

1. COURSE DESCRIPTION – GENERAL INFORMATION			
2.1. Course teacher	Assoc. Prof. Milena Jadrijević-Mladar Takač, PhD	2.1. Year of study	2 <sup>nd</sup>
2.2. Name of the course	<b>Medicinal Chemistry</b>	2.2. Credit value (ECTS)	3.5
2.12. Associate teachers	-	2.3. Type of instruction (number of hours L+E+S+e-learning)	30+0+0
○ Study programme (undergraduate, graduate, integrated)	Medical biochemistry integrated study programme	2.4. Expected enrolment in the course	25
○ Status of the course	Compulsory	2.5. Level of use of e-learning (1, 2, 3 level), percentage of instruction in the course on line (20% maximum)	2 <sup>nd</sup>
2. COURSE DESCRIPTION			
2.1. Course objectives	The primary goal of Medicinal Chemistry in the integrated study of Medical Biochemistry is to introduce students with the major concepts of pharmaceutical chemistry that support research, development and clinical use of drugs, the design and the implementation of pro-drugs, from their structural and physicochemical features important for biological effects and clinical use of drugs, the relationships between chemical structure and biological activity (SAR), and also adverse drug reactions (ADR), to their impact on the diagnostics where it is appropriate, through introduction of main pharmacotherapeutic groups and their subgroups (chemistry, indications, pharmacological effects and side-effects).		
2.2. Enrolment requirements and required entry competences for the course	Enrolment requirement: the attended Organic chemistry		
2.3. Learning outcomes at the level of the study programme to which the course contributes	<ul style="list-style-type: none"> <li>• The application of basic knowledge of pharmaceutical-chemical aspects of drugs that are in clinical use in defining, analyzing and proposing actions related to the research and implementation of new laboratory methods for detecting and monitoring diseases and effects and/or efficacy of the therapy.</li> <li>• Interpretation of the results of laboratory analysis by the clinical aspects by knowing the pharmacotherapeutic groups of drugs, their classification, and the most important representatives.</li> <li>• The assurance of positive interactions with patients, colleagues, health professionals and the public.</li> </ul>		
2.4. Expected learning outcomes at the level of the course (4-10 learning outcomes)	After completing the course students will be able to: <ol style="list-style-type: none"> <li>1. List the most important pharmacotherapeutic groups of drugs and the classification within each group;</li> </ol>		

	<ol style="list-style-type: none"> <li>2. Draw the chemical structure of selected drugs;</li> <li>3. Explain the mechanism of action, based on knowledge of the structural features of the drug;</li> <li>4. Link chemical and biochemical aspects of the drug to its pharmacological effect and side-effects;</li> <li>5. List the indications of selected drugs and their side effects, and the impact of certain drugs to diagnostic tests;</li> <li>6. List the main chemical aspects relevant to research, development and clinical use of drugs</li> </ol>
<p>2.5. Course content broken down in detail by weekly class schedule (syllabus)</p>	<ul style="list-style-type: none"> <li>• Introduction to Medicinal chemistry: Historical background and development. Drugs. Drug classification. Drug use. Rp and OTC drugs. New drug R&amp;D methods. Adverse drug reactions (ADRs).</li> <li>• Drugs acting on the gastrointestinal system and drugs that affect the flux of the substance. Drugs in therapy of water and electrolyte disturbances and acid/base regulation. Acida. Acidotics. Alcalotics; Gastrointestinal drugs: Antacids. Antiemetics. Antiulcer drugs. Antidiarrheal drugs. Laxatives. Chemistry, indications, clinical use and side effects. Diagnostics. Chemistry and clinical use.</li> <li>• Plasma blood substituents and plasma expanders. Antianemics. Drugs in prevention and therapy of infective diseases (antiseptics. Disinfectants, preservatives, acids, esters and phenoles as dermatological products). Urinary tract antiseptics. Quinolone antibiotics (1st generation of gyrase inhibitors; 2nd generation of gyrase inhibitors – fluoroquinolone antibiotics). Features of drugs from each pharmacotherapeutic groups (indications, clinical use and side effects). History of sulfonamide drugs development. Pro-drug approach. Sulfonamides and related drugs.. Chemistry, mechanism of action, indications and clinical use. Sulfonamides classification. Combined sulfonamides. Sulfones.</li> <li>• Cell wall synthesis antibiotics. Beta-lactam antibiotics (Penicillins, Cephalosporins, Carbapenems and Monobactams). Chemistry and mechanism of action. Biosynthesis and stability. Classification. Pro-drug penicillins. Therapeutic combinations. Suicide antibiotics. Features of particular group of antibiotics (indications, clinical use and side effects). Carbapenems. Monobactams and Glycopeptide antibiotic (vancomycin) and other cell wall synthesis inhibitors (daptomycin, fosfomycin, bacitracin, cycloserin).</li> <li>• Bacterial protein synthesis antibiotics. Phenicol (Chloramphenicol). Tetracyclines. MLSK antibiotics (Macrolides: erythronolides (erythromycin and congeners), azalides (azithromycin). Lincosamides. Streptogramins. Ketolides). Aminoglycosides: Ansamycins. Structural features of each group (indication, clinical use and side effects).</li> <li>• Antifungal drugs (polyene antibiotics, griseofulvin and synthetic antimycotics). Chemotherapy of protozoal diseases: Structural features and classification (indications, clinical use and side effects).</li> <li>• Antiviral drugs (virustatics). The most common viral infections. Chemotherapy of viral diseases. Classification of antiviral drugs. Chemistry and mechanisms of action. Indications, clinical use and side effects. HIV Chemotherapy. Interferons. Cytokins.</li> <li>• Antineoplastics (Anticancer) Drugs: Factors that have an impact on tumor formation. Chemotherapy of malignant tumors. Drug classification. Chemistry and mechanism of action. Indication, clinical use and side effects. Hormons and hormon antagonists in antitumor therapy. Protein tyrosine kinase inhibitors ('nib' and 'mab') in antitumor therapy.</li> <li>• Nonsteroidal antiinflammatory drugs (NSAIDs). COX isoenzymes. Chemistry and mechanism of NSAID action. SAR, ADRs. Opioid analgesics: agonists and antagonists. Toxicity. Addction. Antitussive drugs. Antirheumatics.</li> </ul>

	<p>Expectorans (secretolytics, mucolytics). Antimigraine drugs. Gout therapy. Anesthetics (general and local). Features of each group of drugs (indications, clinical use and side effects).</p> <ul style="list-style-type: none"> <li>• Central acting drugs: Muscle relaxants (peripherally-acting and centrally-acting). Antiepileptics/Anticonvulsant drugs. Antiparkinsonian drugs and drugs in treatment other moving disorders. Psychoactive drugs. Antipsyhotics and lithium (Neuroleptics). Antidepressants. Anxiolytics. Sedative-hypnotic drugs. Central and respiratory stimulants. Hallucinogens. Chemistry and mechanism of action. Features of each group (indications, clinical use and side effects).</li> <li>• Drugs affecting the autonomic nervous system (ANS): Drugs affecting the parasympathetic nervous system. Activators (agonists) of cholinoreceptors and inhibitors of cholinesterase. Parasympatolytics – Cholinoreceptor blockers and cholinesterase regenerators. Sympathomimetic drugs. Sympatholytics Adrenoreceptor blockers, Chemistry and mechanism of action. Features of each group of drugs (indications, clinical use and side effects).</li> <li>• Cardiovascular drugs. Antihypertensive drugs (direct and centrally-acting, beta blockers, <math>\alpha_1</math>-blockers, ACE inhibitors, calcium channel blockers, ganglioblockers). Diuretics (thiazides, sulfonamides, LOOP diuretics, carbonic anhydrase inhibitors, osmotic diuretics).. Vasodilators. Antianginal drugs. Anthiarrhythmic drugs. Classification.in each group. Chemistry and mechanism of actions. Indications, clinical use and side effects.</li> <li>• Drugs acting on hemostasis. Hemostatic agents. Antihemorrhagic drugs. Aggregation inhibitors - Antithrombotic drugs. Anticoagulants. Indirect fibrinolytics and antifibrinolytics. Hypolipidemic agents/antilipidemic drugs - Drugs for lowering triglyceride and cholesterol levels (clofibric acid derivatives, nicotinic acid, and inhibitors of the HMG-CoA/statins). Antihistamine H1 receptor antagonists. Features of each drug, the representative in therapeutic group. Chemistry and mechanism of action (indications, clinical use and side effects).</li> <li>• Endocrine drugs. Hormones: hypothalamic and pituitary hormones, thyroid gland hormones, steroid hormones (corticosteroids, glucocorticosterids, mineralocorticoids, gonadal hormones (androgens, estrogens, antiestrogens, gestagens, antigestagens, anabolic hormones). Indications for hormonal and antihormonal therapy. Contraceptives. Antidiabetics (antihyperglycemics): insulin and oral (sulfonylurea derivatives, biguanides). Anti-hypoglycemic drug (glucagon). Features of each group of hormones and representatives. Chemistry, and mechanism of action. Indications, clinical use and side effects.</li> <li>• Eicosanoids (leukotrienes, prostacyclins, prostaglandins, thromboxanes). Vitamins. Therapy of vitamin deficiency and hypervitaminosis. Features of each representative in vitamin group. Chemistry and mechanism of action. Indications, clinical use and side effects.</li> </ul>			
2.6. Type of instruction	<u>lectures</u> seminars and workshops exercises <u>online in entirety</u> <u>mixed e-learning</u> field work	independent study multimedia and the internet laboratory work with the mentor (other)	2.7. Comments: <b>Optional student's contribution</b> to teaching process: Preparation of seminar - Search the relevant literature, - - Preparation of seminar abstract and ppt presentation, - - Seminar topic presentation.	
2.8. Student responsibilities	Attendance to teaching process and participation in group discussions.			
2.9. Screening of student's work	Class	1	Research	Practical training

(specify the proportion of ECTS credits for each activity)	attendance	1	Research		Practical training	
	Experimental work		Report			
	Essay		Seminar essay		(Other--describe)	
	Tests	0.5	Oral exam	2	(Other—describe)	
	Written exam		Project		(Other—describe)	
2.10. Grading and evaluation of student work over the course of instruction and at a final exam	Compulsory: class attendance, MCQ tests, oral exam. Optional: Preparation of seminar topics (seminar abstract in Word document 1A4 page, PowerPoint presentation, 15-20 slides), and the presentation of seminar topics to all students.					
2.11. Required literature (available at the library and via other media)	<b>Title</b>					
	Lecture handouts 2013, Medicinal chemistry, MB2-20, (M. Jadrijević-Mladar Takač)					
	Foye's Principles of Medicinal Chemistry, T. L. Lemke & D. A. Williams (Eds), Lippincot Williams and Wilkins, New York, 2008					
	Drug Action – Basic Principles and Therapeutic Aspects, E. Muchler & H. Derendorf, Medpharm, Stuttgart, 1995. Available at: <a href="http://global.oup.com/uk/orc/chemistry/patrick5e/student/mcqs/">http://global.oup.com/uk/orc/chemistry/patrick5e/student/mcqs/</a>					
	Antitargets, Prediction and Prevention of Drug Side Effects, R. J. Vaz & T. Klabunde (Eds.), Wiley-VCH Series: Methods and Principles in Medicinal Chemistry, Wiley-VCH GmbH & Co. KGaA, Weinheim, 2008. Available at: <a href="http://books.google.hr/books?id=lvN4mZxraMkC&amp;printsec=frontcover#v=onepage&amp;q&amp;f=false">http://books.google.hr/books?id=lvN4mZxraMkC&amp;printsec=frontcover#v=onepage&amp;q&amp;f=false</a>					
2.12. Optional literature	Martindale – The Complete Drug Reference, Ed. 37th – Pharmaceutical Pr, 2009 Remington's Pharmaceutical Sciences, J. E. Tisdale & D. A. Miller, ASHP 2005, Ed. 18th, A. R. Gennaro, Mack Publishing Company, 1990. Wilson and Gisvold's Textbook of Organic Medicinal and Pharmaceutical Chemistry, J. N. Delgado, W. A. Remers and O. Gisvold (ed.), Lippincott Williams and Wilkins, 1998.					
2.13. Methods of monitoring quality that ensure acquisition of exit competences	Outcomes 1-6 are checked by MCQ tests and by oral exam.					