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| **Course code: FFS49**  | **Course: TOXICOLOGICAL CHEMISTRY I**  |
| **Level: Integrated study**  | **Year: IV (Fourth)**  | **Semester: VII (seventh)**  | **ECTS credits: 4 (four)**  |
| **Status: Obligatory** | **Hours per week:** **LECTURES (L): 3 (three) hours** **EXERCISES (E): 1 (one) hour** **SEMINARS (S): 1 (one) hour**  | **Total hours per semester : 75** **(L: 45; E: 15; S: 15)**  |
| **Academic staff:**  | Theoretical class: Prof. dr Miroslav Šober Prof. dr Aleksandra Marjanović Doc. dr Elma OmeragićPractical class: Prof. dr Aleksandra MarjanovićDoc. dr Elma OmeragićAss. Aida Lugušić  |
| **1. Course aims**  | Acquiring teoretical knowledge related to fate of toxic compounds in human organism, intoxication and treatment, and methods of sampling and preperation for identification and determination of toxic compounds in biological fluids, food, water and samples from environment. Learning about mechanisms of action, symptoms and treatment of poisoning with toxic gases and industrial solvents, and also methods for their determination in environment, and markers of exposure for those gases and solvents in biological material. Aim of practical class is to acquire skills and competencies in understanding and application of regulatory requests for handling with chemicals and toxic waste, and also application of novel methods for sampling preparation and analysis. Determination of selected toxic gases in atmosphere, and identification and determination of biomarkers of exposure to those gases in biological material.  |
| **1.1. Content of the course** |
| **a) Theoretical class** Introduction to toxicology, history of toxicology, classification of toxicology, definitions of poisons, classification of compounds based on their acute toxicity; Introduction to toxicokinetics, basic parameters, difussion through membranes, resorption from GIT, respiratory track and skin, distribution; Biotransformation, reactions of phase I-oxidation, reduction and hydrolysis; reaction of phase II-conjugation with glucuronic acid, sulphuric acid and acetic acid, amino acids, glutathion, metilation; Elimination of foreign compounds from the organism; Urgent cases in toxicology, toxidromes, first aid and treatment of acute poisoning, role of the pharmacits in acute intoxication; Mechanism of toxic action: neurotoxic, hepatotoxic and nephrotoxic, genotoxic, chemical carcinogens, endocrine disrupting chemicals; Biomarkers concept, classification of poisons, taking samples, preservation, preparation for the analysis samples of air and volatile compounds, metals and organic compounds; Imunochemical methods in analytical toxicology; Carbon monoxide, sources, mechanism of action, determination of carboxyhemoglobine in blod and CO in air; Caustic gases: NOx, SO2, halogens: mechanism of action, symptoms, determination in air and biomarkers in body fluids; Simple asphyxiants and hydrogen sulphide, mechanism of action, symptoms, determination in air and determination in body fluids; Introduction to II group of poisons; Toxic alcohols: methanol, ethylen glicol, ethanol; mechanism of action, symptoms, determination and biomarkers in body fluids; Benzen, Toluen, xylen, phenols, mechanism of action, symptoms, determination in environment and body fluids, biomarkers of exposure and effects.  |
| **b) Practical class (exercises)** Regulatory bodies that are dealing with poisons and toxic compounds, classification based to LD 50; Basel convention on transboundary movement of toxic waste, dealing with documentation for transport; Prediction of metabolites knowing reactionf of phase I and II; Extraction of toxic compounds and metabolites from body fluids using solid phases (SPE), sample preparation, problems and sources of bias; Case study, estimation of severity of poisoning according to symptoms, use of toxidromes; *In vitro* methods for determination of genotoxic activity; Sampling from environment, SPMD, preparation for the analysis; principles of immunochemical analysis, example of ELISA test for detecting polichlorinated byphenils; Determination of carboxyhemoglobine in blood; Determination of CO in air; Toxic alcohols: identification of biomarkers of exposure; Determination of phenol in urine |
| **1.2. Results**  | Knowing the specific ways of enetring foreign compound in the organism, prediction of metabolites, depending on the structure, and way of elimination from the body. Use of nonspecific methods and procedures in emmergency cases of poisoning, limiting the apsorption, preventing formation of toxic metabolites and enhancing the elimination from the body. Recognition of the symptoms of the poisoning with toxic gases and industrial solvents, sampling and determination of biomarkers of exposure and effects in biological samples, as well as determination of these compounds in samples from the environment.  |
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| **2. Organization of classes**  |
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| ***Description of activities (%)*** |
| **2.1. Way of performing classes**  | 1. lectures, all students in class 2. Laboratory exercises and case study, 3. Public defense of seminars, coments and disscusion in class  | 1. 60,0 % 2. 20,0 % 3. 20,0 %  |
| Components (%) of grades |
| **2.2. Grade description**  | 1. Active participation and presence at theoretical classes 2. Presence at practical classes 3. Seminars 4. Colloquia 5. Teoretical exam (organized in form of two separate test) | 1. 0-2,5 % 2. 0-2,5 % 3. 0-10 % 4. 0-10 % 5. 0-75 %  |
| 3. LITERATUREMandatory:* Toxicological chemistry-unpublished material
* Practical guide for exercises in toxicological chemistry, unpublished material

Additional:* Flanagan, R.J., Taylor, A., Watson, I.D., Whelpton, R. Fundamentals of Analytical Toxicology, John Wiley and Sons, 2007.
* Suzuki, O. and Watanabe, K. Drugs and Poisons in Humans – A Handbook of Practical Analysis. Springer-Verlag Berlin Heidelberg 2005
* Timbrel, J. Introduction to Toxicology. Taylor and Frances 2002.

Web pages* Agency for Toxic Substances and Disease Registry http://www.atsdr.cdc.gov/toxprofiles/index.asp
* US Environmental Protection Agency http://www.epa.gov/
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