



## FIȘA DISCIPLINEI

2023/2024

## 1. Date despre program

1.1 Instituția de învățământ superior	“Alexandru Ioan Cuza” University of Iași
1.2 Facultatea	Faculty of Physics
1.3 Departamentul	Physics
1.4 Domeniul de studii	Physics
1.5 Ciclul de studii	Master
1.6 Programul de studii / Calificarea	Biophysics and Medical Physics

## 2. Date despre disciplină

2.1 Denumirea disciplinei	Interaction of ionizing radiation with matter						
2.2 Titularul activităților de curs	Conf. dr. Catalin-Gabriel BORCIA						
2.3 Titularul activităților de lab.	Conf. dr. Catalin-Gabriel BORCIA						
2.4 An de studiu	I	2.5 Semestru	1	2.6 Tip de evaluare	E	2.7 Regimul disciplinei*	OB

\* OB – Obligatoriu / OP – Opțional

## 3. Timpul total estimat (ore pe semestru și activități didactice)

3.1 Număr de ore pe săptămână	4	din care: 3.2 curs	2	3.3 laborator	2
3.4 Total ore din planul de învățământ	56	din care: 3.5 curs	28	3.6 laborator	28
Distribuția fondului de timp					ore
Studiu după manual, suport de curs, bibliografie și altele					35
Documentare suplimentară în bibliotecă, pe platformele electronice de specialitate și pe teren					35
Pregătire seminarii/laboratoare, teme, referate, portofolii și eseuri					28
Tutoriat					14
Examinări					7
Alte activități .....					-
3.7 Total ore studiu individual					119
3.8 Total ore pe semestru					175
3.9 Număr de credite					7

## 4. Precondiții (dacă este cazul)

4.1 De curriculum	—
4.2 De competențe	—

## 5. Condiții (dacă este cazul)

5.1 De desfășurare a cursului	—
5.2 De desfășurare a seminarului/ laboratorului	Nuclear Physics Laboratory

**6. Competențe specifice acumulate**

<b>Competențe profesionale</b>	<p><b>C1.</b> Identification and proper use of laws, principles, notions and physical methods related to the interaction of ionizing radiations in various circumstances</p> <p><b>C2.</b> Correct application of the analysis methods and of the selection criteria for the solutions targeting a given goal in practical situations</p> <p><b>C3.</b> Planning of analysis strategies using the available methods</p> <p><b>C4.</b> Mastery of research methods and techniques, specific to the specialization Biophysics and Medical Physics</p> <p><b>C5.</b> Analysis and communication of Physics information with didactical, scientific and popularization character</p> <p><b>C6.</b> Capacity of interrelating and teamworking</p> <p><b>C7.</b> Opening to lifelong learning</p>
<b>Competențe transversale</b>	<p><b>CT1.</b> Carrying out the professional tasks in efficient and responsible manner, respecting the rules specific to the domain, under qualified assistance</p> <p><b>CT2.</b> Applying the techniques for efficient team work on various hierarchical levels</p> <p><b>CT3.</b> Efficient use of information sources and of communication and assisted training resources</p> <p><b>CT4.</b> Use of software for analyzing and processing experimental data and to perform virtual experiments</p> <p><b>CT5.</b> Language skills at academic level, in foreign languages, needed for scientific documentation</p> <p><b>CT6.</b> Understanding and ability to apply the principles and the values of the professional and research ethics</p>

**7. Obiectivele disciplinei** (din grila competențelor specifice acumulate)

<b>7.1 Obiectivul general</b>	<ol style="list-style-type: none"> <li>1. Correct identification and use of the physical notions, laws and principles related to the interaction of ionizing radiation with substance, within a given context and capacity to apply this knowledge to practice</li> <li>2. Ability to work in a team to solve experimental and technological problems, demonstrating determination and perseverance to achieve the tasks and fulfill the responsibilities</li> <li>3. Interpretation of the information on ionizing radiation interaction and its communication in coherent and accessible form</li> <li>4. Identification and utilization of bibliographical resources for continuous learning, formation and development</li> </ol>
<b>7.2 Obiectivele specifice</b>	<p>On successful completion of this course, the students will be able to:</p> <ul style="list-style-type: none"> <li>▪ Identify and use adequately the principal laws and physical principles related to the interaction of ionizing radiations with substance in a given context</li> <li>▪ Explain what are the suitable methods to model the interaction of ionizing radiations, in relation to a targeted application</li> <li>▪ Use laboratory equipment to determine the effects of interactions of ionizing radiations</li> <li>▪ Analyse and discuss the measured or numerical modelling data and present a report on the effects of the interaction of ionizing radiation with various materials</li> </ul>

**8. Conținut**

8.1	Curs	Metode de predare	Observații (ore și referințe bibliografice)
1.	Chap. I. Principles and fundamentals of ionizing radiations physics	Lecture online/on-site, thematic debates, applications	2 hours, ref. 1, 3
2.	Chap. II Interaction of heavy charged particles with the substance	Lecture online/on-site, thematic debates, applications	2 hours, ref. 1,3
3.	Chap. III Interaction of light charged particles (electrons and positrons) with the substance	Lecture online/on-site, thematic debates, applications	2 hours, ref. 1, 3



4.	Chap. IV Depth distribution of the energy released to the matter by charged particles	Lecture online/on-site, thematic debates, applications	2 hours, ref. 1, 2, 3
5.	Chap. V Interaction of electrons with the substance (macroscopical description)	Lecture online/on-site, thematic debates, applications	2 hours, ref. 1, 2, 3
6.	Chap. V Fundamentals on the dosimetry of electron beams	Lecture online/on-site, thematic debates, applications	2 hours, ref. 2, 4
7.	Chap. VI Interaction of photons with the substance	Lecture online/on-site, thematic debates, applications	2 hours, ref. 2, 3
8.	Chap. VI Fundamentals on dosimetry of photons beams	Lecture online/on-site, thematic debates, applications	2 hours, ref. 2, 3
9.	Chap. VII Interaction of neutrons with the substance	Lecture online/on-site, thematic debates, applications	2 hours, ref. 3
10.	Chap. VIII The transport of ionizing radiation through the matter	Lecture online/on-site, thematic debates, applications	2 hours, ref. 3, 7
11.	Chap. IX Interaction of ionizing radiation with living matter – fundamentals of radiobiology	Lecture online/on-site, thematic debates, applications	2 hours, ref. 3, 6
12.	Chap. IX Interaction of ionizing radiation with living matter – fundamentals of radioprotection	Lecture online/on-site, thematic debates, applications	2 hours, ref. 3, 6
13.	Chap. X Applications of the interaction of ionizing radiations in medicine (part 1)	Lecture online/on-site, thematic debates, applications	2 hours, ref. 3, 4, 5
14.	Chap. X Applications of the interaction of ionizing radiations in medicine (part 2)	Lecture online/on-site, thematic debates, applications	2 hours, ref. 3, 4, 5

**References****Main references:**

- [1] D. Mihăilescu, C. Borcia – “Interacțiunea radiațiilor ionizante cu substanța. Partea I: radiații încărcate electric”, Ed. Sedcom Libris, Iași, 2007.  
[2] D. Mihăilescu – “Dozimetria radiațiilor ionizante”, Ed. Universității “Al.I.Cuza”, Iași, 2001.  
[3] E. B. Podgoršak - “Radiation Physics for Medical Physicists”, Springer Berlin Heidelberg, 2006.  
[4] E. B. Podgoršak (editor) - “Review of Radiation Oncology Physics: A Handbook for Teachers and Students”, IAEA, Viena, 2003.  
[5] F. Khan – „The Physics of Radiation Therapy”, Williams & Wilkins, 1994.

**Supplementary references:**

- [6] James E. Martin – “Physics for Radiation Protection – A Handbook”, WILEY-VCH Verlag GmbH & Co. KGaA, Weinheim, 2006  
[7] A. Bielajev – „Fundamentals of the Monte Carlo method for neutral and charged particle transport”, Univ. of Michigan, 2001.

8.2	Laborator	Metode de predare	Observații (ore și referințe bibliografice)
1.	Rules for work safety and protection Methods and software for modeling the interaction of ionizing radiation with the substance	Discussion online/on-site, practical work	2 hours, ref. 1, 2, 3



2.	Modeling the geometry and initial conditions for simulating the interaction of ionizing radiation with the substance	Discussion online/on-site, practical work	2 hours, ref. 2
3.	Energy and angular distributions of electrons and positrons in the irradiated substance	Discussion online/on-site, practical work	2 hours, ref. 2
4.	Energy and angular distributions of photons in the irradiated substance	Discussion online/on-site, practical work	2 hours, ref. 2
5.	Simulation of the interaction of electrons and photons in a cylindrical geometry		2 hours, ref. 2
6.	Simulation of beams generated by linear electron accelerators for radiotherapy purposes	Discussion online/on-site, practical work	2 hours, ref. 3
7.	Calculation of dose distributions for electrons and positrons in various materials	Discussion online/on-site, practical work	2 hours, ref. 1, 3
8.	Calculation of dose distributions for photons and positrons in various materials	Discussion online/on-site, practical work	2 hours, ref. 1, 3
9.	Calculation of the dose delivered to risk organs in the patient's body	Discussion online/on-site, practical work	2 hours, ref. 2
10.	Calculation of the stopping power for charged particles in various materials	Discussion online/on-site, practical work	2 hours, ref. 2
11.	Calculation of back-scattering coefficients for charged particles in various materials	Discussion online/on-site, practical work	2 hours, ref. 3
12.	X-ray spectra of photons generated by an electron beam while hitting a target	Discussion online/on-site, practical work	2 hours, ref. 2
13.	Calculation of gamma spectra recorded with various detectors	Discussion online/on-site, practical work	2 hours, ref. 2
14.	Study of DNA damage induced by radiations	Discussion online/on-site, practical work	2 hours, ref. 1
<b>References</b>			
[1] A. Bielajev – „Fundamentals of the Monte Carlo method for neutral and charged particle transport”, Univ. of Michigan, 2001.			
[2] FLUKA: a multi-particle transport code, CERN 2005-10 (2005), INFN/TC_05/11, SLAC-R-773". doi:10.5170/CERN-2005-010			
[3] A. Fasso, A. Ferrari, J. Ranft, Flua manual, available online at <a href="http://www.fluka.org/fluka.php?id=manuals">http://www.fluka.org/fluka.php?id=manuals</a>			

### 9. Coroborarea conținutului disciplinei cu așteptările reprezentanților comunității, asociațiilor profesionale și angajatorilor reprezentativi din domeniul aferent programului

This course aims to prepare the students for working as Medical Physicists or as Physicist in the Radiation Physics domains. It gives the background necessary for sustaining the professional exams in order to obtain their clearance as qualified radiation workers issued by the Romanian National Commission for Nuclear Activities Control. The graduates will be able to use their knowledge in various domains covering medical physics, radiation protection or any other field which implies the use of ionizing radiations.

### 10. Evaluare

Tip activitate	10.1 Criterii de evaluare	10.2 Metode de evaluare	10.3 Pondere în nota finală (%)
10.4 Curs	Analysing and discussing on various theoretical and practical aspects emerging from the course	Exam – written	60%



<b>10.5</b> Laborator	Reports on laboratory work Presentation of an individual project (essay) on a topical issue	Evaluation of laboratory reports / presentation	40%
<b>10.6</b> Standard minim de performanță			
Critical analysis on the methods and criteria used to select the correct solutions to attain specified performance in a given application Physical interpretation on the results of experimental measurements or theoretical calculations, using appropriate numerical or statistical methods Application of an algorithm for a medium complexity software application (data acquisition and analysis, physical phenomena models) Elaboration of an individual project by analysis of results presented in the literature			

Data completării  
28.09.2023

Titular de curs  
Conf. dr. Catalin-Gabriel BORCIA

Titular de laborator  
Conf. dr. Catalin-Gabriel BORCIA

Data avizării în departament

Director de departament  
Conf. dr. Iordana AȘTEFĂNOAEI



## FIȘA DISCIPLINEI

2023/2024

## 1. Date despre program

1.1 Instituția de învățământ superior	University “Alexandru Ioan Cuza” from Iași
1.2 Facultatea	Faculty of Physics
1.3 Departamentul	Physics
1.4 Domeniul de studii	Physics
1.5 Ciclul de studii	Master
1.6 Programul de studii / Calificarea	<i>Master in the specialization „BIOPHYSICS AND MEDICAL PHYSICS”</i>

## 2. Date despre disciplină

2.1 Denumirea disciplinei	Radiation sources and radiological protection						
2.2 Titularul activităților de curs	conf.dr. habil.Lavinia-Petronela Curecheriu lect.dr. Cătălin Agheorghiesei						
2.3 Titularul activităților de seminar	conf.dr. habil. Lavinia-Petronela Curecheriu lect.dr. Cătălin Agheorghiesei						
2.4 An de studiu	I	2.5 Semestru	1	2.6 Tip de evaluare	E	2.7 Regimul disciplinei*	OB

\* OB – Obligatoriu / OP – Opțional

## 3. Timpul total estimat (ore pe semestru și activități didactice)

3.1 Număr de ore pe săptămână	4	din care: 3.2 curs	2	3.3 seminar/laborator	2
3.4 Total ore din planul de învățământ	56	din care: 3.5 curs	28	3.6 seminar/laborator	28
Distribuția fondului de timp					ore
Studiu după manual, suport de curs, bibliografie și altele					45
Documentare suplimentară în bibliotecă, pe platformele electronice de specialitate și pe teren					36
Pregătire seminarii/laboratoare, teme, referate, portofolii și eseuri					33
Tutoriat					0
Examinări					5
Alte activități Proiect individual					
3.7 Total ore studiu individual					119
3.8 Total ore pe semestru					175
3.9 Număr de credite					7

## 4. Precondiții (dacă este cazul)

4.1 De curriculum	Nuclear physics, Dosimetry
4.2 De competențe	Basic knowledge of radiation sources, radioprotection, legislation

## 5. Condiții (dacă este cazul)



5.1 De desfășurare a cursului	Lecture room with multimedia tools (projector, screen) and blackboard, Acces internet, CISCO Webex platform, Skype, etc.
5.2 De desfășurare a seminarului/ laboratorului	Lecture room with multimedia tools (projector, screen) and blackboard, Acces internet, CISCO Webex platform, Skype, Labs for Nuclear Physics

## 6. Competențe specifice acumulate

Competențe profesionale	<p><b>C1.</b> Capacity to identify properly in practical situations the principles, laws and theories focused on the use of ionizing radiation for diagnosis and treatment;</p> <p><b>C2.</b> The ability to use the methods and techniques of using medical equipment and devices or control devices specific to Medical Physics as well as those of scientific research;</p> <p><b>C3.</b> Use of databases, on-line applications, computer tools, and software packages for numeric simulation in Medical Physics, establishment of treatment plans, medical statistics, analysis and processing of experimental data, monitoring in operation and quality assurance.</p>
Competențe transversale	<p><b>CT1.</b> Ability to act with autonomy, responsibility and professional ethics for the safe performance of professional tasks in compliance with legislation, specific deontology and with respect for the environment.</p> <p><b>CT2.</b> Capacity of collaboration and working in a multidisciplinary and diversity team;</p> <p><b>CT3.</b> Capacity to realise a personal project of bibliographical or scientific research</p> <p><b>CT4.</b> Open and positive attitude for solving problems and assuming the professional deontological principles and values.</p>

## 7. Obiectivele disciplinei (din grila competențelor specifice acumulate)

7.1 Obiectivul general	Acquiring the necessary knowledge for the safe conduct of medical and research activities involving the use of radiological sources and equipment.
7.2 Obiectivele specifice	<p>After successfully finalising this discipline, the students will be able to:</p> <ul style="list-style-type: none"><li>• Understand the nature and properties of ionizing radiation;</li><li>• To know the main quantities and dosimetric units;</li><li>• To be able to do dosimetric measurements;</li><li>• To know the basic requirements of radiological protection and security;</li><li>• Understand and apply the basic principles of radiation protection;</li><li>• To become familiar with the concepts of quality assurance and control in radiation protection;</li><li>• To be able to assess the potential risks arising from the use of radiation sources;</li><li>• To perform radiation protection calculations</li></ul>

## 8. Conținut

8.1	Curs	Metode de predare	Observații (ore și referințe bibliografice)
1.	Introduction in the physics of ionizing radiation	Lecture, exposition, observation, explanation, demonstration and discussion with the students	2h [1-10] -online
2.	The activity of a source: definition, the law of radioactive decay, methods for detecting the activity of a source	Lecture, exposition, observation, explanation,	2h [1-10]



		demonstration and discussion with the students	
3.	Sources of ionizing radiation; natural sources of radiation	Lecture, exposition, observation, explanation, demonstration and discussion with the students	2h [1-10]
4.	X-ray sources	Lecture, exposition, observation, explanation, demonstration and discussion with the students	2h [1-10]
5.	Particle accelerators: linear accelerators	Lecture, exposition, observation, explanation, demonstration and discussion with the students	2h [1-10]
6.	Betatron	Lecture, exposition, observation, explanation, demonstration and discussion with the students	2h [1-10]
7.	Cyclotron; Syncrocyclotron	Lecture, exposition, observation, explanation, demonstration and discussion with the students	2h [1-10]
8.	Radioprotection: introduction, international forum, ICRP recomandation	Lecture, exposition, observation, explanation, demonstration and discussion with the students	2h [1-10]
9.	Biological effects of ionizing radiation	Lecture, exposition, observation, explanation, demonstration and discussion with the students	2h [1-10]
10.	Conceptual framework of radiological protection	Lecture, exposition, observation, explanation, demonstration and discussion with the students	2h [1-10]
11.	Quantities and physical units used in dosimetry and radiation protection	Lecture, exposition, observation, explanation, demonstration and discussion with the students	2h [1-10]
12.	External and internal exposure	Lecture, exposition, observation, explanation, demonstration and discussion with the students	2h [1-10]
13.	Shielding of radiation sources	Lecture, exposition, observation, explanation, demonstration and discussion with the students	2h [1-10]
14.	Radiological protection in medical practice. Radioprotection of the population and the environment	Lecture, exposition, observation, explanation, demonstration and discussion with the students	2h [1-10]



**Bibliografie**

1. Oncescu M.: Conceptele radioprotecției, Ed. Horia Hulubei, București, Măgurele, 1996
2. Borcia C.: Surse de radiații și radioprotecția, Ed. Universității „Alexandru Ioan Cuza” din Iași, 2005
3. Mihăilescu C: Curs dozimetrie, Ed. Universității „Alexandru Ioan Cuza” din Iași, 2003
4. Ion Chiosila: Radiațiile și viața, București, 1998
5. S. Mănescu: Tratat de igienă, vol II, Ed. Medicală, 1985
6. Ord. 14/24.01.2000 privind aprobarea Normelor fundamentale de securitate radiologică publicat în MO 404/29.08.2000
7. Directiva 2013/59/EURATOM a Consiliului din 5.12.2013
8. NSR-01 Norme fundamentale de securitate radiologică aprobate prin Ord. Preș. CNCAN 14/24.01.2000 și publicate în MO Partea I nr. 404bis/29.08.2000
9. NSR-11 Normele de securitate radiologică în practicile de radiologie de diagnostic și radiologie intervențională aprobate prin ordinul CNCAN nr. 173/16.10.2003 și publicate în Monitorul Oficial al României, Partea I, nr. 924/23.12.2003
10. NSR-04 Norme privind radioprotecția persoanelor în cazul expunerilor medicale la radiații ionizante aprobate prin Ordinul Ministrului Sănătății și Familiei nr. 285/19.04.2002, Ordinul Președintelui CNCAN nr. 79/04.03.2002 și publicate în Monitorul Oficial al României Partea I, nr. 446bis/25.06.2002.

<b>8.2</b>	<b>Seminar / Laborator</b>	<b>Metode de predare</b>	<b>Observații</b> (ore și referințe bibliografice)
1.	Introduction: sources of radiation and radioprotection	Exposition, explanation, demonstration, dialogue	2h [1-10] -online
2.	Linear particle accelerators	Exposition, explanation, demonstration, dialogue	2h [1-10]
3.	Circle particle accelerators	Exposition, explanation, demonstration, dialogue	2h [1-10]
4.	Interaction of radiation with matter, attenuation of radiation	Exposition, explanation, demonstration, dialogue	2h [1-10]
5.	Physical units of radioprotection	Exposition, explanation, demonstration, dialogue	2h [1-10]
6.	Operating principles of dosimeters and flowmeters	Exposition, explanation, demonstration, dialogue	2h [1-10]
7.	Absorption of ionizing radiation	Exposition, explanation, demonstration, dialogue	2h [1-10]
8.	Exposure to radiation sources	Exposition, explanation, demonstration, dialogue	2h [1-10]
9.	Shielding of radiation sources	Exposition, explanation, demonstration, dialogue	2h [1-10]
10.	Calculation of radiation protection screens for primary radiation	Exposition, explanation, demonstration, dialogue	2h [1-10]
11.	Calculation of radiation protection screens for secondary radiation	Exposition, explanation, demonstration, dialogue	2h [1-10]
12.	Optimization for medical exposures in radiology	Exposition, explanation, demonstration, dialogue	2h [1-10]
13.	Materials for radioprotection	Exposition, explanation, demonstration, dialogue	2h [1-10]
14.	Test	Exposition, explanation, demonstration, dialogue	2h [1-10]

**Bibliografie**

11. Oncescu M.: Conceptele radioprotecției, Ed. Horia Hulubei, București, Măgurele, 1996
12. Borcia C.: Surse de radiații și radioprotecția, Ed. Universității „Alexandru Ioan Cuza” din Iași, 2005
13. Mihăilescu C: Curs dozimetrie, Ed. Universității „Alexandru Ioan Cuza” din Iași, 2003
14. Ion Chiosila: Radiațiile și viața, București, 1998
15. S. Mănescu: Tratat de igienă, vol II, Ed. Medicală, 1985
16. Ord. 14/24.01.2000 privind aprobarea Normelor fundamentale de securitate radiologică publicat în MO 404/29.08.2000
17. Directiva 2013/59/EURATOM a Consiliului din 5.12.2013
18. NSR-01 Norme fundamentale de securitate radiologică aprobate prin Ord. Preș. CNCAN 14/24.01.2000 și publicate în MO Partea I nr. 404bis/29.08.2000
19. NSR-11 Normele de securitate radiologică în practicile de radiologie de diagnostic și radiologie intervențională aprobate prin ordinul CNCAN nr. 173/16.10.2003 și publicate în Monitorul Oficial al României, Partea I, nr. 924/23.12.2003
20. NSR-04 Norme privind radioprotecția persoanelor în cazul expunerilor medicale la radiații ionizante aprobate prin Ordinul Ministrului Sănătății și Familiei nr. 285/19.04.2002, Ordinul Președintelui CNCAN nr. 79/04.03.2002 și publicate în Monitorul Oficial al României Partea I, nr. 446bis/25.06.2002.

**9. Coroborarea conținutului disciplinei cu așteptările reprezentanților comunității, asociațiilor profesionale și angajatorilor reprezentativi din domeniul aferent programului**

The evolution of diagnostic and treatment techniques involving sources of ionizing radiation have also imposed a series of regulations on radioprotection, which requires a thorough understanding of the concepts related to the applications of radiation in diagnosis and treatment.

**10. Evaluare**

Tip activitate	10.1 Criterii de evaluare	10.2 Metode de evaluare	10.3 Pondere în nota finală (%)
10.4 Curs	The correctness of theory and application subjects	Written test	50%
10.5 Seminar/ Laborator	Correct and complete understanding of the applications proposed for the seminar/labs	All day evaluation	50%
<b>10.6 Standard minim de performanță</b>			
Minimum knowledge of understanding the basic concepts, theories, and methods of the field and area of specialization and their appropriate use in professional communication.			

Data completării  
2.10.2023

Titular de curs  
Conf. Dr. Habil. Lavinia-Petronela  
Curecheriu

Titular de seminar  
Conf. Dr. Habil. Lavinia-Petronela  
Curecheriu

Lect. Dr. Cătălin Agheorghiesei

Lect. Dr. Cătălin Agheorghiesei

Data avizării în departament

Director de departament  
Conf. univ. dr. Iordana ASTEFANOAEI



## FIȘA DISCIPLINEI

2023/2024

## 1. Date despre program

1.1 Instituția de învățământ superior	“Alexandru Ioan Cuza” of Iași University
1.2 Facultatea	Faculty of Physics
1.3 Departamentul	Physics
1.4 Domeniul de studii	Physics
1.5 Ciclul de studii	Master
1.6 Programul de studii / Calificarea	Biophysics and Medical Physics

## 2. Date despre disciplină

2.1 Denumirea disciplinei	Simulations methods in medical physics						
2.2 Titularul activităților de curs	Assoc. Prof. PhD. Cătălin BORCIA Assoc. Prof. PhD. Habil. Radu TANASĂ						
2.3 Titularul activităților de seminar	Assoc. Prof. PhD. Cătălin BORCIA Assoc. Prof. PhD. Habil. Radu TANASĂ						
2.4 An de studiu	1	2.5 Semestru	1	2.6 Tip de evaluare	EVP	2.7 Regimul disciplinei	OB

\* OB – Obligatoriu / OP – Opțional

## 3. Timpul total estimat (ore pe semestru și activități didactice)

3.1 Număr de ore pe săptămână	4	din care: 3.2 curs	2	3.3 seminar/laborator	2
3.4 Total ore din planul de învățământ	56	din care: 3.5 curs	28	3.6 seminar/laborator	28
Distribuția fondului de timp					ore
Studiu după manual, suport de curs, bibliografie și altele					30
Documentare suplimentară în bibliotecă, pe platformele electronice de specialitate și pe teren					30
Pregătire seminarii/laboratoare, teme, referate, portofolii și eseuri					30
Tutoriat					20
Examinări					9
Alte activități					0
3.7 Total ore studiu individual					119
3.8 Total ore pe semestru					175
3.9 Număr de credite					7

## 4. Precondiții (dacă este cazul)

4.1 De curriculum	-
4.2 De competențe	Basic computer skills.

## 5. Condiții (dacă este cazul)

5.1 De desfășurare a cursului	Room with access to internet, videoprojector and projection screen.
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5.2 De desfășurare a seminarului/  
laboratorului

**Students must have individual access to computers  
connected to internet.**

## 6. Competențe specifice acumulate

<b>Competențe profesionale</b>	<p>C1 Identify and correctly use laws, principles, concepts and physical methods related to the interaction of ionizing radiation in various circumstances.</p> <p>C2 Correct application of analysis methods and selection criteria for solutions aimed at a specific goal in practical situations</p> <p>C3 Planning analysis strategies using available methods.</p> <p>C4 Mastery of research methods and techniques, specific to the Biophysics and Medical Physics specialization.</p> <p>C5 Analysis and communication of physics phenomena with accent on didactic, scientific and outreach directions.</p>
<b>Competențe transversale</b>	<p>CT1 Carrying out, under qualified assistance, professional tasks efficiently and responsibly, respecting the rules specific to the field.</p> <p>CT2 Romanian and English communication skills regarding scientific results, the ability to make a scientific presentation regarding Monte Carlo methods applied in medical physics.</p> <p>CT3 Competence to cooperate and work in a team.</p> <p>CT4 Use of software to analyze and process experimental data and perform virtual experiments.</p> <p>CT5 The competence to carry out a personal bibliographic or scientific research project.</p> <p>CT6 Open and positive attitude for solving problems and assuming professional deontological principles and values.</p>

## 7. Obiectivele disciplinei (din grila competențelor specifice acumulate)

<b>7.1 Obiectivul general</b>	<ol style="list-style-type: none"> <li>1. Identification and correct use of the methods and algorithms necessary to simulate and model the phenomena of ionizing radiation interaction with the substance applicable to the field of medical physics and the ability to apply this knowledge in practice.</li> <li>2. Ability to work in a team to solve experimental and technological problems, demonstrating determination and perseverance in carrying out tasks and fulfilling responsibilities.</li> <li>3. Interpreting numerical simulation results and communicating them in a coherent and accessible form.</li> <li>4. Identification and use of bibliographic resources for learning, training and continuous development.</li> </ol>
<b>7.2 Obiectivele specifice</b>	<p>On successful completion of this course, students will be able to:</p> <ul style="list-style-type: none"> <li>▪ Simulate radiation transport in an experimental measurement geometry, using Monte Carlo methods to calculate the transmitted energy distribution or other relevant parameters;</li> <li>▪ Understands the assumptions and approximations in computer software based on Monte Carlo methods and the degree of accuracy for calculated results;</li> <li>▪ Identify and discuss the aspects regarding the usefulness and relevance of the implemented programs and the degree of applicability;</li> <li>▪ Comparatively analyze the properties of materials in various practical situations, searching for possible applications.</li> </ul>

## 8. Conținut

8.1	Curs	Metode de predare	Observații (ore și referințe bibliografice)
1	Overview of numerical simulation methods in medical physics.	Lecture, explanation, demonstration	2h [1,2,3,5]
2	FLAIR simulation environment – basic level.	Lecture, explanation, demonstration	2h [1,4,5]



3	Introduction to the Monte Carlo method. Short history. Applications and advantages of the Monte Carlo method.	Lecture, explanation, demonstration	1h [1,2,3,5]
4	Random numbers. Generating uniformly distributed pseudo-random numbers. Testing random numbers. Assessment of imprecision in Monte Carlo simulations.	Lecture, explanation, demonstration	3h [1,2,3,5]
5	Generating random numbers according to a given distribution. Elimination sampling and using inverse distributions. Gaussian, exponential distributions. Other distributions.	Lecture, explanation, demonstration	2h [1,2,3,5]
6	Evaluation of integrals using the Monte Carlo method.	Lecture, explanation, demonstration	2h [1,2,3,5]
7-8	Techniques to make Monte Carlo numerical simulations more efficient (variance reduction, particle history condensation).	Lecture, explanation, demonstration	4h [1,2,3,5]
9-10	FLAIR / FLUKA simulation environment – intermediate level.	Lecture, explanation, demonstration	4h [1,2,3,5]
11	Geometry modeling for the simulation of transport phenomena.	Lecture, explanation, demonstration	2h [1, 6]
12	Defining various materials for realistic interactions simulations	Lecture, explanation, demonstration	2h [6]
13-14	Using Monte-Carlo in medical applications.	Online. Lecture, explanation, demonstration	4h [1, 6]

**Bibliografie****Referințe principale:**

- [1] A. Bielajev – „Fundamentals of the Monte Carlo method for neutral and charged particle transport”, Univ. of Michigan, 2001.
- [2] G.S.Fishman, Monte Carlo: Concepts, Algorithms, and Applications, Springer Verlag, New York. (1995)  
"Monte Carlo Methods in Statistical Physics", ed. K. Binder, Springer- Verlag 1979
- [3] K. Binder. and D.W. Heermann, Monte Carlo Simulation in Statistical Physics. An Introduction (4th edition). Springer. (2002)
- [4] <https://flair.web.cern.ch>
- [5] <http://stoner.phys.uaic.ro/moodle>
- [6] A. Fasso, A. Ferrari, J. Ranft, Fluka manual, @ <http://www.fluka.org/fluka.php?id=manuals>

8.2	Seminar / Laborator	Metode de predare	Observații (ore și referințe bibliografice)
1-2	Simulate the neutron production and energy deposition of a proton beam hitting a lead target using FLAIR / FLUKA. The main steps of a Monte Carlo simulation.	Numerical applications, guided discovery process	4h [2,3]
3-4	Probabilities. Algorithms for generating uniformly distributed pseudo-random numbers. Methods	Numerical applications, guided discovery process	4h [1,4]



	for testing random number generators.		
5	Generating Gaussian and exponential distributions. Evaluation of characteristic statistical parameters. Monte Carlo method for solving integrals.	Numerical applications, guided discovery process	2h [1,4]
6	Particle beam generation and visualization.	Conversation, explanation	2h [1,4]
7	Interaction of particle beams with targets made of composite materials	Conversation, explanation	2h [2,3,4]
8	Variance reduction in Monte Carlo simulations. The effect of defining regions with different weights	Numerical applications, guided discovery process	2h [2,3,4]
9	The effect of the magnetic field on a beam of electrically charged particles	Numerical applications, guided discovery process	2h [2,3,4]
10	Numerical design of a radiotherapy procedure	Conversation, explanation	2h [2,3,4]
11	Methods for defining irradiation geometry using the Flair interface for Fluka	Conversation, explanation	2h [2, 3]
12	Methods of using and/or defining materials using the Flair interface for Fluka	Numerical applications, guided discovery process	2h [2, 3]
13	Examples of medical applications using Fluka	Numerical applications, guided discovery process	4h [2,3]

**Bibliografie**

- [1] A. Bielajev – „Fundamentals of the Monte Carlo method for neutral and charged particle transport”, Univ. of Michigan, 2001.  
[2] FLUKA: a multi-particle transport code, CERN 2005-10 (2005), INFN/TC\_05/11, SLAC-R-773". doi:10.5170/CERN-2005-010  
[3] A. Fasso, A. Ferrari, J. Ranft, Fluka manual, @ <http://www.fluka.org/fluka.php?id=manuals>  
[4] <http://stoner.phys.uaic.ro/moodle>

**9. Coroborarea conținutului disciplinei cu așteptările reprezentanților comunității, asociațiilor profesionale și angajatorilor reprezentativi din domeniul aferent programului**

The objectives and contents were selected in accordance with the expectations of the main employers (hospitals, medical clinics, research institutes, universities, SMEs) in order to favor professional insertion. The discipline aims to provide computing skills to future medical physicists or physicists in the field of radiation physics.

**10. Evaluare**

Tip activitate	10.1 Criterii de evaluare	10.2 Metode de evaluare	10.3 Pondere în nota finală (%)
10.4 Curs	Presence and engagement,	Test from course topics	50%



	constructive feedback		
<b>10.5</b> Seminar/ Laborator	Involvement, preparation of activities, quality of contributions, group activities, working group collaboration	Lab work reports First sight problem tests	50%
<b>10.6</b> Standard minim de performanță			
Identifying and using basic IT concepts, comparing numerical model data with experimental data, designing an algorithm for a complex software application Making graphs and reports to explain the results obtained, assessing the degree of confidence in the results.			

Data completării  
29.09.2023

Titular de curs  
Assoc Prof PhD Cătălin BORCIA  
Assoc Prof PhD Habil Radu TANASĂ

Titular de seminar  
Assoc. Prof. PhD. Cătălin BORCIA  
Assoc Prof PhD Habil Radu TANASĂ

Data avizării în departament

Director de departament  
Conf.dr. Iordana AȘTEFĂNOAEI

**FIȘA DISCIPLINEI****2023/2024****1. Date despre program**

1.1 Instituția de învățământ superior	Universitatea “Alexandru Ioan Cuza” din Iași
1.2 Facultatea	Facultatea de Fizică
1.3 Departamentul	Fizică
1.4 Domeniul de studii	Fizică
1.5 Ciclul de studii	Master
1.6 Programul de studii / Calificarea	Biofizică și Fizică Medicală/ Biophysics and Medical Physics

**2. Date despre disciplină**

2.1 Denumirea disciplinei	Etică și integritate academică						
2.2 Titularul activităților de curs	Prof. univ. dr. Cristian ENĂCHESCU						
2.3 Titularul activităților de seminar	Prof. univ. dr. Cristian ENĂCHESCU						
2.4 An de studiu	1	2.5 Semestru	1	2.6 Tip de evaluare	EVP	2.7 Regimul disciplinei*	OB

\* OB – Obligatoriu / OP – Opțional

**3. Timpul total estimat (ore pe semestru și activități didactice)**

3.1 Număr de ore pe săptămână	2	din care: 3.2 curs	1	3.3 seminar/laborator	1
3.4 Total ore din planul de învățământ	28	din care: 3.5 curs	14	3.6 seminar/laborator	14
Distribuția fondului de timp					ore
Studii după manual, suport de curs, bibliografie și altele					11
Documentare suplimentară în bibliotecă, pe platformele electronice de specialitate și pe teren					5
Pregătire seminarii/laboratoare, teme, referate, portofolii și eseuri					4
Tutoriat					0
Examinări					2
Alte activități					
3.7 Total ore studiu individual					22
3.8 Total ore pe semestru					50
3.9 Număr de credite					2

**4. Precondiții (dacă este cazul)**

4.1 De curriculum	Nu
4.2 De competențe	Nu

**5. Condiții (dacă este cazul)**

5.1 De desfășurare a cursului	-
5.2 De desfășurare a seminarului/ laboratorului	-

**6. Competențe specifice acumulate**





<b>Competențe profesionale</b>	C1. Experiză avansată în domeniu C2. Competențe de a identifica, implementa și oferi soluții problemelor de cercetare
<b>Competențe transversale</b>	CT1. Competențe de comunicare orală și scrisă CT2. Folosirea mijloacelor IT și a tehnologiilor informaționale CT3. Lucrul în echipă și abilități sociale

### 7. Obiectivele disciplinei (din grila competențelor specifice acumulate)

<b>7.1 Obiectivul general</b>	Înșușirea de cunoștințe privind metodologia și etica cercetării științifice
<b>7.2 Obiectivele specifice</b>	La finalizarea cu succes a acestei discipline, studenții vor fi capabili să: <ul style="list-style-type: none"><li>▪ Prelucraze și analizeze informații în mod corect dintr-o varietate de surse bibliografice</li><li>▪ Cunoască metodologia cercetării științifice</li><li>▪ Cunoască principiile fundamentale ale cercetării științifice</li><li>▪ Cunoască ce este un plagiat</li><li>▪ Cunoască obligațiile pe care le au cercetătorii</li><li>▪ Cunoască responsabilitățile ce revin autorilor unui articol științific</li><li>▪ Identifice elementele unei conduite necorespunzătoare în cercetare</li></ul>

2 ore

8.1	Curs	Metode de predare	Observații (ore și referințe bibliografice)
1	Considerații istorice și filosofice asupra eticii	Prelegere, exemplificare	1 ora
2	Principiile fundamentale ale cercetării științifice	Prelegere, exemplificare	1 ora
3	Etica cercetării	Prelegere, exemplificare	1 ora
4	Conduita necorespunzătoare în cercetare	Prelegere, exemplificare	1 ora
5	Etică și comunicare științifică. Autorii și rolul lor	Prelegere, exemplificare	1 ora
6-7	Plagiat și auto-plagiat	Prelegere, exemplificare	2 ore
8-9	Citarea și referințele bibliografice	Prelegere, exemplificare	2 ore
10-11	Mentoratul și colaborările științifice	Prelegere, exemplificare	2 ore
12	Managementul datelor	Prelegere, exemplificare	1 ora



13	Reglementarea eticii în România	Prelegere, exemplificare	1 ora
14	Știință și responsabilitate socială	Prelegere, exemplificare	1 ora

**Bibliografie**

1. Roy Jensen, Communicating Science-an introductory guide for conveying scientific information to academic and public audiences, Second edition, ISBN 978-0-9937397-3-6 (electronic edition), 2016.
2. Jaime A. Teixeira da Silva and Judit Dobrańszki, Multiple Authorship in Scientific Manuscripts: Ethical Challenges, Ghost and Guest/Gift Authorship, and the Cultural/Disciplinary Perspective, Sci. Eng. Ethics 22 (2016) 1457–1472.
3. Karen Englander, Writing and Publishing Science Research Papers in English-A Global Perspective, Springer Dordrecht Heidelberg NewYork London, 2014.
4. B. L. N. Kennet, Planning and Managing Scientific Research- A guide for the beginning researcher, ANU Press, The Australian National University Canberra, 2014.
5. John D'Angelo, Ethics in Science- Ethical Misconduct in Scientific Research, CRC Press, Taylor & Francis, Boca Raton London New York, 2012.
6. A. Yavuz Oruç, Handbook of Scientific Proposal Writing, CRC Press, Taylor & Francis, Boca Raton London New York, 2012.
7. L. Scott Montgomery, The Chicago guide to communicating science, The University of Chicago Press, Chicago and London, 2003.
8. Ivan Valiela, Doing Science-Design, Analysis, and Communication of Scientific Research, Oxford University Press, New York, 2001.
9. European Commission, Ethics for researchers – Facilitating Research Excellence, Bruxelles, 2013
10. "On Being a Scientist: Responsible Conduct in Research"; National Academy Press, Washington D.C, 2009
11. S. Florea, Plagiatul și încălcarea drepturilor de autor, Dezbateri juridice, <https://www.juridice.ro/467536/plagiatul-si-incalcarea-drepturilor-de-autor.html>
13. Legea nr. 206 din 27 mai 2004
14. Codul de etică al UAIC
15. Ghidul de integritate CNECSTDI
16. Ghidul anti-plagiat SNSPA

8.2	Seminar / Laborator	Metode de predare	Observații (ore și referințe bibliografice)
1	Principiile fundamentale ale cercetării științifice	Conversație euristică	1 ora
2-3	Etica cercetării în contextul legislației și reglementărilor actuale românești și europene	Conversație euristică	2 ore
4	Conduita necorespunzătoare în cercetare	Conversație euristică	1 ora
5	Autorii și rolul lor	Conversație euristică	1 ora
6-7	Plagiat și auto-plagiat	Conversație euristică	2 ore
8-9	Citarea și referințele bibliografice	Conversație euristică	2 ore
10-11	Mentoratul și colaborările științifice	Conversație euristică	2 ore
12-13	Managementul datelor	Conversație euristică	2 ore
14	Știință și responsabilitatea socială	Conversație euristică	1 ora

**9. Coroborarea conținutului disciplinei cu așteptările reprezentanților comunității, asociațiilor**

**profesionale și angajatorilor reprezentativi din domeniul aferent programului**

În contextul actual, cunoașterea noțiunilor de etică și integritate este esențială pentru asigurarea corectitudinii activităților desfășurate de studenți și pentru activitatea viitorilor cercetători.

**10. Evaluare**

Tip activitate	10.1 Criterii de evaluare	10.2 Metode de evaluare	10.3 Pondere în nota finală (%)
10.4 Curs			
10.5 Seminar/ Laborator		Probe practice, discutarea unor studii de caz	100%
10.6 Standard minim de performanță			
<ul style="list-style-type: none"><li>• Studenții trebuie să fie capabili să înțeleagă și să aplice regulile de etică în cercetarea științifică</li></ul>			

Data completării  
28.09.2023

Titular de curs  
Prof.dr. Cristian Enăchescu

Titular de seminar  
Prof.dr. Cristian Enăchescu

Data avizării în departament

Director de departament  
Conf.dr. Iordana Aștefănoaei



## FIȘA DISCIPLINEI

2023-2024

## 1. Date despre program

1.1 Instituția de învățământ superior	Universitatea “Alexandru Ioan Cuza” din Iași
1.2 Facultatea	Facultatea de FIZICA
1.3 Departamentul	De FIZICA
1.4 Domeniul de studii	FIZICĂ/PHYSICS
1.5 Ciclul de studii	MASTER
1.6 Programul de studii / Calificarea	„BIOFIZICĂ ȘI FIZICĂ MEDICALĂ” (în limba engleză) / „BIOPHYSICS AND MEDICAL PHYSICS” / Diplomă de master în specializarea „BIOFIZICĂ ȘI FIZICĂ MEDICALĂ” / <i>Master diploma in the specialization „BIOPHYSICS AND MEDICAL PHYSICS”</i>

## 2. Date despre disciplină

2.1 Denumirea disciplinei	Biofizica sistemelor senzoriale / <i>Biophysics of sensorial systems</i>						
2.2 Titularul activităților de curs	Conf. univ. dr. habil. Loredana-Cristina MEREUȚĂ						
2.3 Titularul activităților de seminar	Conf. univ. dr. habil. Loredana-Cristina MEREUȚĂ						
2.4 An de studiu	I	2.5 Semestru	I	2.6 Tip de evaluare	Ex	2.7 Regimul disciplinei*	OP

\* OB – Obligatoriu / OP – Opțional

## 3. Timpul total estimat (ore pe semestru și activități didactice)

3.1 Număr de ore pe săptămână	4	din care: 3.2 curs	2	3.3 seminar/laborator	2
3.4 Total ore din planul de învățământ	56	din care: 3.5 curs	28	3.6 seminar/laborator	28
Distribuția fondului de timp					ore
Studiu după manual, suport de curs, bibliografie și altele					40
Documentare suplimentară în bibliotecă, pe platformele electronice de specialitate și pe teren					40
Pregătire seminarii/laboratoare, teme, referate, portofolii și eseuri					15
Tutoriat					15
Examinări					9
Alte activități .....					
3.7 Total ore studiu individual					119
3.8 Total ore pe semestru					175
3.9 Număr de credite					7

## 4. Precondiții (dacă este cazul)

4.1 De curriculum	
4.2 De competențe	Basic knowledge of biophysics

## 5. Condiții (dacă este cazul)

5.1 De desfășurare a cursului	Videoprojector on line
5.2 De desfășurare a seminarului/ laboratorului	PC, specific software, laboratory equipment



## 6. Competențe specifice acumulate

Competențe profesionale	<ul style="list-style-type: none"><li>- mastery of research methods and techniques, specific to the specialization Biophysics and Medical Physics;</li><li>- language skills at academic level, in foreign languages, needed for scientific documentation;</li><li>- use the software for analyzing and processing experimental data and to perform virtual experiments;</li></ul>
Competențe transversale	<ul style="list-style-type: none"><li>- understanding and ability to apply the principles and the values of the professional and research ethics.</li></ul>

## 7. Obiectivele disciplinei (din grila competențelor specifice acumulate)

7.1 Obiectivul general	Understanding the structure and functions of sensory systems from living bodies;
7.2 Obiectivele specifice	Ability to analyze different physical phenomena underlying the transduction of various stimuli into action potentials of cell membrane.

## 8. Conținut

8.1	Curs	Metode de predare	Observații (ore și referințe bibliografice)
1.	<b>Short review of general biophysics:</b> The cell membrane; Ion channels; Nernst equation; Membrane potential; Action potential; Sensory cell structure.	Course presentation video	2 ore On-line
2.	<b>General principles of sensory physiology I - Biophysics of sensory perception:</b> Classification of Sensory System by Structural Complexity; Properties of sensory systems; Principles of sensory systems.	Course video presentation	2 ore On-line
3.	<b>General principles of sensory physiology II - Receptor physiology:</b> Sensory receptors. Definition and Properties; Classification of sensory receptors.	Course video presentation	2 ore On-line



4.	<b>General principles of sensory physiology III - Sensory pathways:</b> Sensory reception; Transduction; Transmission; Perception. - <b>Sensory coding; -Sensory integration and sensory integration dysfunction</b>	Course video presentation	2 ore On-line
5.	<b>The somatosensory System I - Somatic senses – generalities:</b> Somatic receptors; Response Properties of Fine Touch Fibers; Dynamic Aspects of Somatic Sensory Receptive Fields; Mechanoreceptors Specialized for Proprioception;	Course video presentation	2 ore On-line
6.	<b>The somatosensory System II- Nociception, thermoreception and itch:</b> Pain nociceptors and pain perception; Characteristics of tactile dysfunction and proprioceptive dysfunction.	Course video presentation	2 ore On-line
7.	<b>Biophysics of chemical sensory systems I - Chemical Senses;- Olfactory system – Smell:</b> The Organization of the Olfactory System; Olfactory Perception in Humans; The Olfactory Epithelium and Olfactory Receptor Neurons; The Transduction of Olfactory Signals; Olfactory Coding;	Course video presentation	2 ore On-line
8.	<b>Biophysics of chemical sensory systems II - Gustatory system – Taste:</b> The Organization of the Taste System; Taste Perception in Humans; Transduction of Taste Signals; Neural Coding in the Taste System;	Course video presentation	2 ore On-line
9.	<b>Biophysics of chemical sensory systems III - Trigeminal Chemoreception; Internal Chemoreceptors;</b>	Course video presentation	2 ore On-line
10.	<b>Biophysics of visual system I - The Eye and the retina:</b> Spatial Orientation and the Visual Field; Retinal neurons; Functional Specialization of the Photoreceptors.	Course video presentation	2 ore On-line
11.	<b>Biophysics of visual system II - Sensory Transduction in Photoreceptors:</b> Color vision; Central Visual Pathways; Visual Cortical Areas;	Course video presentation	2 ore On-line
12.	<b>Biophysics of hearing sense -</b> Auditory system and The Audible Spectrum; Structure of sensory cells from cochlea; Mechano-electrical Transduction of Sound Waves mediated by hair cells; Frequency localization in the cochlea; Auditory pathways; The human auditory cortex.	Course video presentation	2 ore On-line
13.	<b>Biophysics of vestibular system I-</b> Organization of vestibular System; Characteristics and peculiarities of sensory (hair) cells from vestibular system; Vestibular transduction	Course video presentation	2 ore On-line
14.	<b>Biophysics of vestibular system II-</b> Testing the integrity of the vestibular system; Thalamocortical pathways carrying vestibular	Course video presentation	2 ore On-line



	information; Characteristics of vestibular dysfunction;		
<b>Bibliografie</b>			
<b>Referințe principale:</b>			
1. <b>BIOFIZICA SISTEMELOR SENZORIALE – Loredana-Cristina MEREUTA, Editura UAIC, 2015</b>			
2. NEUROSCIENCE: Third Edition, Dale Purves et al., © 2004 Sinauer Associates, Inc.			
3. Fundamental neuroscience /by Larry Squire et al.—3rd ed. 2008, Elsevier Inc.			
<b>Referințe suplimentare:</b>			
1. Lehninger_Biochemistry_4e_2005_Acrobat_60			
2. EBooks - Chemistry - Biochemistry Garrett And Grisham 2Nd Ed			
<b>8.2</b>	<b>Seminar / Laborator</b>	<b>Metode de predare</b>	<b>Observații</b> (ore și referințe bibliografice)
1.	Chemical and Electrical Synapses	Video presentation, interactive discussions	2 ore On-line
2.	Visual stimuli and personality – Lusher Test	Laboratory applications computer assisted	2 ore On-line
3.	Light absorption in blood visible components	Laboratory applications computer assisted	2 ore On-line
4.	Refractive properties of biological fluids.	Laboratory applications computer assisted	2 ore On-line
5.	Fractal analyses of normal and modified red blood cell	Laboratory applications computer assisted	2 ore On-line
6.	Antigen - antibody interactions. C-reactive protein (CRP) test.	Laboratory applications computer assisted	2 ore On-line
7.	Correlation between pH and taste modality (sweet, salt, sorrow, bitter and umami)	Laboratory applications	2 ore On-line
8.	G Protein – Coupled Receptors and Second Messengers. Olfactory receptor cascade. Molecular events of olfaction.	Video presentation, interactive discussions	2 ore On-line
9.	Visual system investigation by non-invasive methods – Electroretinogram recording analysis	Laboratory applications computer assisted	2 ore On-line
10.	The Daily Human Requirement for ATP signal transducers. Common features of signaling systems that detect hormones, light, smells, and tastes.	Video presentation, interactive discussions	2 ore On-line
11.	Light absorption and rhodopsine biochemistry. Phototransduction Cascade as an enzymatic amplifier.	Video presentation, interactive discussions	2 ore On-line
12.	Eye movement recording analysis. Dispersion linear function of human eye – transfer with modulation function of horizontal cells from human retina; global transfer function of the eye.	Laboratory applications computer assisted	2 ore On-line



13.	Sound Propagation Reflection, refraction, diffraction. Transmission of Sound. Auditive stimuli and physical parameters Sensitivity of the Human Ear. Laplace's equation in vestibular system of humans internal ear; Transfer function in vestibular system in humans.	Mathematical application, interactive discussions	2 ore On-line
14.	Students project	video presentation	Colloquim 2 h on-line

**Bibliografie**

D. CREANGA, LUCRARI PRACTICE DE BIOFIZICA SISTEMELOR, ED. UNIV. ALEXANDRU IOAN CUZA IASI, 2002

Lehninger Biochemistry\_4e\_2005\_Acrobat\_60;

EBooks - Chemistry - Biochemistry Garrett And Grisham 2Nd Ed

NEUROSCIENCE: Third Edition, Dale Purves et al., © 2004 Sinauer Associates, Inc.

Fundamental neuroscience /by Larry Squire et al.—3rd ed. 2008, Elsevier Inc.

**9. Coroborarea conținutului disciplinei cu așteptările reprezentanților comunității, asociațiilor profesionale și angajatorilor reprezentativi din domeniul aferent programului**

Knowledge of the current methods used in the study of sensory systems;  
Awareness of the topical problems in the biophysics of sensory systems according to the mainstream scientific literature of the last decade.

**10. Evaluare**

Tip activitate	10.1 Criterii de evaluare	10.2 Metode de evaluare	10.3 Pondere în nota finală (%)
10.4 Curs		Written exam	50
10.5 Seminar/ Laborator		Colloquim	50

**10.6 Standard minim de performanță**

PROJECT ELLABORATION

Data completării

Titular de curs

Conf. univ. dr. habil. Loredana-Cristina  
MEREUȚĂ

Titular de seminar

Conf. univ. dr. habil. Loredana-  
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Data avizării în departament

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