



FIȘA DISCIPLINEI

2023-2024

1. Date despre program

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

2. Date despre disciplină

2.1 Denumirea disciplinei	FUNDAMENTALS OF MATHEMATICAL PHYSICS						
2.2 Titularul activităților de curs	CONF. DR. HABIL. Iordana AȘTEFĂNOAEI						
2.3 Titularul activităților de seminar	conf. Dr. habil. Iordana AȘTEFĂNOAEI						
2.4 An de studiu	1	2.5 Semestru	1	2.6 Tip de evaluare	E	2.7 Regimul disciplinei*	OB

* OB – Obligatoriu / OP – Opțional

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

3.1 Număr de ore pe săptămână	4	din care: 3.2 curs	2	3.3 seminar/laborator	2
3.4 Total ore din planul de învățământ	56	din care: 3.5 curs	28	3.6 seminar/laborator	28
Distribuția fondului de timp					ore
Studiu după manual, suport de curs, bibliografie și altele					43
Documentare suplimentară în bibliotecă, pe platformele electronice de specialitate și pe teren					35
Pregătire seminarii/laboratoare, teme, referate, portofolii și eseuri					31
Tutoriat					0
Examinări					8
Alte activități					2
3.7 Total ore studiu individual					119
3.8 Total ore pe semestru					175
3.9 Număr de credite					7

4. Precondiții (dacă este cazul)

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

5. Condiții (dacă este cazul)

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



6. Competențe specifice acumulate

Competențe 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 interrelating and teamworking; C4. application of Physics knowledge to practical situations; C5. opening to lifelong learning.
Competențe 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 competențelor 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	<ul style="list-style-type: none">▪ 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. Conținut

8.1	Curs	Metode de predare Onsite/Online	Observații (ore și referințe bibliografice)
1.	Generalities on differential equations;	Lecture, Applications Onsite	2 ore
2.	Physically significant differential equations;	Lecture, applications, guided discovering process Onsite	2 ore
3.	Ordinary differential equations; First and Second order differential equations	Lecture, applications, guided discovering process Onsite	2 ore
4.	Ordinary differential equations; Higher Order Differential equations	Lecture, debate, guided discovering process Onsite	2 ore
5.	Euler equations. Cauchy-Euler equations	Lecture, applications Onsite	2 ore



6	Systems of first order differential equations;	Lecture, guided discovering process, applications Onsite	2 ore
7	First order differential equations with partial derivatives;	Lecture, guided discovering process, applications Onsite	2 ore
8.	Second order differential equations with partial derivatives;	Lecture, guided discovering process, applications Onsite	2 ore
9	Legendre Polynomials;	Lecture, guided discovering process, applications Onsite	2 ore
10	Basic symmetries and special functions: spherical and Bessel functions;	Lecture, guided discovering process, applications Onsite	2 ore
11.	Laplace and Poisson Equations,	Lecture, guided discovering process, applications Onsite	2 ore
12.	Laplace – Fourier method of variables separation;	Lecture, guided discovering process, applications Onsite	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, guided discovering process, applications Online	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, guided discovering process, applications Onsite	2 ore

Bibliografie**Referințe 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 Differential Equations*, Boston, Academic Press, 1997.

Referințe suplimentare:

8.2	Seminar / Laborator	Metode de predare Onsite/Online	Observații (ore și referințe bibliografice)
1.	Geometrical interpretation of first order differential equations' solutions	Applications, guided discovering process Onsite	2 ore
2.	Homogeneous equations. Applications. Linear equations. Bernoulli equation. Riccati equation.	Applications, guided discovering process Onsite	2 ore



3.	Second order differential equations. I. n-th order differential equations with constant coefficients. Variation of constants method	Applications, guided discovering process Onsite	2 ore
4.	Higher Order Differential equations II. n-th order differential equations with constant coefficients. Variation of constants method	Applications, guided discovering process Onsite	2 ore
5.	Euler equations. Cauchy-Euler equations. Applications.	Applications, guided discovering process Onsite	2 ore
6.	Systems of first order differential equations; Applications	Applications, guided discovering process Onsite	2 ore
7.	First order differential equations with partial derivatives; Applications	Applications, guided discovering process Onsite	2 ore
8.	I. Second order differential equations with partial derivatives; Applications	Applications, guided discovering process Onsite	2 ore
9.	II. Second order differential equations with partial derivatives; Applications	Applications, guided discovering process Onsite	2 ore
10.	Basic symmetries and special functions: spherical and Bessel functions; Applications (I)	Applications, guided discovering process Onsite	2 ore
11.	Basic symmetries and special functions: spherical and Bessel functions; Applications (II)	Applications, guided discovering process Onsite	2 ore
12.	Complex numbers. Operations with complex numbers.	Applications, guided discovering process, debate Onsite	2 ore
13.	Complex functions of real and complex variables	Applications, guided discovering process online	2 ore
14.	Complex series. Singularities and poles. Residua Theorem.	Applications, guided discovering process Onsite	2 ore
Bibliografie 1. V. Barbu. <i>Procese la limita pentru ecuatii cu derivate partiale</i> . Ed. Academiei Romane, Bucuresti, 1993. 2. A. N. Tihonov si A. A. Samarski. <i>Ecuatiile fizicii matematice</i> . Ed. Tehnica, Bucuresti, 1956, 3. V. S. Vladimirov, <i>Ecuatiile fizicii matematice</i> . Ed. St. si Ped, Bucuresti, 1980. 4. I. S. Gradshteyn, I. M. Ryzhik, <i>Table of Integrals, Series, and Products</i> , 7th edn, Academic, New York, 1990. 5. D. Zwillinger, <i>Handbook of Differential Equations</i> , Boston, Academic Press, 1997.			

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



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

Data completării

Titular de curs

Titular de seminar

26 September 2022

CONF. DR. Iordana AȘTEFĂNOAEI

Conf. univ. dr. Iordana Astefanoaei

Data avizării în departament

Director de departament

Conf. univ. dr. Iordana Astefanoaei



FIȘA DISCIPLINEI

2023/2024

1. Date despre program

1.1 Instituția de învățământ superior	University “Alexandru Ioan Cuza” from Iași
1.2 Facultatea	Faculty of Physics
1.3 Departamentul	Physics
1.4 Domeniul de studii	Physics
1.5 Ciclul de studii	Master
1.6 Programul de studii / Calificarea	Master in the specialization „PHYSICS FOR ADVANCED TECHNOLOGIES”

2. Date despre disciplină

2.1 Denumirea disciplinei	Physics of materials I (dielectrics, magnetic materials)						
2.2 Titularul activităților de curs	Prof. dr. Liliana Mitoșeriu, Conf. dr. Ioan Dumitru						
2.3 Titularul activităților de seminar	Conf. dr. habil. Lavinia Curecheriu, Conf. dr. Ioan Dumitru						
2.4 An de studiu	1	2.5 Semestru	1	2.6 Tip de evaluare	E	2.7 Regimul disciplinei	OB

* OB – Obligatoriu / OP – Opțional

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

3.1 Număr de ore pe săptămână	4	din care: 3.2 curs	2	3.3 seminar/laborator	2
3.4 Total ore din planul de învățământ	56	din care: 3.5 curs	28	3.6 seminar/laborator	28
Distribuția fondului de timp					ore
Studiu după manual, suport de curs, bibliografie și altele					50
Documentare suplimentară în bibliotecă, pe platformele electronice de specialitate și pe teren					40
Pregătire seminarii/laboratoare, teme, referate, portofolii și eseuri					35
Tutoriat					15
Examinări					4
Alte activități					0
3.7 Total ore studiu individual					144
3.8 Total ore pe semestru					200
3.9 Număr de credite					8

4. Precondiții (dacă este cazul)

4.1 De curriculum	Electricity and Magnetism, Solid State Physics
4.2 De competențe	Interdisciplinary scientific and technological general background, Positive team working attitude and competences in science communication

5. Condiții (dacă este cazul)



5.1 De desfășurare a cursului	Lecture room with multimedia tools (projector, screen) and blackboard, Acces internet, CISCO Webex platform, Skype, etc.
5.2 De desfășurare a seminarului/ laboratorului	Labs with specific equipments/tools for the characterisation of electrical and magnetic properties of materials with technological applications, Acces internet, CISCO Webex platform, Skype, etc.

6. Competențe specifice acumulate

Competențe profesionale	<p>C1. Capacitaty to identify properly in practical situations the principles, laws, models and theories to describe the electrical and magnetic properties of materials in correlation with composition and microstructures;</p> <p>C2. Capacitaty to identify, classify and describe materials from the point of view of their behaviour under electric/magnetic fields and understanding their potential for possible applications;</p> <p>C3. Capacity to analyse and valorify the experimental results obtained in the lab and identification of error sources and influence of various parameters;</p> <p>C4. Capacitaty to study recommended bibliography, to synthesise scientific information and critically discuss models for interpretation of materials properties with possible technological and industrial applications.</p>
Competențe transversale	<p>CT1. Capacity of communication concerning scientific results, ability to realise a scientific presentation concerning materials with technological applications;</p> <p>CT2. Capacity of collaboration and working in a team;</p> <p>CT3. Capacity to realise a personal project of bibliographical or scientific research;</p> <p>CT4. Open and positive attitude for solving problems and assuming the professional deontological principles and values.</p>

7. Obiectivele disciplinei (din grila competențelor specifice acumulate)

7.1 Obiectivul general	Understanding the electrical and magnetic properties of substances and their correlation with chemical and phase composition and with micro/nanostructural characteristics
7.2 Obiectivele specifice	<p>After successfully finalising this discipline, the students will be able to:</p> <ul style="list-style-type: none"> ▪ Explain the differences between the functional properties of various materials with technological applications with linear/nonlinear response under the application of electric/magnetic fields; ▪ Describe the material response in electric/magnetic field as a function of temperature field frequency, field intensity, mechanical stress; ▪ Use various experimental methods to characterise materials with technological applications from electric/magnetic point of view; ▪ Comparatively analyse the materials properties, searching for potential applications; ▪ Use adequate models for interpretation of polarisation/magnetisation processes in substances.

8. Conținut

8.1	Curs	Metode de predare	Observații (ore și referințe bibliografice)
1.	Eqs. describing the electric field in materials. Dipole, multipole. General properties of dielectrics, classifications.	Lecture, Power Point presentation	2h
2.	Polarization. Fundamental eq. of dielectrics. Applications: dielectric plan, sphere. Local fields (Lorentz, Onsager)	Lecture, Power Point presentation. Case study	2h



3.	Electrostatic forces and energies in substances.	Lecture, Power Point presentation	2h
4.	Induced polarisation. Field-dependence of polarisation and susceptibility in non-polar substances.	Lecture, Power Point presentation	2h
5.	Orientation polarisation. Field-dependence of polarisation and susceptibility in polar substances.	Lecture, Power Point presentation	2h
6.	Dielectric relaxation, empirical laws. Debye relaxation. Microscopical mechanisms.	Lecture, Power Point presentation. Case study	2h
7.	Impedance spectroscopy: principles, methods, applications to determine broadband dielectric properties.	Lecture, Power Point presentation. Case study	2h
8.	Fundamental laws of magnetism in substances. Origin of magnetic properties.	Magistral lecture. Case study	2h
9.	Diamagnetism, paramagnetism, ferromagnetism: phenomenological aspects. Hysteresis loop; permeability and magnetic susceptibility.	Lecture. Debates. Case study	2h
10.	Magnetization of substances in ac fields. Magnetic interactions. Temperature-induced modification of magnetisation curves. Curie temperature.	Lecture. Debates. Case study	2h
11.	Nature of magnetic moments in ferromagnetic solids. Weiss model. Other theories for polarisable media. Theory of magnetisation curves.	Lecture. Computer-aided learning.	2h
12.	Soft magnetic materials. Hard magnetic materials.	Lecture. Debates. Case study	2h
13.	Nanostructured magnetic materials. Thin film magnetic materials.	Magistral lecture	2h
14.	Applications of magnetic materials. Recording/storage media.	Lecture. Case study. Brainstorming	2h

Bibliography**Principal references:**

- L. Mitoseriu, V. Tura, Fizica dielectricilor, Ed. Univ. "A.I. Cuza" Iasi, 1999
- A. Jonsker, Dielectric relaxation in solids, Chelsea Dielectric Press., London, 1983
- A. Ianculescu, L. Mitoseriu, Ceramici avansate cu aplicatii in microelectronica, Ed. Politehnica Bucuresti 2007
- L. Mitoseriu (ed.), New development in advanced functional ceramics, Transworld Res. Network, 2007
- G. Bertotti, Hysteresis in Magnetism (For Physicists, Material Scientists and Engineers) Academic Press Boston, 1998
- R. M. Bozorth, Ferromagnetism, IEEE Press, 1993
- E. Burzo, Fizica fenomenelor magnetice, vol I, II, III, Editura Academiei București, 1979
- S. Chikazumi, Magnetismul Editura Științifică și Enciclopedică, București, 1981

Supplementary references:

- H. Gavrilă, V. Ioniță, Metode experimentale în magnetism Editura UMF, 2003
- H. Gavrilă, H. Chiriac, P. Ciureanu, V. Ioniță, A. Yelon, Magnetism tehnic și aplicat, Editura Academiei Române, 2004
- D. Jiles, Magnetism and Magnetic Materials Chapman & Hall, New York, 1991



- M. E. Lines, A. M. Glass, Principles and Applications of Ferroelectrics and Related Materials, Oxford, Classic Texts in the Physical Sciences), 2001

8.2	Seminar / Laborator	Metode de predare	Observații (ore și referințe bibliografice)
1.	Field and potential of various dipole distributions. Problems with boundary conditions in dielectrics.	Solving problems. Demonstrations	Sem. 2h
2.	Calculation of permittivity of polar and non-polar dielectrics. Problems	Solving problems. Demonstrations. Case studies	Sem. 2h
3.	Problems of dielectric relaxations	Solving problems. Demonstrations. Case studies	Sem. 2h
4.	Study of dielectric relaxation by impedance spectroscopy	Lab activity (experimental)	Lab. 2h
5.	Study of ferro-para phase transition and of Curie-Weiss law in ferroelectric ceramics	Lab activity (experimental)	Lab. 2h
6.	Study of ferroelectric P(E) loops	Lab activity (experimental)	Lab. 2h
7.	Study of non-linear dielectric properties $\epsilon(E)$	Lab activity (experimental)	Lab. 2h
8.	Field and potential of currents distributions. Problems solving.	Solving problems. Debates and discussions	Sem. 2h
9.	Calculations of induction, fields, susceptibility in nonlinear polarisable media. Problems.	Solving problems. Debates and discussions	Sem. 2h
10.	Inductometric methods for determination of M(H) loops and magnetisation curves. Generalities and problems.	Lab activity (experimental)	Lab. 2h
11.	Hysteresisgraph method	Lab activity (experimental)	Lab. 2h
12.	Vibrating magnetometer. High order magnetisation curves. Determination of Curie temperatures.	Lab activity (experimental)	Lab. 2h
13.	Determination of initial permeability and its variation with frequency and temperature.	Lab activity (experimental)	Lab. 2h
14.	Determination of magnetostriction and magnetolectric constants	Lab activity (experimental)	Lab. 2h

Bibliografie

- Electromagnetism. Carte de lucrări practice, A. Mândreci, O. F. Călțun, Editura Universității "Al. I. Cuza", Iași, 2002
- A. Mandreci, O. F. Călțun, L. Spinu, Cr. Papusoi, Electricitate, magnetism și electronică. Probleme rezolvate pentru studenții Facultății de Chimie", partea a doua Editura Universității "Al. I. Cuza", Iași, 1999
- H. Gavrilă, V. Ioniță (2003) Metode experimentale în magnetism Editura UMF
- V. Pop, I. Chicinaș, N. Jumate, (2001) Editura Presa Universitară Clujeană
- O. Călțun editor, Ferite de cobalt magnetostrictive (2009) Editura Universității Alexandru Ioan Cuza Iași

9. Coroborarea conținutului disciplinei cu așteptările reprezentanților comunității, asociațiilor

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

The objectives and contents have been selected according to the expectations of the main employers (research institutes, universities, SMEs, schools) in order to favour the professional insertion. The discipline is adapted to the recommendation of ANCS (National Research Agency) and Physics Romanian Society.

10. Evaluare

Tip activitate	10.1 Criterii de evaluare	10.2 Metode de evaluare	10.3 Pondere în nota finală (%)
10.4 Lecture	Presence, implication, constructive feedback	Written test. Individual project. Written report.	75%
10.5 Seminar/ Laboratory	Implication, preparation of activities, quality of contributions, assuming charges and activities in workteam, collaboration in the workgroup	Individual project, lab portfolio, participation to seminars, solved problems, individual and group tasks	25%
10.6 Standard minim de performanță			
The students should demonstrate their ability to discuss using specific scientific language about the electric/magnetic properties of various materials with technological applications. The students will be able to realise at least an individual mini-project of bibliographic or scientific research and to present it to the community in a coherent way.			

Data completării
01.10.2023

Titular de curs
Prof. dr. Liliana Mitoșeriu,

Titular de seminar
**Conf. dr. habil. Lavinia
Curecheriu**

Conf. dr. Ioan Dumitru,

Conf. dr. Ioan Dumitru

Data avizării în departament

Director de departament
Conf. dr. habil. Iordana Aștefănoaei



FIȘA DISCIPLINEI

2023/2024

1. Date despre program

1.1 Instituția de învățământ 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	Physics for Advanced Technologies

2. Date despre disciplină

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

* OB – Obligatoriu / OP – Opțional

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

3.1 Număr de ore pe săptămână	4	din care: 3.2 curs	2	3.3 laborator	2
3.4 Total ore din planul de învățământ	56	din care: 3.5 curs	28	3.6 laborator	28
Distribuția fondului de timp					ore
Studiu după manual, suport de curs, bibliografie și altele					41
Documentare suplimentară în bibliotecă, pe platformele electronice de specialitate și pe teren					38
Pregătire seminarii/laboratoare, teme, referate, portofolii și eseuri					30
Tutoriat					8
Examinări					2
Alte activități					0
3.7 Total ore studiu individual					119
3.8 Total ore pe semestru					175
3.9 Număr de credite					7

4. Precondiții (dacă este cazul)

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

5. Condiții (dacă este cazul)

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



6. Competențe specifice acumulate

Competențe 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;
Competențe 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 competențelor 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 successfully finalizing this course, the students will be able to: <ul style="list-style-type: none">▪ 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. Conținut

8.1	Curs	Metode de predare	Observații (ore și referințe bibliografice)
1	Generalities. Systems, models and simulations. Errors in numerical calculus: the machine constant and the floating point round-off error.	Lecture, exemplification	2
2	Maple/Maxima programming platform and Python languages: how are they comparing to other programming environments, advantages and disadvantages.	Lecture, exemplification	2
3	The trajectory of a body in a 2D gravitational field: <ul style="list-style-type: none">- 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
4	Finding the trajectory of a body in gravitational field – wind effect (numerically solving the equation of motion).	Lecture, exemplification	2



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

Bibliografie**Referințe:**

- [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.

Referințe suplimentare:

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

8.2	Seminar / Laborator	Metode de predare	Observații (ore și referințe bibliografice)
1.	Errors in numerical calculus.	Problem solving	2
2 - 4	Basic elements of Maple. Differences when comparing Maple with a classical programming language. Advantages. Disadvantages.	Problem solving	6
5 - 6	Physical fields. Visualization.	Problem solving	4
7	Practical work - evaluation	Problem solving	2
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



12 - 14	Numerical study of chaotic systems. Chaotic vs. random.	Problem solving	4
Bibliografie http://stoner.phys.uaic.ro/moodle/ L. Stoleriu, A. Stancu, Introducere in modelarea si simularea proceselor fizice, Ed. Tehnopress, 2007.			

9. Coroborarea conținutului disciplinei cu așteptările reprezentanților comunității, asociațiilor profesionale și 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	50%
10.5 Seminar/Laborator		Two practical tests	50%
10.6 Standard minim de performanță			
Identifying and using basic IT notion, comparing data from numerical models 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
27.09.2023

Titular de curs
Prof. dr. Laurențiu STOLERIU

Titular de laborator
Prof. dr. Laurențiu STOLERIU

Data avizării în departament

Director de departament
Conf. dr. Iordana AȘTEFĂNOAEI



FIȘA DISCIPLINEI

2023/2024

1. Date despre program

1.1 Instituția de învățământ superior	Universitatea “Alexandru Ioan Cuza” din Iași
1.2 Facultatea	Facultatea de Fizică
1.3 Departamentul	Fizică
1.4 Domeniul de studii	PHYSICS FOR ADVANCED TECHNOLOGIES
1.5 Ciclul de studii	MASTER
1.6 Programul de studii / Calificarea	Fizica pentru tehnologii avansate

2. Date despre disciplină

2.1 Denumirea disciplinei	VIRTUAL INSTRUMENTATION						
2.2 Titularul activităților de curs	Lect. Dr. Cătălin AGHEORGHIESEI						
2.3 Titularul activităților de seminar	Lect. Dr. Cătălin AGHEORGHIESEI						
2.4 An de studiu	1	2.5 Semestru	1	2.6 Tip de evaluare	E	2.7 Regimul disciplinei*	CO

* OB – Obligatoriu / OP – Opțional

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

3.1 Număr de ore pe săptămână	4	din care: 3.2 curs	2	3.3 seminar/laborator	2
3.4 Total ore din planul de învățământ	56	din care: 3.5 curs	28	3.6 seminar/laborator	28
Distribuția fondului de timp					ore
Studiu după manual, suport de curs, bibliografie și altele					45
Documentare suplimentară în bibliotecă, pe platformele electronice de specialitate și pe teren					34
Pregătire seminarii/laboratoare, teme, referate, portofolii și eseuri					20
Tutoriat					6
Examinări					4
Alte activități Proiect individual					10
3.7 Total ore studiu individual					119
3.8 Total ore pe semestru					175
3.9 Număr de credite					7

4. Precondiții (dacă este cazul)

4.1 De curriculum	Electricity and magnetism, Electronics, Computer programming
4.2 De competențe	- basics of proper use of laboratory and research instruments - basics of electric and electronic circuits

5. Condiții (dacă este cazul)

5.1 De desfășurare a cursului	Classroom equipped with: screen, projector, computer
5.2 De desfășurare a seminarului/ laboratorului	Laboratory room equipped with scientific equipment and related consumables: acquisition boards, software LabVIEW, oscilloscope, power programmable sources



6. Competențe specifice acumulate

Competențe 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 to teach Physics at secondary and post-secondary education levels; C4. capacity of interrelating and team working; C5. application of Physics knowledge to practical situations; C6. opening to lifelong learning.
Competențe transversale	CT1. mastery of research methods and techniques, specific to the specialization Biophysics and Medical Physics; 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 competențelor specifice acumulate)

7.1 Obiectivul general	Knowledge of the analog and digital experimental measuring methods;
7.2 Obiectivele specifice	On successful completion of this subject, students will be able to: 1. Understanding of the data acquisition system; 2. Ability to analyze and design an virtual acquisition systems of different experimental devices; 3. Awareness of the typical problems in virtual instrumentation, according to the mainstream scientific literature of the last decade

8. Conținut

8.1	Curs	Metode de predare	Observații (ore și referințe bibliografice)
1.	Introduction	Lectures, problems solving	2hours, Refs. 1-6
2.	I. Measuring and control experimental systems – analog systems	Lectures, problems solving	2hours, Refs. 1,2,5
3.	I. Measuring and control experimental systems – digital systems	Lectures, problems solving	2hours, Refs 1,2,5
4.	II. Data acquisition – Data acquisition board	Lectures, problems solving	2hours, Refs 1,2,5
5.	II. Data acquisition – Serial port RS-232, USB	Lectures, problems solving	2hours, Refs 1,2,5



6.	II. Data acquisition – Parallel port IEEE-1284	Lectures, problems solving	2hours, Refs 1,2,5
7.	II. Data acquisition – GPIB port IEEE 488.2	Lectures, problems solving	2hours, Refs 1,2,5
8.	III. Virtual instrumentation programming in LabVIEW – Introduction (front panel, block diagram)	Lectures, problems solving	2hours, Refs 3,4,6
9.	III. Virtual instrumentation programming in LabVIEW – Data types and operators	Lectures, problems solving	2hours, Refs 3,4,6
10.	III. Virtual instrumentation programming in LabVIEW – LabVIEW commands	Lectures, problems solving	2hours, Refs 3,4,6
11.	III. Virtual instrumentation programming in LabVIEW – Graphics in LabVIEW	Lectures, problems solving	2hours, Refs 3,4,6
12.	III. Virtual instrumentation programming in LabVIEW – Design Virtual Instruments in LabVIEW	Lectures, problems solving	2hours, Refs 3,4,6
13.	III. Virtual instrumentation programming in LabVIEW – Advanced Topics	Lectures, problems solving	2hours, Refs 3,4,6
14.	Reviews in Virtual Instrumentation	Lectures, problems solving	2hours, Refs 3,4,6

Bibliografie

Main References:

1. Robert A.Witte, Analog and Digital Measurements, Prentice Hall PTR, 2002
2. John Turner and Martyn Hill, Instrumentation for Engineers and Scientists, Oxford University Press Inc. NY, 1999
3. LabView Tutorial Manual, National InstrumentsCorp., 1996 (www.ni.com).
4. LabVIEW. Basics Course Manual, National Instruments Corp., USA, 1998.

Further References:

5. Tran Tien Lang, Electronics of Measuring Systems: Practical Implementation of Analogue and Digital Techniques, John Wiley & Sons Inc., 1987
6. LabVIEW. Advanced Couse Manual, National Instruments Corp., USA, 1998

8.2	Seminar / Laborator	Metode de predare	Observații (ore și referințe bibliografice)
1.	LabVIEW startup	Problems solving, discussions, practical problems	2 hours, Refs 1-3
2.	Programming structures in LabVIEW	Problems solving, discussions, practical problems	2 hours, Refs 1-3
3.	Data structures used in virtual instrumentation	Problems solving, discussions, practical problems	2 hours, Refs 1-3
4.	Clusters, Files and Nodes	Problems solving, discussions, practical problems	2 hours, Refs 1-3
5.	Virtual instrumentation design	Problems solving, discussions, practical problems	2 hours, Refs 1-3



6.	Analogic signals acquisition (part I)	Problems solving, discussions, practical problems	2 hours, Refs 1-3
7.	Analogic signals acquisition (part II)	Problems solving, discussions, practical problems	2 hours, Refs 1-3
8.	Graphics and special functions in LabVIEW I	Problems solving, discussions, practical problems	2 hours, Refs 1-3
9.	Graphics and special functions in LabVIEW II	Problems solving, discussions, practical problems	2 hours, Refs 1-3
10.	Digital port control using virtual instrumentation I	Problems solving, discussions, practical problems	2 hours, Refs 1-3
11.	Digital port control using virtual instrumentation II	Problems solving, discussions, practical problems	2 hours, Refs 1-3
12.	Individual student practical using LabVIEW	Problems solving, discussions, practical problems	2 hours, Refs 1-3
13.	Individual student practical using LabVIEW	Problems solving, discussions, practical problems	2 hours, Refs 1-3
14.	Individual student practical using LabVIEW	Problems solving, discussions, practical problems	2 hours, Refs 1-3
References 1. LabView Tutorial Manual, National Instruments Corp., 1996 (www.ni.com). 2. LabVIEW. Basics Course Manual, National Instruments Corp., USA, 1998. 3. LabVIEW. Advanced Course Manual, National Instruments Corp., USA, 1998			

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

Course content is consistent with the virtual instrumentation techniques used in scientific and research laboratories in the country and abroad.

10. Evaluare

Tip activitate	10.1 Criterii de evaluare	10.2 Metode de evaluare	10.3 Pondere în nota finală (%)
10.4 Curs	active participation in the class activities	Final exam	50
10.5 Seminar/ Laborator	active participation to labs activities	Weekly monitoring of the projects progress, final presentation of the project on the chosen topic	50
10.6 Standard minim de performanță			
Independent analysis of a typical design for virtual instrumentation, using LabVIEW programming			

Data completării
30.09.2023

Titular de curs
Lect. Dr. Cătălin AGHEORGHIIESEI

Titular de laborator
Lect. Dr. Cătălin AGHEORGHIIESEI

Data avizării în departament

Director de departament
Conf. Dr. Iordana AȘTEFĂNOAIE

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

1.1 Instituția de învățământ superior	Universitatea “Alexandru Ioan Cuza” din Iași
1.2 Facultatea	Faculty of Physics
1.3 Departamentul	Physics
1.4 Domeniul de studii	Physics
1.5 Ciclul de studii	Master
1.6 Programul de studii / Calificarea	PHYSICS FOR ADVANCED TEHNOLOGIES

2. Date despre disciplină

2.1 Denumirea disciplinei	Optical Spectroscopy: methods and instrumentation						
2.2 Titularul activităților de curs	Conf. dr. Valentin POHOAȚĂ						
2.3 Titularul activităților de seminar	Conf. dr. Valentin POHOAȚĂ						
2.4 An de studiu	2	2.5 Semestru	1	2.6 Tip de evaluare	EVP	2.7 Regimul disciplinei*	OP

* OB – Obligatoriu / OP – Opțional

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

3.1 Număr de ore pe săptămână	4	din care: 3.2 curs	2	3.3 seminar/laborator	2
3.4 Total ore din planul de învățământ	56	din care: 3.5 curs	28	3.6 seminar/laborator	28
Distribuția fondului de timp					ore
Studii după manual, suport de curs, bibliografie și altele					25
Documentare suplimentară în bibliotecă, pe platformele electronice de specialitate și pe teren					15
Pregătire seminarii/laboratoare, teme, referate, portofolii și eseuri					4
Tutoriat					6
Examinări					4
Alte activități					
3.7 Total ore studiu individual					69
3.8 Total ore pe semestru					125
3.9 Număr de credite					5

4. Precondiții (dacă este cazul)

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

5. Condiții (dacă este cazul)

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



6. Competențe specifice acumulate

Competențe 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 interrelating and teamworking Application of Physics knowledge to practical situations Opening to lifelong learning
Competențe 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 competențelor 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	<ul style="list-style-type: none">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. Conținut

8.1	Curs On-line și On-site	Metode de predare	Observații (ore și referințe 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 spectrophotometer, 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, van der Waals, 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**Referințe principale:**

- 1.A. Vlahovici, Metode optice si spectrale de analiza, Ed. Univ. "Al. I. Cuza" Iasi, 2002;
- 2.M. Delibaș, Optică și spectroscopie, Iași, 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 și practica spectroscopiei, București, 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 experimentală, 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 și On-site	Metode de predare	Observații (ore și referințe 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, Nabu 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, Aurélie 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 conținutului disciplinei cu așteptările reprezentanților comunității, asociațiilor profesionale și angajatorilor reprezentativi din domeniul aferent programului**

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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 performanță			
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
23.09.2023Titular de curs
Conf. Dr. Valentin PohoățTitular de seminar
Conf. dr. Valentin POHOAȚĂ

Data avizării în departament

Director de departament
Conf. Dr. Iordana Aștefanoaei