SYLABUS
REGARDING THE QUALIFICATION CYCLE 2025/26-2028/29
(extreme dates)
Academic year 2028/29

1. 1. BASIC COURSE/MODULE INFORMATION

Course/Module title	**Lasers in medicine and phototherapy**
Course/Module code *	
Faculty (name of the unit offering the field of study)	Faculty of Exact and Technical Sciences
Name of the unit running the course	Collegium Medicum, Faculty of Medicine
Field of study	Diagnostic systems in medicine
Qualification level	First degree, bachelor
Profile	First degree, bachelor, General academic
Study mode	Stationary
Year and semester of studies	4rd year, 7th semester
Course type	Directional course, Diagnostic apparatus in medicine
Language of instruction	English
Coordinator	**dr hab. n. med. David Aebisher, prof. UR**
Course instructor	dr hab. n. med. David Aebisher, prof. UR

***** as agreed at the faculty

1.1. Learning format – number of hours and ECTS credits

Semester (no.)	Lectures	Classes	Colloquia	Lab classes	Seminars	Practical classes	Internships	others	**ECTS credits**
7	15			15					**2**

1.2. Course delivery methods

☒conducted in a traditional way
☐involving distance education methods and techniques

1.3 Course/Module assessment (exam, pass with a grade, pass without a grade)

LECTURES – WITHOUT A GRADE
LABORATORY WITH A GRADE

2. PREREQUISITES

1. BASICS OF PHYSICS, CHEMISTRY AND BIOLOGY
2. SKILLS TO OPERATE ON BASIC COMPUTER PROGRAMS

3. OBJECTIVES, LEARNING OUTCOMES, COURSE CONTENT, AND INSTRUCTIONAL METHODS

3.1. **Course/Module objectives**

O1	Introduce students to aspects of laser use in medicine considering basic physics, tissue interactions, diagnostics and therapeutics, and therapeutic guidelines.
O2	Provide students with the technical basics of medical laser systems, associated instruments, modes of laser light delivery, and endoscopy.
O3	Provide students with an introduction to application of lasers to diagnostics and disease treatment in medical sub-disciplines including: ophthalmology, dermatology, cardiovascular disease, urology, otorhinolaryngology, neurology, dentistry, and oncology.

3.2 COURSE/MODULE LEARNING OUTCOMES

Learning Outcome	The description of the learning outcome defined for the course/module	Relation to the degree programme outcomes
LO_01	student knows and understands phenomena and processes in the field of medicine, in particular regarding the basics of laser diagnostics and disease treatment in medical sub-disciplines including: ophthalmology, dermatology, cardiovascular disease, urology, otorhinolaryngology, neurology, dentistry, and oncology	K_W03
LO_02	student knows and understands computational methods used to solve typical problems in the field of lasers in medicine and examples of practical implementation of lasers	K_W05
LO_03	student knows and understands the concepts, theorems and methods related to the applications of physics in medicine, in the field of diagnostics and therapy	K_W06
LO_04	student knows and understands at an advanced level aspects of the construction and operation of scientific equipment used in physics, medicine and laser-based technology	K_W07
LO_05	student is able to use the appropriate concepts, tools and methods in solving problems related to the applications of physics in medicine in the use of lasers in diagnostics and therapy	K_U04
LO_06	student is able to plan and perform simple experiments and observations regarding the use of lasers in diagnostics and therapy, as well as to interpret the obtained results and formulate conclusions	K_U06
LO_07	student is ready to understand the social aspects of the	K_K03

	practical application of the acquired knowledge and skills in the field of the use of lasers in diagnostics and therapy and the related responsibility as well as to fulfill social obligations	
LO_08	student is ready to initiate activities to popularize knowledge related to the use of lasers in diagnostics and therapy	K_K04

3.3 Course content

A. Lecture

Content outline
Role of Photons in Chemistry, Physics, and Biology
Photodynamic Therapy Paradigm: Promise and Limitations
Light strategies and guidance
Empowering Photodynamic Therapy with Artificial Intelligence: Current Trends and Future Directions
Learning Algorithms: Techniques and Advances
Artificial Intelligence -Driven Clinical Decision Support Systems
Integration of Multimodal Imaging and Data Fusion

B. Laboratories

Content outline
Basic physics of lasers and laser interaction with tissue
Understanding medical laser systems and laser safety
Understanding laser diagnostics and therapeutics
Lasers and associated laboratory equipment
Current Photobiology in laboratory experiments
Current Photochemistry in laboratory experiments
Current Photodiagnostics in laboratory experiments

3.4 Methods of Instruction

Lectures classes: the class tutor presents theoretical knowledge from a given field which usually takes the form of an expanded monologue, although, sometimes questions may be asked
Laboratory classes: practical classes during which research and experiments are carried out with the use of laboratory equipment and research devices

4. Assessment techniques and criteria

4.1 Methods of evaluating learning outcomes

Learning outcome	Methods of assessment of learning outcomes (e.g. test, oral exam, written exam, project, report, observation during classes)	Learning format (lectures, classes, …)
LO–01	report, observation during classes	LECTURE, LABORATORY
LO–02	report, observation during classes, colloquium	LECTURE, LABORATORY

LO–03	report, observation during classes, colloquium	LECTURE, LABORATORY
LO–04	report, observation during classes	LECTURE, LABORATORY
LO–05	report, observation during classes, presentation	LABORATORY
LO–06	report, observation during classes	LABORATORY
LO–07	observation during classes	LABORATORY
LO–08	observation during classes	LABORATORY

4.2 Course assessment criteria

Lecture – passing a written test covering the topics presented during the lectures. Laboratory - pass with a grade. The condition for completing the classes is to pass the theoretical issues related to the subject of exercises, conduct the experiments according to the schedule, present reports and a multimedia presentation.

5. Total student workload needed to achieve the intended learning outcomes – number of hours and ECTS credits

Activity	Number of hours
Scheduled course contact hours	30
Other contact hours involving the teacher (consultation hours, examinations)	2
Non-contact hours - student's own work (preparation for classes or examinations, projects, etc.)	28
Total number of hours	60
Total number of ECTS credits	**2**

* One ECTS point corresponds to 25-30 hours of total student workload

6. Internships related to the course/module

Number of hours	-
Internship regulations and procedures	-

7. Instructional materials

Compulsory literature: 1. The Science of Phototherapy: An Introduction. Leonard I. Grossweiner, Springer Science & Business Media 2005 (online e-book available); 2. Laser ablation: principles and applications. Miller, John Chester, Berlin: Springer- Verlag, 1994. 3. Laser applications in medicine and biology. Vol. 5. Wolbarsht, Myron L. New York; London: Plenum. 1991.
Complementary literature: 1. Laser ablation and its applications. Phipps Claude, New York: Springer, 2007.

Acceptance by the Head of the Unit or an authorized person