

Course title: TOXICOLOGICAL CHEMISTRY

Course Basic Information	
Academic Unit:	Faculty of Medicine, Department of Pharmacy
Course title:	Toxicological Chemistry
Level:	Graduate
Course Status:	Mandatory
Year of Study:	4 th Year 7 th and 8 th Semester
Number of Classes per Week:	7 th Semester: 2+0+2 8 th Semester: 2+1+2
ECTS Credits:	9 ECTS
Time /Location:	According to the timetable
Teacher:	Prof.ass.dr. Zana Sulejmani-Ibraimi
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Course Description:	Toxicological chemistry is a scientific discipline, which deals with the study of the toxic effects of various substances on living organisms and the consequences that remain after these poisonings. This discipline explains the interactions between chemical substances and biological systems, which cause harmful effects that affect the life and normal functioning of living organisms. Toxicological chemistry also studies the nature, mechanisms of action and factors influencing the development of these damages, treatment of poisoning and related antidotes, sampling methods, identification and determination of toxic substances in biological and environmental samples, as well as methods of determination of toxins in the environment.
Course Goals:	The aims of this course are to acquaint and train students with the basic principles of Toxicological Chemistry, to enable them to perform routine analysis of the characterization of factors that may affect the toxicological effect, such as: the way of exposure to the poison (way of entry of poison), knowledge of the specifics on foreign substances in the body and symptoms of poisoning, predicting the mechanism of action of the poison, metabolism and type of metabolite, modes of elimination from the body, providing first aid and finding the appropriate antidote, knowledge of analytical sampling methods and

	determination of poisons in biological and environmental samples.
Expected Learning Outcomes:	Students will study the basic toxicological concepts and principles of the interaction of toxins and toxicants within the human body (absorption, distribution, metabolism and elimination of toxins from the body). They will understand the biochemical mechanisms of poison toxicity, recognize the different types of side effects, describe the toxic-kinetic characteristics of poisons, and understand basic therapeutic procedures, such as emergency aid in poisoning and antidotes. Students will be able to link the risk assessment and safety from poisons to human health and the environment. They will also be introduced to the classification and labeling of chemicals, safety management and treatment.

Student Workload (should be in compliance with student's Learning Outcomes)

Activity	Hours	Day/ Week	Total
Lectures	2	30	60
Theory/ Lab Work/Exercises	2	30	60
Practical Work			
Consultations with the teacher			3
Field Work			
Test, seminar paper	1	15	15
Homework			
Self-study (library or home)	2	15	45
Preparation for final exam	1	1	40
Assessment time (test, quiz, final exam)			2
Projects, presentations, etc.			
Total			225

Teaching Methods:	Lectures are held in an interactive way. The presentation is shown on the LCD projector, while the exercises are always held in the laboratory and are always supervised. Laboratory work is conducted in groups, discussing with students about the presented issues. Students will work in groups of two, first examining the basic principles for the work to be performed and then elaborating on the individual problems encountered during the training.
Assessment Methods:	The evaluation method is done with tests and colloquia. The exam is written, where each question in the test / colloquium is evaluated with several points. The examination commission consists of 2 professors (professor and subject assistant).

	Manner of evaluation:	
	Practical exam	10%
	Seminars or other engagements	5%
	Regular attendance in lectures and exercises	5%
	Colloquium 1	10%
	Colloquium 2	10%
	Final exam	60%
	Total:	100%
	Consultations with students are done 2 (twice) a week.	

Primary Literature:	<ol style="list-style-type: none"> 1. Flanagan, R.J., Taylor, A., Watson, I.D., Whelpton, R. Fundamentals of Analytical Toxicology, John Wiley and Sons, 2007. 2. Manahan SE. Toxicological chemistry and biochemistry. CRC Press; 2002 Sep 25. 3. Marrs, T.C., Maynard, R.L., Sidel, F,R, eds: Chemical Warfare Agents – Toxicology and Treatment, second edition. John Wiley and Sons, 2007. 4. Timbrel, J. Introduction to Toxicology. Taylor and Frances 2002. 5. Hodgson E, editor. A textbook of modern toxicology. John Wiley & Sons; 2004 Apr 9. 6. Olson KR, Anderson IB, Benowitz NL, Blanc PD, Clark RF, Kearney TE, Kim-Katz SY, Wu AH, editors. Poisoning & drug overdose. Lange Medical Books/McGraw-Hill; 2007. 7. Kimia toksikologjike, Prof.dr. Besnik Juca, Tiranë 1998.
Additional Literature:	From the internet publications (PubMed, MedLine, etc.)

Designed teaching plan	
Week	Title of the Lecture
Week 1:	Introduction to Toxicological Chemistry, History and Separation
Week 2:	Poisons and poisonings, determination of poisons, their classification based on acute toxicity
Week 3:	Toxico-kinetics, basic parameters, passage through membranes, resorption from the gastrointestinal tract, respiratory tract and through the skin, distribution of toxins
Week 4:	The mode of action of toxins in the body, biotransformation, phase I reactions - oxidation, reduction and hydrolysis; phase II reactions - synthesis reactions
Week 5:	General rules of treatment of poisons, elimination of foreign substances from the body, emergencies in toxicology, first aid and treatment of acute poisoning, the role of pharmacists in acute poisoning
Week 6:	Mechanisms of chronic poisoning: neurotoxic effects, hepatotoxic and nephrotoxic effects, genotoxic effects, chemically induced carcinogenesis, substances with endocrine effects
Week 7:	Biological and environmental sampling, conservation and preparation for toxicological analysis
Week 8:	Gaseous poisons (Cl, Br, H ₂ S dhe SO ₂), possibilities of poisoning, mechanism of action, symptoms, treatment and assistance in poisoning.

Week 9:	Gaseous poisons (NO, NO ₂ , CO dhe CO ₂), possibilities of poisoning, mechanism of action, symptoms, treatment and assistance in poisoning.
Week 10:	Cyanide and HCN poisoning, possibilities of poisoning, mechanism of action, symptoms, treatment and assistance in poisoning.
Week 11:	Poisoning with Chloroform, Chloral Hydrate, CCl ₄ , Hexachloran and DDT, possibilities of poisoning, mechanism of action, symptoms, treatment and assistance in poisoning.
Week 12:	Toxic alcohol poisoning: Methanol, Ethanol and Ethylene glycol, possibilities of poisoning, mechanism of action, symptoms, treatment and assistance in poisoning.
Week 13:	Formaldehyde, Acetone and Acetic Acid poisoning, possibilities of poisoning, mechanism of action, symptoms, treatment and assistance in poisoning.
Week 14:	Benzene, Toluene, Phenol and Cresol poisoning, possibilities of poisoning, mechanism of action, symptoms, treatment and assistance in poisoning.
Week 15:	Nitrobenzene and Aniline poisoning, possibilities of poisoning, mechanism of action, symptoms, treatment and assistance in poisoning.
Week 16:	Poisoning with Oxalate, Oxalic Acid and Nitrophenols, possibilities of poisoning, mechanism of action, symptoms, treatment and assistance in poisoning.
Week 17:	Poisoning with Salicylates and Sulfonamides, possibilities of poisoning, mechanism of action, symptoms, treatment and assistance in poisoning.
Week 18:	Poisoning with Barbiturates, Benzodiazepines and Cardiotonic Heterosides, possibilities of poisoning, mechanism of action, symptoms, treatment and assistance in poisoning.
Week 19:	Caffeine, Theophylline and Theobromine poisoning, possibilities of poisoning, mechanism of action, symptoms, treatment and assistance in poisoning.
Week 20:	Nicotine and Coniine poisoning, possibilities of poisoning, mechanism of action, symptoms, treatment and assistance in poisoning.
Week 21:	Poisoning with opium alkaloids: Morphine, Codeine, Narceine, Narcotics and Heroin, possibilities of poisoning, mechanism of action, symptoms, treatment and assistance in poisoning.
Week 22:	Poisoning with substances of abuse and used as a means of pleasure: Amphetamine, Mescaline and Cannabinoids, possibilities of poisoning, mechanism of action, symptoms, treatment and assistance in poisoning.
Week 23:	Poisoning with Atropine, Hyoscyamine and Scopolamine, possibilities of poisoning, mechanism of action, symptoms, treatment and assistance in poisoning.
Week 24:	Cocaine, Novocain and Strychnine poisoning, possibilities of poisoning, mechanism of action, symptoms, treatment and assistance in poisoning.
Week 25:	Metal poisons (As, Sb, Hg, Pb, Cu), possibilities of poisoning, mechanism of action, symptoms, treatment and assistance in poisoning.

Week 26:	Metal poisons (Cd, Cr, Mn, Zn and Ba), possibilities of poisoning, mechanism of action, symptoms, treatment and assistance in poisoning.
Week 27:	Poisoning with corrosive substances: Acids and Bases, possibilities of poisoning, mechanism of action, symptoms, treatment and assistance in poisoning.
Week 28:	Non-metallic poisons (Nitrites, Nitrates and Chlorides), possibilities of poisoning, mechanism of action, symptoms, treatment and assistance in poisoning.
Week 29:	Organophosphate poisoning, Fluoride and Fluorosilicates, Choline Esterase Inhibitors, possibilities of poisoning, mechanism of action, symptoms, treatment and assistance in poisoning.
Week 30:	Poisoning with Nerve Agents (neuroparalytic poisons) and war poisons (Sarin, Tabun, Soman, VX), possibilities of poisoning, mechanism of action, symptoms, treatment and assistance in poisoning.

Academic Policies and Code of Conduct

The lesson starts and ends on time. The tools used during the lecture should be cleaned and stored at the end of the lecture. The professor and assistant inform the students about the criteria for regular participation in lectures and exercises. They will set the rules of conduct, such as maintaining silence during lectures and exercises, the punctuality of coming to lectures and exercises on time, turning off cell phones, or any other technological device. The professor and the assistant show intellectual, pragmatic, and collegial attitude, always encouraging the students towards success.

Note | If a student has more than 3 class assignments evaluated below 50% he/she loses the right on taking the final exam. Evaluation is done from 0-100 %.