Name of the course	**Personalized medicine and biotechnology**				**Code**	
Type of study program *Cycle*	Integrated study program, medicine				**Year of study**	3rd
Credits (ECTS) :	**1**	*Semester*	VI		Number of hours per semester (l+e+s)	30 (10+10+10)
Status of the course:	required	*Preconditions:*		*Comparative conditions:*		
Access to course:	Third year students			*Hours of instructions*:		According to schedule

Course teacher:	Head: Prof. Sandra Kostić, PhD, MSc in Biotechnology
Consultations:	According to individual arrangement
E-mail address and phone number:	sandra.kostic@mefst.hr
Associate teachers	Prof. KatarinaVukojević, MD, PhD Prof. Vlatka Martinović, MD, PhD Prof Una Glamočlija, PhD, MSc in Pharmacy
Consultations:	According to individual arrangement
E-mail address and phone number:	katarina.vukojevic@mef.sum.ba
The aims of the course:	Understanding the concepts of precision medicine; tools for diagnosis and custom treatments tailored to each patient. The students will also learn the main ethical, social and legal issues involving the methods of biotechnology and integration of personalized medicine into the clinics.
Learning outcomes (general and specific competences):	After the end of the course, students will be able to: - Describe and explain the types and the use of each type of biotechnology; specifically, medical biotechnology - Identify and describe the main laboratory methods used for personalized medicine - Name and explain the loss and gain of function experiments, such as CRISPR/CAS technology, knock in/out and knockdown technology, LoxP/Cre system, overexpression - Explain the basis of pharmacogenomics and pharmacogenetics - Understand the role of bioinformatics with the emerging big data bases, in order to process large-scale raw data, interpret and integrate this data and translate the results into the medical practice. - Name and describe the examples of personalized treatment for specific conditions - Describe the challenges from ethical, legal and social aspects of integration of personalized medicine into the existing healthcare system

<table>
<tr><td>Course content (Syllabus):</td><td colspan="4">Introduction to biotechnology, the main aspects of medical biotechnology
Molecular diagnostics as basis - Laboratory methods for personalized medicine (sequencing, DNA and RNA isolation and analysis, cDNA synthesis, qPCR, gene expression analysis, SNP analysis, flow cytometry…)
How to make a model - Loss and gain of function experiments (CRISPR/CAS, knock in/out, LoxP/Cre system and overexpression)
Embryonic models for drug development
Bioinformatics – what to do with all the data?
The basis of pharmacogenomics and pharmacogenetics
Examples of personalized treatments for specific conditions (chronic diseases)
The integration of personalized medicine into the existing healthcare system - the challenges from ethical, legal and social aspects</td></tr>
<tr><td rowspan="3">Format of instruction (mark in bold)</td><td>Lectures</td><td>Exercises</td><td>Seminars</td><td>Independent assignments</td></tr>
<tr><td>Consultations</td><td>Work with mentor</td><td>Field work</td><td>Other</td></tr>
<tr><td colspan="4"></td></tr>
<tr><td>Student responsibilities</td><td colspan="4">Final exam
Students will be evaluated based on:
• Active participation in seminars and exercises.
• Read teaching texts and develop their own critical thinking about the material and express those views.
• work in small groups</td></tr>
<tr><td rowspan="3">Screening student work (mark in bold)</td><td>Class attendance</td><td>Class participations</td><td>Seminar essay</td><td>Practical training</td></tr>
<tr><td>Oral exam</td><td>Written exam</td><td>Continous assesment</td><td>Essay</td></tr>
<tr><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="5">Detailed evaluation within a European system of points</td></tr>
</table>

STUDENTS RESPONSIBILITIES	**HOURS**	**PROPORTIONS OF ECTS CREDITS**	**PROPORTIONS OF MARK**
Class attendance and participations		0,1	10%
Seminar essay		0,3	20%
Written exam		0,6	70%
Oral exam			
Practical work			

Required literature:	Jain KK (2015) Textbook of Personalized Medicine, 2nd Edition, Springer, New York Kostic S, Martinovic V, Vukojevic K, Glamoclija U. Personalized medicine and biotechnology (2020). Textbook (for internal use)
Optional literature:	Hays P (2017) Advancing Healthcare Through Personalized Medicine 1st Edition, CRC Press, Taylor & Francis Group Current review and original scientific articles
Additional information about the course	Methods of monitoring the quality of teaching: student survey Quality control analysis by the students and teachers Analysis of passing the exams The report of the Office for the quality of teaching

Annexes: calendar classes

The number of teaching units	TOPICS AND LITERATURE
I.	Title: Introduction to biotechnology The main aspects of medical biotechnology (2 h L and 2 h S)
	Short description: Definition and the types of biotechnology; application of medical biotechnology in science and clinics.
	Literature: required and optional
II.	Title: Molecular diagnostics as basis - Laboratory methods for personalized medicine (sequencing, DNA and RNA isolation and analysis, cDNA synthesis, qPCR, gene expression analysis, SNP analysis, flow cytometry…) How to make a model - Loss and gain of function experiments (CRISPR/CAS, knock in/out, LoxP/Cre system and overexpression), embryonic models for drug development (2 h L, 2 h S and 5 h P)
	Short description: Description of laboratory methods and tools used for personalized medicine – research, diagnostics and treatment
	Literature: required and optional
III.	Title: Bioinformatics – what to do with all the data? Examples of personalized treatments for specific conditions (chronic diseases) (2 h L and 2 h S)
	Short description: The use of bioinformatics for the storing, processing, analysing and interpreting data. The possibilities of personalized medicine treatments – examples.
	Literature: required and optional
IV.	Title: The basis of pharmacogenomics and pharmacogenetics Systematic reviews on pharmacogenomics and pharmacogenetics (Cohrane

	database) Examples of personalized medicine based pharmacogenetics (2 h L, 2 h S and 2 h P)
	Short description: Defining the terms pharmacogenomics and pharmacogenetics and their role in personalized treatments
	Literature: required and optional
V.	Title: The integration of personalized medicine into the existing healthcare system - the challenges from ethical, legal and social aspects (2 h L and 2 h S, 3 h P)
	Short description: Explaining the challenges of integrating personalized medicine into existing healthcare from different points of view
	Literature: required and optional