INSTRUMENTAL MEASUREMENT TECHNIQUES AND PHYSICAL METHODS IN BIOMEDICAL ANALYTICS	
GENERAL INFORMATIONS	
Course coordinator	Prof. Ljubica Glavaš-Obrovac, MscBiotech, PhD
Associates	Prof. Tatjana Belovari, MD,PhD Asst. Prof. Marijana Leventić, MBiol, PhD Asst. Prof. Dario Mandić, MbiochemMed, PhD Asst. Prof. Katarina Mišković Špoljarić, MengProc, PhD Asst. Prof. Teuta Opačak-Bernardi, MbiolMol, PhD Asst. Prof. Barbara Viljetić, MEduBiol et Chem, PhD
Study Programme	Undergraduate University Study of Medical Laboratory Diagnostics
Status of the course	mandatory
Year of study, semester	2nd year, 3rd semester
ECTS	**4**
Workload (hours)	Lectures: 30; Seminars: 15; Laboratory exercises: 15
Expected number of students	30-35
COURSE DESCRIPTION	
Course objectives	
Acquisition of knowledge about analysis, synthesis, and evaluation of highly specialized terms and principles as well as theories on which work is based in various medical and research laboratories with an emphasis on chemical and physical-mathematical laws.	
Course entry requirements and competencies needed for the course	
In accordance with the conditions for enrolment in the 2nd year of this study programme.	
Learning outcomes at study programme level	
1.1, 2.2, 2.6, 2.7	
Expected learning outcomes at course level	
After attending lectures and completing seminars, studying independently and passing the exam, students will be able to: 1. choose instrumental techniques suitable for the determination of a specific analyte. 2. critically evaluate the chosen instrumental technique. 3. from all acceptable techniques for the analysis of the same component based on the given criteria, choose the most appropriate one 4. conduct an analysis of the selected real sample. 5. present the results of the performed analysis.	
Course content	
Lectures: *Spectroscopy*: Introduction to spectroscopic methods. Application of quantum theory. UV-VIS spectroscopy, IR and Raman spectroscopy. Fluorescence and phosphorescence, principles and measuring instruments. Beer-Lambert law. *Optical methods*: Measurements based on the turbidity of colloidal solutions (nephelometry and turbidimetry), refractometry and polarimetry. Flame photometry. Laws of refraction of light. Payleigh's equation. Mass spectrometry. *Electrochemistry*: Introduction to electrochemical methods, pH determination theory and electrode selection. *Radiochemistry:* Radiochemical methods. Application of radioactive elements in diagnostics and therapy. *Chromatography*: Principle of chromatography. Types of chromatography - column chromatography, plate and gas chromatography, HPLC. *Electrophoresis:* Theoretical basis of electrophoresis. Electrofocusing. Immunoelectrophoresis. *Chemiluminescence and*	

bioluminescence: Application in analytics and diagnostics. Ion exchangers: Cation and anion exchangers. *Analytics in molecular biology and forensic medicine*. DNA analysis and sample evaluation. *Microscopic techniques*: Transmission and scanning electron microscope. Application of the microscope as an analytical tool.

Seminars: UV VIS spectroscopy, IR and Raman spectroscopy. Reviews of spectral photometry work. The working principle of the mass spectrometer. Electrodes. Automation in clinical chemistry. Study of biological samples by microscopy techniques.

Laboratory exercises: Application of atomic absorption spectrophotometry. Gas chromatography and liquid chromatography. Colorimetric and potentiometric determination of pH Determination of the concentration of an unknown analyte using the UV VIS method. Preparation of samples for DNA analysis. Isolation and amplification of DNA. Capillary electrophoresis.

Forms of teaching

Lectures; seminars; seminar work, laboratoty 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. The student has to attend all forms of exams required.

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

Exam methods: written and oral exam.

Teaching activity	ECTS	Learning outcome	Student activity	Evaluation methods	Grade points	
					Min.	Max.
Attending classes	0.25	1-3	Attendance,	Attendance records	4	7
Seminar paper	0.75	4,5	Seminar paper	Writing and presenting seminar paper	8	15
Partially exams	0.5	4,5	Entrance colloquium in exercises	Written partial test	6	15
	0.5	1-3	Knowledge check from the seminar	Written partial test	6	15
Final exam	2	1-5	Studying for final exam	Written exam	17 12	28 20
Total	**4**				**50**	**100**

Evaluation of written part of final exam:

Percentage of correct answers (%)	Grade points
60.00-64.99	14
65.00-69.99	16
70.00-74.99	18
75.00-79.99	20
80.00-84.99	22
85.00-89.99	24
90.00-94.99	26
95-100	28

Formulating the final grade:
Grade points achieved in classes are combined with points achieved in the final exam. Grading in the ECTS system is 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
Čvorišćec D, Čepelak I. Štrausova medicinska biokemija, Medicinska naklada, Zagreb, 2009.	7	
Janković S. i Eterović D. Fizikalne osnove i klinički aspekti medicinske dijagnostike, Medicinska naklada, Zagreb, 2002.	7	
Štraus B, Stavljenić-Rukavina A, Plavšić F. Analitičke tehnike u kliničkom laboratoriju. Medicinska naklada, Zagreb, 1997.	7	

Further reading

1. Gaw A, Murphy M, Cowan R, O'Reilly, Stewart M, Shepherd J. Clinical Biochemistry 3rd Edition. Elsevier, Oxford, 2004. (http://intl.elsevierhealth.com/gaw)
2. Lawrence A. Kaplan, Amadeo J. Pesce, Steven C Kazmierczak: Clinical Chemistry, Mosby, 2003., selected chapters.

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.