FIŞA DISCIPLINEI

2021-2022

1. Date despre program

1.1 Instituţia de învăţământ superior	**“Alexandru Ioan Cuza” University of Iaşi**
1.2 Facultatea	**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			**Chaotic Phenomena and Control Methods**				
2.2 Titularul activităţilor de curs			**Assoc.Prof.Habil. Ph.D. Dan-Gheorghe DIMITRIU**				
2.3 Titularul activităţilor de seminar			**Assoc.Prof.Habil. Ph.D. Dan-Gheorghe DIMITRIU**				
2.4 An de studiu	**2**	**2.5** Semestru	**1**	**2.6** Tip de evaluare	**E**	**2.7** Regimul disciplinei*	**OB**

** OB – Obligatoriu / OP – Opţional*

3. Timpul total estimat (ore pe semestru şi activităţi 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 învăţământ	**56**	din care: **3.5** curs	**28**	**3.6** seminar/laborator	**28**
Distribuţia fondului de timp					ore
Studiu după manual, suport de curs, bibliografie şi altele					**35**
Documentare suplimentară în bibliotecă, pe platformele electronice de specialitate şi pe teren					**30**
Pregătire seminarii/laboratoare, teme, referate, portofolii şi eseuri					**30**
Tutoriat					**18**
Examinări					**6**
Alte activităţi					**0**

3.7 Total ore studiu individual	**119**
3.8 Total ore pe semestru	**175**
3.9 Număr de credite	**7**

4. Precondiţii (dacă este cazul)

4.1 De curriculum	
4.2 De competenţe	

5. Condiţii (dacă este cazul)

5.1 De desfăşurare a cursului	
5.2 De desfăşurare a seminarului/ laboratorului	

6. Competenţe specifice acumulate

Competenţe profesionale	**C1.** Identification of the main subjects of the physics of chaotic phenomena **C2.** Formulation of hypotheses and models regarding the obtained experimental research results **C3.** Critical analysis of the results obtained by using the known models/theories **C4.** Explaining and interpretation of the physical phenomena and the operationality of the key concepts based on the proper use of the laboratory devices **C5.** Critical evaluation of the experimental results, including the uncertainty degree of the obtained experimental results
Competenţe transversale	**CT1.** Identification of the role and responsibilities as a member of a team and the application of communication techniques and efficient teamworking **CT2.** Efficient capitalization of the learning resources and techniques for own development **CT3.** Analysis and communication of Physics information with didactical, scientific and popularization character **CT4.** Opening to lifelong learning

7. Obiectivele disciplinei (din grila competenţelor specifice acumulate)

7.1 Obiectivul general	Identification of the main subjects of the physics of chaotic phenomena
7.2 Obiectivele specifice	At the successful finalization of this course, the students will be able to: ▪ Formulate hypotheses and models on the obtained experimental research results ▪ Critically analyse the obtained results by using the known models/theories ▪ Explain and interpret physical phenomena and to operate with the key concepts based on the proper using of the experimental results ▪ Critically evaluate the experimental results, including the uncertainty degree of the obtained experimental results

8. Conţinut

8.1	**Curs**	**Metode de predare**	**Observaţii** (ore şi referinţe bibliografice)
1.	Nonlinear dynamics. Bifurcations	Exposure, demonstration, conversation, university lecture, synthesizing analysis, computer assisted education	6 hours [1,4]
2.	Main characteristics of the chaotic systems	Exposure, demonstration, conversation, university lecture, synthesizing analysis, computer assisted education	2 hours, [1-4]
3.	Routes to chaos: by intermittency, by quasi-periodicity, by cascade of period-doubling bifurcations (Feigenbaum scenario). Crises	Exposure, demonstration, conversation, university lecture, synthesizing analysis, computer assisted education	4 hours, [1-4]
4.	Quantities for chaotic states characterization: Lyapunov exponents, Kolmogorov-Sinai entropy, box-counting dimension, informational dimension, correlation dimension, generalized correlation dimension, Hausdorff dimension, Lyapunov dimension	Exposure, demonstration, conversation, university lecture, synthesizing analysis, computer assisted education	6 hours, [1-4]

5.	Chaotic systems examples and analysis	Exposure, demonstration, conversation, university lecture, synthesizing analysis, computer assisted education	4 hours, [1-4]
6.	Chaos control by feedback methods (Ott-Grebogi-Yorke method, Pyragas methods)	Exposure, demonstration, conversation, university lecture, synthesizing analysis, computer assisted education	2 hours, [1-4]
7.	Chaos control through synchronization	Exposure, demonstration, conversation, university lecture, synthesizing analysis, computer assisted education	1 hour, [1-4]
8.	Experimental chaos control (plasma, lasers, chemistry, biology, medicine, robotics)	Exposure, demonstration, conversation, university lecture, synthesizing analysis, computer assisted education	2 hours, [1-4]
9.	Chaos anti-control	Exposure, demonstration, conversation, university lecture, synthesizing analysis, computer assisted education	1 hour, [1-4]

Bibliografie

Referinţe principale:
[1] A. H. Nayfeh, B. Balachandran – Applied Nonlinear Dynamics – Analytical, Computational, and Experimental Methods, Wiley-VCH, Weinheim, 2004;
[2] H. G. Schuster, W. Just – Deterministic chaos. An Introduction, 4th ed., Wiley-VCH, Weinheim, 2005
[3] J. C. Sprott – Chaos and Time Series Analysis, Oxford University Press, Oxford, 2003;
[4] S. H. Strogatz – Nonlinear Dynamics and Chaos, 2nd ed., Westview Press, Boulder, 2015.

Referinţe suplimentare:
[1] R. C. Hilborn – Chaos and Nonlinear Dynamics – An Introduction for Scientists and Engineers, 2nd ed., Oxford University Press, Oxford, 2001;
[2] E. Lorenz – The Essence of Chaos, University of Washington Press, Seattle, 1993;
[3] J. C. Sprott – Elegant Chaos – Algebraically Simple Chaotic Flows, World Scientific, Singapore, 2010;
[4] E. Schöll, H. G. Schuster (Eds.) – Handbook of Chaos Control, 2nd ed., Wiley-VCH, Weinheim, 2008.

8.2	**Seminar / Laborator**	**Metode de predare**	**Observaţii** (ore şi referinţe bibliografice)
1.	Bifurcations	Exercise solving, discussions	6 hours [1]
2.	Experimental analysis of some scenarios of transition to chaos in plasma (by cascade of sub-harmonic bifurcations, by type I intermittency, Feigenbaum scenario)	Experiment, synthesizing analysis, computer assisted education	4 hours, [1-3]
3.	Turbulence analysis in liquids. Rayleigh-Bénard convection. Rosensweig instability	Experiment, synthesizing analysis, computer assisted education, numerical simulation	2 hours, [1-3]
4.	Analysis of uncorrelated dynamics of some complex space charge structures in plasma. Flicker noise	Experiment, synthesizing analysis, computer assisted education	2 hours, [1-3]
5.	Analysis of noise influence on some nonlinear phenomena in plasma	Experiment, synthesizing analysis, computer assisted education	2 hours, [1-3]

6.	Analysis of chaotic time series with specialized software	Synthesizing analysis, computer assisted education, numerical simulation	4 hours, [1-3]
7.	Chua chaotic circuit. Control of chaos. Chaos-based communication	Experiment, synthesizing analysis, computer assisted education	4 hours, [1-3] onsite
8.	Control of chaos in plasma by using external circuit elements	Experiment, synthesizing analysis, computer assisted education	2 hours, [1-3] onsite
9.	Analysis of some instabilities in plasma. Quasi-periodicity	Experiment, synthesizing analysis, computer assisted education	2 hours, [1-3] onsite

Bibliografie

[1] A. H. Nayfeh, B. Balachandran – Applied Nonlinear Dynamics – Analytical, Computational, and Experimental Methods, Wiley-VCH, Weinheim, 2004;
[2] W.-H. Steeb – The Nonlinear Workbook, 4th ed., World Scientific, Singapore, 2008;
[3] H. J. Korsch, H.-J. Jodl, T. Hartmann – Chaos – A Program Collection for the PC, 3rd ed., Springer-Verlag, Berlin, 2008.

9. Coroborarea conţinutului disciplinei cu aşteptările reprezentanţilor comunităţii, asociaţiilor profesionale şi angajatorilor reprezentativi din domeniul aferent programului

The content of the course perfectly corroborate with the expectations of the community, profesional associations, and main employers representatives from the program domain.

10. Evaluare

Tip activitate	10.1 Criterii de evaluare	10.2 Metode de evaluare	10.3 Pondere în nota finală (%)
10.4 Curs	The assimilation degree of the professional and transversal competences	Written and oral exam	70%
10.5 Seminar/ Laborator	The assimilation degree of the professional and transversal competences	Continuous, formative, summative	10% presence 20% seminar and laboratory participation
10.6 Standard minim de performanţă			
Independent solving of some physical problems of medium complexity. Assuming and solving of some research support activities. Design of an experimental device for validation of a physical model corresponding to a given problem.			

Data completării 27.09.2021
Titular de curs Assoc.Prof.Habil. Dan-Gheorghe DIMITRIU
Titular de seminar Assoc.Prof.Habil. Dan-Gheorghe DIMITRIU

Data avizării în departament

Director de departament
Assoc.Prof. Iordana AȘTEFĂNOAEI

FIŞA DISCIPLINEI

2021-2022

1. Date despre program

1.1 Instituţia de învăţământ superior	**“Alexandru Ioan Cuza” University of Iasi**
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 (English)**

2. Date despre disciplină

2.1 Denumirea disciplinei			**Neurotransmiţători şi neurofarmaceutice/ *Neurotransmitters and neuropharmaceuticals***				
2.2 Titularul activităţilor de curs			**Prof.univ.dr. Tudor LUCHIAN**				
2.3 Titularul activităţilor de seminar			**Prof.univ.dr. Tudor LUCHIAN**				
2.4 An de studiu	**II**	**2.5** Semestru	**I**	**2.6** Tip de evaluare	**E**	**2.7** Regimul disciplinei*	**OB**

** OB – Obligatoriu / OP – Opţional*

3. Timpul total estimat (ore pe semestru şi activităţi 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 învăţământ	**56**	din care: **3.5** curs	**28**	**3.6** seminar/laborator	**28**
Distribuţia fondului de timp					ore
Studiu după manual, suport de curs, bibliografie şi altele					**41**
Documentare suplimentară în bibliotecă, pe platformele electronice de specialitate şi pe teren					**37**
Pregătire seminarii/laboratoare, teme, referate, portofolii şi eseuri					**32**
Tutoriat					**5**
Examinări					**4**
Alte activităţi					

3.7 Total ore studiu individual	**119**
3.8 Total ore pe semestru	**175**
3.9 Număr de credite	**7**

4. Precondiţii (dacă este cazul)

4.1 De curriculum	**General Physics, Electricity and Magnetism, Mathematical Analysis, General Biophysics, Biochemistry, Human Anatomy and Physiology**
4.2 De competenţe	

5. Condiţii (dacă este cazul)

5.1 De desfăşurare a cursului	On line
5.2 De desfăşurare a seminarului/ laboratorului	**On line**

6. Competenţe specifice acumulate

Competenţe profesionale	– identification and proper use of laws, principles, notions and physical methods in various circumstances; – analysis and communication of Physics information with didactical, scientific and popularization character; – capacity to teach Physics at secondary and post-secondary education levels; – capacity of interrelationing and teamworking; – application of Physics knowledge to practical situations; – opening to lifelong learning.
Competenţe transversale	– mastery of research methods and techniques, specific to the specialization Biophysics and Medical Physics; – language skills at academic level, in foreign languages, needed for scientific documentation; – use of communication and information technologies; – use the software for analyzing and processing experimental data and to perform virtual experiments; – understanding and ability to apply the principles and the values of the professional and research ethics.

7. Obiectivele disciplinei (din grila competenţelor specifice acumulate)

7.1 Obiectivul general	The layout of essential concepts and paradigsm which underlie the description of neurotransmitters and neuropharmaceuticals, as well as their interaction with ion channels. We will follow and describe particular hypothesis and experimental data that led to the discovery of neurotransmitters. A particular emphasis will be put on the presentation of physical and chemical results which explain the molecular interaction between neurotransmitters and ion channels. Ability to analyze different physical phenomena underlying the transduction of various stimuli into action potentials of cell membrane.
7.2 Obiectivele specifice	▪ knowledge and understanding of biological and physical phenomena underlying the synthesis, and release of neurotransmitters and their interactions with specific receptors; ▪ knowledge and understanding of physical phenomena underlying the transduction of various stimuli into action potentials of the cell membrane; ▪ molecular modelling of neurotransmitters' and neuropeptides' structure; ▪ processing and analysis of experimental data recorded in electrophysiology experiments on ion channels; ▪ oral presentation and communication of a documented project regarding neurotransmitters and neuropharmaceuticals, related to concrete physiological or pathological conditions; ▪ critical perspective on the project with highlight on current research topics and paradigms.

8. Conţinut

8.1	**Curs**	**Metode de predare**	**Observaţii** (ore şi referinţe bibliografice)
1.	Molecular description of physical processes associated to neuronal excitation.	oral presentation , explanation, dialogue, video support	2 ore On-line

2.	Particular natural and artificial toxins used to isolate and purify various ion channels involved in cellular excitability.	oral presentation, explanation, dialogue, video support	2 ore On-line
3.	Electrical vs. chemical synapses. Physical and chemical principles of synapses functioning.	oral presentation, explanation, dialogue, video support	2 ore On-line
4.	Neurotransmitters mechanism of release (calcium induced exocytose)	oral presentation, explanation, dialogue, video support	2 ore On-line
5.	Excitatory and inhibitory post-synaptic potentials.	oral presentation, explanation, dialogue, video support	2 ore On-line
6.	Cellular signaling.	oral presentation, explanation, dialogue, video support	2 ore On-line
7.	Molecular mechanism of signal transduction mediated by membrane receptors.	oral presentation, explanation, dialogue, video support	2 ore On-line
8.	Natural systems for the exogenous expression and study of ion channels.	oral presentation, explanation, dialogue, video support	2 ore On-line
9.	Stochastic methods and principles for studying the kinetics of various ion channels and their interaction with various chemicals.	oral presentation, explanation, dialogue, video support	2 ore On-line
10.	The description of an experimental setup used in patch-clamp experiments.	oral presentation, explanation, dialogue, video support	2 ore On-line
11.	Principles of calcium channels identification in excitable membranes.	oral presentation, explanation, dialogue, video support	2 ore On-line
12.	The general description of structure and function of calcium channels.	oral presentation, explanation, dialogue, video support	2 ore On-line

13.	The general description of the structure and function of chemically-modulated ion channels involved in synaptic communication. Ionotropic receptors.	oral presentation, explanation, dialogue, video support	2 ore On-line
14.	The general description of the structure and function of chemically-modulated G coupled receptors. Metabotropic receptors.	oral presentation, explanation, dialogue, video support	2 ore On-line

Bibliografie:

1. T. Luchian – *Introducere în biofizica moleculară și celulară*, 'Alexandru I. Cuza' University Publishing House, Iași, 2001
2. Lodish, H., Baltimore, D., Berk, A., Zipursky, S. L., Matsudaira, P., Darnell, J. W. H. – *Molecular Cell Biology (3rd edition)*, 1995, Freeman and Company, New York
3. Hille, B. – *Ionic Channels of Excitable Membranes*, 1992, Sinauer Associates, Inc.
4. T. Luchian – *Electrofiziologie moleculară. Teorie și Aplicații*, Sedcom Libris, Iași, 2006
5. Trimmer, J. S. and W. S. Agnew 1989. Annu. Rev. Physiol. 51: 401-418
6. Duch, D. S. and S. R. Levinson 1987. J. Membr. Biol. 98: 43-52
7. Tamkun, M., Talvenheimo, J., Catterall, W. 1984. J. Biol. Chem. 259: 1688
8. Furman, R., Tanaka, J., Mueller, P., Barchi, R. L. 1986. Proc. Natl. Acad. Sci. USA. 83: 488
9. Roberts, R. H. and R. L Barchi 1987. J. Biol. Chem. 262: 2298
10. R. J. Lewis, K. J. Nielsen, D. J. Craik, M. L. Loghnan, D. A. Adams, I. A. Sharpe, T. Luchian, D. J. Adams, T. Bond, L. Thomas, A. Jones, J. L. Matheson, R. Drinkwater, P. R. Andrews, P. F. Alewood. J. Biol. Chem. 2000, 275:45 35335
11. T. Luchian 2001. BBA-Biomembranes. 1512:2 329

8.2	**Laborator**	**Metode de predare**	**Observaţii** (ore şi referinţe bibliografice)
1.	Concepts of health and occupational safety. Knowledge of specific legislation. Training of labor protection. Technical documentation of a project.	explanation, dialogue	2 ore On-line
2.	Biostatistics and statistical description of experimental data.	explanation, dialogue, demonstration	2 ore On-line
3.	Numerical analysis of the 1-D diffusion equation.	explanation, dialogue, demonstration.	2 ore On-line
4-5.	Extracellular potentials measurements. Theory and practice.	explanation, dialogue, demonstration, group practical activities	4 ore On-line
6-7.	Intracellular potentials measurements. Theory and practice.	explanation, dialogue, demonstration, group practical activities	4 ore On-line

8.	Numerical simulation of ion channels activity.	explanation, dialogue, demonstration, individual or group practical activities	2 ore On-line
9.	Statistical analysis of stochastic time-series data.	explanation, dialogue, demonstration, individual or group practical activities	2 ore On-line
10.	Quantitative analysis of Markov data series.	explanation, dialogue, demonstration, individual or group practical activities	2 ore On-line
11.	Solving of the diffusion equation for the stationary and non-stationary case.	explanation, dialogue, demonstration, individual or group practical activities	2 ore On-line
12.	Structural and functional elements of neurotransmitter receptors (ionotropic and metabotropic). Structure identification and analysis using protein structure models (PDB files).	oral presentation, explanation, dialogue, video support	2 ore On-line
13.	Oral presentation of a documented project regarding neurotransmitters and neuropharmaceuticals, related to concrete physiological or pathological conditions; critical discussions.	oral presentation, explanation, dialogue, video support	2 ore On-line
14.	Oral presentation of a documented project regarding neurotransmitters and neuropharmaceuticals, related to concrete physiological or pathological conditions; critical discussions.	oral presentation, explanation, dialogue, video support	2 ore On-line

Bibliografie

1. Legea Protectiei Muncii nr. 90/1996. Norme privind sănătatea şi securitatea în muncă în laboratoare.
2. *THE AXON GUIDE, A guide to Electrophysiology & Biophysics Laboratory Techniques*, 2008, MDS Analytical Technologies USA;
3. T. Luchian – *Electrofiziologie moleculară. Teorie și Aplicații*, Sedcom Libris, Iași, 2006
4. Hille, B. – *Ionic Channels of Excitable Membranes*, 1992, Sinauer Associates, Inc.
5. Douglas C. Montgomery, George C. Runger, *Applied Statistics and Probability for Engineers*, 3rd Edition, 2003, John Wiley & Sons, Inc.

9. Coroborarea conţinutului disciplinei cu aşteptările reprezentanţilor comunităţii, asociaţiilor profesionale şi angajatorilor reprezentativi din domeniul aferent programului

Knowledge of the current methods used in the study of neurotransmitters;
Awareness of the topical problems on neurotransmitters 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	Knowledge of the essential concepts and paradigms which underlie the description, function and study of neurotransmitters, their receptors and cell signaling; Clear and concise information;	Written exam	50 %
10.5 Seminar/ Laborator	Corect solving of tasks and problems; Proactive attitude, spirit of initiative; Rigorous documentation of the written project; Communication and presentation skills.	Colloquim Written project with oral presentation	25 % 25 %
10.6 Standard minim de performanţă			
Essential concepts and paradigms which underlie the description of neurotransmitters and neuropharmaceuticals, as well as their interaction with ion channels; project elaboration.			

Data completării: 27.09.2021

Titular de curs
Prof.univ.dr. Tudor LUCHIAN

Titular de seminar
Prof.univ.dr. Tudor LUCHIAN

Data avizării în departament

Director de departament
Conf.univ.dr. Iordana ASTEFANOAEI

FIŞA DISCIPLINEI

2021-2022

1. Date despre program

1.1 Instituţia de învăţământ superior	**“Alexandru Ioan Cuza” University of Iaşi**
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	**Quality ensurance in the practice of medical physicists**						
2.2 Titularul activităţilor de curs	**Conf. dr. habil. Ionuţ Cristian TOPALĂ**						
2.3 Titularul activităţilor de lab.	**Conf. dr. habil. Ionuţ Cristian TOPALĂ**						
2.4 An de studiu	**II**	**2.5** Semestru	**1**	**2.6** Tip de evaluare	**E**	**2.7** Regimul disciplinei*	**OB**

* *OB – Obligatoriu / OP – Opţional*

3. Timpul total estimat (ore pe semestru şi activităţi 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 învăţământ	**56**	din care: **3.5** curs	**28**	**3.6** laborator	**28**	
Distribuţia fondului de timp					ore	
Studiu după manual, suport de curs, bibliografie şi altele					**28**	
Documentare suplimentară în bibliotecă, pe platformele electronice de specialitate şi pe teren					**28**	
Pregătire seminarii/laboratoare, teme, referate, portofolii şi eseuri					**28**	
Tutoriat					**8**	
Examinări					**2**	
Alte activităţi						

3.7 Total ore studiu individual	**94**
3.8 Total ore pe semestru	**150**
3.9 Număr de credite	**6**

4. Precondiţii (dacă este cazul)

4.1 De curriculum	Nuclear physics, Dosimetry and radiation protection, Radiology and medical imaging, Physics of radiotherapy. Irradiation techniques
4.2 De competenţe	—

5. Condiţii (dacă este cazul)

5.1 De desfăşurare a cursului	—
5.2 De desfăşurare a seminarului/ laboratorului	

6. Competenţe specifice acumulate

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

7. Obiectivele disciplinei (din grila competenţelor specifice acumulate)

7.1 Obiectivul general	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 2. Ability to work in a team to solve experimental and technological problems, demonstrating determination and perseverance to achieve the tasks and fulfil the responsibilities 3. Interpretation of the information on ionizing radiation interaction and its communication in coherent and accessible form 4. Identification and utilization of bibliographical resources for continuous learning, formation and development
7.2 Obiectivele specifice	On successful completion of this course, the students will be able to: ▪ Identify and use adequately the principal laws and physical principles related to the interaction of ionizing radiations with substance in a given context ▪ Explain what are the suitable methods to model the interaction of ionizing radiations, in relation to a targeted application ▪ Use laboratory equipment to determine the effects of interactions of ionizing radiations ▪ 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

8. Conţinut

8.1	**Curs**	**Metode de predare**	**Observaţii** (ore şi referinţe bibliografice)
1.	Quality assurance: principles, tools and techniques		2 hours, ref. 1 - 6
2.	Technology, quality control (QC) and quality assurance (QA) in classical radiography and Computed Radiography (CR)		2 hours, ref. 5, S1

3.	Technology, quality control (QC) and quality assurance (QA) in digital radiography	Online lecture, thematic debates, applications	2 hours, ref. 5, S1
4.	Technology, quality control (QC) and quality assurance (QA) in classical and digital pediatric radiography		2 hours, ref. 5, S1
5.	Quality assurance of image receptor and of the photographic process		2 hours, ref. 5, S1
6.	Technology, quality control (QC) and quality assurance (QA) in classical and digital mammography		2 hours, ref. 6
7.	Technology, quality control (QC) and quality assurance (QA) in fluoroscopy		2 hours, ref. 1
8.	Performance evaluation and quality control of scintillation cameras in planar mode		2 hours, ref. 1
9.	Performance evaluation and quality control of scintillation cameras in whole body mode		2 hours, ref. 2
10.	Technology, quality control (QC) and quality assurance (QA) in digital angiography		2 hours, ref. 3
11.	Technology, quality control (QC) and quality assurance (QA) in computed tomography (CT).		2 hours, ref. 3
12.	Technology, quality control (QC) and quality assurance (QA) in single photon emission tomography		2 hours, ref. 3
13.	Technology, quality control (QC) and quality assurance (QA) in positron emission tomography		2 hours, ref. 4
14.	Technology, quality control (QC) and quality assurance (QA) in Magnetic Resonance Imaging (MRI).		2 hours, ref. 7

References

Main references:

1. *Quality Control Recommendations for Diagnostic Radiography*, Conference of Radiation Control Program Directors, Inc., 205 Capital Avenue, Frankfort, Kentucky 40601, www.crcpd.org
2. *Quality Assurance Programme for Computed Tomography*: Diagnostic and Therapy Applications, IAEA Human Health Series No. 19, Vienna 2012.
3. *Quality Assurance for SPECT Systems*, IAEA Human Health Series No. 6, Vienna 2009.
4. *Quality Assurance for PET and PET/CT Systems*, IAEA Human Health Series No. 1, Vienna 2009.
5. *Quality Assurance Programme for Digital Mammography*, IAEA Human Health Series No. 17, Vienna 2011
6. AAPM REPORT NO. 74, *Quality Control In Diagnostic Radiology*, Medical Physics Publishing 2002
7. AAPM REPORT NO. 100, *Acceptance Testing and Quality Assurance Procedures for Magnetic Resonance Imaging Facilities*, American Association of Physicists in Medicine, 2010.

Suplementary references:

S1. EUROPEAN COMMISSION RADIATION PROTECTION N° 162, Criteria for Acceptability of Medical Radiological Equipment used in Diagnostic Radiology, Nuclear Medicine and Radiotherapy (2012)

8.2	Laborator	Metode de predare	Observaţii (ore şi referinţe bibliografice)
1.	Practical aspects and implementation of quality control procedures in classical radiology	Discussion and debates, including professionals. Practical work, set up a QC/QA system.	2 hours, ref. 1
2.	Practical aspects and implementation of quality control procedures in digital radiology		2 hours, ref. 1
3.	Practical aspects and implementation of quality control procedures in classical and digital pediatric radiography		2 hours, ref. 1
4.	Practical aspects and implementation of quality control procedures for the image receptor and the photographic process		2 hours, ref. 1
5.	Practical aspects and implementation of quality control procedures in classical and digital mammography		2 hours, ref. 1, 5
6,	Practical aspects and implementation of quality control procedures in fluoroscopy		2 hours, ref. 1
7.	Practical aspects and implementation of quality control procedures in evaluating scintillation cameras in planar mode		2 hours, ref. 1
8.	Practical aspects and implementation of quality control procedures in evaluating scintillation cameras in whole body mode		2 hours, ref. 2
9.	Practical aspects and implementation of quality control procedures in digital angiography		2 hours, ref. 3
10.	Practical aspects and implementation of quality control procedures in computed tomography (CT).		2 hours, ref. 3
11.	Practical aspects and implementation of quality control procedures in single photon emission computed tomography (SPECT)		2 hours, ref. 3
12.	Practical aspects and implementation of quality control procedures in positron emission tomography (PET)		2 hours, ref. 4
13.	Practical aspects and implementation of quality control procedures in Magnetic Resonance Imaging (MRI).		2 hours, ref. 6
14.	Revision of all presented QC/QA systems.	Discussion.	2 hours, ref. 1-6

References

Main references:
1. *Quality Control Recommendations for Diagnostic Radiography*, Conference of Radiation Control Program Directors, Inc., 205 Capital Avenue, Frankfort, Kentucky 40601, www.crcpd.org
2. *Quality Assurance Programme for Computed Tomography*: Diagnostic and Therapy Applications, IAEA Human Health Series No. 19, Vienna 2012.
3. *Quality Assurance for SPECT Systems*, IAEA Human Health Series No. 6, Vienna 2009.
4. *Quality Assurance for PET and PET/CT Systems*, IAEA Human Health Series No. 1, Vienna 2009.

Suplementary references:
5. *Quality Assurance Programme for Digital Mammography*, IAEA Human Health Series No. 17, Vienna 2011
6. AAPM REPORT NO. 100, *Acceptance Testing and Quality Assurance Procedures for Magnetic*

Resonance Imaging Facilities, American Association of Physicists in Medicine, 2010.

9. Coroborarea conţinutului disciplinei cu aşteptările reprezentanţilor comunităţii, asociaţiilor profesionale şi angajatorilor reprezentativi din domeniul aferent programului

This course aims to introduce the main paradigms in QC/QA system. This will be an important component of daily activity of our graduates that select Medical Physicists as future profession. It offers comprehensive information on technology and quality assurance in medical physics to sustain the professional exams in order to obtain medical physics staffing levels, as defined by the Romanian National Commission for Nuclear Activities Control. The graduates will be able to use their acquired knowledge as medical physicists, for implementing quality assurance programmes for various devices used in medical imaging and diagnostics.

10. Evaluare

Tip activitate	**10.1 Criterii de evaluare**	**10.2 Metode de evaluare**	**10.3 Pondere în nota finală (%)**
10.4 Curs	- completeness and correctness of the acquired knowledge; - capacity of operating with the acquired knowledge; - capacity of analysis; - logical coherence.	Exam (CNCAN type questions)	50%
10.5 Laborator	- active participation to practical works and debates; - the capacity of using in practice the acquired knowledge. - individual Quality Assurance Plan	Laboratory	50%
10.6 Standard minim de performanţă			
- Independent set up of QC/QA systems in medical physics and implementation of related actions. - Reports for practical works, after analysis of results presented in the literature and debates with professionals.			

Data completării
30.09.2021

Titular de curs
Conf. dr. habil. Ionut Cristian TOPALA

Titular de laborator
Conf. dr. habil. Ionut Cristian TOPALA

Data avizării în departament

Director de departament
Conf. dr. Iordana ASTEFANOAEI

FIŞA DISCIPLINEI

2021-2022

1. Date despre program

1.1 Instituţia de învăţământ superior	**"Alexandru Ioan Cuza" University of Iaşi**
1.2 Facultatea	**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			**Biocompatibility and biomaterials**					
2.2 Titularul activităţilor de curs			**Lect. Dr. Alina Silvia CHIPER**					
2.3 Titularul activităţilor de seminar			**Lect. Dr. Alina Silvia CHIPER**					
2.4 An de studiu	**II**	**2.5** Semestrul	**I**	**2.6** Tip de evaluare	**EVP**	**2.7** Regimul disciplinei*		**Op**

** OB – Obligatoriu / OP – Opţional*

3. Timpul total estimat (ore pe semestru şi activităţi didactice)

3.1 Număr de ore pe săptămână	**4**	**3.2.** din care: 2 curs	**28**	**3.3** seminar/laborator	**28**
3.4 Total ore din planul de învăţământ	**56**	**3.5** din care: 2 laborator	**28**	**3.6** seminar/laborator	**28**

Distribuţia fondului de timp	ore
Studiu după manual, suport de curs, bibliografie şi altele	**30**
Documentare suplimentară în bibliotecă, pe platformele electronice de specialitate şi pe teren	**15**
Pregătire seminarii/laboratoare, teme, referate, portofolii şi eseuri	**18**
Tutoriat	**2**
Examinări	**4**
Alte activităţi	**0**

3.7 Total ore studiu individual	**69**
3.8 Total ore pe semestru	**125**
3.9 Număr de credite	**5**

4. Precondiţii (dacă este cazul)

4.1 De curriculum	Mechanics, optics, general chemistry, plasma physics, solid state physics, human anatomy and physiology
4.2 De competenţe	Use of computer and computer programs or graphical representation; use of digital measuring and control devices.

5. Condiţii (dacă este cazul)

5.1 De desfăşurare a cursului	
5.2 De desfăşurare a seminarului/ laboratorului	

6. Competenţe specifice acumulate

Competenţe profesionale	C1 Identification and proper use of laws, principles, notions and physical methods in various circumstances; C2 Analysis and communication of Physics information with didactical, scientific and popularization character; C3 Application of Physics knowledge to practical situations;
Competenţe transversale	CT1 Mastery of research methods and techniques, specific to the specialization Physics for Advanced Technologies; CT2 Use the software for analyzing and processing experimental data and to perform virtual experiments; CT3 Understanding and ability to apply the principles and the values of the professional and research ethics.

7. Obiectivele disciplinei (din grila competenţelor specifice acumulate)

7.1 Obiectivul general	1. Knowledge on the biomaterials used in medicine, its analysis and what are the methods for biocompatibility improvement. 2. Knowledge on the main plasma effects onto various materials for use in industry.
7.2 Obiectivele specifice	At the end of this course the students will be capable ▪ to explain *Concepts of Biomaterials and Biocompatibility* ▪ to perform *Methods for materials testing* ▪ to analize *Practical aspects of biomedical devices: sterilization, manufacturing, clinical trials and ethical issues, price of implants and allocation of resources* ▪ to evaluate *Specific parameters at interface Biomaterial - Biological environment.* ▪ to design and manufacture plasma reactors (as laboratory experimental set-up) for technological/industrial applications.

8. Conţinut

8.1	**Curs**	**Metode de predare**	**Observaţii** (ore şi referinţe bibliografice)
1.	Fundamentals of biomaterials science. Practical aspects of medical devices: manufacturing, storage quality, regulatory and ethical issues.	Lecture, explanation, debate, problematization	2 hours
2.	Concept of biocompatibility.		2 hours
3.	Physico-chemical properties of (bio)materials: mechanical, physical, chemical and biological properties.		2 hours Ref. 1. (ch. 1) Ref. 2 (ch.5)
4.	Surface properties and surface characterization of materials used in medical applications.		4 hours Ref. 1. (ch. 1.4), Ref. 4
5.	Classes of biomaterials used in medicine, medical requirements and clinical significance.		2 hours Ref. 1. (ch. 2)
6	Desinfection and sterilization of biomaterials.		2 hours
7.	Elements in contact with the surface of a biomaterial: blood composition, plasma proteins, cells, tissues.		2 hours
8	Biological testing of biomaterials: general requirements. *In vitro, in vivo* preclinical and *in vivo* clinical testings.		2 hours Ref. 1 (ch.5)

9.	Standards and regulation for investigation of biomaterials and biocompatibility	Lecture, explanation, debate, problematization	2 hours Ref. 1 (ch. 10), Ref. 2 (ch. 12)
10.	Improvement of materials biocompatibility by plasma processing. Plasma in medicine.		2 hours Ref. 3, 6, 7
11.	Effects of plasmas onto different types of materials (cleaning, functionalization, etching, deposition etc.).		2 hours Ref. 3, 6, 7
12.	Advanced technologies used to modify/improve physico-chemical properties of materials.		2 hours Ref. 3, 6, 7
13.	Technologies based on plasma for use in industry.		2 hours Ref. 3, 6, 7

Main references

1. *Biomaterials Science, An Introduction to Materials in Medicine*, 2nd Edition, Eds. B. D. Ratner and A. S. Hoffman et al., Elsevier Academic Press, New York, 2004.
2. *Handbook of Biomaterials Biocompatibility, Ed. by Masoud Mozafari, Elsevier* - Woodhead Publishing, United Kingdom , 2020
3. H. Boenig, *Fundamentals of Plasma Chemistry and Technology*, Technomic Publishing Co. Inc. Lancaster Basel, 1990.
4. *Practical Surface Analysis*, 2- edition, Ed. by D.Briggs, M.P.Seah, J.Wiley & Sons Ltd, 1990.

Suplementary references

6. *Plasma-surface modification of biomaterials*, P.K.Chua, J.Y.Chena, L.P.Wanga, N.Huang, Elsevier Science B.V, 2002.
7. Articles on *Biomaterials and Biocompatibility.*

8.2	**Laborator**	**Metode de predare**	**Observaţii** (ore şi referinţe bibliografice)
1.	Safe Laboratory Practices. General presentation of instrumentation and experimental techniques.	Statistics and data analysis techniques. Data analysis software.	2 hours
2.	Physico-chemical properties of (bio)materials. Study of mechanical properties demanded by practice.	Problematization, observation, dialog, explications, demonstrations. Set-up of experimental arrangements and work strategy. Experimental data analysis, interpretatation.	2 hours
3.	Materials surface analysis by AFM and SEM. Roughness of surface.		2 hours
4.	Contact angle technique applied for (bio)materials.		2 hours
5.	Interfacial energy: key parameter at the interface materials – biological environment.		4 hours
6.	Modification of materials surface properties using air plasma and UV radiations.		4 hours
7.	Sterilizations techniques in biomaterial science: UV sterilization.		2 hours
8.	Permeability coefficient of artificial membranes.		2 hours
9.	Artificial blood: size distribution of red blood cells.		2 hours
10.	Circulation devices in the biomaterial science: chemical pulses and mixing using syringe and peristaltic pumps.		2 hours
11.	Fluorescence microscopy applied for biomaterials and cells analysis.		2 hours
12.	Evaluation		2 hours

References
1. *Biomaterials and Plasma Processing,* edited by Nicoleta Dumitrascu, Ionut Topala, Alexandru Ioan Cuza University Press, Iasi, 2011.
2. *Practical Surface Analysis*, 2-ed., Edited by D.Briggs, M.P.Seah, J.Wiley & Sons Ltd, 1990.
3. *Biomaterials Science, An Intoduction to Materials in medicine*, Eds. B. D. Ratner and A. S. Hoffman, Academic Press, New York, 1996.
4. Articles about *Biomaterials and Biocompatibility.*

9. Coroborarea conţinutului disciplinei cu aşteptările reprezentanţilor comunităţii, asociaţiilor profesionale şi angajatorilor reprezentativi din domeniul aferent programului

The course will introduce the fundamentals on the biomaterials science, specific requirements for orthopedic, cardiovascular, dental and other medical applications, molecular and cellular interactions of biomaterials with host organism and biological environment etc. All above information will be of practical interest for the health care system, giving solutions about how it can protect and improve our life quality.
Alexandru Ioan Cuza University of Iasi and Faculty of Physics offer the infrastructure, adjacent facilities, experience and high expertise imposed today for materials study (AFM, ellipsometry, XPS, AES, IR and fluorescence spectroscopy, spectrometry etc.). In our laboratories there are also various experimental set – ups for (bio)materials processing (plasmas at low and atmospheric pressure, laser ablation, MU plasma, ions beam etc.).

10. Evaluare

Tip activitate	10.1 Criterii de evaluare	10.2 Metode de evaluare	10.3 Pondere în nota finală (%)
10.4 Course	- completeness and correctness of the acquired knowledge; - capacity of operating with the acquired knowledge; - capacity of analysis, personal interpretation, originality, creativity; - logical coherence.	Formative assessment (during the semester): Presentation of a scientific project in the topic of biomaterials. Written examination.	70 %
10.5 Seminar/ Laborator	- active participation to practical works; - the capacity of using in practice the acquired knowledge.	Formative assessment (during the semester): Laboratory report for every practical work.	30 %

10.6 Standard minim de performanţă
- Elaboration of a project on the identification and use of the main concepts in a real context: a given clinical situation.
- Physical interpretation of the results of experimental measurements, using appropriate numerical or statistical methods.
- Written report for every practical work.

Data completării	Titular de curs	Titular de seminar
27 Sept. 2021	**Lect. Dr. Alina Silvia CHIPER**	**Lect. Dr. Alina Silvia CHIPER**

Data avizării în departament

Director de departament
Assoc. Prof. dr. Iordana ASTEFANOAEI

FIŞA DISCIPLINEI

2021/2022

1. Date despre program

1.1 Instituţia de învăţământ superior	**“Alexandru Ioan Cuza” University of Iasi**
1.2 Facultatea	**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			**Specialized practice**				
2.2 Titularul activităţilor de curs			**-**				
2.3 Titularul activităţilor de seminar/laborator			**Fiz. dr. Cristin Petrica Constantin**				
2.4 An de studiu	**2**	**2.5** Semestru	**2**	**2.6** Tip de evaluare	**EVP**	**2.7** Regimul disciplinei*	**OB**

** OB – Obligatoriu / OP – Opţional*

3. Timpul total estimat (ore pe semestru şi activităţi didactice)

3.1 Număr de ore pe săptămână	**4**	din care: **3.2** curs	**-**	**3.3** laborator	**4**
3.4 Total ore din planul de învăţământ	**48**	din care: **3.5** curs	**-**	**3.6** laborator	**48**

Distribuţia fondului de timp	ore
Studiu după manual, suport de curs, bibliografie şi altele	**18**
Documentare suplimentară în bibliotecă, pe platformele electronice de specialitate şi pe teren	**30**
Pregătire laboratoare, portofolii şi eseuri	**61**
Tutoriat	**14**
Examinări	**4**
Alte activităţi	**-**

3.7 Total ore studiu individual	**127**
3.8 Total ore pe semestru	**175**
3.9 Număr de credite	**7**

4. Precondiţii (dacă este cazul)

4.1 De curriculum	**General biophysics; Electricity and magnetism; Biochemistry; Elements of microscopy; Thermodynamics & statistical physics; Physical data processing; Informational technologies; Foreign language (English)**
4.2 De competenţe	**Application of physics knowledge in concrete situations from related fields, and in experiments, using standard laboratory equipment; Use of software packages for data analysis and processing; The interdisciplinary approach of physics topics; Communication and analysis of scientific and popularization information in the field of physics.**

5. Condiţii (dacă este cazul)

5.1 De desfăşurare a cursului	-
5.2 De desfăşurare a seminarului/ laboratorului	**-** systems and softwere for analysis and data processing - access to research laboratories from the Faculty of Physics

6. Competenţe specifice acumulate

Competenţe profesionale	– identification and proper use of laws, principles, notions and physical methods in various circumstances; – analysis and communication of Physics information with didactical, scientific and popularization character; – capacity to teach Physics at secondary and post-secondary education levels; – capacity of interrelationing and teamworking; – application of Physics knowledge to practical situations; – opening to lifelong learning.
Competenţe transversale	– mastery of research methods and techniques, specific to the specialization Biophysics and Medical Physics; – language skills at academic level, in foreign languages, needed for scientific documentation; – use of communication and information technologies; – use the software for analyzing and processing experimental data and to perform virtual experiments; – understanding and ability to apply the principles and the values of the professional and research ethics.

7. Obiectivele disciplinei (din grila competenţelor specifice acumulate)

7.1 Obiectivul general	Knowledge of research methods and techniques used in Biophysics and Medical Physics and the ability to conduct research projects using one or more of these techniques, and to communicate scientific results at an academic level.
7.2 Obiectivele specifice	- mastery of research methods and techniques used in Biophysics and Medical Physics; - the knowledge and understanding of physical phenomena underlying these methods and techniques; - conducting a research project using one or more of these techniques in one of the specialized laboratories of the Faculty of Physics or in collaboration with other Faculties; - processing and analysis of experimental data obtained upon implementation of the project; - oral presentation and communication of experimental results and their interpretation; - critical perspective on the project with highlight of its creative and innovative elements.

8. Conţinut

8.1	**Curs**	**Metode de predare**	**Observaţii** (ore şi referinţe bibliografice)
8.2	**Laborator**	**Metode de predare**	**Observaţii** (ore şi referinţe bibliografice)
1.	Concepts of health and occupational safety. Knowledge of specific legislation. Training of labor protection. The organization and functioning of science laboratories. Technical documentation of a project.	explanation, dialogue	4 h [1,2,3]
2.	Visits to research laboratories specialized in Biophysics and Medical Physics from the Faculty of Physics; presentation of the main research projects carried out in these laboratories with details on the methods and techniques used for acquisition and analysis of physical data. **The Characterization of Molecular Organization in BioMaterials Laboratory** Optical Microscopy, Dark field Microscopy. Visualization of nanoparticles internalized in biological tissue samples via Dark field Microscopy.	explanation, dialogue, demonstration, group practical activities	4 h
3.	***Molecular Biophysics and medical Physics Laboratory** Preparation of ferrofluids and their application in medicine.	explanation, dialogue, demonstration, group practical activities	4 h
4.	***The Characterization of Molecular Organization in BioMaterials Laboratory** Preparation of Giant Unilamellar Vesicles (GUVs) as biomimetic lipid systems. Electroformation methods.	explanation, dialogue, demonstration, group practical activities	4 h
5.	***The Characterization of Molecular Organization in BioMaterials Laboratory** Confocal Microscopy: Study of the activity of pore forming peptides or proteins in biomimetic lipid systems (GUVs) via confocal microscopy techniques.	explanation, dialogue, demonstration, group practical activities	4 h

6.	*__The Characterization of Molecular Organization in BioMaterials Laboratory__ Single molecule fluorescence microscopy: Study of fluorescently labeled, membrane active peptides in biomimetic lipid systems (GUVs). Determination of diffusion coefficients of peptides inside the lipid bilayer.	explanation, dialogue, demonstration, group practical activities	3 h
7.	*__Molecular Biophysics and medical Physics Laboratory__ Preparation of biomimetic lipid systems: planar lipid membranes via the Montal&Mueller technique and small unilamellar vesicles (SUVs) via the hydration method.	explanation, dialogue, demonstration, group practical activities	3 h
8.	*__Molecular Biophysics and medical Physics Laboratory__ Electrophysiology techniques: Study of the activity of pore forming peptides (AMPs) in planar lipid membranes.	explanation, dialogue, demonstration, group practical activities	3 h
9.	Analysis and interpretation of electrophysiology data previously recorded (membrane activity of AMPs); Data analysis softwere: Clampfit, Origin.	explanation, dialogue, demonstration, individual or group practical activities	3 h
10.	*__Molecular Biophysics and medical Physics Laboratory__ Electrophysiology techniques: Study of transmembrane pores and porins (alfa- hemolysin, OmpF) - interactions between small pore translocating peptides and alfa-hemolysin.	explanation, dialogue, demonstration, group practical activities	3 h
11.	Analysis and interpretation of electrophysiology data previously recorded (interactions between small pore translocating peptides and alfa- hemolysin); Data analysis softwere: Clampfit; Origin.	explanation, dialogue, demonstration, individual or group practical activities	3 h

12.	Small research projects carried on by students in teams, in one of the specialized laboratories of the Faculty of Physics.	explanation, dialogue, individual or group practical activities	3 h
13.	Practical details on the making, writing and submission of scientific papers.	oral presentation, explanation, dialogue, video support	3 h
14.	Presentation of their projects in the form of a full scientific article, in writing communication of methods and techniques used, data processing and analysis, interpretation of results and their importance.	oral presentation, explanation, dialogue, video support	4 h

* *Visits to research laboratories specialized in Biophysics and Medical Physics from the Faculty of Physics; presentation of the main research projects carried out in these laboratories with details on the methods and techniques used for acquisition and analysis of physical data.*

Bibliografie

1. Legea Protectiei Muncii nr. 90/1996. Norme privind sănătatea şi securitatea în munca în laboratoare.
2. Lege privind practica elevilor si studentilor, 258/2007.
3. Regulamentul de practică al studenţilor, Facultatea de Fizică, Univ. Al. I. Cuza din Iaşi.
4. Garrett and Grisham, *BIOCHEMISTRY*, 2nd Edition;
5. Corina Ciobănaşu, *Mobility and translocation of TAT Peptides in Model Membrane*, 2010, PhD Thesis
6. Jaakko Malmivuo, Robert Plonsey, *BIOELECTROMAGNETISM, Principles and Applications of Bioelectric and Biomagnetic Fields*, 1995, Oxford University Press;
7. *THE AXON GUIDE, A guide to Electrophysiology & Biophysics Laboratory Techniques*, 2008, MDS Analytical Technologies USA;
8. Aurelia Apetrei, *Investigații nanoscopice ale interacțiunilor dintre peptide citotoxice și sisteme lipido- proteice*, 2011, Teză de Doctorat
9. *Metode experimentale avansate pentru studiul şi analiza bio-nano-sistemelor*, 2012, Casa Cărții de Știință Cluj-Napoca, ed. Mihaela Aluaș and Simion Simon;
10. Douglas C. Montgomery, George C. Runger, *Applied Statistics and Probability for Engineers*, 3rd Edition, 2003, John Wiley & Sons, Inc.

9. Coroborarea conţinutului disciplinei cu aşteptările reprezentanţilor comunităţii, asociaţiilor profesionale şi angajatorilor reprezentativi din domeniul aferent programului

The content of these paractical activities is consistent with the expectations of community representatives, professional associations and employers in the field of Biophysics and Medical Physics.

10. Evaluare

Tip activitate	10.1 Criterii de evaluare	10.2 Metode de evaluare	10.3 Pondere în nota finală (%)
10.4 Practical work	- attending the visits in prophile laboratories, and documenting the aquired knowledge into a practice notebook - mastering a technique used in one of the visited laboratories (or other), and the ability to conduct a small reaserch project understanding the investigated phenomena, and data analysis and interpretation - - understanting of the basic structure and content of a written scientific article	• practical method • written method 1) practice notebook written during the semester 2) research project: ➢ project conducted during the semester: 60% of 2) ➢ presentation of the project in the form of a full scientific article: 40% of 2)	30% 70%

10.5 Standard minim de performanţă

- conducting a small research project using one or more experimental methods and techniques used in Biophysics and Medical Physics in one of the research laboratories of the Faculty of Physics or in collaboration with other Faculties;
- the knowledge and understanding of physical phenomena underlying the methods and techniques used in the project;
- processing and analysis of experimental data obtained upon implementation of the project;
- in writing presentation of the project in the form of a full scientific article.

Data completării
29.09.2021

Titular de curs
-

Titular de laborator
Fiz. dr. Cristin Petrica Constantin

Data avizării în departament:

Director de departament
Conf.univ. dr. Iordana AȘTEFĂNOAEI

FIŞA DISCIPLINEI

2021-2022

1. Date despre program

1.1 Instituţia de învăţământ superior	“Alexandru Ioan Cuza” University of Iaşi
1.2 Facultatea	Faculty of Physics
1.3 Departamentul	Physics
1.4 Domeniul de studii	Physics, Master
1.5 Ciclul de studii	Master
1.6 Programul de studii / Calificarea	**Biophysics and Medical Physics**

2. Date despre disciplină

2.1 Denumirea disciplinei			FUNDAMENTALS OF MATHEMATICAL PHYSICS				
2.2 Titularul activităţilor de curs			CONF. DR. Iordana AȘTEFĂNOAEI /prof. dr. Ciprian DARIESCU				
2.3 Titularul activităţilor de seminar			prof. dr. Ciprian DARIESCU				
2.4 An de studiu	**1**	**2.5** Semestru	**1**	**2.6** Tip de evaluare	**E**	**2.7** Regimul disciplinei*	**OB**

* *OB – Obligatoriu / OP – Opţional*

3. Timpul total estimat (ore pe semestru şi activităţi 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 învăţământ	**56**	din care: **3.5** curs	**28**	**3.6** seminar/laborator	**28**

Distribuţia fondului de timp	ore
Studiu după manual, suport de curs, bibliografie şi altele	**43**
Documentare suplimentară în bibliotecă, pe platformele electronice de specialitate şi pe teren	**35**
Pregătire seminarii/laboratoare, teme, referate, portofolii şi eseuri	**31**
Tutoriat	**0**
Examinări	**8**
Alte activităţi	**2**

3.7 Total ore studiu individual	**119**
3.8 Total ore pe semestru	**175**
3.9 Număr de credite	**7**

4. Precondiţii (dacă este cazul)

4.1 De curriculum	Mathematical Physics Equations, Differential Equations, Functional Analysis, Algebra.
4.2 De competenţe	Computer skills, programming knowledge, English knowledge

5. Condiţii (dacă este cazul)

5.1 De desfăşurare a cursului	Online on Webex platform, computer, tablet
5.2 De desfăşurare a seminarului	Online on Webex platform, computer, tablet

6. Competenţe specifice acumulate

Competenţe profesionale	**C1.** identification and proper use of laws, principles, notions and physical methods in various circumstances; **C2.** analysis and communication of physics information with didactical, scientific and popularization character; **C3.** capacity of interrelationing and teamworking; **C4.** application of Physics knowledge to practical situations; **C5.** opening to lifelong learning.
Competenţe transversale	**CT1.** mastery of research methods and techniques, specific to the Master specialization **CT2.** language skills at academic level, in foreign languages, needed for scientific documentation; **CT3.** use of communication and information technologies; CT4. use the software for analyzing and processing experimental data and to perform virtual experiments; **CT5**. understanding and ability to apply the principles and the values of the professional and research ethics.

7. Obiectivele disciplinei (din grila competenţelor specifice acumulate)

7.1 Obiectivul general	The present course intends to supply good knowledge on basics and main results of mathematical physics. By its role, this course should prepare the student for a Ph.D. in Physics. Therefore, the modern views and the checked formalisms are constantly emphasized as far as possible.
7.2 Obiectivele specifice	▪ Ability to use theoretical physics methods in various fields; ▪ application of knowledge to practical situations; ▪ Ability in extracting information from a large variety of sources. ▪ Use of specific software for analyzing and processing experimental data;

8. Conţinut

8.1	**Curs**	**Metode de predare**	**Observaţii** (ore şi referinţe bibliografice)
1.	Generalities on differential equations;	Lecture, Applications	2 ore
2.	Physically significant differential equations;	Lecture, applications, guided discovering process	2 ore
3.	Ordinary differential equations; First and Second order differential equations	Lecture, applications, guided discovering process	2 ore
4.	Ordinary differential equations; Higher Order Differential equations	Lecture, debate, guided discovering process	2 ore
5.	Euler equations. Cauchy-Euler equations	Lecture, applications	2 ore
6	Systems of first order differential equations;	Lecture, guided discovering process, applications	2 ore

7	First order differential equations with partial derivatives;	Lecture, guided discovering process, applications	2 ore
8.	Second order differential equations with partial derivatives;	Lecture, guided discovering process, applications	2 ore
9	Legendre Polynomials;	Lecture, guided discovering process, applications	2 ore
10	Basic symmetries and special functions: spherical and Bessel functions;	Lecture, guided discovering process, applications	2 ore
11.	Laplace and Poisson Equations,	Lecture, debate	2 ore
12.	Laplace – Fourier method of variables separation;	Lecture, applications	2 ore
13.	Parabolic equations: General physical processes, Heat propagation equation, solutions and Laplace-Fourier method, heat propagation equation in entire space, fundamental solution of heat propagation operator.	Lecture, applications	2 ore
14.	Hyperbolic equations: physical general processes, Wave equation and standard conditions, Laplace-Fourier method and types of solutions, Propagation in R^3 : radiation conditions.	Lecture, applications,debate, guided discovering process	2 ore

Bibliografie

Referinţe principale:

1. V. Barbu. *Procese la limita pentru ecuatii cu derivate partiale*. Ed. Academiei Romane, Bucuresti, 1993.
2.A. N. Tihonov si A. A. Samarski. *Ecuatiile fizicii matematice*. Ed. Tehnica, Bucuresti, 1956,
3. V. S. Vladimirov, *Ecuatiile fizicii matematice*. Ed. St. si Ped, Bucuresti, 1980.
4. I. S.Gradshteyn, I. M Ryzhik, *Table of Integrals, Series, and Products*, 7th edn, Academic, New York, 1990.
5. D. Zwillinger, *Handbook of Differenţial Equations* , Boston, Academic Press, 1997.

Referinţe suplimentare:

8.2	**Seminar / Laborator**	**Metode de predare**	**Observaţii** (ore şi referinţe bibliografice)
1.	Geometrical interpretation of first order differential equations' solutions	Applications, guided discovering process	2 ore
2.	Homogeneous equations. Applications. Linear equations. Bernoulli equation. Riccati equation.	Applications, guided discovering process	2 ore
3.	Second order differential equations. I. n-th order differential equations with constant coefficients. Variation of constants method	Applications, guided discovering process	2 ore
4.	Higher Order Differential equations II. n-th order differential equations with constant coefficients. Variation of	Applications, guided discovering process	2 ore

	constants method		
5.	Euler equations. Cauchy-Euler equations. Applications.	Applications, guided discovering process	2 ore
6.	Systems of first order differential equations; Applications	Applications, guided discovering process	2 ore
7.	First order differential equations with partial derivatives; Applications	Applications, guided discovering process	2 ore
8.	I. Second order differential equations with partial derivatives; Applications	Applications, guided discovering process	2 ore
9	II. Second order differential equations with partial derivatives; Applications	Applications, guided discovering process	2 ore
10.	Basic symmetries and special functions: spherical and Bessel functions; Applications (I)	Applications, guided discovering process	2 ore
11.	Basic symmetries and special functions: spherical and Bessel functions; Applications (II)	Applications, guided discovering process	2 ore
12.	Complex numbers. Operations with complex numbers.	Applications, guided discovering process, debate	2 ore
13.	Complex functions of real and complex variables	Applications, guided discovering process	2 ore
14.	Complex series. Singularities and poles. Residua Theorem.	Applications, guided discovering process	2 ore

Bibliografie

1. V. Barbu. *Procese la limita pentru ecuatii cu derivate partiale*. Ed. Academiei Romane, Bucuresti, 1993.
2. A. N. Tihonov si A. A. Samarski. *Ecuatiile fizicii matematice*. Ed. Tehnica, Bucuresti, 1956,
3. V. S. Vladimirov, *Ecuatiile fizicii matematice*. Ed. St. si Ped, Bucuresti, 1980.
4. I. S.Gradshteyn, I. M Ryzhik, *Table of Integrals, Series, and Products*, 7th edn, Academic, New York, 1990.
5. D. Zwillinger, *Handbook of Differenţial Equations* , Boston, Academic Press, 1997.

9. Coroborarea conţinutului disciplinei cu aşteptările reprezentanţilor comunităţii, asociaţiilor profesionale şi angajatorilor reprezentativi din domeniul aferent programului

10. Evaluare

Tip activitate	10.1 Criterii de evaluare	10.2 Metode de evaluare	10.3 Pondere în nota finală (%)
10.4 Curs	Course attendance	Written paper	50%

	active participation to class activities		
10.5 Seminar/ Laborator	Seminar activity and rate of participation	presentation of a research topic	50%
10.6 Standard minim de performanţă			
Obtaining the minimal grade 5 for each ongoing assessment.			

Data completării	Titular de curs	Titular de seminar
1 October 2021	CONF. DR. Iordana AȘTEFĂNOAEI prof. dr. Ciprian DARIESCU	prof. dr. Ciprian DARIESCU

Data avizării în departament

Director de departament
Conf. univ. dr. Iordana Astefanoaei

FIŞA DISCIPLINEI

2021/2022

1. Date despre program

1.1 Instituţia de învăţământ superior	**“Alexandru Ioan Cuza” University of Iasi**
1.2 Facultatea	**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	**Practical work**						
2.2 Titularul activităţilor de curs	**-**						
2.3 Titularul activităţilor de seminar/laborator	**Fiz. dr. Mihaela Maria OPREA**						
2.4 An de studiu	**2**	**2.5** Semestru	**2**	**2.6** Tip de evaluare	**EVP**	**2.7** Regimul disciplinei*	**OB**

** OB – Obligatoriu / OP – Opţional*

3. Timpul total estimat (ore pe semestru şi activităţi didactice)

3.1 Număr de ore pe săptămână	**4**	din care: **3.2** curs	**-**	**3.3** laborator	**4**
3.4 Total ore din planul de învăţământ	**48**	din care: **3.5** curs	**-**	**3.6** laborator	**48**

Distribuţia fondului de timp	ore
Studiu după manual, suport de curs, bibliografie şi altele	**18**
Documentare suplimentară în bibliotecă, pe platformele electronice de specialitate şi pe teren	**30**
Pregătire laboratoare, portofolii şi eseuri	**61**
Tutoriat	**14**
Examinări	**4**
Alte activităţi	**-**

3.7 Total ore studiu individual	**127**
3.8 Total ore pe semestru	**175**
3.9 Număr de credite	**7**

4. Precondiţii (dacă este cazul)

4.1 De curriculum	**General biophysics; Biochemistry; Thermodynamics & statistical physics; Nuclear physics; Detectors, dosimetry and radioprotection; Physical data processing; Informational technologies; Foreign language (English)**
4.2 De competenţe	**Application of physics knowledge in concrete situations from related fields, and in experiments, using standard laboratory equipment; Use of software packages for data analysis and processing; The interdisciplinary approach of physics topics; Communication and analysis of scientific and popularization information in the field of physics.**

5. Condiţii (dacă este cazul)

5.1 De desfăşurare a cursului	-
5.2 De desfăşurare a seminarului/ laboratorului	**-** systems and softwere for analysis and data processing - access to research laboratories from the Faculty of Physics

6. Competenţe specifice acumulate

Competenţe profesionale	– identification and proper use of laws, principles, notions and physical methods in various circumstances; – analysis and communication of Physics information with didactical, scientific and popularization character; – capacity to teach Physics at secondary and post-secondary education levels; – capacity of interrelationing and teamworking; – application of Physics knowledge to practical situations; – opening to lifelong learning.
Competenţe transversale	– mastery of research methods and techniques, specific to the specialization Biophysics and Medical Physics; – language skills at academic level, in foreign languages, needed for scientific documentation; – use of communication and information technologies; – use the software for analyzing and processing experimental data and to perform virtual experiments; – understanding and ability to apply the principles and the values of the professional and research ethics.

7. Obiectivele disciplinei (din grila competenţelor specifice acumulate)

7.1 Obiectivul general	Knowledge of research methods and techniques used in Biophysics and Medical Physics and the ability to conduct research projects using one or more of these techniques, and to communicate scientific results at an academic level.
7.2 Obiectivele specifice	- mastery of research methods and techniques used in Biophysics and Medical Physics; - the knowledge and understanding of physical phenomena underlying these methods and techniques; - conducting a research project using one or more of these techniques in one of the specialized laboratories of the Faculty of Physics or in collaboration with other Faculties; - processing and analysis of experimental data obtained upon implementation of the project; - oral presentation and communication of experimental results and their interpretation; - critical perspective on the project with highlight of its creative and innovative elements.

8. Conţinut

8.1	**Curs**	**Metode de predare**	**Observaţii** (ore şi referinţe bibliografice)
8.2	**Laborator**	**Metode de predare**	**Observaţii** (ore şi referinţe bibliografice)
1.	Concepts of health and occupational safety. Knowledge of specific legislation. Training of labor protection. The organization and functioning of science laboratories. Technical documentation of a project.	explanation, dialogue	4 h [1,2,3]
2.	Visits to research laboratories specialized in Biophysics and Medical Physics from the Faculty of Physics; presentation of the main research projects carried out in these laboratories with details on the methods and techniques used for acquisition and analysis of physical data. **Molecular Biophysics and medical Physics Laboratory** Fluorescence spectroscopy: study of the adsorption of membrane active peptides containing tryptophan in small unilamellar vesicles (SUVs) via the shift of Trp emission spectra.	explanation, dialogue, demonstration, group practical activities	4 h
3.	Analysis and interpretation of fluorescence spectroscopy data previously recorded (membrane adsorption of Trp containing peptides); Data analysis softwere: Origin.	explanation, dialogue, demonstration, individual or group practical activities	4 h
4.	***Surface analysis laboratory** Preparation of supported lipid bilayers (SLBs) on mica substrates via the lipid fusion method of SUVs.	explanation, dialogue, demonstration, group practical activities	4 h

5.	*__Surface analysis laboratory__ Atomic Force Microscopy investigation of SLBs (water vapor plasma hydroxilation of AFM tips, AFM measurements in liquid, topographic imaging of SLBs)	explanation, dialogue, demonstration, group practical activities	4 h
6.	*__Surface analysis laboratory__ Atomic Force Spectroscopy investigation of SLBs (AFS force measurements in liquid, force curves between hydroxilated AFM tips and SLBs)	explanation, dialogue, demonstration, group practical activities	4 h
7.	Analysis and interpretation of atomic force spectroscopy data previously recorded (force curves between hydroxilated AFM tips and SLBs); Data analysis softwere: LabVIEW, Origin.	explanation, dialogue, demonstration, individual or group practical activities	3 h
8.	*__Molecular Genetics and Archeogenetics Laboratory (Faculty of Biology)__ Polymerase chain reaction (PCR), Cromatography techniques.	explanation, dialogue, demonstration, group practical activities	3 h
9-10.	*__Particle accelerator Facility (“Sf. Spiridon” Hospital)__ Radiation therapy treatment planning; Radioprotection.	explanation, dialogue, demonstration, group practical activities	6 h
11-12.	Small research projects carried on by students in teams, in one of the specialized laboratories of the Faculty of Physics (or other)	explanation, dialogue, individual or group practical activities	6 h
13.	Practical details on the making, writing, structure and design of scientific poster presentations.	oral presentation, explanation, dialogue, video support	3 h

14.	Presentation of their projects in the form of a scientific poster, in writing and oral communication of methods and techniques used, data processing and analysis, interpretation of results and their importance.	oral presentation, explanation, dialogue, video support	3 h

* *Visits to research laboratories specialized in Biophysics and Medical Physics from the Faculty of Physics (or other); presentation of the main research projects carried out in these laboratories with details on the methods and techniques used for acquisition and analysis of physical data.*

Bibliografie

1. Legea Protectiei Muncii nr. 90/1996. Norme privind sănătatea şi securitatea în munca în laboratoare.
2. Lege privind practica elevilor si studentilor, 258/2007.
3. Regulamentul de practică al studenţilor, Facultatea de Fizică, Univ. Al. I. Cuza din Iaşi.
4. Garrett and Grisham, *BIOCHEMISTRY*, 2nd Edition;
5. Jaakko Malmivuo, Robert Plonsey, *BIOELECTROMAGNETISM, Principles and Applications of Bioelectric and Biomagnetic Fields*, 1995, Oxford University Press;
6. *THE AXON GUIDE, A guide to Electrophysiology & Biophysics Laboratory Techniques*, 2008, MDS Analytical Technologies USA;
7. *Metode experimentale avansate pentru studiul şi analiza bio-nano-sistemelor*, 2012, Casa Cărții de Știință Cluj-Napoca, ed. Mihaela Aluaș and Simion Simon;
8. Douglas C. Montgomery, George C. Runger, *Applied Statistics and Probability for Engineers*, 3rd Edition, 2003, John Wiley & Sons, Inc.

9. Coroborarea conţinutului disciplinei cu aşteptările reprezentanţilor comunităţii, asociaţiilor profesionale şi angajatorilor reprezentativi din domeniul aferent programului

The content of these paractical activities is consistent with the expectations of community representatives, professional associations and employers in the field of biophysics and medical physics.

10. Evaluare

Tip activitate	10.1 Criterii de evaluare	10.2 Metode de evaluare	10.3 Pondere în nota finală (%)
10.4 Practical work	- attending the visits in prophile laboratories, and documenting the aquired knowledge into a practice notebook - mastering a technique used in one of the visited laboratories (or other), and the ability to conduct a small reaserch project - understanding the investigated phenomena, and data analysis and interpretation - understanting of the basic structure, design and content of a scientific poster	• practical method • written method 1) practice notebook written during the semester 2) research project: ➢ project conducted during the semester: 60% of 2) ➢ presentation of the project in the form of a poster: 40% of 2)	30% 70%

10.5 Standard minim de performanţă

- conducting a small research project using one or more experimental methods and techniques used in Biophysics and Medical Physics in one of the research laboratories of the Faculty of Physics or in collaboration with other Faculties;
- the knowledge and understanding of physical phenomena underlying the methods and techniques used in the project;
- processing and analysis of experimental data obtained upon implementation of the project;
- oral presentation in the form of a scientific poster and communication of experimental results obtained.

Data completării: 29.09. 2021

Titular de curs: -

Titular de laborator: Fiz. dr. Mihaela Maria OPREA

Data avizării în departament:

Director de departament: Conf. univ. dr. Iordana AȘTEFĂNOAEI

FIŞA DISCIPLINEI

2021/2022

1. Date despre program

1.1 Instituţia de învăţământ superior	**Universitatea “Alexandru Ioan Cuza” din Iaşi**
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			**Optical Spectroscopy: methods and instrumentation**					
2.2 Titularul activităţilor de curs			**Lect. dr. Valentin POHOAŢĂ**					
2.3 Titularul activităţilor de seminar			**Lect. dr. Valentin POHOAŢĂ**					
2.4 An de studiu	**2**	**2.5** Semestru	**1**	**2.6** Tip de evaluare	**EVP**	**2.7** Regimul discipinei*	**OP**	

** OB – Obligatoriu / OP – Opţional*

3. Timpul total estimat (ore pe semestru şi activităţi 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 învăţământ	**56**	din care: **3.5**	curs	**28**	**3.6** seminar/laborator	**28**
Distribuţia fondului de timp						ore
Studiu după manual, suport de curs, bibliografie şi altele						**25**
Documentare suplimentară în bibliotecă, pe platformele electronice de specialitate şi pe teren						**24**
Pregătire seminarii/laboratoare, teme, referate, portofolii şi eseuri						**16**
Tutoriat						
Examinări						**4**
Alte activităţi						

3.7 Total ore studiu individual	**69**
3.8 Total ore pe semestru	**125**
3.9 Număr de credite	**5**

4. Precondiţii (dacă este cazul)

4.1 De curriculum	Optics. Physics of atoms and molecules. Plasma Physics. Spectroscopy and Lasers.
4.2 De competenţe	

5. Condiţii (dacă este cazul)

5.1 De desfăşurare a cursului	
5.2 De desfăşurare a seminarului/ laboratorului	Presence is mandatory at practical laboratories. Students will conduct individual or group laboratory experiments.

6. Competenţe specifice acumulate

Competenţe profesionale	Identification and proper use of laws, principles, notions and physical methods in various circumstances Analysis and communication of Physics information with didactical, scientific and popularization character Capacity to teach Physics at secondary and post-secondary education levels Capacity of interrelationing and teamworking Application of Physics knowledge to practical situations Opening to lifelong learning
Competenţe transversale	Mastery of research methods and techniques, specific to the specialization Plasma Physics, Spectroscopy and Self-Organization Language skills at academic level, in foreign languages, needed for scientific documentation Use of communication and information technologies Use the software for analyzing and processing experimental data and to perform virtual experiments Understanding and ability to apply the principles and the values of the professional and research ethics

7. Obiectivele disciplinei (din grila competenţelor specifice acumulate)

7.1 Obiectivul general	Familiarization with the major spectroscopic tools and research techniques used in the analysis and control of composition, structure and quality of the materials. The course will review the main techniques and spectral methods of investigation, spectral types of appliances, basic components, sources and spectrum detectors..
7.2 Obiectivele specifice	▪ On successful completion of this subject, students will be able to understand what spectral techniques are indicated for both qualitative and quantitative diagnosis of samples in different states of aggregation.

8. Conţinut

8.1	**Curs On-line și On-site**	**Metode de predare**	**Observaţii** (ore şi referinţe bibliografice)
1.	Vibrational Spectroscopy. Infrared spectroscopy. Classical acquisitions techniques (pallets, gas and liquid cell, nujol emulsion)	Lecture, thematic debates, applications.	4 h [1-9]
2.	Vibrational Spectroscopy. Infrared spectroscopy. New acquisitions techniques (ATR, diffuse reflectance)	Lecture, thematic debates, applications.	2 h [1-9]
3.	Elastic light scattering – Rayleigh scattering, Mie scattering, non-selective scattering or geometrical scattering.	Lecture, thematic debates, applications.	2 h [1-9]
4.	Inelastic scattering- Raman scattering.	Lecture, thematic debates, applications.	2 h [1-9]
5.	Molecular Spectroscopy - Visible and Ultraviolet Spectroscopy	Lecture, thematic debates, applications.	2 h [1-9]

6.	Components of various types of instrument for optical spectroscopy. instrumentation – spectrophotometer, monochromator, double beam scanning specttrophottometter, artefacts.	Lecture, thematic debates, applications.	4 h [1-9]
7.	Fluorescence spectroscopy	Lecture, thematic debates, applications.	2 h [1-9]
8.	X-Ray Fluorescence	Lecture, thematic debates, applications.	2 h [1-9]
9.	Nuclear Magnetic Resonance Spectroscopy.	Lecture, thematic debates, applications.	2 h [1-9]
10.	Laser-induced spectroscopy. Atomic emission spectroscopy, molecular, UV-VIS-IR. Atomic fluorescence spectroscopy. FTIR and Raman vibrational spectroscopy.	Lecture, thematic debates, applications.	2 h [1-9]
11	Laser induced fluorescence. Broadenings mechanisms, shifts and splits. (Doppler, Stark, Zeeman, wan der Walls, resonance broadenings of spectral lines)	Lecture, thematic debates, applications.	2 h [1-9]
12.	Mass Spectrometry.Types of Mass Spectrometers. Inductively coupled plasma mass spectrometry (ICP-MS). Gas Chromatography—Mass Spectrometry (GC-MS). Matrix Assisted Laser Desorption/Ionization MALDI	Lecture, thematic debates, applications.	2 h [10,11]

Bibliografie

Referinţe principale:

1.A. Vlahovici, Metode optice si spectrale de analiza, Ed. Univ. “Al. I. Cuza“Iasi, 2002;
2.M. Delibaş, Optică şi spectroscopie, Iaşi, 1999;
3.M. Strat, Spectroscopie si laseri, Ed.Univ. “Al. I. Cuza” Iasi, 1988;
4.M. Strat, Introducere in spectroscopia mediilor condensate, Ed. Tehnica, Bucuresti, 1985;
5.M. Strat, Analiza structurala prin metode fizice, Ed. Academiei Romane, 1985;
6.A. N. Zaidel, s.a., Tehnica şi practica spectroscopiei, Bucureşti, 1984;
7.I. Iova, “Spectroscopie si laseri”, Ed.Univ. Bucuresti, 1984;
8.M. A. Eliasevici, Spectroscopie atomica si moleculara, Ed. Academiei Române, Bucuresti, 1966;
9.D. Birca-Galateanu, M. Giurgea, I. Iova, V. Sahini, A. Trutia si R. Titeica, Introducere in spectroscopia experimentala, Ed. Tehnica, Bucuresti, 1966.
10 Christopher G. Herbert, Robert A.W. Johnstone, Mass Spectrometry Basics June 26, 2002, CRC Press
11. Dr. Christoph A. Schalley Modern Mass Spectrometry, 2003 Springerlink

8.2	**Laborator On-line şi On-site**	**Metode de predare**	**Observaţii** (ore şi referinţe bibliografice)
1.	Spectrophotometer and monochromator for UV-VIS: technical details.	Essays, laboratory work	2 h [1]
2.	Colour theory - CIE 1931 colour space	Essays, laboratory work	2 h [1,4]
3	Night vision and thermal vision – human body temperature measurement	Essays, laboratory work	2 h [1]
4.	Absorption spectra of blood: pulse oximeter	Essays, laboratory work	2 h [1]

5.	The antioxidant properties of Vitamin E determined by UV-VIS spectroscopy using the DPPH method.	Essays, laboratory work	2 h [1,5]
6.	Surface plasmon resonance in silver nanoparticles monitored by UV-VIS spectroscopy	Essays, laboratory work	2 h [1,6,7]
7.	FTIR spectrometer: technical specifications	Essays, laboratory work	2 h [1]
8.	Use of FTIR spectra in identification of pharmaceutical products.	Essays, laboratory work	2 h [1,8]
9.	IR Spectra analysis, deconvolution of fine structure peaks.	Essays, laboratory work	2 h [1]
10.	Fluorescence spectrometers and microscopy: technical details; spectra of chlorophyll	Essays, laboratory work	2 h [1,3]
11.	Structural vibration spectroscopy using Raman technique	Essays, laboratory work	2 h [1,10]
12	Compositional analysis by mass spectrometry.	Essays, laboratory work	2 h [1,11]
13.	The Use of the FTIR-ATR technique to Examine Polymer coated surfaces	Essays, laboratory work	2 h [1,12]
14.	LIDAR – air pollutant measurements by Raman analysis	Essays, laboratory work	2 h [1]

Bibliografie

1. Laboratory reports (.pdf)
2. Biochim Biophys Acta. 1966 Jun 8;120(2):247-58. Absorption and fluorescence spectra of spinach chloroplast fractions obtained by solvent extraction. Cederstrand CN, Rabinowitch E, Govindjee.
3. Plant, Cell and Environment (2002) 25, 1663–1676 The use of chlorophyll fluorescence excitation spectra for the non-destructive in situ assessment of UV-absorbing compounds in leaves; Z. G. Cerovic, A. Ounis, A. Cartelat, G. Latouche, Y. Goulas, S. Meyer, I. Moya
4. https://en.wikipedia.org/wiki/CIE_1931_color_space
5. Estimation of antiradical properties of antioxidants using DPPH assay: A critical review and results; Krishnanand Mishra, Himanshu Ojha, Nabo Kumar Chaudhury; Food Chemistry 130 (2012) 1036–1043
6. International Journal of Pharmacy and Biological Sciences (e-ISSN: 2230-7605); IJPBS Volume 2 Issue 3 Jul-Sep 2012 pages 10-14; Synthesis and characterisation of silver nanoparticles; Basavaraj Udapudi, Praveenkumar Naik, Sabiha Tabassum Savadatti, Rupali Sharma, Samprita Balgi
7. Spectroscopy 17 (2003) 255–273 255; IOS Press; Surface plasmon resonance: principles, methods and applications in biomedical sciences; Patrick Englebienne, Anne Van Hoonacker, Michel Verhas
8. Yves Roggo, Pascal Chalus, Lene Maurer, Carmen Lema-Martinez, Aur´elie Edmond, Nadine Jent, A review of near infrared spectroscopy and chemometrics in pharmaceutical technologies, Journal of Pharmaceutical and Biomedical Analysis 44 (2007) 683–700
9. Amarendra Narayan Misra, Meena Misra and Ranjeet Singh, (2012) Chlorophyll Fluorescence in Plant Biology, Biophysics, Dr. Prof. Dr. A.N. Misra (Ed.), ISBN: 978-953-51-0376-9, InTech
10. Ewen Smith, Modern Raman Spectroscopy– A Practical Approach, John Wiley & Sons Ltd
11.Dr. Christoph A. Schalley Modern Mass Spectrometry, 2003 Springerlink
12. Advanced Aspects of Spectroscopy; Edited by Muhammad Akhyar Farrukh, ISBN 978-953-51-0715-6, 548 pages, Publisher: InTech, Chapters published August 29, 2012 under CC BY 3.0 license DOI: 10.5772/2757; Chapter 3 The Use of the FTIR-ATR technique to Examine the Polymers Surface by Wieslawa Urbaniak-Domagala
13. Advanced Aspects of Spectroscopy; Edited by Muhammad Akhyar Farrukh, ISBN 978-953-51-0715-6, 548 pages, Publisher: InTech, Chapters published August 29, 2012 under CC BY 3.0 license DOI: 10.5772/2757; Chapter 1 Electronic (Absorption) Spectra of 3d Transition Metal Complexes by S. Lakshmi Reddy, Tamio Endo and G. Siva Reddy

9. Coroborarea conţinutului disciplinei cu aşteptările reprezentanţilor comunităţii, asociaţiilor profesionale şi angajatorilor reprezentativi din domeniul aferent programului

10. Evaluare

Tip activitate	**10.1 Criterii de evaluare**	**10.2 Metode de evaluare**	**10.3 Pondere în nota finală (%)**
10.4 Curs	Critical analysis on the methods and criteria used to select the correct solutions to attain specified performance in a given application	summative evaluation	Written exam 50%
10.5 Seminar/ Laborator	Physical interpretation on the results of experimental measurements or theoretical calculations, using appropriate numerical or statistical methods	formative evaluation	Practical work reports (30%) Individual project (essay) (20%)
10.6 Standard minim de performanţă			
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
29.09.2021

Titular de curs
Lect. univ.dr. Valentin Pohoaţă

Titular de seminar
Lect. univ. dr. Valentin POHOAŢĂ

Data avizării în departament

Director de departament
Conf. univ. dr. Iordana Ștefanoaei

FIŞA DISCIPLINEI

2021-2022

1. Date despre program

1.1 Instituţia de învăţământ superior	**"Alexandru Ioan Cuza" University of Iasi**
1.2 Facultatea	**Faculty of Physics**
1.3 Departamentul	**Department of Physics**
1.4 Domeniul de studii	**Physics**
1.5 Ciclul de studii	**Master**
1.6 Programul de studii / Calificarea	Appleid Medical Physics

2. Date despre disciplină

2.1 Denumirea disciplinei			**Modeling of physical processes**					
2.2 Titularul activităţilor de curs			**Prof. dr. Laurenţiu STOLERIU**					
2.3 Titularul activităţilor de laborator			**Prof. dr. Laurenţiu STOLERIU**					
2.4 An de studiu	**2**	**2.5** Semestru	**1**	**2.6** Tip de evaluare	**EVP**	**2.7** Regimul disciplinei*	**OB**	

** OB – Obligatoriu / OP – Opţional*

3. Timpul total estimat (ore pe semestru şi activităţi 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 învăţământ	**56**	din care: **3.5** curs	**28**	**3.6** laborator	**28**
Distribuţia fondului de timp					ore
Studiu după manual, suport de curs, bibliografie şi altele					**28**
Documentare suplimentară în bibliotecă, pe platformele electronice de specialitate şi pe teren					**16**
Pregătire seminarii/laboratoare, teme, referate, portofolii şi eseuri					**15**
Tutoriat					**8**
Examinări					**2**
Alte activităţi					**0**

3.7 Total ore studiu individual	**69**
3.8 Total ore pe semestru	**125**
3.9 Număr de credite	**5**

4. Precondiţii (dacă este cazul)

4.1 De curriculum	**Undergraduate course in programming languages**
4.2 De competenţe	**Basic computer skills**

5. Condiţii (dacă este cazul)

5.1 De desfăşurare a cursului	**Room with access to internet, videoprojector and projection screen**
5.2 De desfăşurare a seminarului/ laboratorului	**Students must have individual access to computers**

6. Competenţe specifice acumulate

Competenţe profesionale	C1.1 Mastery of research methods and techniques, specific to the specialization Advanced Materials. Nanotechnologies; C2.1 Language skills at academic level, in foreign languages, needed for scientific documentation; C3.1 Use of communication and information technologies; C4.1 Use the software for analyzing and processing experimental data and to perform virtual experiments;
Competenţe transversale	CT1. Use of communication and information technologies; CT2. Use the software for analyzing and processing experimental data and to perform virtual experiments; CT3. Understanding and ability to apply the principles and the values of the professional and research ethics.

7. Obiectivele disciplinei (din grila competenţelor specifice acumulate)

7.1 Obiectivul general	C1. Identification and proper use of laws, principles, notions and physical methods in various circumstances; C2. Analysis and communication of Physics information C3. Capacity to teach Physics at secondary and post-secondary education levels; C4. Application of Physics knowledge to practical situations; C5. Opening to lifelong learning.
7.2 Obiectivele specifice	After successfuly finalizing this course, the students will be able to: ▪ Use computing modeling tools to describe physics problems ▪ Identify and control sources of numerical errors ▪ Analyze numerical results and establish conclusions starting from numerical simulations

8. Conţinut

8.1	**Curs**	**Metode de predare**	**Observaţii** (ore şi referinţe bibliografice)
1	Generalities. Systems, models and simulations. Errors in numerical calculus: the machine constant and the round-off error.	Lecture, exemplification	2 ore
2	Maple programming platform: how it compares to other programming environments, advantages and disadvantages.	Lecture, exemplification	2 ore
3	The trajectory of a body in a 2D gravitational field: - plotting the parametric trajectory starting from known solutions, - finding solutions by solving the equation of motion, - the consequences of adding viscous friction	Lecture, exemplification	2 ore
4	Finding the trajectory of a body in gravitational field – wind effect (numerically solving the equation of motion).	Lecture, exemplification	2 ore

	Movement in central force field.		
5	Computing and graphical representation of fields. Electrical field of a system of electric charges. The field lines spectrum of a system of two electric charges.	Lecture, exemplification	2 ore
6	Advanced computing of field lines - plotting electric field lines for an arbitrary number of electric charges.	Lecture, exemplification	2 ore
7	Harmonic oscillator. Different ways of approaching animations in Maple/Maxima	Lecture, exemplification	2 ore
8	Discussing the solution of the practical work problem. Lissajous curves	Lecture, exemplification	2 ore
9	More advanced programming in Maple/Maxima – plotting the resonance curve	Lecture, exemplification	2 ore
10	More advanced programming in Maple/Maxima – animating a falling satellite	Lecture, exemplification	2 ore
11	Working with external data in Maple/Maxima: read, write, statistics.	Lecture, exemplification	2 ore
12	Nonlinear systems: the double pendulum. Random vs. chaotic vs. deterministic.	Lecture, exemplification	2 ore
13 - 14	Analyzing chaos: Lyapunov exponents, phase portraits, Poincare sections.	Lecture, exemplification	4 ore

Bibliografie

Referinţe:

[1] L. Stoleriu, A. Stancu, Introducere in modelarea si simularea proceselor fizice, Ed. Tehnopress, 2007.
[2] F. Wang, Physics with MAPLE, Wiley-VCH, 2005.
[3] W. Press et al, “Numerical Recipes”, Cambridge University Press, 1992
[4] Burden R. et al, “Numerical analysis”, PWS-KENT Publishing Company, Boston, 1985.
[5] B. Char et al, “Maple V”, Springer Verlag, 1992.
[6] Blachman N.R. et al, “Maple V - quick reference”, Brooks/Cole Publishing Company, Pacific Grove, California, 1994.
[6] G.L. Baker, J.P.Gollub, “Chaotic dynamics. An introduction”, Cambridge University Press, 1990.

Referinţe suplimentare:

http://stoner.phys.uaic.ro/moodle/

8.2	**Seminar / Laborator**	**Metode de predare**	**Observaţii** (ore şi referinţe bibliografice)
1.	Errors in numerical calculus.	Problem solving	2 ore
2 - 4	Basic elements of Maple/Maxima. Differences when comparing Maple/Maxima with a classical programming language. Advantages. Disadvantages.	Problem solving	6 ore
5 - 6	Physical fields. Visualization.	Problem solving	4 ore
7	Practical work - evaluation	Problem solving	2 ore
8 - 11	Solving ordinary differential equations (ODEs) and systems of ODEs. From a high order ODE to a system of first order ODEs.	Problem solving	8 ore

12 - 14	Numerical study of chaotic systems. Chaotic vs. random.	Problem solving	6 ore

Bibliografie

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L. Stoleriu, A. Stancu, Introducere in modelarea si simularea proceselor fizice, Ed. Tehnopress, 2007.

9. Coroborarea conţinutului disciplinei cu aşteptările reprezentanţilor comunităţii, asociaţiilor profesionale şi angajatorilor reprezentativi din domeniul aferent programului

In Romania there is a strong need for scientists and engineers with strong numerical skills as more and more companies are engaging in CAD activities.

10. Evaluare

Tip activitate	10.1 Criterii de evaluare	10.2 Metode de evaluare	10.3 Pondere în nota finală (%)
10.4 Curs		Personal project	70%
10.5 Seminar/ Laborator		Two practical tests	30%
10.6 Standard minim de performanţă			
Identifying and using basic IT notion, comparing numerical models data with experimental data, designing of an algorithm for a medium complex software application Making graphs and reports to explain the obtained results, evaluating the degree of confidence in the results.			

Data completării
24.09.2021

Titular de curs
Prof. dr. Laurenţiu STOLERIU

Titular de laborator
Prof. dr. Laurenţiu STOLERIU

Data avizării în departament

Director de departament
Conf. dr. Iordana AŞTEFĂNOAEI