

[Medicinski fakultet u Rijeci]

## Curriculum 2025/2026

[Za kolegij]

# Medical Physics and Biophysics

Study programme: **Medical Studies in English (R)**  
[Sveučilišni integrirani prijediplomski i diplomski studij]  
Department: **[Katedra za medicinsku fiziku i biofiziku]**  
Course coordinator: **prof. dr. sc. Žauhar Gordana, prof. fizike i kemije**

Year of study: **1**  
ECTS: **6**  
Incentive ECTS: **0 (0.00%)**  
Foreign language: **Possibility of teaching in a foreign language**

**Course information:**

Medical Physics and Biophysics is an introductory course, which gives students an insight into the physical principles required for a better understanding of processes in other fields, such as anatomy, biochemistry, physiology, histology, pathology, etc. The purpose of this course is to motivate students to use the analytical and quantitative approach in the research of human body functions.

**COURSE STRUCTURE**

Lectures: 30 hours

Seminars: 20 hours

Practicals: 25 hours

Total hours: 75

The lectures and practicals will be held at the University Campus on Trsat at the Faculty of Physics (Address: Radmile Matejčić 2, 51000 Rijeka).

During practicals, students will develop abilities and skills in using various measuring devices, which are a part of different medical devices. Upon completing this course, students will be able to collect data, critically evaluate and interpret the results, as well as correctly use the International System of Units and Measurements in medicine.

**List of assigned reading:**

I.P. Herman. Physics of the Human Body, Springer, Berlin, 2016

**List of optional reading:**

R. K. Hobbie, B.J. Roth. Intermediate Physics for Medicine and Biology, Springer, New York, 2015

## **Examination Manner:**

### **FINAL EXAM**

#### **Final Exam:**

Students cannot take the final exam if:

- they have achieved less than 25 grade points at the end, and/or
- have 30% or more unexcused absences from class
- have not passed the First and Second Midterm Exam
- have not positive grade for each practical

Such a student will be graded F (fail), will not be able to earn ECTS credits or take the final exam, or will have to re-enroll for the course the following academic year.

**The final exam is oral.**

#### **Assessment of the oral part of the final exam:**

<b>Grade on oral exam</b>	<b>Credits</b>
sufficient	10-20
good	21-30
very good	31-40
excellent	41-50

#### **Assessment of the oral part of the final exam:**

<b>Grade on oral exam</b>	<b>Credits</b>
sufficient	10-20
good	21-30
very good	31-40
excellent	41-50

The ECTS grading system is defined by the following criteria:

- A (5) - 90 - 100 credits
- B (4) - 75 - 89,9 credits
- C (3) - 60 - 74,9 credits
- D (2) - 50 - 59,9 credits

#### **Final Exam Date:**

- 15.06.2026.
- 29.06.2026.
- 13.07.2026.
- 03.09.2026.
- 17.09.2026.

## **Curriculum:**

### **Seminars list (with titles and explanation):**

**S1 Calculating Measurement Errors and Estimating Measurement Accuracy**

-

**S2 Optics**

-

**S3 Vectors and Operations with Vectors. Graphical Representation of Measurement Results and Interpretation of Graphs. Differential Calculus.**

-

**S4 Levers in the Human Body**

-

**S5 Hydromechanics**

-

**S6 Physics of Breathing**

-

**S7 Diffusion and Osmosis. Transport of Energy and Matter through Cell Membranes**

-

**S8 Sound. Hearing and the Ear.**

-

**S9 Medical Use of X-Rays**

-

**S10 Application of Radioactive Isotopes in Nuclear Medicine**

-

### **Lectures list (with titles and explanation):**

**L1 Introduction. SI Units.**

-

**L2 Optics in Medicine. Laws of Refraction and Reflection: Image Formation by Plane and Spherical Surfaces of Refraction**

-

**L3 The Human Eye - the Optical Model**

-

**L4 Errors of optical systems**

-

**L5 Image Formation by Lens and Microscope**

-

**L6 Types of Optical Microscopes. Electron microscopes**

-

**L7 Fundamental Forces. Statics of the Body. Review of Forces, Torques and Equilibrium**

-

**L8 Mechanics of the Human Body. Implementation of Newton's Laws: Levers in the Body, Passive Walking and High Jump.**

-

**L9 Mechanical Properties of Tissues. Elasticity and Strength of Materials. Viscoelastic Properties of Body Tissues - Mechanical Models.**

-

**L10 Fluids. Hydrostatics. Surface Tension and Its Implications. Law of Laplace.**

-

**L11 Hydrodynamics. Bernoulli's Equation, Viscosity and Poiseuille's Law. Turbulent Flow**

-

**L12 Rheological Properties of Blood. Physics of the Circulatory System. Consequences of Clogged Arteries**

-

**L13 Ideal and Real Gases. Gas Laws. Physics of Breathing**

-

**L14 Basic Principles of Thermodynamics: I and II Law.**

-

**L15 Thermodynamics of a Biological system. Transfer of Heat.**

-

**L16 Transfer of Particles and Ions through Membranes. Action Potential.**

-

**L17 Physical Basis of Electro- and Magneto- Diagnostics (EKG, EEG, EMG).**

-

**L18 Dielectric Properties of Tissues. Tissues in Electric Field.**

-

**L19 Therapeutic Applications of Electric Fields.**

-

**L20 Matter in the External Magnetic Field: A Biological System in the Electric Circuit, Magneto therapy**

-

**L21 Oscillations and Waves d Waves.**

-

**L22 Sound Waves: The Physics of Hearing. Intensity of Soun. Connection between Physical and Physiological Parameters of Sound.**

-

**L23 Structure of Atom and Molecule: Molecular Bonds and Energy States**

-  
**L24 Electromagnetic Waves**

-  
**L25 Medical Use of X Rays**

-  
**L26 Structure of the Atomic Nucleus. Nuclear Decay. Decay Rate and Half-life**

-  
**L27 Radioactivity. Alfa, Beta and Gamma Decay.**

-  
**L28 Interaction of Photons with Matter. Detection and Dosimetry of Ionizing Radiation.**

-  
**L29 Application of Ultrasound in Medicine.**

-  
**L30 Final Lecture and Preparation for Final Exam.**

-  
**Exercises list (with titles and explanation):**

**P0 Introduction to Practicals. General Laboratory Safety Procedures and Rules.**

-  
**P1 Mechanical Waves**

-  
**P2 Audiometry**

-  
**P3 Surface Tension and Viscosity**

-  
**P4 Calorimetry**

-  
**P5 Thermal Environmental Conditions**

-  
**P6 Index of Refraction. Spectroscopy**

-  
**P7 Spherical Mirrors and Lenses**

-  
**P8 Electric Circuits**

-  
**P9 Measurement of Resistance. The Wheatstone Bridge Method**

-

**P10 Ionizing radiation**

-

**P11 Compensation**

-

**P12 Compensation**

-

**Student obligations:**

The attendance at lectures, seminars and practicals is mandatory. If necessary, a student can be absent from 30% of the classes of the overall course workload but has to make up for the practicals he/she failed to attend. Students' obligations are course attendance and active participation in all practicals and seminars.

Throughout the course, students have two midterm exams (tests) consisting of 14 questions each.

Test 1 covers the topics presented in seminars 1-5.

Test 2 covers the topics presented in seminars 6-10.

The completion and proper documentation of each practical as well as the consent of the course instructor are required for course completion.

Evaluation of students' work:

Students can obtain a total of 100 credits (a maximum of 50 credits during the course and a maximum of 50 credits on the final exam). Students are allowed to take the final exam if they acquire a minimum of 25 credits during the semester.

Students who did not gain 50% on each midterm exam may retake their midterm exams. A student can repeat the mid-term exam a maximum of two times, and if he/she still does not pass it, he/she must re-enrol for the course.

On the final exam, students can obtain a maximum of 50 credits. The final exam is oral.

**Exam (exam taking, description of the written/oral/practical part of the exam, point distribution, grading criteria):**

**Assessment (exams, description of written / oral / practical exam, the scoring criteria):**

	<b>Assessment</b>	<b>Grade Point Maximum</b>
<b>Midterm Exams</b>	Midterm 1 (14 questions)	14
	Midterm 2 (14 questions)	14
	<b>total</b>	<b>28</b>
<b>Practicals</b>	Accepted practicals and reports 10 x 5 x 0.4 credits	20
	<b>total</b>	<b>48</b>
<b>Active participation</b>	Active participation during seminars	<b>2</b>
<b>TOTAL</b>		<b>50</b>
<b>Final exam</b>	Oral part	50
	<b>total</b>	<b>50</b>
<b>TOTAL</b>		<b>100</b>

**Partial exams:**

Two midterm exams are scheduled during the trimester.

1. Midterm exam. 14 questions
2. Midterm exam. 14 questions

**Practicals:**

Throughout 10 practicals a student can obtain a maximum of 20 credits.

Each completed and accepted practical is assessed. A student may miss a maximum of two practicals, which he/she must make up in order to fulfil the requirements for taking the final exam.

**Active participation during seminars:**

During the trimester student participation and dedication will be monitored. A maximum of 2 points is awarded through active participation.

**Midterm Exams Date:**

Firs Midterm Exam 24.04.2026.

Second Midterm Exam 08.06.2026.

## **Other notes (related to the course) important for students:**

### **Retaking the course:**

A student who acquires less than 25 credits during the course has failed the course, is graded with F, and must retake the course MEDICAL PHYSICS AND BIOPHYSICS.

### **Professors and associates are available daily during working hours via e-mail for all questions regarding teaching.**

Gordana Žauhar, PhD, Full Professor [gordana.zauhar@uniri.hr](mailto:gordana.zauhar@uniri.hr)

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Ivan Pribanić, Assistant [ipribanic@uniri.hr](mailto:ipribanic@uniri.hr)

Marijana Majetić, senior technician [marijana.majetic@uniri.hr](mailto:marijana.majetic@uniri.hr)

Marija Musulin, senior technician [marija.musulin@uniri.hr](mailto:marija.musulin@uniri.hr)

Course content and all course-related information can be found on the **Merlin 2025/2026** portal.

## COURSE HOURS 2025/2026

### Medical Physics and Biophysics

<b>Lectures</b> (Place and time or group)	<b>Exercises</b> (Place and time or group)	<b>Seminars</b> (Place and time or group)
<b>04.03.2026</b>		
L1 Introduction. SI Units.: <ul style="list-style-type: none"><li>• [Kampus O-029] (10:15 - 12:00) <sup>[149]</sup><ul style="list-style-type: none"><li>◦ MPBP</li></ul></li></ul> L2 Optics in Medicine. Laws of Refraction and Reflection: Image Formation by Plane and Spherical Surfaces of Refraction: <ul style="list-style-type: none"><li>• [Kampus O-029] (10:15 - 12:00) <sup>[149]</sup><ul style="list-style-type: none"><li>◦ MPBP</li></ul></li></ul>		
prof. dr. sc. Žauhar Gordana, prof. fizike i kemije <sup>[149]</sup>		
<b>11.03.2026</b>		
L3 The Human Eye - the Optical Model: <ul style="list-style-type: none"><li>• [Kampus O-029] (08:15 - 10:00) <sup>[149]</sup><ul style="list-style-type: none"><li>◦ MPBP</li></ul></li></ul> L4 Errors of optical systems: <ul style="list-style-type: none"><li>• [Kampus O-029] (08:15 - 10:00) <sup>[149]</sup><ul style="list-style-type: none"><li>◦ MPBP</li></ul></li></ul>	P0 Introduction to Practicals. General Laboratory Safety Procedures and Rules.: <ul style="list-style-type: none"><li>• [Kampus O-162] (10:00 - 11:00) <sup>[457]</sup> <sup>[1458]</sup> <sup>[2812]</sup><ul style="list-style-type: none"><li>◦ MPBP P A</li></ul></li><li>• [Kampus O-162] (12:00 - 13:00) <sup>[337]</sup> <sup>[1458]</sup> <sup>[2812]</sup><ul style="list-style-type: none"><li>◦ MPBP V B</li></ul></li><li>• [Kampus O-162] (13:00 - 14:00) <sup>[337]</sup> <sup>[1458]</sup> <sup>[2812]</sup><ul style="list-style-type: none"><li>◦ MPBP P C</li></ul></li></ul>	S1 Calculating Measurement Errors and Estimating Measurement Accuracy: <ul style="list-style-type: none"><li>• [Kampus O-152] (10:15 - 12:00) <sup>[149]</sup><ul style="list-style-type: none"><li>◦ MPBP S B</li></ul></li></ul>
Majetić Marijana, viša laborantica <sup>[1458]</sup> · Musulin Marija, viša laborantica <sup>[2812]</sup> · Pribanić Ivan, mag. edu. phys. et math. <sup>[457]</sup> · doc.dr. sc. Čargonja Marija <sup>[337]</sup> · prof. dr. sc. Žauhar Gordana, prof. fizike i kemije <sup>[149]</sup>		
<b>13.03.2026</b>		
		S1 Calculating Measurement Errors and Estimating Measurement Accuracy: <ul style="list-style-type: none"><li>• [P08] (09:15 - 11:00) <sup>[149]</sup><ul style="list-style-type: none"><li>◦ MPBP S A</li></ul></li></ul>
prof. dr. sc. Žauhar Gordana, prof. fizike i kemije <sup>[149]</sup>		
<b>18.03.2026</b>		
L5 Image Formation by Lens and Microscope: <ul style="list-style-type: none"><li>• [Kampus O-029] (08:15 - 10:00) <sup>[149]</sup><ul style="list-style-type: none"><li>◦ MPBP</li></ul></li></ul> L6 Types of Optical Microscopes. Electron microscopes: <ul style="list-style-type: none"><li>• [Kampus O-029] (08:15 - 10:00) <sup>[149]</sup><ul style="list-style-type: none"><li>◦ MPBP</li></ul></li></ul>	P1 Mechanical Waves: <ul style="list-style-type: none"><li>• [Kampus O-162] (10:00 - 12:00) <sup>[457]</sup> <sup>[1458]</sup> <sup>[2812]</sup><ul style="list-style-type: none"><li>◦ MPBP P A</li></ul></li><li>• [Kampus O-162] (13:00 - 15:00) <sup>[337]</sup> <sup>[1458]</sup> <sup>[2812]</sup><ul style="list-style-type: none"><li>◦ MPBP V B</li></ul></li><li>• [Kampus O-162] (15:00 - 17:00) <sup>[337]</sup> <sup>[1458]</sup> <sup>[2812]</sup><ul style="list-style-type: none"><li>◦ MPBP P C</li></ul></li></ul>	S2 Optics: <ul style="list-style-type: none"><li>• [Kampus O-152] (10:15 - 12:00) <sup>[149]</sup><ul style="list-style-type: none"><li>◦ MPBP S B</li></ul></li></ul>
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<b>20.03.2026</b>		

		S2 Optics: <ul style="list-style-type: none"> <li>• [P06] (09:15 - 11:00) <sup>[149]</sup> <ul style="list-style-type: none"> <li>◦ MPBP S A</li> </ul> </li> </ul>
prof. dr. sc. Žauhar Gordana, prof. fizike i kemije <sup>[149]</sup>		
<b>25.03.2026</b>		
L7 Fundamental Forces. Statics of the Body. Review of Forces, Torques and Equilibrium: <ul style="list-style-type: none"> <li>• [Kampus O-029] (08:15 - 10:00) <sup>[2300]</sup> <ul style="list-style-type: none"> <li>◦ MPBP</li> </ul> </li> </ul> L8 Mechanics of the Human Body. Implementation of Newton's Laws: Levers in the Body, Passive Walking and High Jump.: <ul style="list-style-type: none"> <li>• [Kampus O-029] (08:15 - 10:00) <sup>[2300]</sup> <ul style="list-style-type: none"> <li>◦ MPBP</li> </ul> </li> </ul>	P2 Audiometry: <ul style="list-style-type: none"> <li>• [Kampus O-162] (10:00 - 12:00) <sup>[457] [1458] [2812]</sup> <ul style="list-style-type: none"> <li>◦ MPBP P A</li> </ul> </li> <li>• [Kampus O-162] (12:00 - 14:00) <sup>[337] [1458] [2812]</sup> <ul style="list-style-type: none"> <li>◦ MPBP V B</li> </ul> </li> <li>• [Kampus O-162] (14:00 - 16:00) <sup>[337] [1458] [2812]</sup> <ul style="list-style-type: none"> <li>◦ MPBP P C</li> </ul> </li> </ul>	S3 Vectors and Operations with Vectors. Graphical Representation of Measurement Results and Interpretation of Graphs. Differential Calculus.: <ul style="list-style-type: none"> <li>• [Kampus O-152] (10:15 - 12:00) <sup>[149]</sup> <ul style="list-style-type: none"> <li>◦ MPBP S B</li> </ul> </li> </ul>
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<b>27.03.2026</b>		
		S3 Vectors and Operations with Vectors. Graphical Representation of Measurement Results and Interpretation of Graphs. Differential Calculus.: <ul style="list-style-type: none"> <li>• [P05] (09:15 - 11:00) <sup>[149]</sup> <ul style="list-style-type: none"> <li>◦ MPBP S A</li> </ul> </li> </ul>
prof. dr. sc. Žauhar Gordana, prof. fizike i kemije <sup>[149]</sup>		
<b>01.04.2026</b>		
L9 Mechanical Properties of Tissues. Elasticity and Strength of Materials. Viscoelastic Properties of Body Tissues – Mechanical Models.: <ul style="list-style-type: none"> <li>• [Kampus O-029] (08:15 - 10:00) <sup>[2300]</sup> <ul style="list-style-type: none"> <li>◦ MPBP</li> </ul> </li> </ul> L10 Fluids. Hydrostatics. Surface Tension and Its Implications. Law of Laplace.: <ul style="list-style-type: none"> <li>• [Kampus O-029] (08:15 - 10:00) <sup>[2300]</sup> <ul style="list-style-type: none"> <li>◦ MPBP</li> </ul> </li> </ul>	P3 Surface Tension and Viscosity: <ul style="list-style-type: none"> <li>• [Kampus O-162] (10:00 - 12:00) <sup>[457] [1458] [2812]</sup> <ul style="list-style-type: none"> <li>◦ MPBP P A</li> </ul> </li> <li>• [Kampus O-162] (12:00 - 14:00) <sup>[337] [1458] [2812]</sup> <ul style="list-style-type: none"> <li>◦ MPBP V B</li> </ul> </li> <li>• [Kampus O-162] (14:00 - 16:00) <sup>[337] [1458] [2812]</sup> <ul style="list-style-type: none"> <li>◦ MPBP P C</li> </ul> </li> </ul>	S4 Levers in the Human Body: <ul style="list-style-type: none"> <li>• [Kampus O-152] (10:15 - 12:00) <sup>[149]</sup> <ul style="list-style-type: none"> <li>◦ MPBP S B</li> </ul> </li> <li>• [Kampus O-029] (14:15 - 16:00) <sup>[149]</sup> <ul style="list-style-type: none"> <li>◦ MPBP S A</li> </ul> </li> </ul>
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<b>08.04.2026</b>		
L11 Hydrodynamics. Bernoulli's Equation, Viscosity and Poiseuille's Law. Turbulent Flow: <ul style="list-style-type: none"> <li>• [Kampus O-029] (08:15 - 10:00) <sup>[2300]</sup> <ul style="list-style-type: none"> <li>◦ MPBP</li> </ul> </li> </ul> L12 Rheological Properties of Blood. Physics of the Circulatory System. Consequences of Clogged Arteries: <ul style="list-style-type: none"> <li>• [Kampus O-029] (08:15 - 10:00) <sup>[2300]</sup> <ul style="list-style-type: none"> <li>◦ MPBP</li> </ul> </li> </ul>	P4 Calorimetry: <ul style="list-style-type: none"> <li>• [Kampus O-162] (10:00 - 12:00) <sup>[457] [1458] [2812]</sup> <ul style="list-style-type: none"> <li>◦ MPBP P A</li> </ul> </li> <li>• [Kampus O-162] (12:00 - 14:00) <sup>[337] [1458] [2812]</sup> <ul style="list-style-type: none"> <li>◦ MPBP V B</li> </ul> </li> <li>• [Kampus O-162] (14:00 - 16:00) <sup>[337] [1458] [2812]</sup> <ul style="list-style-type: none"> <li>◦ MPBP P C</li> </ul> </li> </ul>	S5 Hydromechanics: <ul style="list-style-type: none"> <li>• [Kampus O-152] (10:15 - 12:00) <sup>[149]</sup> <ul style="list-style-type: none"> <li>◦ MPBP S B</li> </ul> </li> </ul>

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### 10.04.2026

#### S5 Hydromechanics:

- [P06] (09:15 - 11:00) <sup>[149]</sup>
  - MPBP S A

prof. dr. sc. Žauhar Gordana, prof. fizike i kemije <sup>[149]</sup>

### 15.04.2026

#### L13 Ideal and Real Gases. Gas Laws. Physics of Breathing:

- [Kampus O-029] (08:15 - 10:00) <sup>[2300]</sup>
  - MPBP

#### L14 Basic Principles of Thermodynamics: I and II Law.:

- [Kampus O-029] (08:15 - 10:00) <sup>[2300]</sup>
  - MPBP

#### P5 Thermal Environmental Conditions:

- [Kampus O-162] (10:00 - 12:00) <sup>[457] [1458] [2812]</sup>
  - MPBP P A
- [Kampus O-162] (12:00 - 14:00) <sup>[337] [1458] [2812]</sup>
  - MPBP V B
- [Kampus O-162] (14:00 - 16:00) <sup>[337] [1458] [2812]</sup>
  - MPBP P C

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### 22.04.2026

#### L15 Thermodynamics of a Biological system. Transfer of Heat.:

- [Kampus O-029] (08:15 - 10:00) <sup>[2300]</sup>
  - MPBP

#### L16 Transfer of Particles and Ions through Membranes. Action Potential.:

- [Kampus O-029] (08:15 - 10:00) <sup>[2300]</sup>
  - MPBP

#### P6 Index of Refraction. Spectroscopy:

- [Kampus O-162] (10:00 - 12:00) <sup>[457] [1458] [2812]</sup>
  - MPBP P A
- [Kampus O-162] (12:00 - 14:00) <sup>[337] [1458] [2812]</sup>
  - MPBP V B
- [Kampus O-162] (14:00 - 16:00) <sup>[337] [1458] [2812]</sup>
  - MPBP P C

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### 29.04.2026

#### L17 Physical Basis of Electro- and Magneto-Diagnostics (EKG, EEG, EMG).:

- [Kampus O-029] (08:15 - 10:00) <sup>[2300]</sup>
  - MPBP

#### L18 Dielectric Properties of Tissues. Tissues in Electric Field.:

- [Kampus O-029] (08:15 - 10:00) <sup>[2300]</sup>
  - MPBP

#### P7 Spherical Mirrors and Lenses:

- [Kampus O-162] (10:00 - 12:00) <sup>[457] [1458] [2812]</sup>
  - MPBP P A
- [Kampus O-162] (12:00 - 14:00) <sup>[337] [1458] [2812]</sup>
  - MPBP P C
- [Kampus O-162] (14:00 - 16:00) <sup>[337] [1458] [2812]</sup>
  - MPBP V B

#### S6 Physics of Breathing:

- [Kampus O-152] (10:15 - 12:00) <sup>[149]</sup>
  - MPBP S B
- [Kampus O-152] (12:15 - 14:00) <sup>[149]</sup>
  - MPBP S A

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### 06.05.2026

<p>L21 Oscillations and Waves d Waves.:  <ul style="list-style-type: none"> <li>• [Kampus O-029] (08:15 - 10:00) <sup>[149]</sup> <ul style="list-style-type: none"> <li>◦ MPBP</li> </ul> </li> </ul> <p>L22 Sound Waves: The Physics of Hearing. Intensity of Soun. Connection between Physical and Physiological Parameters of Sound.:  <ul style="list-style-type: none"> <li>• [Kampus O-029] (08:15 - 10:00) <sup>[149]</sup> <ul style="list-style-type: none"> <li>◦ MPBP</li> </ul> </li> </ul> </p></p>	<p>P8 Electric Circuits:  <ul style="list-style-type: none"> <li>• [Kampus O-162] (10:00 - 12:00) <sup>[457] [1458] [2812]</sup> <ul style="list-style-type: none"> <li>◦ MPBP P A</li> </ul> </li> <li>• [Kampus O-162] (12:00 - 14:00) <sup>[337] [1458] [2812]</sup> <ul style="list-style-type: none"> <li>◦ MPBP V B</li> </ul> </li> <li>• [Kampus O-162] (14:00 - 16:00) <sup>[337] [1458] [2812]</sup> <ul style="list-style-type: none"> <li>◦ MPBP P C</li> </ul> </li> </ul> </p>	<p>S7 Diffusion and Osmosis. Transport of Energy and Matter through Cell Membranes:  <ul style="list-style-type: none"> <li>• [Kampus O-152] (10:15 - 12:00) <sup>[149]</sup> <ul style="list-style-type: none"> <li>◦ MPBP S B</li> </ul> </li> </ul> </p>
<p>Majetić Marijana, viša laborantica <sup>[1458]</sup> · Musulin Marija, viša laborantica <sup>[2812]</sup> · Pribanić Ivan, mag. edu. phys. et math. <sup>[457]</sup> · doc.dr. sc. Čargonja Marija <sup>[337]</sup> · prof. dr. sc. Žauhar Gordana, prof. fizike i kemije <sup>[149]</sup></p>		
<p><b>08.05.2026</b></p>		
		<p>S7 Diffusion and Osmosis. Transport of Energy and Matter through Cell Membranes:  <ul style="list-style-type: none"> <li>• [P07] (09:15 - 11:00) <sup>[149]</sup> <ul style="list-style-type: none"> <li>◦ MPBP S A</li> </ul> </li> </ul> </p>
<p>prof. dr. sc. Žauhar Gordana, prof. fizike i kemije <sup>[149]</sup></p>		
<p><b>13.05.2026</b></p>		
<p>L19 Therapeutic Applications of Electric Fields.:  <ul style="list-style-type: none"> <li>• [Kampus O-029] (08:15 - 10:00) <sup>[2300]</sup> <ul style="list-style-type: none"> <li>◦ MPBP</li> </ul> </li> </ul> <p>L20 Matter in the External Magnetic Field: A Biological System in the Electric Circuit, Magneto therapy:  <ul style="list-style-type: none"> <li>• [Kampus O-029] (08:15 - 10:00) <sup>[2300]</sup> <ul style="list-style-type: none"> <li>◦ MPBP</li> </ul> </li> </ul> </p></p>	<p>P9 Measurement of Resistance. The Wheatstone Bridge Method:  <ul style="list-style-type: none"> <li>• [Kampus O-162] (10:00 - 12:00) <sup>[457] [1458] [2812]</sup> <ul style="list-style-type: none"> <li>◦ MPBP P A</li> </ul> </li> <li>• [Kampus O-162] (12:00 - 14:00) <sup>[337] [1458] [2812]</sup> <ul style="list-style-type: none"> <li>◦ MPBP V B</li> </ul> </li> <li>• [Kampus O-162] (14:00 - 16:00) <sup>[337] [1458] [2812]</sup> <ul style="list-style-type: none"> <li>◦ MPBP P C</li> </ul> </li> </ul> </p>	<p>S8 Sound. Hearing and the Ear.:  <ul style="list-style-type: none"> <li>• [Kampus O-152] (10:15 - 12:00) <sup>[149]</sup> <ul style="list-style-type: none"> <li>◦ MPBP S B</li> </ul> </li> </ul> </p>
<p>Majetić Marijana, viša laborantica <sup>[1458]</sup> · Musulin Marija, viša laborantica <sup>[2812]</sup> · Pribanić Ivan, mag. edu. phys. et math. <sup>[457]</sup> · doc.dr. sc. Čargonja Marija <sup>[337]</sup> · prof. dr. sc. Žauhar Gordana, prof. fizike i kemije <sup>[149]</sup> · prof. dr. sc. Žuvić Marta, prof. matematike i fizike <sup>[2300]</sup></p>		
<p><b>15.05.2026</b></p>		
		<p>S8 Sound. Hearing and the Ear.:  <ul style="list-style-type: none"> <li>• [P09 - NASTAVA NA ENGLESKOM JEZIKU] (09:15 - 11:00) <sup>[149]</sup> <ul style="list-style-type: none"> <li>◦ MPBP S A</li> </ul> </li> </ul> </p>
<p>prof. dr. sc. Žauhar Gordana, prof. fizike i kemije <sup>[149]</sup></p>		
<p><b>20.05.2026</b></p>		
<p>L23 Structure of Atom and Molecule: Molecular Bonds and Energy States:  <ul style="list-style-type: none"> <li>• [Kampus O-029] (08:15 - 10:00) <sup>[252]</sup> <ul style="list-style-type: none"> <li>◦ MPBP</li> </ul> </li> </ul> <p>L24 Electromagnetic Waves:  <ul style="list-style-type: none"> <li>• [Kampus O-029] (08:15 - 10:00) <sup>[252]</sup> <ul style="list-style-type: none"> <li>◦ MPBP</li> </ul> </li> </ul> </p></p>	<p>P10 Ionizing radiation:  <ul style="list-style-type: none"> <li>• [Kampus O-162] (10:00 - 12:00) <sup>[457] [1458] [2812]</sup> <ul style="list-style-type: none"> <li>◦ MPBP P A</li> </ul> </li> <li>• [Kampus O-162] (12:00 - 14:00) <sup>[337] [1458] [2812]</sup> <ul style="list-style-type: none"> <li>◦ MPBP V B</li> </ul> </li> <li>• [Kampus O-162] (14:00 - 16:00) <sup>[337] [1458] [2812]</sup> <ul style="list-style-type: none"> <li>◦ MPBP P C</li> </ul> </li> </ul> </p>	<p>S9 Medical Use of X-Rays:  <ul style="list-style-type: none"> <li>• [Kampus O-152] (10:15 - 12:00) <sup>[252]</sup> <ul style="list-style-type: none"> <li>◦ MPBP S B</li> </ul> </li> </ul> </p>
<p>izv. prof. dr. sc. Jurković Slaven, spec. med. fiz. <sup>[252]</sup> · Majetić Marijana, viša laborantica <sup>[1458]</sup> · Musulin Marija, viša laborantica <sup>[2812]</sup> · Pribanić Ivan, mag. edu. phys. et math. <sup>[457]</sup> · doc.dr. sc. Čargonja Marija <sup>[337]</sup></p>		

<b>22.05.2026</b>		
		S9 Medical Use of X-Rays: <ul style="list-style-type: none"> <li>• [P09 - NASTAVA NA ENGLESKOM JEZIKU] (09:15 - 11:00) <sup>[252]</sup> <ul style="list-style-type: none"> <li>◦ MPBP S A</li> </ul> </li> </ul>
izv. prof. dr. sc. Jurković Slaven, spec. med. fiz. <sup>[252]</sup>		
<b>27.05.2026</b>		
L25 Medical Use of X Rays: <ul style="list-style-type: none"> <li>• [Kampus O-029] (08:15 - 10:00) <sup>[252]</sup> <ul style="list-style-type: none"> <li>◦ MPBP</li> </ul> </li> </ul> L26 Structure of the Atomic Nucleus. Nuclear Decay. Decay Rate and Half-life: <ul style="list-style-type: none"> <li>• [Kampus O-029] (08:15 - 10:00) <sup>[252]</sup> <ul style="list-style-type: none"> <li>◦ MPBP</li> </ul> </li> </ul>	P11 Compensation: <ul style="list-style-type: none"> <li>• [Kampus O-162] (10:00 - 12:00) <sup>[457] [1458] [2812]</sup> <ul style="list-style-type: none"> <li>◦ MPBP P A</li> </ul> </li> <li>• [Kampus O-162] (12:00 - 14:00) <sup>[337] [1458] [2812]</sup> <ul style="list-style-type: none"> <li>◦ MPBP P C</li> </ul> </li> <li>• [Kampus O-162] (14:00 - 16:00) <sup>[337] [1458] [2812]</sup> <ul style="list-style-type: none"> <li>◦ MPBP V B</li> </ul> </li> </ul>	S10 Application of Radioactive Isotopes in Nuclear Medicine: <ul style="list-style-type: none"> <li>• [Kampus O-152] (10:15 - 12:00) <sup>[252]</sup> <ul style="list-style-type: none"> <li>◦ MPBP S B</li> </ul> </li> </ul>
izv. prof. dr. sc. Jurković Slaven, spec. med. fiz. <sup>[252]</sup> · Majetić Marijana, viša laborantica <sup>[1458]</sup> · Musulin Marija, viša laborantica <sup>[2812]</sup> · Pribanić Ivan, mag. edu. phys. et math. <sup>[457]</sup> · doc.dr. sc. Čargonja Marija <sup>[337]</sup>		
<b>29.05.2026</b>		
		S10 Application of Radioactive Isotopes in Nuclear Medicine: <ul style="list-style-type: none"> <li>• [P09 - NASTAVA NA ENGLESKOM JEZIKU] (09:15 - 11:00) <sup>[252]</sup> <ul style="list-style-type: none"> <li>◦ MPBP S A</li> </ul> </li> </ul>
izv. prof. dr. sc. Jurković Slaven, spec. med. fiz. <sup>[252]</sup>		
<b>03.06.2026</b>		
L27 Radioactivity. Alfa, Beta and Gamma Decay.: <ul style="list-style-type: none"> <li>• [Kampus O-029] (08:15 - 10:00) <sup>[252]</sup> <ul style="list-style-type: none"> <li>◦ MPBP</li> </ul> </li> </ul> L28 Interaction of Photons with Matter. Detection and Dosimetry of Ionizing Radiation.: <ul style="list-style-type: none"> <li>• [Kampus O-029] (08:15 - 10:00) <sup>[252]</sup> <ul style="list-style-type: none"> <li>◦ MPBP</li> </ul> </li> </ul>	P12 Compensation: <ul style="list-style-type: none"> <li>• [Kampus O-162] (10:00 - 12:00) <sup>[457] [1458] [2812]</sup> <ul style="list-style-type: none"> <li>◦ MPBP P A</li> </ul> </li> <li>• [Kampus O-162] (12:00 - 14:00) <sup>[337] [1458] [2812]</sup> <ul style="list-style-type: none"> <li>◦ MPBP V B</li> </ul> </li> <li>• [Kampus O-162] (14:00 - 16:00) <sup>[337] [1458] [2812]</sup> <ul style="list-style-type: none"> <li>◦ MPBP P C</li> </ul> </li> </ul>	
izv. prof. dr. sc. Jurković Slaven, spec. med. fiz. <sup>[252]</sup> · Majetić Marijana, viša laborantica <sup>[1458]</sup> · Musulin Marija, viša laborantica <sup>[2812]</sup> · Pribanić Ivan, mag. edu. phys. et math. <sup>[457]</sup> · doc.dr. sc. Čargonja Marija <sup>[337]</sup>		
<b>10.06.2026</b>		
L29 Application of Ultrasound in Medicine.: <ul style="list-style-type: none"> <li>• [Kampus O-029] (08:15 - 10:00) <sup>[149]</sup> <ul style="list-style-type: none"> <li>◦ MPBP</li> </ul> </li> </ul> L30 Final Lecture and Preparation for Final Exam.: <ul style="list-style-type: none"> <li>• [Kampus O-029] (08:15 - 10:00) <sup>[149]</sup> <ul style="list-style-type: none"> <li>◦ MPBP</li> </ul> </li> </ul>		
prof. dr. sc. Žauhar Gordana, prof. fizike i kemije <sup>[149]</sup>		

### List of lectures, seminars and practicals:

LECTURES (TOPIC)	Number of hours	Location
L1 Introduction. SI Units.	1	[Kampus O-029]
L2 Optics in Medicine. Laws of Refraction and Reflection: Image Formation by Plane and Spherical Surfaces of Refraction	1	[Kampus O-029]
L3 The Human Eye – the Optical Model	1	[Kampus O-029]
L4 Errors of optical systems	1	[Kampus O-029]
L5 Image Formation by Lens and Microscope	1	[Kampus O-029]
L6 Types of Optical Microscopes. Electron microscopes	1	[Kampus O-029]
L7 Fundamental Forces. Statics of the Body. Review of Forces, Torques and Equilibrium	1	[Kampus O-029]
L8 Mechanics of the Human Body. Implementation of Newton's Laws: Levers in the Body, Passive Walking and High Jump.	1	[Kampus O-029]
L9 Mechanical Properties of Tissues. Elasticity and Strength of Materials. Viscoelastic Properties of Body Tissues – Mechanical Models.	1	[Kampus O-029]
L10 Fluids. Hydrostatics. Surface Tension and Its Implications. Law of Laplace.	1	[Kampus O-029]
L11 Hydrodynamics. Bernoulli's Equation, Viscosity and Poiseuille's Law. Turbulent Flow	1	[Kampus O-029]
L12 Rheological Properties of Blood. Physics of the Circulatory System. Consequences of Clogged Arteries	1	[Kampus O-029]
L13 Ideal and Real Gases. Gas Laws. Physics of Breathing	1	[Kampus O-029]
L14 Basic Principles of Thermodynamics: I and II Law.	1	[Kampus O-029]
L15 Thermodynamics of a Biological system. Transfer of Heat.	1	[Kampus O-029]
L16 Transfer of Particles and Ions through Membranes. Action Potential.	1	[Kampus O-029]
L17 Physical Basis of Electro- and Magneto- Diagnostics (EKG, EEG, EMG).	1	[Kampus O-029]
L18 Dielectric Properties of Tissues. Tissues in Electric Field.	1	[Kampus O-029]
L19 Therapeutic Applications of Electric Fields.	1	[Kampus O-029]
L20 Matter in the External Magnetic Field: A Biological System in the Electric Circuit, Magneto therapy	1	[Kampus O-029]
L21 Oscillations and Waves d Waves.	1	[Kampus O-029]
L22 Sound Waves: The Physics of Hearing. Intensity of Soun. Connection between Physical and Physiological Parameters of Sound.	1	[Kampus O-029]
L23 Structure of Atom and Molecule: Molecular Bonds and Energy States	1	[Kampus O-029]
L24 Electromagnetic Waves	1	[Kampus O-029]
L25 Medical Use of X Rays	1	[Kampus O-029]
L26 Structure of the Atomic Nucleus. Nuclear Decay. Decay Rate and Half-life	1	[Kampus O-029]
L27 Radioactivity. Alfa, Beta and Gamma Decay.	1	[Kampus O-029]
L28 Interaction of Photons with Matter. Detection and Dosimetry of Ionizing Radiation.	1	[Kampus O-029]
L29 Application of Ultrasound in Medicine.	1	[Kampus O-029]
L30 Final Lecture and Preparation for Final Exam.	1	[Kampus O-029]

<b>EXERCISES (TOPIC)</b>	<b>Number of hours</b>	<b>Location</b>
P0 Introduction to Practicals. General Laboratory Safety Procedures and Rules.	1	[Kampus O-162]
P1 Mechanical Waves	2	[Kampus O-162]
P2 Audiometry	2	[Kampus O-162]
P3 Surface Tension and Viscosity	2	[Kampus O-162]
P4 Calorimetry	2	[Kampus O-162]
P5 Thermal Environmental Conditions	2	[Kampus O-162]
P6 Index of Refraction. Spectroscopy	2	[Kampus O-162]
P7 Spherical Mirrors and Lenses	2	[Kampus O-162]
P8 Electric Circuits	2	[Kampus O-162]
P9 Measurement of Resistance. The Wheatstone Bridge Method	2	[Kampus O-162]
P10 Ionizing radiation	2	[Kampus O-162]
P11 Compensation	2	[Kampus O-162]
P12 Compensation	2	[Kampus O-162]

<b>SEMINARS (TOPIC)</b>	<b>Number of hours</b>	<b>Location</b>
S1 Calculating Measurement Errors and Estimating Measurement Accuracy	2	[Kampus O-152] [P08]
S2 Optics	2	[Kampus O-152] [P06]
S3 Vectors and Operations with Vectors. Graphical Representation of Measurement Results and Interpretation of Graphs. Differential Calculus.	2	[Kampus O-152] [P05]
S4 Levers in the Human Body	2	[Kampus O-029] [Kampus O-152]
S5 Hydromechanics	2	[Kampus O-152] [P06]
S6 Physics of Breathing	2	[Kampus O-152]
S7 Diffusion and Osmosis. Transport of Energy and Matter through Cell Membranes	2	[Kampus O-152] [P07]
S8 Sound. Hearing and the Ear.	2	[Kampus O-152] [P09 - NASTAVA NA ENGLESKOM JEZIKU]
S9 Medical Use of X-Rays	2	[Kampus O-152] [P09 - NASTAVA NA ENGLESKOM JEZIKU]
S10 Application of Radioactive Isotopes in Nuclear Medicine	2	[Kampus O-152] [P09 - NASTAVA NA ENGLESKOM JEZIKU]

**EXAM DATES (final exam):**

1.	15.06.2026.
2.	29.06.2026.
3.	13.07.2026.
4.	03.09.2026.
5.	17.09.2026.