

TOXICOLOGICAL CHEMISTRY	
GENERAL INFORMATION	
Course teacher	Asst. Prof. Sanja Mandić, MMedBiochem, PhD
Associates	Asst. Prof. Dario Mandić, MMedBiochem, PhD Asst. Prof. Vesna Horvat, MMedBiochem, PhD Maja Lukić, MMedBiochem Tihana Pavošević, MMedBiochem Tara Rolić, MMedBiochem
Study programme	Graduate University Study of Medical Laboratory Diagnostics
Course status	mandatory
Year of study, semester	1 st year, 1 st semester
ECTS credits	5
Form of teaching (number of classes)	Lectures 30; Seminars: 15; Practicums: 15
Expected number of students attending the course	20
COURSE DESCRIPTION	
Course objectives	
Introduce students to the fundamentals of general toxicology, types of the most common toxins and their antidotes, as well as to the basic principles of analytical toxicological chemistry applied in confirming the presence of toxins in all kinds of samples. Present to students the measurement procedures used in toxicology.	
Course entry requirements and competencies needed for the course	
Completed courses at the Undergraduate Study Programme of Medical Laboratory Diagnostics or equivalent bachelor's degree (baccalaureate)	
Learning outcomes at study programme level	
1.1, 1.2, 2.1, 2.2, 2.4, 2.5, 2.6, 2.7, 3.1, 3.2	
Expected learning outcomes at course level	
After attending lectures, completing seminars and exercises, independent study and passing the exam, students will be able to: <ol style="list-style-type: none"> 1. explain the processes of absorption, distribution and excretion (including metabolism) of poisons. 2. evaluate the factors on which the extent of absorption, distribution, and excretion of poison depends. 3. explain toxicological-kinetic processes (absorption, distribution, metabolism and elimination) 4. explain the biochemical mechanisms of toxicity of basic groups of poisons (chemicals). 5. evaluate the procedures of emergency aid and therapy (and antidotes) with regard to the toxicological characteristics of the poison (chemical). 6. relate danger and risk and safety from poisons (chemicals)/poisoning to human health and the environment (ecosystem.) 7. apply an adequate method for toxicological analysis of a biological sample. 8. recommend an adequate method for toxicological analysis of a biological sample 9. interpret the result of the toxicological analysis of the biological sample 	
Course content	

Lectures: Introduction to toxicology: Importance and fundamentals of toxicology; general information about intoxication; classification of intoxication; causes of intoxication; factors which affect toxicity. Toxicological chemical analysis: Sample selection, storage and analysis; biological samples; air, water, soil, food; general procedures in chemical toxicological analysis: based on the type of toxin, intoxication and sample: air, water; procedures for confirming the presence of toxins; colour tests and sediment reactions. Techniques used in toxicology: Immunochemical techniques; spectrometric techniques and chromatographic techniques in toxicology. Types of toxins: Toxic gases (CO, CO₂, H₂S); alcohols; industrial organic chemicals; acids and bases; toxic medications; addictive substances; metals (lead, mercury, thallium, arsenic, iron, aluminium, antimony, cadmium, copper, chromium, selenium); metalloids (cyanides, ammonia, nitrogen oxides and hypochlorite, phosphorus and its compounds, halogen compounds); pesticides; chemical warfare agents. Protection against toxins: Application of legal regulations in the protection against toxins. Identification of toxins and application of adequate antidotes in cases of intoxication.

Seminars: Toxicological chemical analysis (problem assignments); Methods in toxicology (problematic tasks); Medicines and addictive substances (problematic tasks); Alcohols (problematic tasks and interpretation of findings); Pesticides (interpretation of findings); gaseous poisons (interpretation of findings); battle poisons (interpretation of findings); Protection against poison (problem seminar); Antidotes (problem seminar); Metals and metalloids (problem seminar);

Laboratory exercises: Immunochemical methods in toxicology; gas chromatography/mass spectrometry; HPLC/LCMS; atomic absorption spectrometry; thin layer chromatography; Spot tests;

Forms of teaching

Lectures, seminars and laboratory exercises.

Students' responsibilities

Attendance is obligatory throughout all course forms, and the student has to attend all the exams. Student absence of up to 30% is considered acceptable in each teaching form. Practical work and seminars that were not completed have to be taken in the form of colloquiums.

Monitoring students' work (*Connecting learning outcomes, teaching methods and evaluation*)

Teaching activity	ECTS	Learning outcome	Student activity	Evaluation methods	Grade points	
					Min.	Max.
Attending classes lectures seminars	1	1-9	Attendance, Seminar paper	Attendance records Preparation and presentation	1 4	5 15
laboratory exercises	1	7-9	Practical work	acknowledged excersises	15	30
Final exam	2	1-9	Studying for final exam	Written exam	30	50
Total	5				50	100

Evaluation of written part of final exam

Percentage of correct answers (%)	Grade
60.00-64.99	30
65.00-69.99	33
70.00-74.99	36

75.00-79.99	39
80.00-84.99	41
85.00-89.99	43
90.00-94.99	47
95.00-100	50

Formulating the final grade:

Grade points achieved in classes are combined with points achieved in the final exam. Grading system involves absolute grading and represents one's final achievement. Grades are numerically expressed as follows: A – excellent (5): 80-100 grade points; B – very good (4): 70-79.99 grade points; C – good (3): 60-69.99 grade points; D – sufficient (2): 50-59.99 grade points

Assigned reading (available in the library and in other media)

Title	Number of copies in the library	Availability in other media
Plavšić F., Žuntar I., Uvod u analitičku toksikologiju, Školska knjiga, Zagreb, 2007.	5	
Sanja Mandić i suradnici. Priručnik za seminare i vježbe iz Toksikološke kemije, Medicinski fakultet Osijek, Osijek, 2022.		Merlin system, MEFOS
Sutlović D. et al., Osnove forenzične toksikologije, Redak, Split 2011	5	

Further reading

1. Duraković Z. et al., Klinička toksikologija, Grafos, Zagreb 2000.
2. Wallace Hayes A. Principles and Methods of Toxicology, 5th ed, Taylor & Francis Inc, Informa Healthcare, New York, 2007.
3. D. Mebs, Venomous and Poisonous Animals. Stuttgart: Medpharm Scientific Publ.; Boca Raton, London, New York, Washington, DC: CRC Press, 2002.

Quality assurance methods that ensure the acquisition of exit competencies

Anonymous, quantitative, standardised students' opinion survey on the course and teacher's work, carried out by the Quality Assurance Office of the Faculty of Medicine in Osijek.

Note

E-learning does not enter the course of the subject but it is used in teaching and contains links to different pages, videos and audio materials available on the web pages.