adverse effects, describe toxokinetic properties of basic chemical groups and understand basic principles of first aid and also therapeutic approach. Students will know to link terms hazard, risk assessment and safety from chemicals/poisoning in field of human health and environment. Also, students will be introduced with classification and labelling of chemicals (MSDS, material safety data sheet) and safety handling according to legislation of Republic of Croatia and EU.		
2.2. Enrolment requirements and required entry competences for the course	Passed exam of Analytical chemistry 2. Pre-knowledge of Physiology, Pathophysiology and Pharmacology.		
2.3. Learning outcomes at the level of the study programme to which the course contributes	• Develop solutions of practical problems in production and monitoring of safe and appropriate application of drugs (recognize basic principles of safe work, handling and management with chemicals). • Inform and advise patients and general population about the effects and appropriate application of drugs, possible side-effects of chemicals, dietary supplements and herbal preparations, as well as their combinations.		

2.4. Expected learning outcomes at the level of the course (4-10 learning outcomes)	Passing the exam students will be able to: 1. Describe and explain basic toxicological topics, terms; 2. Describe absorption, distribution and elimination (including metabolisms) of poisons as well as factors that influence the extant of these processes; 3. List of basic toxicological processes (absorption, distribution, metabolisms and elimination) and biochemical mechanisms of toxicity of basic group of poisons (chemicals); 4. Estimate procedures of first aid and therapy (antidotes) depending on toxicological characteristics of poisons (chemicals); 5. Link hazard, risk assessment and safety of poisons (chemicals)/poisoning in context of human health and environment; 6. Recognize labels of chemical classification and procedures of safe handling.
2.5. Course content broken down in detail by weekly class schedule (syllabus)	LECTURES: • Introduction to toxicology with short history of toxicology (examples of poisoning) • Basic toxicology terms – 1st part • Basic toxicology terms – 2nd part • Transport across membranes. Lipophilicity/Hydrophilicity • Absorption of poisons • Distribution of poisons • Elimination of poisons • Inorganic poisons • Gases • Industrial organic chemicals • Pesticides • Biochemical mechanisms of toxicity of therapeutic drugs • Therapeutic drug monitoring (TDM) • Basis of nanotoxicology • Basis of military toxicology (chemical warfare agents) • Drugs of abuse • Ecotoxicology SEMINARS: • Documentary “Fashion victims” educational film • Sampling and samples for toxicological analysis • Extraction of poisons from various toxicological samples, Detection of toxicity, Screening test and confirmative

techniques for final detection of poisons
- Excipient toxicity and safety in drug dosage forms
- The handling of chemicals in health institutions (in pharmacies)
- Poisons of plants
- Poisons of mushrooms
- Poisons of animals
- Mycotoxins, Bacterial toxins
- Seminar student's essays with discusion and repetition of materials
- Documentary “The toxin return”” educational film

DEMONSTRATION EXERCISES

Demonstration of sample preparation for toxicological analysis, accent on results of analysis and commentary, and assessment of health compliance of different samples (for example food, drinks, sredstava za opću uporabu and food suplements)

2.6. Type of instruction			2.7. Comments:
	lectures **seminars** and workshops exercises online in entirety mixed e-learning field work	independent study multimedia and the internet laboratory work with the mentor (other) **demonstration exercises**	

2.8. Student responsibilities	Class attendance, positive mark of seminar essay, passed exams, written and oral					
2.9. Screening of student’s work (specify the proportion of ECTS credits for each activity so that the total number of CTS credits is equal to the credit value of the course)	Class attendance	1	Research		Practical training	
	Experimental work		Report			
	Essay		Seminar essay	1	(Other--describe)	
	Tests		Oral exam	2	(Other—describe)	
	Written exam	1	Project		(Other—describe)	

2.10. Grading and evaluation of student work over the course of instruction and at a final exam	Positive mark of seminar essay with short oral presentation. Written exam – 25 multiple choice questions, 60 % of correct answers is needed for passing

2.11. Required literature (available at the library and via other media)	**Title**
	Plavšić F. i Žuntar I. Analitička toksikologija, Školska knjiga, Zagreb, 2006.
	Plavšić F. i sur. Osnove kliničke farmakokinetike, Školska knjiga, Zagreb, 1993.
	Žuntar I., Plavšić F., Wolf Čoporda A., Štraus B. Određivanje koncentracije lijekova tijekom terapije, str. 605-621., U: Štrausova medicinska biokemija; ur. Čvorišćec D., Čepelak I., Medicinska naklada, Zagreb, 2009.
	Duraković Z. i sur., Klinička toksikologija, Grafos, Zagreb, 2011.
	Osnove forenzične toksikologije, ur. Davorka Sutlović, Web knjižara Redak, Split, 2011. Sveučilišni udžbenik Sveučilišta u Splitu. • Davorka Sutlović, Irena Žuntar. Apsorpcija, raspodjela, metabolizam i izlučivanje: ARMI. str. 19-58.

	• Irena Žuntar, Franjo Plavšić. Otrovi biljaka i životinja. str. 171-210.		
	Toksikolgija hrane, ur. Davorka Sutlović, Web knjižara Redak, Split, 2011. Sveučilišni udžbenik Sveučilišta u Splitu. • Irena Žuntar, Franjo Plavšić. Otrovi gljiva. str. 271-277. Žuntar I, Slišković I, Plavšić F. Analiza gospodarenja kemikalijama u ljekarnama u Hrvatskoj. Farm Glas 2007;63:723-750. Timbrell JA. Principles of Biochemical Toxicology, Fourth Edition, Informa Healthcare, New York, 2009. Dart RC i sur., Medical Toxicology, Third Edition, Lippincott, Williams & Wilkins, Philadelphia, 2004.		
2.12. Optional literature	Irena Žuntar, Alka Wolf Čoporda, Franjo Plavšić. Farmakokinetički kemijski procesi. str. 18-24. U: Farmakoterapija u gerijatriji, Geriatric pharmacotherapy, ur. Zijad Duraković, C. T. – Poslovne informacije d.o.o., Medixova medicinska biblioteka, Zagreb, 2011. Sveučilišni udžbenik: Sveučilišta u Zagrebu, Sveučilišta u Osijeku, Sveučilišta u Mostaru, Sveučilišta u Splitu i Sveučilišta u Rijeci.		
2.13. Methods of monitoring quality that ensure acquisition of exit competences	Outcomes are verified by written and oral exams.		