DI 101F.EN Real and Complex Analysis

1. Study program

1.1. University	University of Bucharest
1.2. Faculty	Faculty of Physics
1.3. Department	Department of Theoretical physics, Mathematics, Optics, Plasma, and Lasers
1.4. Field of study	Physics
1.5. Course of study	Undergraduate/Bachelor of Science
1.6. Study program	Physics (in English)
1.7. Study mode	Full-time study

2. Course unit

2.1. Course unit title	**Real and Complex Analysis**							
2.2. Teacher				**Prof. dr. Claudia Timofte**				
2.3. Tutorials/Practicals instructor(s)				**Prof. dr. Claudia Timofte**				
2.4. Year of study	1	2.5. Semester	I	2.6. Type of evaluation	E	2.7. Type of course unit	Content[1)]	**DC**
							Type[2)]	**DI**

[1)] fundamental (DF), speciality (DS), complementary (DC); [2)] compulsory (DI), elective (DO), optional (DFac)

3. Total estimated time (hours/semester)

3.1. Hours per week in curriculum	**6**	distribution: Lecture	**3**	Practicals/Tutorials	**3**
3.2. Total hours per semester	**84**	distribution: Lecture	**42**	Practicals/Tutorials	**42**

Distribution of estimated time for study	**hours**
3.2.1. Learning by using one's own course notes, manuals, lecture notes, bibliography	**30**
3.2.2. Research in library, study of electronic resources, field research	**27**
3.2.3. Preparation for practicals/tutorials/projects/reports/homeworks	**30**
3.2.4. Examination	**4**
3.2.5. Other activities	**0**

3.3. Total hours of individual study	**87**
3.4. Total hours per semester	**175**
3.5. ECTS	**7**

4. Prerequisites (if necessary)

4.1. curriculum	High school mathematics courses
4.2. competences	Not applicable

5. Conditions/Infrastructure (if necessary)

5.1. for lecture	Multimedia infrastructure (video projector, PC). Lecture notes. Recommended bibliography.
5.2. for practicals/tutorials	Video projector, PC.

6. Specific competences acquired

Professional competences	C1. The identification and the appropriate use of the main physical laws and principles in a given context. C2. The use of suitable software packages for data analysis and processing. C3. Solving physics problems under given conditions using analytical, numerical and statistical methods. C5. The ability to analyse and to communicate the didactic, scientific and popularization information of Physics.
Transversal competences	CT3 - The efficient use of the information sources and of the communication and professional development resources in Romanian and in a widely used foreign language (English), as well.

7. Course objectives

7.1. General objective	• Knowledge and understanding: knowledge and appropriate use of the specific notions of mathematical analysis. • Achieving a thorough theoretical knowledge. • Gaining computation skills.
7.2. Specific objectives	• Knowledge and appropriate use of the fundamental concepts of mathematical analysis. • Developing the ability to work in a team. • Developing computational skills. • The use of MATHEMATICA software for dealing with differential calculus problems.

8. Contents

8.1. Lecture [chapters]	Teaching techniques	Observations
Metric spaces. Normed spaces. Spaces with scalar product. Real and complex Euclidean spaces.	Systematic exposition - lecture. Examples.	4 hours
Sequences of real and complex numbers. Convergent and fundamental sequences. Complete spaces. Series in normed spaces. Number series. Convergence tests.	Systematic exposition - lecture. Examples.	6 hours
Limits of functions. Continuous functions. Continuous functions on compact sets. Uniform continuity. Connected sets.	Systematic exposition - lecture. Examples.	6 hours
Differentiable functions on R^n. Partial derivatives. Jacobi matrix. Differential operators : gradient, divergence, curl. Applications in mechanics.	Systematic exposition - lecture. Examples.	10 hours
Higher order differentials. Taylor's formula. Local extrema. Implicit functions and systems of implicit functions.	Systematic exposition - lecture. Examples.	6 hours
Sequences and series of functions. Pointwise and uniform convergence.	Systematic exposition - lecture. Critical analysis. Examples.	2 hours
Power series. Taylor series. Trigonometric series. Fourier series. Applications to physics.	Systematic exposition - lecture. Examples.	4 hours
Integrable functions. Improper integrals. Parameter-dependent integrals. Improper integrals depending on parameters. Euler's	Systematic exposition - lecture. Examples.	4 hours

functions.		

Bibliography:

- G. Arfken, H. Weber, “Mathematical Methods for Physicists”, Elsevier Academic Press, 2005.
- P. Bamberg, S. Sternberg, “A Course in Mathematics for Students of Physics”, Cambridge University Press, 1990.
- N. Cotfas, L. Cotfas, “Elements of Mathematical Analysis” (in Romanian), Editura Universității din București, 2010.
- R. Courant, “Differential and Integral Calculus”, Wiley, New York, 1992.
- A. Halanay, V. Olariu, S. Turbatu, “Mathematical Analysis” (in Romanian), E.D. P., 1983.
- W. Rudin, “Principles of Mathematical Analysis”, McGraw-Hill, New York, 1964.
- D. Stefănescu, “Real Analysis” (in Romanian), Editura Universității din București, 1990.
- C. Timofte, ‘’Differential Calculus ‘’, Editura Universității din București, 2009.
- C. Timofte, ‘’Complex Analysis ‘’, Editura Universității din București, 2014.

8.2. Tutorials	Teaching and learning techniques	Observations
The seminar follows the course content. The issues to be discussed are meant to provide the student with a deep understanding of the theoretical concepts presented during the course, to develop computing skills and the appropriate use of the basic concepts of real and complex analysis.	Exposition. Guided work.	

Bibliography:

L. Aramă, T. Morozan, “Problems of Differential and Integral Calculus” (in Romanian), Ed.Tehnică, Bucureşti, 1978.

Armeanu, D. Blideanu, N. Cotfas, I. Popescu, I. Şandru, ‘’Problems of Complex Analysis’’ (in Romanian), Ed.Tehnică, 1995.

Gh. Bucur, E. Câmpu, S. Găină, “Problems of Differential and Integral Calculus” (in Romanian), vol. I- III, Ed.Tehnică, Bucureşti, 1978.

Demidovich, B., “Problems in Mathematical Analysis”, Mir Publishers, Moscow, 1977.

N. Donciu, D. Flondor, “Mathematical Analysis. Problems” (in Romanian), Editura ALL, 1998.

D. Ştefănescu, S. Turbatu, ‘’Analytical Functions. Problems’’ (in Romanian), Universitatea din București, 1986.

8.3. Practicals	Teaching and learning techniques	Observations

8.4. Project	Teaching and learning techniques	Observations

9. Compatibility of the course unit contents with the expectations of the representatives of epistemic communities, professional associations and employers (in the field of the study program)

This course unit develops some theoretical and practical competences and abilities, which are important for an undergraduate student in the field of modern Physics, corresponding to national and international standards. The contents and teaching methods were selected after a thorough analysis of the contents of similar course units in the syllabus of other universities from Romania or the

European Union. The contents are in line with the requirements of the main employers of the graduates (industry, research, secondary school teaching).

10. Assessment

Activity type	10.1. Assessment criteria	10.2. Assessment methods	10.3. Weight in final mark
10.4. Lecture	- coherence and clarity of exposition; - correct use of mathematical methods and techniques; - ability to analyse specific examples.	Written test/oral examination	80%
10.5.1. Tutorials	- ability to use specific problem solving methods; - ability to analyse the results; - ability to present and discuss the results.	Homeworks/written tests	20%
10.5.2. Practicals			
10.5.3. Project			
10.6. Minimal requirements for passing the exam			
Requirements for mark 5 (10 points scale) Fulfillment of at least 50% of each of the criteria that determine the final grade.			

Date	Teacher's name and signature	Practicals/Tutorials instructor(s) name(s) and signature(s)
29.04.2016	Prof. dr. Claudia Timofte	Prof. dr. Claudia Timofte

Date of approval

Head of Department

Prof. dr. Virgil Băran

DI 102F.EN Algebra, Geometry and Differential Equations

1. Study program

1.1. University	University of Bucharest
1.2. Faculty	Faculty of Physics
1.3. Department	Department of Theoretical physics, Mathematics, Optics, Plasma, and Lasers
1.4. Field of study	Physics
1.5. Course of study	Undergraduate/Bachelor of Science
1.6. Study program	Physics (in English)
1.7. Study mode	Full-time study

2. Course unit

2.1. Course unit title	**Algebra, Geometry and Differential Equations**							
2.2. Teacher				Prof. Dr. Doru Ștefănescu				
2.3. Tutorials/Practicals instructor(s)				Prof. Dr. Doru Ștefănescu				
2.4. Year of study	I	2.5. Semester	I	2.6. Type of evaluation	E	2.7. Type of course unit	Content[1)]	**DC**
							Type[2)]	**DI**

[1)] fundamental (DF), speciality (DS), complementary (DC); [2)] compulsory (DI), elective (DO), optional (DFac)

3. Total estimated time (hours/semester)

3.1. Hours per week in curriculum	**6**	distribution: Lecture	**3**	Practicals/Tutorials	**3**
3.2. Total hours per semester	**84**	distribution: 1-st semester	**84**	2-nd semester	**0**

Distribution of estimated time for study	**hours**
3.2.1. Learning by using one's own course notes, manuals, lecture notes, bibliography	30
3.2.2. Research in library, study of electronic resources, field research	27
3.2.3. Preparation for practicals/tutorials/projects/reports/homeworks	30
3.2.4. Examination	**4**
3.2.5. Other activities	**0**

3.3. Total hours of individual study	**87**
3.4. Total hours per semester	**175**
3.5. ECTS	**7**

4. Prerequisites (if necessary)

4.1. curriculum	High school mathematics courses
4.2. competences	

5. Conditions/Infrastructure (if necessary)

5.1. for lecture	Multimedia room (with video projector). Lecture notes. Recommended bibliography.
5.2. for practicals/tutorials	Video projector. Computers.

6. Specific competences acquired

Professional competences	C1. The identification and the appropriate use of the main physical laws and principles in a given context. C3. Solving physics problems under given conditions using analytical, numerical and statistical methods. C4 – Applying of knowkledge of Physics to concrete contexts in Physics and to experiments. C5 – Communication and analysis of information from Physics, with didactic purpose or for research and popularization. C6 – Interdisciplinary approach of some physical subjects.
Transversal competences	CT3 - The efficient use of the information sources and of the communication and professional development resources in Romanian and in a widely used foreign language, as well.

7. Course objectives

7.1. General objective	• Knowledge, understanding and appropriate use of the specific notions of linear algebra, geometry and of some methods of integration of some ordinary differential equations. • Achieving a thorough theoretical knowledge. • Gaining computing skills.
7.2. Specific objectives	- Knowledge and appropriate use of the fundamental notions of linear algebra. - Developing computing skills. - Developing the ability to apply appropriate methods for modeling of physical phenomena.

8. Contents

8.1. Lecture [chapters]	Teaching techniques	Observations
ALGEBRAIC STRUCTURES (Review). VECTOR SPACES. Linear independence. Subspaces. The span of a set of vectors. Basis and dimension of a vector space.	Systematic exposition - lecture. Critical analysis. Examples.	6 hours
The change of basis matrix. The change of coordinates of a vector at the change of basis. Sums and intersections of subspaces. Direct sums of subspaces. Complements of a subspace. Factor spaces. Lines, planes, hyperplanes**.**	Systematic exposition - lecture. Critical analysis. Examples.	6 hours
MATRICES. Linear maps (linear transformations). The image (range) and the kernel of a linear map. Isomorphism of vector spaces. The matrix associated to a linear map with respect to a pair of bases. Operations with matrices. The change of associated matrix at the change of bases. The algebra of matrices and geometrical optics.	Systematic exposition - lecture. Critical analysis. Examples.	6 hours
LINEAR SYSTEMS. Gauss-Jordan elimination, applications to linear systems and to finding the rank or the inverse of a matrix. Determinants. Solving linear systems.	Systematic exposition - lecture. Critical analysis. Examples.	3 hours
EUCLIDEAN SPACES. Inner product. Orthogonality. Orthogonal bases, orthonormal bases. The Gram-Schmidt orthogonalisation method.. The	Systematic exposition - lecture. Critical analysis. Examples.	3 hours

orthogonal complement of a subspace. Description of quantic systems through finite dimensional Hilbert spaces.		
QUADRATIC FORMS. The Law of Inertia. The normal (canonical) form of a quadratic form.	Systematic exposition - lecture. Critical analysis. Examples.	3 hours
COMPLEMENTS OF VECTOR CALCULUS. Cross product. Mixed product. Applications to physics problems. TENSOR PRODUCT. Linear forms and bilinear forms . The dual space. The bidual space. The dual basis and the canonical isomorphism. Multilinear maps and multilinear forms. Tensors. Operations with tensors. The change of coordinates of a tensor at a change of basis.	Systematic exposition - lecture. Critical analysis. Examples.	6 hours
MATRIX STRUCTURE. Eigenvalues and eigenvectors. The characteristic polynomial. Invariant subspaces. The structure of linear operators. Diagonalisation. The adjoint of a linear operator. Self-adjoint operators. Orthogonal operators.	Systematic exposition - lecture. Critical analysis. Examples.	3 hours
APPLICATIONS IN GEOMETRY. Affine spaces and transformations. Affine subspaces. Affine frames. Quadrics. The normalized equation of a quadric. The classification of quadrics.	Systematic exposition - lecture. Critical analysis. Examples.	3 hours
DIFFERENTIAL EQUATIONS. Ordinary differential equations : of first order, of higher order, linear, with constant coefficients.	Systematic exposition - lecture. Critical analysis. Examples.	3 hours

Bibliography:
V. Barbu, *Ecuații diferențiale*, Ed. Junimea, 1985.
D. Blideanu, I. Popescu, D. Ștefănescu, *Probleme de algebră liniară*, Ed. Univ. București (1986).
N. Cotfas, *Elemente de algebră liniară* , Ed. Univ. București, 2009.
A. Givental, *Linear Algebra and Differential Equations*, (Berkeley Mathematics Lecture Notes, vol. 11) AMS (2001).
A. I. Kostrikin, Yu. I. Manin, *Linear Algebra and Geometry,* Gordon and Breach Science Publishers (1989).
S. Lang, *Linear Algebra*, Springer (2007).
D. Ștefănescu, *Modele matematice în fizică*, Ed. Univ. București (1984).
E. B. Vinberg, *A Course in Algebra*, (Graduate studies in Mathematics, vol. 56) AMS (2003).

8.2. Tutorials [main themes]	Teaching and learning techniques	Observations
The seminar follows the course content. The issues to be discussed are meant to provide the student with a deep understanding of the theoretical concepts presented during the course, to develop computing skills and the appropriate use of the basic concepts of linear algebra, geometry and ordinary differential equations presented in lectures.	Exposition. Guided work	42 hours
Bibliography: the same as for the Lecture.		

8.3. Practicals [practical activities, projects, etc.]	Teaching and learning techniques	Observations
Bibliography:		
8.4. Project	Teaching and learning techniques	Observations
Bibliography:		

9. Compatibility of the course unit contents with the expectations of the representatives of epistemic communities, professional associations and employers (in the field of the study program)

This course unit develops some theoretical and practical competences and abilities which are important for an undergraduate student in the field of modern Physics, corresponding to national and international standards. The contents and teaching methods were selected after a thorough analysis of the contents of similar course units in the syllabus of other universities from Romania or the European Union. The contents are in line with the requirements of the main employers of the graduates (industry, research, secondary school teaching).

10. Assessment

Activity type	10.1. Assessment criteria	10.2. Assessment methods	10.3. Weight in final mark
10.4. Lecture	- coherence and clarity of exposition - correct use of mathematical methods and theories - ability to analyse specific examples	Written test/oral examination	80%
10.5.1. Tutorials	- ability to use specific problem solving methods - ability to analyse the results - ability to present and discuss the results.	Homeworks/written tests	20%
10.5.2. Practicals			
10.5.3. Project			
10.6. Minimal requirements for passing the exam			
Requirements for mark 5 (10 points scale) Fulfillment of at least 50% of each of the criteria that determine the final grade.			

Date
21.04.2016

Teacher's name and signature

Prof. Dr. Doru Ștefănescu

Practicals/Tutorials instructor(s) name(s) and signature(s)

Prof. Dr. Doru Ștefănescu

Date of approval

Head of Department
Prof. dr. Virgil Băran

DI 103F.EN Mechanics

1. Study program

1.1. University	University of Bucharest
1.2. Faculty	Faculty of Physics
1.3. Department	Department of Structure of the Matter, Earth and Atmospheric Physics, Astrophysics
1.4. Field of study	Physics
1.5. Course of study	Undergraduate/Bachelor of Science
1.6. Study program	Physics (in English)
1.7. Study mode	Full-time study

2. Course unit

2.1. Course unit title	**Mechanics**							
2.2. Teacher				**Lector. Dr. Catalin Berlic**				
2.3. Tutorials/Practicals instructor(s)				**Lect. Dr. Cristina Miron, Asist. Dr. Oana Dobrescu**				
2.4. Year of study	1	2.5. Semester	I	2.6. Type of evaluation	E	2.7. Type of course unit	Content[1)]	**DF**
							Type[2)]	**DI**

[1)] fundamental (DF), speciality (DS), complementary (DC); [2)] compulsory (DI), elective (DO), optional (DFac)

3. Total estimated time (hours/semester)

3.1. Hours per week in curriculum	**8**	distribution: Lecture	**4**	Practical/Tutorials	**4**
3.2. Total hours per semester	**112**	distribution: 1-st semester	**112**	2-nd semester	**0**

Distribution of estimated time for study	**hours**
3.2.1. Learning by using one's own course notes, manuals, lecture notes, bibliography	**28**
3.2.2. Research in library, study of electronic resources, field research	**26**
3.2.3. Preparation for practical/tutorials/projects/reports/homework	**30**
3.2.4. Examination	**4**
3.2.5. Other activities	**0**

3.3. Total hours of individual study	**84**
3.4. Total hours per semester	**200**
3.5. ECTS	**8**

4. Prerequisites (if necessary)

4.1. curriculum	Not applicable
4.2. competences	Good level of understanding of algebraic calculation, of the geometry, trigonometry and elementary math analysis.

5. Conditions/Infrastructure (if necessary)

5.1. for lecture	Multimedia room equipped with computer and video-projector. Lecture Notes. Recommended reading.
5.2. for practicals/tutorials	Laboratory facilities necessary for carrying out practical works. Computer, video-projector, software packages for data analysis and processing.

	Internet connection. Seminar room.

6. Specific competences acquired

Professional competences	C1 - Identification and proper use of the key laws and principles of physics in a given context. - 2 credits C2 – Solving imposed condition physics problems - 2 credits C4 - Apply knowledge of physics in experiments using standard laboratory equipment - 1 credit C5 – Communication and analysis of didactic, scientific and dissemination of information - 1 credit
Transversal competences	CT1- Achievement of the professional duties in an efficient and responsible way with compliance with deontological legislation specific to the domain under qualified assistance. - 1 credit CT3 - Effective use of information, communication and training assistance, both in Romanian and in a foreign language. - 1 credit

7. Course objectives

7.1. General objective	Assimilation of the concepts in the domains, develop the ability to perform and interpret experimental works and solving specific problems in classical mechanics.
7.2. Specific objectives	- Acquiring the ability to understand infinitesimal mechanical motion; - Learning from simple (mass point) to complex (system of mass points) following specific conservation laws; - Acquiring the ability to solve exercises of classical mechanics and to formulate rigorous and substantiated theoretical conclusions; - Developing the capacity to perform and/or design experiments in order to check the laws of the classical mechanics; - Develop the ability to carry out a presentation of a project with a specific theme. - Acquisition of a profound theoretical understanding of the studied topic. - knowledge of specific physical theories/models - developing the ability to work in a team - knowledge and use of specific experimental methods

8. Contents

8.1. Lecture [chapters]	Teaching techniques	Observations
1. Introduction. Role of the mechanics between classical branches of physics. Fundamental concepts: space, time, mass. Units of measure. Dimensional analysis.	Systematic exposition - lecture. Heuristic conversation. Critical analysis. Examples	2 hours
2. Scalar and vector quantities. Addition and subtraction of vectors. Dot product, cross product. Versors. **3. Coordinate systems in plane and space.** Cartesian coordinates. Versors coordinate axes. Polar Coordinates. Spherical coordinates. Cylindrical coordinates.	Systematic exposition - lecture. Heuristic conversation. Critical analysis. Examples	2 hours
4. Kinematics of the mass point. Trajectory. Equation of movement. Velocity. Average and instantaneous velocity. Vector velocity. Cartesian components of the velocity. Hodograph. Acceleration. Average and	Systematic exposition - lecture. Heuristic conversation. Critical analysis. Examples	2 hours

instantaneous velocity. Vector acceleration. Cartesian components of the acceleration. Frénet formula. Curvature radius of the trajectory. Normal and tangential acceleration.		
5. Movement types of the mass point. Curvilinear movement. Movement with constant vector acceleration. Uniform rectilinear motion. Uniform variate rectilinear movement. Oblique throw in vacuum. Circular movement. Helical motion.	Systematic exposition - lecture. Heuristic conversation. Critical analysis. Examples	2 hours
6. Laws of the mechanics. Statements and discussion. Definition of the linear momentum. Inertial and non-inertial reference systems. Galilei transformations.	Systematic exposition - lecture. Heuristic conversation. Critical analysis. Examples	2 hours
7. Movement of the mass point under the influence of different types of forces. Constant force. Time dependent force. Velocity dependent force. Air friction. Position dependent force. Application to the dynamics of the harmonic oscillator. Gravitational pendulum.	Systematic exposition - lecture. Heuristic conversation. Critical analysis. Examples	4 hours
8. Dynamics of the mass point. Theorem of the variation of the linear momentum of the mass point. Torque. Angular momentum. Theorem of the variation of the angular momentum of the mass point. Work. Power. Kinetic energy. Theorem of the variation of the kinetic energy of the mass point. Potential energy. Conservative forces. Total energy. Conservation of the energy. Friction and friction forces.	Systematic exposition - lecture. Heuristic conversation. Critical analysis. Examples	4 hours
9. Dynamics of a system of particles. Definition of the system of particles. Internal and external forces. Theorem of the variation of the linear momentum of a system of particles. Theorem of the variation of the angular momentum of a system of particles. Theorem of the variation of the total kinetic energy. Energy conservation for a system of particles. Mass centre. Movement around the mass centre. Decomposition theorems.	Systematic exposition - lecture. Heuristic conversation. Critical analysis. Examples	4 hours
10. Collisions. Conservation laws. Plastic collision. Elastic collision. Collision coefficients.	Systematic exposition - lecture. Heuristic conversation. Critical analysis. Examples	2 hours
11. Kinematics of the rigid body. Translation and rotation. Poisson formula. Euler formula. Helical movement. Chasles theorem. Distribution of the accelerations. Rivals theorem. Plane movement.	Systematic exposition - lecture. Heuristic conversation. Critical analysis. Examples	4 hours
12. Dynamics of rigid-bodies. Kinetic energy	Systematic exposition -	4 hours

of rotation of a rigid body. Angular momentum relative to the rotation axis. Work. Power. Moments of inertia. Rotational angular momentum. Derivative of the rotational angular momentum. Derivative Kinetic energy of rotation. General expression of the angular momentum. Principal moment of inertia and principal axes. Steiner Theorem. Perpendicular axis theorem**.** Calculus of the moments of inertia. Torsion Pendulum. Physics Pendulum. Gyroscope.	lecture. Heuristic conversation. Critical analysis. Examples	
13. Statics of a rigid-bodies. Couple of forces. Resultant of two parallel forces. Reduction of a system of forces. Varignon Theorem. Condition of equilibrium of a rigid body. Applications. Center of gravity. Guldin - Pappus's Theorems.	Systematic exposition - lecture. Heuristic conversation. Critical analysis. Examples	2 hours
14. Gravity. Kepler's Laws. Newton's Law of Universal Gravitation. Central force. Motion in the central force field. General properties of motion under a central force. Velocity and acceleration. Angular momentum. Binet equation. Integrals of motion. Types of trajectories. Gravitational field. Gravitational potential. Gravitational acceleration.	Systematic exposition - lecture. Heuristic conversation. Critical analysis. Examples	4 hours
15. Kinematics and dynamics in non-inertial frames of reference. Absolute, relative and transport movement. Composition of movements, velocities and accelerations. Non-inertial reference systems. Complementary forces. Coriolis force. Applications. Foucault Pendulum.	Systematic exposition - lecture. Heuristic conversation. Critical analysis. Examples	2 hours
16. Relativistic mechanics. Einstein's postulates. Lorentz transformations. Consequences of the Lorentz transformations: Length contraction, time dilatation, simultaneity. Velocity addition. Minkowski space. Spacetime diagrams. Relativistic dynamics: linear momentum, mass, force and energy.	Systematic exposition - lecture. Heuristic conversation. Critical analysis. Examples	2 hours
17. Mechanics of the elastic bodies. Stress and strain. Hooke Law. Elastic properties of a typical solid under normal stress. Lateral contraction. Compressibility. One-dimensional deformation of a rod due to the normal stress. Shear stress. Bending. Torsion of a wire.	Systematic exposition - lecture. Heuristic conversation. Critical analysis. Examples	2 hours
18. Fluid mechanics. Hydrostatics**.** Pascal law. Hydrostatic pressure. Archimedes' Principle. Applications. Hydrodynamics. Description of	Systematic exposition - lecture. Heuristic conversation. Critical	2 hours

the fluid flow. Stationary Flow. Equation of Continuity. Equation of Motion for the flow of an ideal fluid. Bernoulli's Equation. Applications. Viscosity and viscous flow. Poiseuille's law. Stokes' Equation. Turbulent flow. Reynolds Number.	analysis. Examples	
19. Oscillations. Simple harmonic oscillator. Superposition of two simple harmonic motions with same direction and same frequency. Superposition of two simple harmonic motions with same direction and different frequencies. Beats. Superposition of two simple harmonic motions with perpendicular directions and same frequency. Damped harmonic oscillator. Forced harmonic oscillator. Coupled oscillators.	Systematic exposition - lecture. Heuristic conversation. Critical analysis. Examples	4 hours
20. Waves. One-dimensional waves. Transversal waves. Longitudinal waves. Wave propagation. Plane wave. Deformation of solids produced by waves. Wave equation. Waves in solids. Longitudinal waves in liquids. Longitudinal waves in gases. Stationary waves. Huygens' principle. Interference. Diffraction. Reflection and refraction of waves. Doppler effect.	Systematic exposition - lecture. Heuristic conversation. Critical analysis. Examples	4 hours
21. Acoustic systems. Vibrating string. Equation of motion. Solution of the equation. Modes of vibration. Sound waves. Sound level. Sound analysis.	Systematic exposition - lecture. Heuristic conversation. Critical analysis. Examples	2 hours
Total		**56 hours**
Bibliography: 1. Walter Hauser – Introduction to the Principles of Mechanics, Addison-Wesley Publishing Company, 1966 2. A. P. Arya - Introduction to Classical Mechanics - 2nd Edition, Pearson, 1997 3. V. Dima, E. Barna, Mecanica si acustica. Probleme rezolvate, Editia a II-a revazuta si adaugita, Editura Universitatii din Bucuresti, 2006 4. A. Hristev - Mecanica si acustica Ed. Didactica si Pedagogica 1984 5. Lecture notes in electronic format that will be available on the faculty web-site		
8.2. Tutorials [main themes]	Teaching and learning techniques	Observations
Some specific theme	Guided work	2-4-6 hours
Bibliography: ...whatever you decide to indicate...		
8.3. Practicals [practical activities, projects, etc.]	Teaching and learning techniques	Observations
1. Introduction. Dimensional analysis. Errors and estimation of errors.	Guided practical activity	4 hours
2. Mathematical pendulum. Reversible	Guided practical	4 hours

pendulum.	activity	
3. The free fall. Determination of the sliding friction coefficient with tribometer.	Guided practical activity	4 hours
4. Mach pendulum. Maxwell pendulum.	Guided practical activity	4 hours
5. Dynamic study of the torsion. Physical pendulum.	Guided practical activity	4 hours
6. Gyroscope. Verification of the Steiner theorem	Guided practical activity	4 hours
7. Free surface of a liquid in rotational moving. The pycnometer.	Guided practical activity	4 hours
8. Superposition of two simple harmonic motions with perpendicular directions (Lissajous figures). Coupled oscillations on the linear air cushion.	Guided practical activity	4 hours
9. The wind tunnel. Resistance forces.	Guided practical activity	4 hours
10. Coupled pendulums.	Guided practical activity	4 hours
11. Study of the damped and forced oscillations using the Pohl pendulum.	Guided practical activity	4 hours
12. Determination of the shear modulus using torsion. Study of the torsion using an elastic rod. Parallel axis theorem.	Guided practical activity	4 hours
13. Measuring the speed of sound in the air using the König tube. Acoustic resonators.	Guided practical activity	4 hours
14. Laboratory exam	Exam	4 hours
Total		**56 hours**
Bibliography: 1. C. Ciucu, Cristina Miron, V. Barna, Mecanica fizica si acustica (I), Editia a IX-a, Editura Universitatii din Bucuresti, 2009. 2. E. Barna, C. Ciucu, Cristina Miron, V. Barna, C. Berlic, Mecanica fizica si acustica (II), Editia a IX-a, Editura Universitatii din Bucuresti, 2010.		
8.4. Project [only if included in syllabus]	Teaching and learning techniques	Observations
Bibliography: ...whatever you decide to indicate...		

9. Compatibility of the course unit contents with the expectations of the representatives of epistemic communities, professional associations and employers (in the field of the study program)

This course unit forms/develops some theoretical and/or practical competences and abilities which are fundamental for an undergraduate student in the field of modern Physics, corresponding to national and european/international standards. The contents and teaching methods were selected after a thorough analysis of the contents of similar course units in the syllabus of other universities from Romania or the European Union. The contents are in line with the requirements/expectations of the main employers of the graduates (industry, research, secondary school teaching).

10. Assessment

Activity type	10.1. Assessment criteria	10.2. Assessment methods	10.3. Weight in

			final mark
10.4. Lecture	- coherence and clarity of exposition - correct use of equations/mathematical methods/physical models and theories - ability to indicate/analyse specific examples	1. Partial examination. Written test examination of theoretical competences. 2. Final examination. Written and oral test examinations of theoretical competences.	20% 50%
10.5.1. Tutorials	- ability to use specific problem solving methods - ability to analyse the results	Homeworks/written tests	
10.5.2. Practicals	- ability to use specific experimental methods/apparatus - ability to perform/design specific experiments - ability to present and discuss the results	1. Lab reports 2. Examination	20% 10%
10.5.3. Project [only if included in syllabus]	- coherence and clarity of exposition - correct use of mathematical and physical methods/models - ability to use specific experimental methods/apparatus - ability to present and discuss the results	Report	
10.6. Minimal requirements for passing the exam Performing all laboratory work. Participating to minimum 50% of the lectures			
Requirements for mark 5 (10 points scale) Correct treatment of a an theoretical subject at final exam.			

Date	Teacher's name and signature Lector. Dr. Catalin Berlic	Practicals/Tutorials instructor(s) name(s) and signature(s) Lect. Dr. Cristina Miron, Asist. Dr. Oana Dobrescu

Date of approval

Head of Department
Prof. univ. dr. Alexandru JIPA

DO 104 F.1.EN Computer Programming

1. Study program

1.1. University	University of Bucharest
1.2. Faculty	Faculty of Physics
1.3. Department	Department of Electricity, Solid State Physics and Biophysics
1.4. Field of study	Physics
1.5. Course of study	Undergraduate/Bachelor of Science
1.6. Study program	Physics (in English)
1.7. Study mode	Full-time study

2. Course unit

2.1. Course unit title	**Computer Programming**							
2.2. Teacher				**Prof. univ. dr. Mihaela Sin**				
2.3. Tutorials/Practicals instructor(s)				**Prof. univ. dr. Mihaela Sin, Lect. univ. dr. Vasile Bercu**				
2.4. Year of study	1	2.5. Semester	I	2.6. Type of evaluation	C	2.7. Type of course unit	Content[1)]	**DC**
							Type[2)]	**CO**

[1)] fundamental (DF), speciality (DS), complementary (DC); [2)] compulsory (DI), elective (DO), optional (DFac)

3. Total estimated time (hours/semester)

3.1. Hours per week in curriculum	**4**	distribution: Lecture	**2**	Practicals/Tutorials	**2**
3.2. Total hours per semester	**56**	distribution: 1-st semester	**56**	2-nd semester	**0**

Distribution of estimated time for study	**hours**
3.2.1. Learning by using one's own course notes, manuals, lecture notes, bibliography	**25**
3.2.2. Research in library, study of electronic resources, field research	**25**
3.2.3. Preparation for practicals/tutorials/projects/reports/homeworks	**40**
3.2.4. Examination	**4**
3.2.5. Other activities	

3.3. Total hours of individual study	**90**
3.4. Total hours per semester	**150**
3.5. ECTS	**6**

4. Prerequisites (if necessary)

4.1. curriculum ...	-
4.2. competences ...	High school mathematics, fundamental algorithms

5. Conditions/Infrastructure (if necessary)

5.1. for lecture	Videoprojector
5.2. for practicals/tutorials	Computer room

6. Specific competences acquired

Professional competences	• C2 – Using of dedicated software for data analysis and processing • C3 – Solving physics problems in given conditions, using numerical and statistical methods • C5 – Presenting and analysing information of didactics, scientific and outreach in physics • C6 – Interdisciplinary approach of some physics problems
Transversal competences	- CT3 -Efficient use of information and communication resources available.

7. Course objectives

7.1. General objective	Getting acquinted with computer programming basics, especially with C/C++ programming language. Developing algorithms for solving physical problems.
7.2. Specific objectives	- knowledge of programming language specifics; physical theories/models - developing the ability of modelling and solving physical problems; - using the computing skills for experimental and theoretical applications

8. Contents

8.1. Lecture [chapters]	Teaching techniques	Observations
Main chapters	Systematic exposition - lecture. Heuristic conversation. Critical analysis. Examples	2-4 hours
- Hardware. Computer architecture. Binary system. - Software. Operation systems and programming languages. Short history. - Correlation between the scientific coding language and the solving problem type: model calculations, simulation, data acquisition and processing. Examples of complex codes. - Scientific languages mostly used in physics: evolution, general characteristics, distinctive features	Systematic exposition - lecture.	2 hours
- Programming stages: problem solving, developing algorithm, implementation, compilation, execution. - Structure of a C++ program - Preprocessor directives, headers, libraries - Input/output	Systematic exposition - lecture. Examples	2 hours
- Variable types. Constants. - Operators: arithmetic, relational and comparison, logical, assignment, conditional, sizeof, dot (.), arrow (-$^{\circ}$), increment and decrement, etc.	Systematic exposition - lecture. Examples	2 hours
- Control structures	Systematic exposition -	2 hours

• selection statements:: if – else, switch • iteration statements (loops): while, do – while, for • jump statements: continue, break, goto, etc. - Functions: types, declaring, prototypes, calling	lecture. Examples	
- Arrays: initializing, accessing the values using references and pointers - Reference and dereference operators - Strings, operations with strings	Systematic exposition - lecture. Examples	2 hours
- Pointers: declaring pointers, operations, comparison - Ponters and references	Systematic exposition - lecture. Examples	4 hours
- Dynamic memory: operators new, delete - Data structures	Systematic exposition - lecture. Examples	4 hours
- Classes: definition, objects, constructors, deconstructors, initialization, access to members, copy and move constructors	Systematic exposition - lecture. Examples	4 hours
- Object Oriented Programming (OOP). Characteristics: encapsulation, inheritance, polymorphism	Systematic exposition - lecture.	4 hours
- Analysis of complex codes written in C++: Root, GEANT4	Systematic exposition - lecture	2 hours

Bibliography:
1. Bjarne Stroustrup – Principles and Practice Using C++ - Addison – Wesley Publishing Company, 2009
2 Bjarne Stroustrup – The Design and Evolution of C++, - Addison – Wesley Publishing Company, 1994
3. R. Andonie, I. Gârbacea – Algoritmi fundamentali, o perspectivă C++ - Editura Libris, Cluj – Napoca, 1995
4. M. Hjorth-Jensen – Computational Physics, Universitatea din Oslo, note de curs, 2012
5. https://isocpp.org
6. www.cplusplus.com
7. www.learncpp.com
8. http://www.stroustrup.com

8.2. Tutorials [main themes]	Teaching and learning techniques	Observations
Some specific theme	Guided work	2-4-6 hours

Bibliography:
...whatever you decide to indicate...

8.3. Practicals [practical activities, projects, etc.]	Teaching and learning techniques	Observations
Basic statements in C and C++. Applying the sequence Edit-Compile-Link-Run for C++ codes in operation system Linux	Guided practical activity	2 hours
Developing codes including different types of variables, operators, control structures, preproccesor directives, functions	Guided practical activity	4 hours
Developing codes including arrays, strings, pointers	Guided practical activity	4 hours
Developing codes which use dynamic memory and data structures,classes	Guided practical activity	4 hours

Developing codes emphasizing the advanteges of OOP	Guided practical activity	4 hours
Random number generation and applications	Guided practical activity	2 hours
Plotting with GnuPlot. Input/output from files	Guided practical activity	2 hours
Performance analysis and optimization	Guided practical activity	4 hours
The structure of complex codes. Comparison between C++ and the latest versions of Fortran	Exposition. Examples	2 hours
Bibliography: 1. Bjarne Stroustrup, Programming, Principles and Practice Using C++, Addison-Wesley Publishing, 2008 2. Bjarne Stroustrup, The Design and Evolution of C++, Addison-Wesley Publishing Company, 1994 3. https://isocpp.org		
8.4. Project [only if included in syllabus]	Teaching and learning techniques	Observations
Bibliography: ...whatever you decide to indicate...		

9. Compatibility of the course unit contents with the expectations of the representatives of epistemic communities, professional associations and employers (in the field of the study program)

This course unit develops practical competences and abilities which are fundamental for an undergraduate student in the field of modern Physics, corresponding to national and european/international standards. The contents and teaching methods were selected after a thorough analysis of the contents of similar course units in the syllabus of other universities from Romania or the European Union. The contents are in line with the requirements/expectations of the main employers of the graduates (economy, research, education).

10. Assessment

Activity type	10.1. Assessment criteria	10.2. Assessment methods	10.3. Weight in final mark
10.4. Lecture	- knowledge, understanding, coherence, logics and clarity of exposition	Written test	45%
10.5.1. Tutorials			
10.5.2. Practicals	- ability to model a problem, create an algorithm, implement it into a functional code	Computer code	55%
10.5.3. Project [only if included in syllabus]			
10.6. Minimal requirements for passing the exam Participation to all practical activities and at least 7 leactures.			
Requirements for mark 5 (10 points scale) - - Solving 25% of the written test. - Developing and presenting a code with a low degree of complexity but fully functional.			

Date	Teacher’s name and signature Prof. univ. dr. Mihaela Sin	Practicals/Tutorials instructor(s) name(s) and signature(s) Prof. univ. dr. Mihaela Sin Lect. univ. dr. Vasile Bercu

Date of approval

Head of Department
Prof. univ. dr. Alexandru JIPA

DO 104 F.2.EN Physical Chemistry

1. Study program

1.1. University	University of Bucharest
1.2. Faculty	Faculty of Physics
1.3. Department	Department of Electricity, Solid State Physics and Biophysics
1.4. Field of study	Exact and natural sciences / Physics
1.5. Course of study	Undergraduate/Bachelor of Science
1.6. Study program	Physics (in English)
1.7. Study mode	Full-time study

2. Course unit

2.1. Course unit title	**Physical Chemistry**							
2.2. Teacher				Lect. dr. Marcela Elisabeta BĂRBÎNŢĂ PĂTRAŞCU				
2.3. Tutorials/Practicals instructor(s)				Lect. dr. Marcela Elisabeta BĂRBÎNŢĂ PĂTRAŞCU56				
2.4. Year of study	1	2.5. Semester	1	2.6. Type of evaluation	C	2.7. Type of course unit	Content[1)]	**DC**
							Type[2)]	**DO**

[1)] fundamental (DF), speciality (DS), complementary (DC); [2)] compulsory (DI), elective (DO), optional (DFac)

3. Total estimated time (hours/semester)

3.1. Hours per week in curriculum	**4**	distribution: Lecture	**2**	Tutorials/ Practicals	**2**
3.2. Total hours per semester	**56**	distribution: lecture	**28**	Tutorials/ Practicals	**28**

Distribution of estimated time for study	**hours**
3.2.1. Learning by using one's own course notes, manuals, lecture notes, bibliography	**35**
3.2.2. Research in library, study of electronic resources, field research	**20**
3.2.3. Preparation for practicals/tutorials/projects/reports/homeworks	**35**
3.2.4. Examination	**4**
3.2.5. Other activities	**0**

3.3. Total hours of individual study	**90**
3.4. Total hours per semester	**150**
3.5. ECTS	**6**

4. Prerequisites (if necessary)

4.1. curriculum	
4.2. competences	C2: Use of software packages for data analysis

5. Conditions/Infrastructure (if necessary)

5.1. for lecture	Multimedia infrastructure (videoprojector, PC), Internet access
5.2. for practicals/tutorials	Interactive equipments, Phywe experimental setups, computers with internet connection, projector, whiteboard; instruments and modern accessories: laboratory glassware, pipettes and micropipettes, magnetic stirrers, mechanical stirrer (VIBRAX stirrer), pH meter InoLab 7110, ovens, system for purifying water Milli-Q system (conductivity $\leq$ 0.1 mS cm^{-1}), Perkin Elmer Lambda 2S spectrophotometer, specific reagents.

6. Specific competences acquired

Professional competences	- C1 – Identification and correct use of physical laws and principles in given contexts - C5 – Analysis and communication/presentation of scientific data - C6 - Interdisciplinary approach of topics in physics.
Transversal competences	- CT3 – Efficient use of the sources of scientific information and communication of scientific data in English

7. Course objectives

7.1. General objective	The aim of this course is to introduce students to the fundamentals of Physical Chemistry, to understand the concepts of composition, physico-chemical properties and transformations of matter and energy involved in these transformations.
7.2. Specific objectives	Knowledge of specific physical theories and models used in physical chemistry; Using the acquired knowledge to solve specific problems in physical chemistry; performing and interpretation of experiments. Understanding the dynamics of chemical processes, factors that influence the reaction rate; calculation of the kinetic parameters. Calculation the amount of heat released / necessary to conduct a chemical reaction. Predict the outcome of chemical reactions based on thermodynamic parameters. Getting information about material properties from phase diagrams. Calculation of the equilibrium compositions and equilibrium constants. Understanding the basic concepts in electrochemistry.

8. Contents

8.1. Lecture [chapters]	Teaching techniques	Observations
Introduction to physical chemistry (main physical chemistry subjects; tangent with other disciplines; general notions).	Systematic exposition - lecture. Examples	2 hours
Chemical Thermodynamics. (Types of systems. Thermodynamic parameters. The laws of thermodynamics. Thermochemistry. Equations Gibbs - Helmholtz. Chemical potentials.)	Systematic exposition - lecture. Examples	7 hours
Phase equilibrium (basics; phase diagram; ideal and real solutions)	Systematic exposition - lecture. Examples	5 hours
Chemical equilibrium (Law of mass action for chemically homogeneous and heterogeneous equilibrium. Equilibrium constants)	Systematic exposition - lecture. Examples	5 hours
Chemical kinetics (Fundamentals. Reaction rate. Reaction order. Reaction mechanisms. Arrhenius equation)	Systematic exposition - lecture. Examples	5 hours
Electrochemistry (Specific electrical and equivalent conductivity of electrolyte solutions and their dependence on the dilution. The potential of the electrode. The double electric layer. Nernst equation for electrode potential. Classification of electrodes. Dependence of electromotive force on the electrolyte concentration. Fuel cells. Potentiometers. pH. Electrolysis and its applications)	Systematic exposition - lecture. Examples	4 hours

Bibliography:

- Neniţescu, C. D., General Chemistry, Editura Didactică şi Pedagogică, Bucureşti, 1978
- Linus Pauling, General Chemistry, Editura Ştiinţifică, Bucureşti, 1988
- Parotă, A., Vasile, A. D., *Probleme de chimie aplicată*, vol. 1, Editura Tehnică, Bucureşti, 1988
- P. Atkins and L. Jones, Chemical Principles: the quest for insight, 5th Ed., Freeman (New York, 2010).
- R. Chang, Chemistry, 8th Ed., McGraw-Hill (New York, 2004).
- **M. E. Barbinta-Patrascu**, N. Badea, A. Meghea, Oxidative stress studies on plant DNA exposed to ozone, ***Journal of Optoelectronics and Advanced Materials,*** 15 (5-6), 596 – 601, **2013.**
- **Barbinta Patrascu, M. E.,** Badea, N., Tugulea, L., Meghea, A. Photo-oxidative stress on model membranes – studies by optical methods, ***Key Engineering Materials***, 415, p. 29-32, 2009.
- T. W. Shattuck, *Physical Chemistry*, Colby College, 2015.
- M. Klotz, R. M. Rosenberg, *Chemical Thermodynamics: Basic Theory and Methods*, Benjamin/Cummings, Menlo Park, CA, 1986.
- J. S. Winn, *Physical Chemistry*, Harper Collins, New York, NY, 1995.
- K. A. Dill, S. Bromberg, *Molecular Driving Forces: Statistical Thermodynamics in Chemistry and*
- *Biology*, Garland Science, New York, NY, 2003. Chapts. 1-7.
- D. A. McQuarrie, J. D. Simon, *Physical Chemistry: A Molecular Approach*, University Science Books, 1997.
- P. W. Atkins, J. de Paula, *Physical Chemistry, 7th Ed.*, Freeman, New York, NY, 2002.

8.2. Tutorials [main themes]	Teaching and learning techniques	Observations

Bibliography:

8.3. Practicals [practical activities, projects, etc.]	Teaching and learning techniques	Observations
Instructions for safety and health at work for activities in physical chemistry lab. Familiarization with laboratory equipment and accessories.	Systematic exposition - lecture. Conversations. Examples	2 hours
Types of concentrations; measurement units. Solving problems. Preparation of solutions of a certain concentration. Successive dilutions.	Systematic exposition - lecture. Conversations. Examples. Applications. Guided practical activity	4 hours
Determination of the viscosity of liquids	Guided practical activity	2 hours
Acetic acid adsorption on activated carbon. Determination of the adsorption isotherm.	Guided practical activity	4 hours
Determination of dissociation constant of electrolyte solutions	Guided practical activity	2 hours
Chemical equilibrium. Le Chatelier's Principle	Guided practical activity	2 hours
The reaction kinetics of the reduction of methylene blue with ascorbic acid	Guided practical activity	2 hours
Determination of Activation Energy	Guided practical activity	2 hours
Electromotive force of the Daniell-Jacobi cell	Guided practical activity	4 hours
Discussing laboratory reports. Solving problems and tests of physical chemistry	Systematic exposition - lecture. Conversations.	4 hours

	Examples. Applications.	

Bibliography:
- András Kiss, Lívia Nagy, Géza Nagy, Barna Kovács, Beáta Peles-Lemli, Sándor Kunsági-Máté (Eds.), Manual for Physical Chemistry Laboratory (Experiments for Undergraduate Students), 2014.
- **Bărbînţă-Pătraşcu, M. E.,** *Chemistry for students. Laboratory manual*.
- Tennessee End of Course Practice Test for Chemistry, Tennessee Department of Education Web site, USA, 2013.
http://depts.washington.edu/chemcrs/bulkdisk/chem155A_win04/info_Lab_Manual.pdf
http://chemistry.harvard.edu/files/chemistry/files/2012_1_9_safetymanual1.pdf
http://www.homepages.dsu.edu/bleilr/npmanual.pdf
http://ocw.mit.edu/courses/chemistry/5-301-chemistry-laboratory-techniques-january-iap-2012/labs/MIT5_301IAP12_comp_manual.pdf

8.4. Project [only if included in syllabus]	Teaching and learning techniques	Observations
Bibliography:		

9. Compatibility of the course unit contents with the expectations of the representatives of epistemic communities, professional associations and employers (in the field of the study program)

This course unit aims at developing specific theoretical and practical competences and abilities in the field of physical chemistry, corresponding to national and european/international standards. The contents and teaching methods were selected after a thorough analysis of the contents of similar course units in the syllabus of other universities from Romania or the European Union (University of Coimbra, https://apps.uc.pt/courses/EN/unit/8394/33/2016-2017?menor=true&type=ram&id=349; University of California Los Angeles UCLA, http://www.chemistry.ucla.edu/physical-chemistry; Colby College, http://www.colby.edu/chemistry/PChem/syllabi/; Washington State University, www.tyr0.chem.wsu.edu/~kipeters/Chem331/; University College London, https://www.ucl.ac.uk/chemistry/undergraduate/courses/synopses/year1/chem1301; McGill University https://ronispc.chem.mcgill.ca/ronis/chem223). The contents are in line with the requirements/expectations of the main employers of the graduates (industry, research – e.g. the National R&D Institute for Materials Physics, secondary school teaching).

10. Assessment

Activity type	10.1. Assessment criteria	10.2. Assessment methods	10.3. Weight in final mark
10.4. Lecture	- coherence and clarity of exposition - correct use of equations/and theories - ability to indicate/analyse specific examples	Written test	60%
10.5.1. Tutorials			
10.5.2. Practicals	- ability to perform specific experiments - ability to present and discuss the results - ability to use specific problem solving methods - ability to analyse the results	Lab reports; practical evaluation	40%
10.5.3. Project [only if included in syllabus]			

10.6. Minimal requirements for passing the exam
All practical activities must be finalized.
Requirements for mark 5 (10 points scale) - Performing all experiments and presentation of Lab reports - Correct solution for indicated subjects in the final test

Date	Teacher's name and signature Lect. dr. Marcela Elisabeta BĂRBÎNŢĂ PĂTRAŞCU	Practicals/Tutorials instructor(s) name(s) and signature(s) Lect. dr. Marcela Elisabeta BĂRBÎNŢĂ PĂTRAŞCU

Date of approval

Head of Department,
Assoc. Prof. Petrică CRISTEA

DI 105 F.EN FIŞA DISCIPLINEI

1.Date despre program

1.1 Instituţia de învăţământ superior	**Universitatea din Bucureşti**
1.2 Facultatea/Departamentul	**Facultatea de Fizica**
1.3 Catedra	**Limbi Moderne**
1.4 Domeniul de studii	**Fizica**
1.5 Ciclul de studii	**Licenţă - 3 ani/180 credite (ECTS)**
1.6 Programul de studii/Calificarea	**FIZICA**
	An I, ZI

2.Date despre disciplină

2.1 Denumirea disciplinei					**PRACTICA LIMBII ENGLEZE**			
2.2 Titularul activităţilor de curs					-			
2.3 Titularul activităţilor de seminar					**Profesor Asociat dr. Teleoaca Anca Irinel**			
2.4 Anul de studiu	**I**	2.5 Semestrul	**I**	2.6 Tipul de evaluare	**V**	2.7 Regimul disciplinei	Conţinut	**DC**
							Obligativitate	**DI**

3.Timpul total estimat (ore pe semestru al activităţilor didactice)

3.1 Număr de ore pe săptămână	-	din care: 3.2 curs	-	3.3 seminar	**1**
3.4 Total ore din planul de învăţământ	**14**	din care: 3.5 curs	-	3.6 seminar	**14**
3.7 Distribuţia fondului de timp					**Ore**
Studiul după manual, suport de curs, bibliografie şi notiţe					4
Documentare suplimentară în bibliotecă, pe platformele electronice de specialitate					2
Pregătire seminarii, teme, referate, portofolii şi eseuri					1
Tutoriat					
Examinări					4
Alte activităţi/ Conferinte					-
3.7 Total ore studiu individual					**7**
3.8 Total ore pe semestru (3.4. + 3.7)					**14**
3.9 Numărul de credite					**1**

4.Precondiţii (acolo unde este cazul)

5.Condiţii (acolo unde este cazul)

5.1 de desfăşurare a cursului	
5.2 de desfăşurare a seminarului	• Nivel B1

6.Competenţe specifice acumulate

Competenţe profesionale	• Descrierea şi prezentarea unor structuri gramaticale • Descrierea şi prezentarea metodelor specifice formarii cuvintelor. • Utilizarea acestor concepte, noţiuni şi metode pentru pentru dezvoltarea gandirii critice. • Utilizarea unor criterii şi metode adecvate pentru evaluarea meritelor şi limitelor diverselor abordari metodologice. • Dezvoltarea capacitatii de a aplica in mod creativ informatia dobandita..
Competenţe transversale	• Îndeplinirea la termen, în mod riguros, eficient şi responsabil, a unor sarcini profesionale cu grad ridicat de complexitate, în condiţii de autonomie decizională, cu respectarea riguroasă a deontologiei profesionale.

7.Obiectivele disciplinei (reieşind din grila competenţelor specifice acumulate)

7.1 Obiectivul general al disciplinei	• Studentii trebuie să deprindă abilitatea de a disocia intre diferitele abordari teoretice. • Studentii vor dobandi abilitatea de a gandi critic si de a face conexiuni intre diferitele mecanisme de formare a cuvintelor. Si utilizare a valorilor verbului.
7.2 Obiectivele specifice	• Studentii trebuie să deprindă abilitatea de a identifica mecanismele specifice analizei structurii cuvintului, sa utilizeze in contexte proprii vocabularul de specialitate. ▪ Dezvoltarea gândirii critice şi analitice, a competenţelor de argumentare logică pe suport oral şi în scris

8.Conţinuturi

	General Issues	**Conversational Topics**	**Grammar**	**Projects**
I.VALORILE NEGATIEI	Human-Computer Interaction	*Everything We Know about Computers* (I)	**Expressing negation; Compound nouns;**	I. *Computers versus Books*
II. COMPUNEREA	Spatial Relations	*Computer Applications* (II)	**The Preposition; Blending; Acronyms;**	II. *Dreaming about Life*
III.PREPOZITIA SI ROLULEI	A New Signification of the Concept of People – Machine Connection	*The Internet* (I)	**The sequence of tenses; Expressing the containment relation.**	III. *The Perfect Job*
IV. VALORILE MODALE ALE LIMBII ENGLEZE	The Electronic World	*Are You Real Webbers?* (II)	**Expressing modality on the Net;**	IV. *Internet in 20 Years*
				V. *Romania in EU*
V. ARGUMENT	Pros & Cons	*The Interview* (I)	Questioning: Past and Future;	

AREA IN DISCURSUL STIINTIFIC PERSPECTIVE SI RETROSPECTIVE			Ways of persuading.	
VI. LIMBAJUL SI TIPURILE DE DISCURS	Simulating an Interview	*The Interview* (II)	Communicative Discourse.	
VII. FUNCTIILE LIMBII SUBSTANTIVUL SI CONSTRUCTIILE '-ING'	Debating over Likes and Dislikes Regarding the Media Ads.	*On Advertising*	The noun & the plural; The [–ing] pattern; The Infinitive. Language functions.	
VIII. STILURILE FUNCTIONALE ALE LIMBII	On Style (I)		Applications, order & remittance, inquiries and replies.	**References** Anca Irinel Teleoaca *English 4 Physics* *50 Ideas you really need to know about the Universe*,Joanne Baker, Quercus
IX. IDIOMURILE DIN LIMBA ENGLEZA	On Style (II)	*Writing a Letter*	General appearance; heading & inside address; salutation; complimentary close; addressing the envelope.	**1.**L.G.Alexander *Essay and Letter Writing*, Longman, 1961 **2.** Michael Swan *Practical English Usage*, OUP, 1997
X. COEZIUNE. CONECTORI. TIPURI DE PARAGRAF	Improving the Word & Sentence Patterns	*How to Write an Essay*	Style: levels of English usage; economy, consistency, logic; coordination & subordination.	**3.** *English Idioms in Use*, Michael McCarthy and Felicity O'Dell, CUP, 2005
	Improving the W-S Patterns	*Working on a Project. The Great Debate*	The Main Components of a Written Project; An Oral Presentation of the Project	**4.** Virginia Evans, *Successful Writing – Proficiency*, Express Publishing, 2000
	EVALUARE	**CRITERII**	**METODE APLICATIVE**	**PONDERE din NOTA FINALA**
		-nivelurile de intelegere si calitatea argumentării	Sarcini aplicative Texte scrise	**50%**

		prin folosirea structurilor sintactice si gramaticale in mod corespunzator. -participarea la discuţii prin exprimare coerenta si argumentare analitica	Exprimare orala Portofoliu lingvistic CV, Resume, Letter of Intent	**50%**

9.Coroborarea conţinuturilor disciplinei cu aşteptările reprezentanţilor comunităţii epistemice, asociaţiilor profesionale şi angajatori reprezentativi din domeniul aferent programului

- Seminarul dezvoltă competenţe care le permit studenţilor accesul la literatura de specialitate in limba engleza.
- În elaborarea sarcinilor de lucru s-a ţinut seama de codurile etice şi de standardele de cunoaştere specifice comunităţii academice a UVT.

10.Standard minim de performanţă

- Parcurgerea lecturilor obligatorii. Contributii personale la seminarii.
- Înţelegerea şi aplicarea corecta a conceptelor morfo-sintactice de bază/metodelor de analiză a unui text stiintific discutate la curs.
- Prezenţa la cel puţin 70% din cursuri.

Semnătura titularului de curs
.....

Semnătura titularului de seminar
Profesor Asociat dr. Teleoaca Anca Irinel

Data completării

Data avizării în departament
.....

Semnătura şefului departament
Conf dr Diana Ionita

DI.106.F.EN - EDUCATIE FIZICĂ Și SPORT

Denumirea disciplinei	**EDUCATIE FIZICĂ Și SPORT**					
Anul de studiu	I	Semestrul	I	Tipul de evaluare finală (**E / V / C**)		**V**
Categoria formativă a disciplinei **DF -** fundamentală, **DG -** generală, **DS -** de specialitate, **DE -** economică/managerială, **DU -** umanistă						**DG**
Regimul disciplinei {**Ob**-obligatorie, **Op**-opţională, **F**-facultativă}				**Ob**	Numărul de credite	**2**
Total ore din planul de învăţământ	**14**	Total ore studiu individual		**14**	Total ore pe semestru	**14**
Titularul disciplinei	***Asist. univ. dr. Cătălin Serban***					

** Daca disciplina are mai multe semestre de studiu, se completează câte o fişă pentru fiecare semestru*

Facultatea	**FIZICĂ**
Departamentul	DEPARTAMENTUL DE EDUCAŢIE FIZICĂ ŞI SPORT
Domeniul fundamental de ştiinţă, artă, cultură	Educaţie fizică şi sport
Domeniul pentru studii universitare de licenţă	**Discipline de pregătire în domeniul licenţei**
Direcţia de studii	

Numărul total de ore (pe semestru) din planul de învăţământ
(Ex: 28 la C dacă disciplina are curs de 14_saptămâni x 2_h_curs pe săptămână)

Total	**C****	**S**	**L**	**P**
14				**14**

*** C-curs, S-seminar, L-activităţi de laborator, P-proiect sau lucrări practice*

Discipline anterioare	**Obligatorii** (condiţionate)	---
	Recomandate	

Estimaţi **timpul total (ore pe semestru)** al activităţilor de **studiu individual** pretinse studentului *(completaţi cu zero activităţile care nu sunt cerute)*

1. Descifrarea şi studiul notiţelor de curs	**2 h**	8. Pregătire prezentări orale	
2. Studiu după manual, suport de curs		9. Pregătire examinare finală	**2 h**
3. Studiul bibliografiei minimale indicate	**1 h**	10. Consultaţii	**2 h**
4. Documentare suplimentară în bibliotecă		11. Documentare pe teren	
5. Activitate specifică de pregătire		12. Documentare pe	**2**

SEMINAR şi/sau LABORATOR			INTERNET	**h**
6. Realizare teme, referate, eseuri, traduceri etc.	**2 h**		13. Alte activităţi: Participare la competiţii sportive	**2 h**
7. Pregătire lucrări de control			14. Alte activităţi: Participare la organizare evenimente sportive	**1 h**
	TOTAL ore studiu individual (pe semestru) = 14 h			

Competenţe generale (competenţele generale sunt menţionate în fişa domeniului de licenţă şi fişa specializării)	
Competenţe specifice disciplinei	**1. <u>Cunoaştere şi înţelegere</u>** *(cunoaşterea şi utilizarea adecvata a noţiunilor specifice disciplinei)* - Acumularea de cunoştiinţe privind activităţile motrice; - Cunoştinţe privind efectele activităţilor motrice asupra organismului; - Cunoştiinţe privind metodologia conceperii programelor de activ. motrice de timp liber; - Cunoştiinţe privind solicitările funcţionale în vederea solicitării efortului;
	2. <u>Explicare şi interpretare</u> *(explicarea şi interpretarea unor idei, proiecte, procese, precum şi a conţinuturilor teoretice şi practice ale disciplinei)* ▪ Definirea obiectivelor, sarcinilor specifice activităţilor desfăşurate; ▪ Mijloace de implementare a programelor de timp liber; ▪ Comunicarea în sport şi relaţiile publice(integrarea socială); ▪ Promovarea interdisciplinarităţii ştiinţelor motrice; ▪ Capacitatea de a înţelege,opera şi extinde activ. motrică în timpul liber si recreere; ▪ Capacitatea de a valorifica efectele pozitive ale activ. motrice asupra personalităţii şi calităţii vieţii;
	3. <u>Instrumental – aplicative</u> *(proiectarea, conducerea şi evaluarea activităţilor practice specifice; utilizarea unor metode, tehnici şi instrumente de investigare şi de aplicare)* ▪ Să conceapă programe sportive de timp liber pentru recreere; ▪ Să conceapă şi să aplice programe sportive de pregătire sau perfecţionare; ▪ Să coordoneze, să se integreze şi să participe la activităţile sportive ; ▪ Să identifice soluţii privind optimizarea timpului liber; ▪ Să mobilizeze resursele umane în acţiunea de voluntariat; ▪ Să cunoască modalităţile de evaluare a stării de sănătate (capacităţii de efort);
	4. <u>Atitudinale</u> *(manifestarea unei atitudini pozitive şi responsabile faţă de domeniul ştiinţific / cultivarea unui mediu ştiinţific centrat pe valori şi relaţii democratice / promovarea unui sistem de valori culturale, morale şi civice / valorificarea optima şi creativa a propriului potenţial în activităţile ştiinţifice / implicarea în dezvoltarea instituţională şi în promovarea inovaţiilor ştiinţifice / angajarea în relaţii de parteneriat cu alte persoane - instituţii cu responsabilităţi similare / participarea la propria dezvoltare profesională)* ▪ Să se integreze şi să participe la activităţile sportive promovând valorile fair-play-ului; ▪ Să dezvolte relaţii principale şi constructive cu partenerii sociali; ▪ Să se adapteze la situaţii noi; ▪ Să dezvolte atitudini pro-active , gândire pozitivă şi relaţii interpersonale.

Conţinutul programei	*LUCRĂRI PRACTICO-METODICE – 14 ore :* 1. Evaluarea somato-funcţională 1 oră; 2. Evaluarea motrică 1 oră; 3. Însuşirea unor metode şi tehnici în sporturile colective: volei, handbal, fotbal, baschet 1 oră; 4. Însuşirea unor programe pentru dezvoltare fizică armonioasă 1 oră; 5. Însuşirea unor metode sportive ca formă a practicării exerciţiilor fizice 1 oră; 6. Însuşirea unor metode şi tehnici privind educarea esteticii corporale prin fitness 1 oră; 7. Însuşirea unor tehnici pentru prelucrarea selectivă a aparatului locomotor 1 oră; 8. Însuşirea unor programe pentru optimizarea condiţiei fizice 1 oră; 9. Însuşirea unor rograme pentru educarea elasticităţii musculare şi supleţei articulare 1 oră; 10. Însuşirea unor rograme pentru combaterea stresului 1 oră; 11. Însuşirea unor rograme pentru combaterea obezităţii 1 oră; 12. Însuşirea unor rograme pentru corectarea atitudinilor vicioase 1 oră; 13. Însuşirea unor reguli privind practicarea unor sporturi colective: volei, handbal, fotbal, baschet 1 oră; 14. Verificare intermediară 1 oră;

Bibliografia	● Bocu Traian – Activitatea fizică în viaţa omului contemporan; ● Bota Aura – Activităţi fizice de timp liber; ● Ganciu Mihaela – Gimnastica aerobică-mijloc de îmbunătăţire a calităţii vieţii; ● Georgescu Florian – Cultura fizică-fenomen social; ● Dumitrescu Remus– Didactica educaţiei fizice; ● N.I.Ponomariov – Funcţiile sociale ale culturii fizice şi sportului;
Lista materialelor didactice necesare	Cărţi şi materiale de specialitate; Laptop – retroproiector, cronometru, cântar, combină muzicală Fileu volei, Mingi volei, Mingi medicinale, Saltele de gimnastica, Lada de gimnastica, Capra de gimnastica, Alte obiecte specifice invatarii jocului de volei

La stabilirea notei finale se iau în considerare	Ponderea în notare, exprimată in % {Total=100%}
- răspunsurile la examen / colocviu (evaluarea finală)	50%
- testarea continuă pe parcursul semestrului	10 %
- activităţile gen teme / referate / eseuri / traduceri / proiecte etc	20%
- alte activităţi *(precizaţi)* . .organizare competiţii sportive	20%

Descrieţi modalitatea practică de evaluare finală, E/V. *{de exemplu: lucrare scrisă (descriptivă şi/sau test grilă şi/sau probleme etc.), examinare orală cu bilete, colocviu individual ori în grup, proiect etc.}.colocviu individual*

Verificare individuală:
- verificarea cunoştinţelor teoretice
- Trecerea probelor şi testelor de motricitate
- Alcătuirea unui program de activitate independentă

Cerinţe minime pentru nota 5 (sau cum se acordă nota 5)	Cerinţe pentru nota 10 (sau cum se acordă nota 10)

- Participarea la 50 % din numărul total de lecţii - Participarea la o competiţie sportivă - să dovedească însuşirea minimă a noţiunilor generale ale managementului şi marchetingului în educaţia fizică	- frecvenţă săptămânală 100% - participarea la 2 competiţii sportive - capacitatea de a aplica cunoştinţele dobândite - capacitatea de a crea programe(proiecte) care vizează managementul sportiv

Data completării: 05.04.2016

Semnătura titularului:

Asist. univ. dr. Cătălin Serban

DI 107F.EN Equations of mathematical physics

1. Study program

1.1. University	University of Bucharest
1.2. Faculty	Faculty of Physics
1.3. Department	Department of Theoretical physics, Mathematics, Optics, Plasma, and Lasers
1.4. Field of study	Physics
1.5. Course of study	Undergraduate/Bachelor of Science
1.6. Study program	Physics (in English)
1.7. Study mode	Full-time study

2. Course unit

2.1. Course unit title	**Equations of mathematical physics**							
2.2. Teacher				**Prof.dr.Ion ARMEANU**				
2.3. Tutorials/Practicals instructor(s)				**Asist. drd. Adrian STOICA**				
2.4. Year of study	I	2.5. Semester	II	2.6. Type of evaluation	E	2.7. Type of course unit	Content[1)]	**DS**
							Type[2)]	**DI**

[1)] fundamental (DF), speciality (DS), complementary (DC); [2)] compulsory (DI), elective (DO), optional (DFac)

3. Total estimated time (hours/semester)

3.1. Hours per week in curriculum	**5**	distribution: Lecture	**2**	Practicals/Tutorials	**3**
3.2. Total hours per semester	**70**	Lecture	**28**	Practicals/Tutorials	**42**

Distribution of estimated time for study	**hours**
3.2.1. Learning by using one's own course notes, manuals, lecture notes, bibliography	**50**
3.2.2. Research in library, study of electronic resources, field research	**20**
3.2.3. Preparation for practicals/tutorials/projects/reports/homeworks	**31**
3.2.4. Examination	**4**
3.2.5. Other activities	**0**

3.3. Total hours of individual study	**101**
3.4. Total hours per semester	**175**
3.5. ECTS	**7**

4. Prerequisites (if necessary)

4.1. curriculum	Real and Complex Analysis . Algebra, Geometry and Differential equations.
4.2. competences	Programming skills.

5. Conditions/Infrastructure (if necessary)

5.1. for lecture	Multimedia room (with video projector). Lecture notes. Recommended bibliography.
5.2. for practicals/tutorials	Video projector. Computers.

6. Specific competences acquired

Professional competences	C1. The identification and the appropriate use of the main physical laws and principles in a given context. C2. The use of suitable software packages for data analysis and processing. C3. Solving physics problems under given conditions using analytical, numerical and statistical methods. C5. The ability to analyse and communicate the didactic, scientific and popularization information of Physics.
Transversal competences	CT3. The efficient use of the information sources and of the communication and professional development resources in Romanian and in a widely used foreign language, as well.

7. Course objectives

7.1. General objective	• Assimilation of various techniques of interpretation and solving PDE and integral equations.
7.2. Specific objectives	• Developing computational skills. • The use of MATHEMATICA software for dealing with numerical and analytic methods in PDE and integral equations, Fourier expansion in orthogonal polynomials, Bessel functions, spherical harmonics functions. • Developing the ability to use appropriate models for modelling physical phenomena

8. Contents

8.1. Lecture [chapters]	Teaching techniques	Observations
Linear and bounded operators on a normed space. Linear functionals. Riesz theorem. The adjoint of a bounded linear operator on a Hilbert space.	Systematic exposition – lecture. Examples.	3 hours
Compact operators. Eigenvalues and eigenvectors. Fredholm alternative. Applications to the integral equations. Applications to the integral equations. Sturm Liouville problem.	Systematic exposition - lecture. Examples.	3 hours
Spherical harmonics functions. Orthogonal polynomials. Bessel functions. Applications to the study of explicitly solvable quantum systems.	Systematic exposition - lecture. Examples.	8 hours
Integral transforms. Laplace transform. Fourier transform. Applications in spectroscopy and imaging.	Systematic exposition - lecture. Examples.	2 hours
Problems in the theory of partial differential equations. Initial and boundary conditions. The classification and the procedure for reducing quasilinear equations of the second order to a canonical form.	Systematic exposition - lecture. Examples.	2 hours

Elliptic equations. Green's identities and the integral representation formula with potentials. Maximum principle, mean value theorem. Newtonian potential, simple layer and double layers potentials. Boundary value problems(Dirichlet and Neumann) for Laplace's equation. Green's function for the interior Dirichlet problem. Applications in electrodynamics.	Systematic exposition - lecture. Examples.	6 hours
Hyperbolic equations. Solutions of the wave equation in the cases of n=1,2,3. Domain of dependence, region of influence. Huygens' principle. The finite vibrating string problem. Separation of variables method.	Systematic exposition - lecture. Examples.	2 hours
Parabolic equations. Maximum principle. The solution of the Cauchy's problem. Use Fourier's method of separation of variables to solve mixed problem.	Systematic exposition - lecture. Examples.	2 hours

Bibliography:

1. G. Arfken, H.Weber, "Mathematical Methods for Physicists", *Elsevier Academic Press*, 2005.
2. A. N. Tikhonov, A. A.Samarskii, " Equations of Mathematical Physics", Dover Publications; Reprint edition 2011
3. R.Courant., D. Hilbert, "Methods of Mathematical Physics. Vol. 2, Partial Differential Equations", *Wiley*, 1989
4. M.Reed, B.Simon, "Methods of Modern Mathematical Physics " vol I-IV, *Academic Press*, 1972-1978
5. I. Armeanu, " Functional Analysis "(in Romanian) , *Ed.Universitatii din Bucuresti*, 1998
6. V.Branzanescu, O.Stanasila,"Special Topics in Mathematics"(in Romanian), *Editura ALL* 1998
7. N. Teodorescu, V.Olariu-,"Ordinary and Partial Differential Equations" (in Romanian) vol I-III, *Ed.Tehnica*, 1978-1980
8. V.Teodorescu, "Equations of Mathematical Physics"(in Romanian), *Ed.Universitatii din Bucuresti*, 1984
9. V.S.Vladimirov, "Equations of Mathematical Physics", 1971

8.2. Tutorials	Teaching and learning techniques	Observations
The seminar follows the course content. The problems arising in theoretical physics regarding to special functions, Fourier series expansion, full transformation will be supported with examples in MATHEMATICA.	Exposition. Guided work.	

Bibliography:

1. V.S. Vladimirov, "**A Collection of Problems on the Equations of Mathematical Physics", *Mir Publishers Moscow*, 1980**
2. N.N. Lebedev, "**Special Functions & Their Applications",** *Dover Publications*, 1972
3. Ghe.Mocica, "Problems of Special Functions", *Editura Didactica si Pedagogica*, 1988
4. T.Stanasila, V.Olariu, "Ordinary and Partial Differential Equations" , *Editura Tehnica*,1982

8.3. Practicals	Teaching and learning	Observations
8.4. Project	Teaching and	Observations

	learning techniques	

9. Compatibility of the course unit contents with the expectations of the representatives of epistemic communities, professional associations and employers (in the field of the study program)

This course unit develops some theoretical and practical competences and abilities, which are important for an undergraduate student in the field of modern Physics, corresponding to national and international standards. The contents and teaching methods were selected after a thorough analysis of the contents of similar course units in the syllabus of other universities from Romania or the European Union.

10. Assessment

Activity type	10.1. Assessment criteria	10.2. Assessment methods	10.3. Weight in final mark
10.4. Lecture	- coherence and clarity of exposition; - correct use of mathematical methods and techniques; - ability to analyse specific examples.	Written test/oral examination	80%
10.5.1. Tutorials	- ability to use specific problem solving methods; - ability to analyse the results; - ability to present and discuss the results.	Homeworks/written tests	20%
10.5.2. Practicals			
10.5.3. Project			
10.6. Minimal requirements for passing the exam **Requirements for mark 5 (10 points scale)** Fulfillment of at least 50% of each of the criteria that determine the final grade.			

Date

20.04.2016

Teacher's name and signature

Prof. dr. Ion ARMEANU

Practicals/Tutorials instructor(s) name(s) and signature(s)

Asist. drd. Adrian STOICA

Head of Department

Prof. dr. Virgil Băran

Date of approval

DI 108 F.EN Molecular physics

1. Study program

1.1. University	University of Bucharest
1.2. Faculty	Faculty of Physics
1.3. Department	Department of Structure of matter, Atmospheric and earth physics, Astrophysics
1.4. Field of study	Physics
1.5. Course of study	Undergraduate/Bachelor of Science
1.6. Study program	Physics (in English)
1.7. Study mode	Full-time study

2. Course unit

2.1. Course unit title	**Molecular Physics**							
2.2. Teacher				**Prof. univ. dr. Vlad POPA-NITA**				
2.3. Tutorials/Practicals instructor(s)				**Sanda VOINEA , Anca DUMITRU**				
2.4. Year of study	1	2.5. Semester	2	2.6. Type of evaluation	E	2.7. Type of course unit	Content[1)]	**DF**
							Type[2)]	**DI**

[1)] fundamental (DF), speciality (DS), complementary (DC); [2)] compulsory (DI), elective (DO), optional (DFac)

3. Total estimated time (hours/semester)

3.1. Hours per week in curriculum	8	distribution: Lecture	**4**	Practicals/Tutorials	**4**
3.2. Total hours per semester	**112**	distribution: 1-st semester	**0**	2-nd semester	**112**

Distribution of estimated time for study	**hours**
3.2.1. Learning by using one's own course notes, manuals, lecture notes, bibliography	**30**
3.2.2. Research in library, study of electronic resources, field research	**24**
3.2.3. Preparation for practicals/tutorials/projects/reports/homeworks	**30**
3.2.4. Examination	**4**
3.2.5. Other activities	**0**

3.3. Total hours of individual study	**84**
3.4. Total hours per semester	**200**
3.5. ECTS	**8**

4. Prerequisites (if necessary)

4.1. curriculum	...some (preceding) courses
4.2. competences	...some previously formed competences / Not applicable

5. Conditions/Infrastructure (if necessary)

5.1. for lecture	Room with multimedia devices. Lecture references
5.2. for practicals/tutorials	Experimental works for theoretical subjects discussed in the lecture. Computers.

6. Specific competences acquired

Professional competences	C1 - Identification and proper use of the key laws and principles of physics in a given context. - 2 credits C2 – Solving imposed condition physics problems - 2 credits C4 - Apply knowledge of physics in experiments using standard laboratory equipment - 1 credit C5 – Communication and analysis of didactic, scientific and dissemination of information - 1 credit
Transversal competences	CT1- Achievement of the professional duties in an efficient and responsible way with compliance with deontological legislation specific to the domain under qualified assistance. - 1 credit CT3 - Effective use of information, communication and training assistance, both in Romanian and in a foreign language. - 1 credit

7. Course objectives

7.1. General objective	The assimilation of general framework of macroscopic and microscopic studies of thermal phenomena

7.2. Specific objectives	- **Knowledge and understanding** -Understanding of general structure of thermodynamics - The correct assimilation of thermodynamic laws and the relations between them, of the reversible process as an important model in thermodynamics - The knowledge of description of thermodynamic system by state equations and the connections with response functions. - Using the thermodynamic potentials in analysis of states - The concepts of microstate, macrostate, statistical ensemble and distribution function - Connection between the thermodynamic and statistical description of thermal phenomena. - **Explanation and interpretation** Connection between the theoretical concepts defined in lecture and experimental investigation in practical work in the laboratory. The practical application of the general principles in solving the concrete problems.

8. Contents

8.1. Lecture [chapters]	Teaching techniques	Observations
Thermodynamics of equilibrium and nonequilibrium processes 1. Introduction: Object. Method. History. Fundamental concepts 2. Thermal equilibrium and temperature. The zero law of thermodynamics. Temperature measure. Thermometric scales. 3. The thermic equation of state. Thermic coefficients. Experimental determination. 4. The first law of thermodynamics. Mechanical work. The first law – fundamental statment. Heat. The first law – general statement. Caloric	Systematic exposition - lecture. Heuristic conversation. Critical analysis. Examples	

coefficients. Experimental determination. The polytropic process. Adiabatic exponent. The Joule experiment. The Joule-Thomson experiment. The liquefaction of gasses. 5. The second law of thermodynamics. Fundamental statement. The Carnot process and Carnot theorem. The absolute temperature.Clausius equality. Cyclic, polytermic processes. Entropy. The calculation of entropy variation in reversible processes. Entropy and reversibility. Irreversible processes. The principle of maximal entropy. Entropy and irreversibility. Equivalent formulations of the second law. Fundamental relation of thermodynamics. Entropy calculation. Gibbs paradox. Thermodynamics solving of Gibbs paradox. 6. Thermodynamics potentials. Equilibrium thermodynamics states. Legendre transformation. The principle of minimum of energy. The fundamental property of thermodynamics potentials. Dependence of the thermodynamic potentials on the mass of the system. Chemical potential. 7. The third law of thermodynamics. Statement. Consequences. 8. Phase transitions. Equilibrium conditions for an isolated system. Stability criteria for equilibrium states. Equilibrium conditions for a system at constant pressure and temperature. Clausius-Clapeyron equation. Applications. Experimental determination of sublimation latent heat. The triple point. The Ehrenfest classification of phase transformations. The study of liquid-gas phase transition in the framework of van der Waals model. Metastable states. The critical state. The law of corresponding states. The Landau theory of phase transitions. First and second order phase transitions. Gibbs phase rule. 9. Thermodynamic of irreversible processes. Introduction in the theory of continuum medium. Conservation laws. The local form of the second law of thermodynamics. The entropy source. The thermic conductivity and diffusion. Dissipative		

structures. 10. Introduction to molecular-kinetic theory. Object. History. The probability theory. Random variables with discrete spectrum. Binomial distribution. Random variables with continuum spectrum. Gauss distribution. 11. Introduction in statistical physics. Phases space. Microstate and macrostate. Statistical ensemble. Distribution functions. The fundamental postulate. Canonical distribution function. Relation with thermodynamics. Energy fluctuation. Canonical distribution for an ideal monoatomic gas. 12. Kinetic theory of an ideal gas. The distribution functions of velocity vector, velocity modulus, reduced velocity. Distribution function of translation kinetic energy. The difference in behaviour of one molecule and the entire gas. The flux of molecules. Effusion. The molecular-kinetic expression of the pressure of an ideal gas. Distribution function of positions. 13. The ideal gas composed by poliatomic molecules. The translation movement of the center of mass. Rotation movement. Vibration movement. The comparison of theoretical results with experimental ones. The equipartition theorem of energy on freedom degrees. 14. Van der Waals model. Configuration integral. The interaction potential energy. Van der Waals equations of state. 15. Elementary kinetic theory of transport phenomena. Collision time. and scattering cross section. Viscosity. Thermic conductivity. Diffusion.		
Bibliography: 1.Vlad Popa-Nita, Molecular physics(first part- Thermodynamics), Ed. Univ. Buc. (1994). 2.Vlad Popa-Nita, Molecular Physics (second part- Kinetic theory and elements of statistical physics), Ed. Univ. Buc. (1998). 3. V. Filip, Introductory Thermal Physics, Ed. Univ. Buc., 2006. 4. M. W. Zemanski, Heat and Thermodynamics (McGraw-Hill, 1968). 5. S. Titeica, Termodinamica (Ed. Academiei, 1982) 6. I. Prigogine, From Being to Becoming (H. W. Treeman company, 1980). physics), Ed. Univ. Buc. (1998). 7. F. Reif, Statistical physics-Cursul de Fizica Berkley, vol. 5 (Editura Didactica si Pedagogica, 1983). 8.S. Stefan si V. Filip, Fizica Fenomenelor Termice. Culegere de Probleme, Ed. Univ. Buc., 2002.		
8.2. Tutorials [main themes]	Teaching and	Observations

	learning techniques	
Some specific theme	Guided work	
Bibliography: ...whatever you decide to indicate...		
8.3. Practicals [practical activities, projects, etc.]	Teaching and learning techniques	Observations
1 Determination of specific heat of a solid body by calorimetric. 2. Determination of specific heat of a liquid by cooling method. 3. The Dalton law. 4. Determination of specific heat of a liquid by Hirn calorimeter. 5. Latent heat of crystallization. 6. Adiabatic exponent of gases 7. Determination of mechanic equivalent of calorie by Puluj. 8.The vapour pressure of water at temperatures less than 100C. 9. The heat capacity of gases (Cobra3). 10. The thermic equation of state of ideal gases. 11. Joule-Thomson effect. 12. Surface tension. 13. Stefan-Boltmann law. 14. The viscosity of a liquid with Hoppler viscozimeter. 15. Determination of the relative density and molecular mass by effusion method. 16. Air viscosity 17. Gas in a gravitational uniform field. 18. Microscopic study of thermic equilibrium of a gas in contact with a thermostat. 19.Maxwell distribution. 20. Thermic conductivity of metals.	Guided practical activity	
Another experiment	Guided practical activity	
Bibliography: ...whatever you decide to indicate...		
8.4. Project [only if included in syllabus]	Teaching and learning techniques	Observations
Bibliography: 1. Sabina Stefan (coordonator) Fizica moleculară –Lucrari practice, Ed. Univ. Bucuresti. 2. http://www.fizica.unibuc.ro/Fizica/Studenti/Cursuri/Main.php		

9. Compatibility of the course unit contents with the expectations of the representatives of epistemic communities, professional associations and employers (in the field of the study program)

This course unit forms competences and abilities which are important for an undergraduate student in the field of modern Physics, corresponding to national and international standards. The contents and teaching methods were selected after a thorough analysis of the contents of similar course units in the syllabus of other universities from Romania or the European Union. The contents are in line with the

requirements of the main employers of the graduates students.

10. Assessment

Activity type	10.1. Assessment criteria	10.2. Assessment methods	10.3. Weight in final mark
10.4. Lecture	- coherence and clarity of exposition - correct use of equations/mathematical methods/physical models and theories - ability to indicate/analyse specific examples	Written test and oral examination	60%
10.5.1. Tutorials			
10.5.2. Practicals	- ability to use specific experimental methods/apparatus - ability to perform/design specific experiments - ability to present and discuss the results		40%
10.5.3. Project [only if included in syllabus]	- coherence and clarity of exposition - correct use of mathematical and physical methods/models - ability to use specific experimental methods/apparatus - ability to present and discuss the results	Report	
10.6. Minimal requirements for passing the exam 1. All practical activities must be finished 2. Marks greater than 5 obtained to tests during the semester			
Requirements for mark 5 (10 points scale) Minimal knowledge of the theoretical concepts and of the practical works.			

Date
6.05.2016

Teacher's name and signature

Prof. Dr. Vlad POPA-NITA

Practicals/Tutorials instructor(s) name(s) and signature(s)
As. Sanda VOINEA, Lect. Dr. Anca DUMITRU

Date of approval

Head of Department
Prof. Univ. dr. Alexandru JIPA

DI 109F.EN Electricity and Magnetism

1. Study program

1.1. University	University of Bucharest
1.2. Faculty	Faculty of Physics
1.3. Department	Department of Electricity, Solid State Physics and Biophysics
1.4. Field of study	Physics
1.5. Course of study	Undergraduate/Bachelor of Science
1.6. Study program	Physics (in English)
1.7. Study mode	Full-time study

2. Course unit

2.1. Course unit title	**Electricity and Magnetism**							
2.2. Teacher				**Professor Ştefan Antohe**				
2.3. Tutorials/Practicals instructor(s)				**Associate Professor Petrică Cristea, Lecturer Cezar Tazlăoanu**				
2.4. Year of study	1	2.5. Semester	II	2.6. Type of evaluation	E	2.7. Type of course unit	Content[1)]	**DF**
							Type[2)]	**DI**

[1)] fundamental (DF), speciality (DS), complementary (DC); [2)] compulsory (DI), elective (DO), optional (DFac)

3. Total estimated time (hours/semester)

3.1. Hours per week in curriculum	**8**	distribution: Lecture	**4**	Tutorials/Practicals	**4**
3.2. Total hours per semester	**112**	distribution: Lecture	**56**	Tutorials/Practicals	**56**

Distribution of estimated time for study	**hours**
3.2.1. Learning by using one's own course notes, manuals, lecture notes, bibliography	**50**
3.2.2. Research in library, study of electronic resources, field research	**20**
3.2.3. Preparation for practicals/tutorials/projects/reports/homeworks	**14**
3.2.4. Examination	**4**
3.2.5. Other activities	**0**

3.3. Total hours of individual study	**84**
3.4. Total hours per semester	**200**
3.5. ECTS	**8**

4. Prerequisites (if necessary)

4.1. curriculum	Real and complex calculus; Algebra, geometry, and differential equations, Mechanics
4.2. competences	• C1- Identify and make appropriate use of main physical laws and principles in a given context.

5. Conditions/Infrastructure (if necessary)

5.1. for lecture	Multimedia infrastructure (videoprojector, PC)
5.2. for practicals/tutorials	Experimental setups for carrying out basic and fundamental experiments on electricity and magnetism

6. Specific competences acquired

Professional competences	• C1- Identify and make appropriate use of the main laws and principles of physics, in a given context. • C1.3 – Understand how the main laws and principles in physics can be applied to solving simple theoretical and practical problems under qualified guidance. • C2.3 - Make use of computers and data aquisition boards to control basic experiments or processes, and automation of experimental data collection. • C4 – Carry out basic experiments in physics by using specific laboratory equipment. • C5 – Analize and communicate basic scientific, educational and popular information on physics.
Transversal competences	• CT3- Efficient use of trousted sources of scientific information and profficient communication of scientific data in English

7. Course objectives

7.1. General objective	Establish the grounding in electromagnetism in preparation for more advanced courses
7.2. Specific objectives	- Understand the huge step of abstraction when switching from mechanical point of view with forces, to the concept of field, using specific examples of the gravitational, electric and magnetic fields, with some applications. - Understand and analize basic electric circuits - Understand the close connection between electricity and magnetism, leading to the discovery of electromagnetic waves - Knowledge and use of specific experimental methods connected to the study of electrical circuits and networks.

8. Contents

8.1. Lecture [chapters]	Teaching techniques	Observations
Fundamental interactions. Associated forces and fields in nature. Relative strength of fundamental interactions. The modern concept of charge.	Systematic exposition - lecture. Examples.	1 hour
Electric charges. Conservation and quantization of charge. Consequences.	Systematic exposition - lecture. Examples.	1 hour
Coulomb’s Law. The superposition principle.	Systematic exposition - lecture. Examples.	2 hours
The formalism of electrostatic field in vacuum. Electric field and electric potential. Properties.	Systematic exposition - lecture. Examples.	2 hours
Intensities and potentials. The superposition principle. Conservative nature of electrostatic field.	Systematic exposition - lecture. Examples.	2 hours
Point charge distributions and associated charge densities. Continuous charge distributions.	Systematic exposition - lecture. Examples.	2 hours

The moments of a charge distribution. The potential and the field of a dipole.	Systematic exposition - lecture. Examples.	2 hours
Gauss' law. Integral and in point forms of Gauss' Law. Laplace's and Poisson's equations. Consequences and applications.	Systematic exposition - lecture. Examples.	2 hours
Electrostatic energy of various sistems of charges at rest. Electrostatic energy stored in electrostatic field. Meaning and consequences.	Systematic exposition - lecture. Examples.	2 hours
The electrostatic field in matter. Ideal conductors and insulators under electrostatic field.	Systematic exposition - lecture. Examples.	2 hours
Electric displacement vector and electric polarization vector. Equations and properties.	Systematic exposition - lecture. Examples.	2 hours
Polarization of matter and electric permitivity.	Systematic exposition - lecture. Examples.	2 hours
Capacitance and capacitors.		2 hours
DC steady-state electrical currents. Current intensity and current density. Continuity equation.	Systematic exposition - lecture. Examples.	2 hours
Physics of conduction. Electric mobility and electric conductivity.	Systematic exposition - lecture. Examples.lecture. Examples.	2 hours
Linear media and Ohm's Law. Electric resistance and resistors.	Systematic exposition - lecture. Examples.lecture. Examples.	2 hours
Electromotive force and voltaic cells. Voltage sources and current sources. Principle of operation.	Systematic exposition - lecture. Examples.lecture. Examples.	2 hours
Basic electric circuits . Kirchooff's rules	Systematic exposition - lecture. Examples.	2 hours
Transient currents in RC circuits. Charging and discharging electric capacitors.	Systematic exposition - lecture. Examples.	2 hours
Power dissipation in electric circuits. Joule effect. In point Joule's Law.	Systematic exposition - lecture. Examples.	2 hours
Oersted discovery. The magnetic field due to DC steady-state currents. Lorentz force. Definition of magnetic flux density. Properties.	Systematic exposition - lecture. Examples.	2 hours
Biot-Savart Law. Integral and differential form of Ampere's Law. Magnetic forces on current carrying wires.	Systematic exposition - lecture. Examples.	2 hours
Vector potential and its properties.	Systematic exposition - lecture. Examples.	2 hours
Inductances, self-inductances, and mutual inductances. Magnetic moments.	Systematic exposition - lecture. Examples.	2 hours
Electromagnetic induction. Faraday's Law. Applications.	Systematic exposition - lecture. Examples.	2 hours
Alternating current (AC) circuits. Impedances and admitances. Resonance and physical meaning.	Systematic exposition - lecture. Examples.	2 hours

Power and energy in alternating-current Circuits.	Systematic exposition - lecture. Examples.	2 hours
Matter under magnetic field. Magnetic properties.	Systematic exposition - lecture. Examples.	2 hours
Electromagnetic waves and energy stored in electromagnetic field. Consequences.	Systematic exposition - lecture. Examples.	2 hours
Recommended lectures: 1. Stefan ANTOHE, Electricitate şi Magnetism, Vol. I, Editura Universităţii din Bucureşti, 1999. 2. Stefan ANTOHE, Electricitate şi Magnetism, Vol. II, Editura Universităţii din Bucureşti, 2002. 3. Edward M. Purcell, Electricitate şi Magnetism, Berkeley Physics Course, Vol. II, Editura Didactica şi Pedagogică, Bucuresti, 1982. 4. R. P. Feynman, R. B. Leighton, M. Sands, The Feynman Lectures on Physics, Vol. 2, Addyson-Wesley, 1964.		
8.2. Tutorials [main themes]	Teaching and learning techniques	Observations
8.3. Practicals [practical activities, projects, etc.]	Teaching and learning techniques	Observations
Electrifying various bodies by friction, influence, and contact. Principle of electroscope operation.	Guided practical activity	1 hour
Electrostatic interaction of point charges. Coulomb’s Law.	Guided practical activity	2 hours
Millikan experiment and charge quantization.	Guided practical activity	2 hours
Conductors at electrostatic equilibrium. Charge vs potential.	Guided practical activity	2 hours
The electrostatic capacitance of parallel plate capacitors.	Guided practical activity	2 hours
Dielectrics. Measurements of static dielectric constant of various solids.	Guided practical activity	1 hours
Using voltmeters and ammeters in various configurations: upstream and downstream connections for measuring electrical resistances.	Guided practical activity	2 hours
Measuring electrical resistances using Wheatstone Bridge and Kelvin method.	Guided practical activity	2 hours
Measurement of electric resistivity for various metals: Al, Cu.	Guided practical activity	2 hours
The efect of temperature on electrical resistivity of metals and semiconductors.	Guided practical activity	2 hours
Potentiometric measurements: precise measurements of electromotive forces.	Guided practical activity	2 hours
Thermoelectric effects (Peltier and Seebeck effects). Applications.	Guided practical activity	2 hours
The narrow electron beam tube. Principle of oscilloscope operation.	Guided practical activity	2 hours
Current-Voltage characteristics of a vacuum diode.	Guided practical activity	2 hours
Current-Voltage characteristics of semiconductor diodes.	Guided practical activity	2 hours

Biot-Savart Law. Measuring the magnetic density of flux of circular coils and solenoids.	Guided practical activity	1 hours
Measurement of Earth's Magnetic Field.	Guided practical activity	2 hours
Magnetic forces.	Guided practical activity	1 hours
Specific charge of the electron.	Guided practical activity	2 hours
Magnetic moment in the magnetic field.	Guided practical activity	2 hours
Ferromagnetic hysteresis.	Guided practical activity	2 hours
The Hall Effect.	Guided practical activity	2 hours
The Faraday's electromagnetic induction law.	Guided practical activity	2 hours
The transient regime in RLC cicuits. Damped oscillations.	Guided practical activity	2 hours
Resonance phenomena in series and parallel AC circuits.	Guided practical activity	2 hours
Coupled Oscillating Circuits.	Guided practical activity	2 hours
The Ohm's laws for AC circuits.	Guided practical activity	2 hours
Kirchhoff's laws for AC circuits.	Guided practical activity	1 hour
Measurements with AC Wheatstone Bridge.	Guided practical activity	2 hours
Power measurements in DC and AC circuits.	Guided practical activity	2 hours
The power characteristics of a single phase transformer.	Guided practical activity	1 hour
Recommended lectures: 1. I. Secăreanu, V. Ruxandra, M. Logofătu, S. Antohe, Electricitate şi magnetism, Lucrări de laborator, Tipografia Universităţii din Bucureşti, 1988. 2. P. Cristea and S. Antohe, Experiments on electricity and magnetism (will be printed)		
8.4. Project [only if included in syllabus]	Teaching and learning techniques	Observations
Bibliography:		

9. Compatibility of the course unit contents with the expectations of the representatives of epistemic communities, professional associations and employers (in the field of the study program)

This course unit aims at developing specific theoretical, practical competences, and abilities in the field of electric phenomena and electromagnetism. The content corresponds to all national and european/international standards. The content of lectures and the teaching methods were carefully selected and framed after the content of similar lecture units in the general syllabus of known universities from Romania, European Union, and US top universities. All lectures and the proposed experiments comply with the high standards requirements and expectations of our main employers of the graduates (industry, research – e.g. the National R&D Institute for Materials Physics, elementary

and high school teaching).

10. Assessment

Activity type	10.1. Assessment criteria	10.2. Assessment methods	10.3. Weight in final mark
10.4. Lecture	- coherence and clarity of exposition - correct use of equations/mathematical methods/physical models and theories - ability to indicate/analyse specific examples	Written test/oral examination	30%/30%
10.5.2. Practicals	- ability to use specific experimental methods/apparatus - ability to perform/design specific experiments - ability to present and discuss the results	Short lab written reports and practical examination	40%
10.6. Minimal requirements for passing the exam All practical activities attended and completed.			
Requirements for mark 5 (10 points scale) - Carrying out all mandatory experiments and completing all of written short reports. - Correct answer to basic questions and knowledge of basic laws of electromagnetism.			

Date
05.05.2016

Teacher's name and signature
Prof. Ştefan ANTOHE

Practical instructor, name(s) and signature(s)
Assoc. Prof. Petrică CRISTEA

Lecturer Cezar TAZLĂOANU

Date of approval

Head of Department,

Associate Professor Petrică CRISTEA

DI 110 F.EN Processing of Physical Data and Numerical Methods

1. Study program

1.1. University	University of Bucharest
1.2. Faculty	Faculty of Physics
1.3. Department	Department of Theoretical Physics, Mathematics, Optics, Plasma, Lasers
1.4. Field of study	Physics
1.5. Course of study	Undergraduate/Bachelor of Science
1.6. Study program	Physics (in English)
1.7. Study mode	Full-time study

2. Course unit

2.1. Course unit title	**Processing of Physical Data and Numerical Methods**							
2.2. Teacher				**Lect. Dr. Roxana ZUS**				
2.3. Tutorials/Practicals instructor(s)				**Asist. Adrian STOICA**				
2.4. Year of study	1	2.5. Semester	II	2.6. Type of evaluation	C	2.7. Type of course unit	Content[1)]	**DS**
							Type[2)]	**DI**

[1)] fundamental (DF), speciality (DS), complementary (DC); [2)] compulsory (DI), elective (DO), optional (DFac)

3. Total estimated time (hours/semester)

3.1. Hours per week in curriculum	**3**	distribution: Lecture	**2**	Practicals/Tutorials	**1**
3.2. Total hours per semester	**42**	distribution: Lecture	**28**	Practicals/Tutorials	**14**

Distribution of estimated time for study	**hours**
3.2.1. Learning by using one's own course notes, manuals, lecture notes, bibliography	**25**
3.2.2. Research in library, study of electronic resources, field research	**19**
3.2.3. Preparation for practicals/tutorials/projects/reports/homeworks	**25**
3.2.4. Examination	**4**
3.2.5. Other activities	

3.3. Total hours of individual study	**79**
3.4. Total hours per semester	**125**
3.5. ECTS	**5**

4. Prerequisites (if necessary)

4.1. curriculum	Programming Languages, Algebra, Analysis, Differential Equations
4.2. competences	Knowledge of programming, linear algebra, analysis, differential equations

5. Conditions/Infrastructure (if necessary)

5.1. for lecture	Computer, Video projector Lecture notes Bibliography
5.2. for practicals/tutorials	Computer network Lecture notes Bibliography

6. Specific competences acquired

Professional competences	• C2 – Using of dedicated software for data analysis and processing • C3 – Solving physics problems in given conditions, using numerical and statistical methods • C5 – Presenting and analysing information of didactics, scientific and outreach in physics • C6 – Interdisciplinary approach of some physics problems
Transversal competences	- CT3 -Efficient use of information and communication resources available.

7. Course objectives

7.1. General objective	Learning techniques of numerical solving of problems and data analysis
7.2. Specific objectives	- Understanding specific problematic and correlation between analytic and applicative aspects; - Developing abilities for numerical calculus; - Developing abilities for adapting numerical algorithms to physics problems; - Developing abilities for data analysis and interpretation from numerical estimations and to formulate rigorous theoretical conclusions.

8. Contents

8.1. Lecture [chapters]	Teaching techniques	Observations
1. Solution of Linear Algebraic Equations Direct Methods: Gaussian Elimination, Gauss-Jordan Elimination Iterative Methods: Jacobi, Gauss-Seidel, Successive Over Relaxation Matrix Decomposition: Doolittle Factorization, Crout Factorization, Cholesky Factorization Tridiagonal and Band Diagonal Systems of Equation Eigenvalues and Eigenvectors of a Matrix Singular Value Decomposition	Systematic exposition - lecture. Critical analysis. Examples	6 hours
2. Non-linear Equations and Roots of Polynomials Bisection Method Newton-Raphson Method False Positon Method Secant Method Müller's Method Lobacevski-Graeffe's Method Bairstow Method Methods for Non-linear Systems of Equations: Fixed Point Iteration Method, Newton-Raphson Method	Systematic exposition - lecture. Critical analysis. Examples	- hours
3. Function approximation **Polynomial Interpolation:** Lagrange, Newton, Hermite	Systematic exposition - lecture. Critical analysis. Examples	- hours

Spline Interpolation: quadratic spline, cubic spline, Bezier **Function approximation on inner product spaces** Continuous least squares approximation (orthogonal polynomials, trigonometric polynomials) Discrete least squares approximation (least squares approximations, discrete orthogonal polynomials, Chebyshev)		
4. Numerical Evaluation of Derivatives Classical Difference Formulas Richardson Extrapolation	Systematic exposition - lecture. Examples	- hours
5. Numerical Evaluation of Integrals Classical Formulas for Equally Spaced Abscissas: closed, open, semi-open formulas Gaussian Quadratures and Orthogonal Polynomials Monte-Carlo Integration	Systematic exposition - lecture. Critical analysis. Examples	- hours
6. Numerical Solution of Ordinary Differential Equations Direct Methods for Initial Value Problems Euler's Method of order I Euler's Method of order II Runge-Kutta Methods Richardson Extrapolation and Bulirsch-Stoer Method Second-Order Conservative Equations	Systematic exposition - lecture. Critical analysis. Examples	- hours
7. Numerical Solution of Partial Differential Equations Finite difference methods	Systematic exposition - lecture. Examples	- hours
Bibliography: - William H. Press, Saul A. Teukolsky, William T. Vetterling, Brian P. Flannery, "Numerical Recipes: The Art of Scientific Computing", 3rd ed.,Cambridge University Press, 2007 - R. Burden, J. D. Faires, "*Numerical Analysis*", Thomson Brooks/Cole, 2010 - George W. Collins , "Fundamental Methods and Data Analysis", 2003 - Morten Hjorth-Jensen , "Computational Physics", University of Oslo, 2006 - Roxana Zus, Lecture notes		
8.2. Tutorials [main themes]	Teaching and learning techniques	Observations
8.3. Practicals [practical activities, projects, etc.]	Teaching and learning techniques	Observations
Environment for programming the numerical methods exposed in the lecture	Systematic exposition. Heuristic conversation. Guided practical activity	1 hour
Programming the methods for solving linear algebraic equations. Applications in physics.	Guided practical activity	3 hours
Programming the methods for solving non-	Guided practical	3 hours

linear equations and finding roots of polynomials. Applications in physics.	activity	
Interpolation and extrapolation of data points. Function approximation.	Guided practical activity	2 hours
Numerical derivation.	Guided practical activity	1 hour
Programming the methods for numerical solution of integrals. Applications in physics.	Guided practical activity	2 hours
Programming the methods for numerical solution of ordinary differential equations. Applications in physics.	Guided practical activity	2 hours
Bibliography: - William H. Press, Saul A. Teukolsky, William T. Vetterling, Brian P. Flannery, “Numerical Recipes: The Art of Scientific Computing”, 3rd ed.,Cambridge University Press, 2007 - R. Burden, J. D. Faires, "*Numerical Analysis*", Thomson Brooks/Cole, 2010 - George W. Collins , “Fundamental Methods and Data Analysis”, 2003 - Morten Hjorth-Jensen , “Computational Physics”, University of Oslo, 2006 - Roxana Zus, Lecture notes - Roxana Zus, Adrian Stoica, Practical activities notes		
8.4. Project [only if included in syllabus]	Teaching and learning techniques	Observations

9. Compatibility of the course unit contents with the expectations of the representatives of epistemic communities, professional associations and employers (in the field of the study program)

For the elaboration of the contents, of the teaching and learning methods, the teachers have consulted the corresponding lectures from national and international universities. The content is in agreement with the research topics of the R&D institutes that use numerical methods for solving specific problems, simulations and/or processing of physical data.

10. Assessment

Activity type	10.1. Assessment criteria	10.2. Assessment methods	10.3. Weight in final mark
10.4. Lecture	- coherence and clarity of exposition - correct use of methods - ability to indicate/analyse specific examples	Written test and oral examination	50%
10.5.1. Tutorials			
10.5.2. Practicals	- ability to apply specific methods for a given problem - ability to present and discuss the results	Evaluation through practical activity	50%
10.5.3. Project [only if included in syllabus]			
10.6. Minimal requirements for passing the exam			
Requirements for mark 5 (10 points scale)			

Correct exposition of 50% from the theoretical topics at the final exam. Correct numerical solution of one problem at the final exam.

Date 25.03.2016	Teacher’s name and signature Lect. Dr. Roxana ZUS	Practicals/Tutorials instructor(s) name(s) and signature(s) Asist.univ. Adrian STOICA

Date of approval

Head of Department

Prof. Dr. Ing. Virgil Băran

DI.111.F.EN - Practica limbii engleze

1.Date despre program

1.1 Instituţia de învăţământ superior	**Universitatea din Bucureşti**
1.2 Facultatea/Departamentul	**Facultatea de Fizica**
1.3 Catedra	**Limbi Moderne**
1.4 Domeniul de studii	**Fizica**
1.5 Ciclul de studii	**Licenţă - 3 ani/180 credite (ECTS)**
1.6 Programul de studii/Calificarea	**Fizică Medicală / Fizcian medical**
	An I, ZI

2.Date despre disciplină

2.1 Denumirea disciplinei						**Practica limbii engleze**		
2.2 Titularul activităţilor de curs						-		
2.3 Titularul activităţilor de seminar						**Profesor Asociat dr. Teleoaca Anca Irinel**		
2.4 Anul de studiu	**1**	2.5 Semestrul	**2**	2.6 Tipul de evaluare	**V**	2.7 Regimul disciplinei	Conţinut	**DC**
							Obligativitate	**DI**

3.Timpul total estimat (ore pe semestru al activităţilor didactice)

3.1 Număr de ore pe săptămână	**0**	din care: 3.2 curs	-	3.3 seminar	**1**
3.4 Total ore din planul de învăţământ	**14**	din care: 3.5 curs	-	3.6 seminar	**14**

3.7 Distribuţia fondului de timp	**Ore**
Studiul după manual, suport de curs, bibliografie şi notiţe	4
Documentare suplimentară în bibliotecă, pe platformele electronice de specialitate	2
Pregătire seminarii, teme, referate, portofolii şi eseuri	1
Tutoriat	
Examinări	4
Alte activităţi/ Conferinte	-
3.7 Total ore studiu individual	**7**
3.8 Total ore pe semestru (3.4. + 3.7)	**14**
3.9 Numărul de credite	**1**

4.Precondiţii (acolo unde este cazul)

5.Condiţii (acolo unde este cazul)

5.1 de desfăşurare a cursului	

5.2 de desfăşurare a seminarului	• Nivel B1

6.Competenţe specifice acumulate

Competenţe profesionale	• Sa poata sa descrie grafice/diagrame sau sa prezinte in limba engleza metode stiintifice. • Sa recunoasca metodelor specifice formarii cuvintelor. • Sa utilizeze concepte, noţiuni şi metode pentru pentru dezvoltarea gandirii critice. • Utilizarea unor criterii şi metode adecvate pentru evaluarea meritelor şi limitelor diverselor abordari metodologice. • Dezvoltarea capacitatii de a aplica in mod creativ abilitatile cognitive dobandite in engleza prin: *listening, reading, writing, speaking*.
Competenţe transversale	• Îndeplinirea la termen, în mod riguros, eficient şi responsabil, a unor sarcini profesionale cu grad ridicat de complexitate, în condiţii de autonomie decizională, cu respectarea riguroasă a deontologiei profesionale.

7.Obiectivele disciplinei (reieşind din grila competenţelor specifice acumulate)

7.1 Obiectivul general al disciplinei	• Studentii trebuie să deprindă abilitatea de a extrage informatia din texte sau din reprezentari vizuale, ca de exemplu, desene grafice sau diagrame, apoi sa o redea intr-o gandire coerenta si clara.. • Studentii vor dobandi abilitatea de a gandi critic si de a face conexiuni intre diferitele mecanisme de formare a cuvintelor si chiar de a adapta mesajul nevoilor limbii.
7.2 Obiectivele specifice	• La finalul cursului, studentii trebuie să deprindă abilitatea de a scrie corect si de a se exprima liber intr-o engleza fluenta. De asemenea, ei trebuie sa poata compara si contrasta idei, folosind structurile invatate. ▪ Sa dezvolte o gândire critica şi analitica a competenţelor de argumentare logică pe suport oral şi în scris

8.Conţinuturi

Programa An I, sem.I	**General Issues**	**Conversational Topics**	**Grammar**	**Projects**
I.VALORILE VERBALE	Thinking Digital	*Everything We Know about Computers* (II)	Classifying; Foreign Nouns;	I. *Computers versus Books*
II. VERBUL	Spatial Relations	*Computer Applications* (II)	The Noun Modifiers	II. *Dreaming about Life*
III.ADVERBUL	A New Signification of the Concept of People – Machine Connection	*The Web* (I)	Non-Finites	III.
IV. VALORILE TEMPORALE ALE LIMBII	The Electronic World	*The Scientific Method.* (I) *Quantities.*	Ways of compare and contrast objects or ideas.	IV.

ENGLEZE				
				V.
V. DISCURSUL STIINTIFIC	Pros & Cons of ways to interpreting data	*Historical Contributions to the Development of Physics* (I)	Graphs and diagrams. Signs and Symbols in EST.	
VI. LIMBAJUL SI TIPURILE DE DISCURS	Simulating a Job Interview	*Historical Contributions to the Development of Physics* (II)	Communicative Discourse. The Sentence.	
VII. FUNCTIILE LIMBII GRUPUL NOMINAL COMPLEX	Preposing and Postposing	*What is Nanoscience*	The Clauses of Reason and Result.	
VIII. VORBIREA INDIRECTA	An Exploration of the English-Speaking World	*The Scientific Method.* (II)	The Relative and the Purpose Clause. Reporting Clauses.	**References** 1.Anca Irinel Teleoaca Experimenting with *English 4 Physics* 2. *50 Ideas you really need to know about the Universe*,Joanne Baker, Quercus
IX. IDIOMURILE DIN LIMBA ENGLEZA	On Style (II)	*Writing a Letter to a scientist*	General appearance; heading & inside address; salutation; complimentary close; addressing the envelope.	3. R. Huddleston, G. K. Pullum, *A Student's Introduction to English Grammar,* Cambridge, 2005 4.*Einstein. Bucuria Gandirii,* Univers, 2014 5. *Albert Einstein. Cuvinte Memorabile*. Humanitas. 2008
X. COEZIUNE. CONECTORI. TIPURI DE PARAGRAF	Improving the Word & Sentence Patterns	*How to Write an Essay* (II)	Style: levels of English usage; economy, consistency, logic;	6. *English Idioms in Use*, Michael McCarthy and Felicity O'Dell,

			coordination & subordination.	CUP, 2005
	Improving the W-S Patterns	*Working on a Project. The Review of a Book*	The Main Components of a Written Project; Oral Assignment of a given topic	**7.** Virginia Evans, *Successful Writing – Proficiency,* Express Publishing, 2000
	EVALUARE	**CRITERII**	**METODE APLICATIVE**	**PONDERE din NOTA FINALA**
		-nivelurile de intelegere si calitatea argumentării prin folosirea corecta a structurilor sintactice si gramaticale necesare. -participarea la discuţii prin exprimare coerenta si argumentare analitica	Sarcini aplicative Texte scrise (CV, A Book Review, Letter of Complaint) Exprimare orala libera pe un subiect dat Portofoliu lingvistic	**50%** **50%**

9.Coroborarea conţinuturilor disciplinei cu aşteptările reprezentanţilor comunităţii epistemice, asociaţiilor profesionale şi angajatori reprezentativi din domeniul aferent programului

- Seminarul dezvoltă competenţe care le permit studenţilor accesul la literatura de specialitate in limba engleza.
- În elaborarea sarcinilor de lucru s-a ţinut seama de codurile etice şi de standardele de cunoaştere specifice comunităţii academice a UVT.

10.Standard minim de performanţă

- Parcurgerea lecturilor obligatorii. Contributii personale la seminarii.
- Înţelegerea şi aplicarea corecta a conceptelor morfo-sintactice de bază/metodelor de analiză a unui text stiintific discutate la curs.
- Prezenţa la cel puţin 70% din cursuri.

Semnătura titularului de curs/seminar
Prof. Asociat Dr. Anca-Irinel Teleoaca

Data completării

Data avizării în departament

Semnătura şefului departament
Conf dr Diana Ionita

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DI.112.F.EN - EDUCATIE FIZICĂ ȘI SPORT

Denumirea disciplinei	**EDUCATIE FIZICĂ Și SPORT**					
Anul de studiu	I	Semestrul	2	Tipul de evaluare finală (**E / V / C**)		**V**
Categoria formativă a disciplinei **DF** - fundamentală, **DG** - generală, **DS** - de specialitate, **DE** - economică/managerială, **DU** - umanistă						**DG**
Regimul disciplinei {**Ob**-obligatorie, **Op**-opţională, **F**-facultativă}				**Ob**	Numărul de credite	**2**
Total ore din planul de învăţământ	**14**	Total ore studiu individual		**14**	Total ore pe semestru	**14**
Titularul disciplinei	***Asist. univ. dr. Cătălin Serban***					

** Daca disciplina are mai multe semestre de studiu, se completează câte o fişă pentru fiecare semestru*

Facultatea	**FIZICĂ**
Departamentul	DEPARTAMENTUL DE EDUCAŢIE FIZICĂ ŞI SPORT
Domeniul fundamental de ştiinţă, artă, cultură	Educaţie fizică şi sport
Domeniul pentru studii universitare de licenţă	**Discipline de pregătire în domeniul licenţei**
Direcţia de studii	

Numărul total de ore (pe semestru) din planul de învăţământ
(Ex: 28 la C dacă disciplina are curs de 14_saptămâni x 2_h_curs pe săptămână)

Total	**C****	**S**	**L**	**P**
14				**14**

*** C-curs, S-seminar, L-activităţi de laborator, P-proiect sau lucrări practice*

Discipline anterioare	**Obligatorii** (condiţionate)	---
	Recomandate	

Estimaţi **timpul total (ore pe semestru)** al activităţilor de **studiu individual** pretinse studentului *(completaţi cu zero activităţile care nu sunt cerute)*

1. Descifrarea şi studiul notiţelor de curs	**2 h**	8. Pregătire prezentări orale	
2. Studiu după manual, suport de curs		9. Pregătire examinare finală	**2 h**
3. Studiul bibliografiei minimale indicate	**1 h**	10. Consultaţii	**2**

			h
4. Documentare suplimentară în bibliotecă		11. Documentare pe teren	
5. Activitate specifică de pregătire SEMINAR şi/sau LABORATOR		12. Documentare pe INTERNET	**2 h**
6. Realizare teme, referate, eseuri, traduceri etc.	**2 h**	13. Alte activităţi: Participare la competiţii sportive	**2 h**
7. Pregătire lucrări de control		14. Alte activităţi: Participare la organizare evenimente sportive	**1 h**

TOTAL ore studiu individual (pe semestru) = 14 h

Competenţe generale (competenţele generale sunt menţionate în fişa domeniului de licenţă şi fişa specializării)	
Competenţe specifice disciplinei	**1. <u>Cunoaştere şi înţelegere</u>** *(cunoaşterea şi utilizarea adecvata a noţiunilor specifice disciplinei)* - Acumularea de cunoştiinţe privind activităţile motrice; - Cunoştinţe privind efectele activităţilor motrice asupra organismului; - Cunoştiinţe privind metodologia conceperii programelor de activ. motrice de timp liber; - Cunoştiinţe privind solicitările funcţionale în vederea solicitării efortului;
	2. <u>Explicare şi interpretare</u> *(explicarea şi interpretarea unor idei, proiecte, procese, precum şi a conţinuturilor teoretice şi practice ale disciplinei)* ▪ Definirea obiectivelor, sarcinilor specifice activităţilor desfăşurate; ▪ Mijloace de implementare a programelor de timp liber; ▪ Comunicarea în sport şi relaţiile publice(integrarea socială); ▪ Promovarea interdisciplinarităţii ştiinţelor motrice; ▪ Capacitatea de a înţelege,opera şi extinde activ. motrică în timpul liber si recreere; ▪ Capacitatea de a valorifica efectele pozitive ale activ. motrice asupra personalităţii şi calităţii vieţii;
	3. <u>Instrumental – aplicative</u> *(proiectarea, conducerea şi evaluarea activităţilor practice specifice; utilizarea unor metode, tehnici şi instrumente de investigare şi de aplicare)* ▪ Să conceapă programe sportive de timp liber pentru recreere; ▪ Să conceapă şi să aplice programe sportive de pregătire sau perfecţionare; ▪ Să coordoneze, să se integreze şi să participe la activităţile sportive ; ▪ Să identifice soluţii privind optimizarea timpului liber; ▪ Să mobilizeze resursele umane în acţiunea de voluntariat; ▪ Să cunoască modalităţile de evaluare a stării de sănătate (capacităţii de efort);

	4. <u>Atitudinale</u> *(manifestarea unei atitudini pozitive şi responsabile faţă de domeniul ştiinţific / cultivarea unui mediu ştiinţific centrat pe valori şi relaţii democratice / promovarea unui sistem de valori culturale, morale şi civice / valorificarea optima şi creativa a propriului potenţial în activităţile ştiinţifice / implicarea în dezvoltarea instituţională şi în promovarea inovaţiilor ştiinţifice / angajarea în relaţii de parteneriat cu alte persoane - instituţii cu responsabilităţi similare / participarea la propria dezvoltare profesională)* ▪ Să se integreze şi să participe la activităţile sportive promovând valorile fair-play-ului; ▪ Să dezvolte relaţii principale şi constructive cu partenerii sociali; ▪ Să se adapteze la situaţii noi; ▪ Să dezvolte atitudini pro-active , gândire pozitivă şi relaţii interpersonale.

<u>Conţinutul programei</u>	*<u>LUCRĂRI PRACTICO-METODICE – 14 ore :</u>* 1. Evaluarea somato-funcţională 1 oră; 2. Evaluarea motrică 1 oră; 3. Însuşirea unor metode şi tehnici în sporturile colective: volei, handbal, fotbal, baschet 1 oră; 4. Însuşirea unor programe pentru dezvoltare fizică armonioasă 1 oră; 5. Însuşirea unor metode sportive ca formă a practicării exerciţiilor fizice 1 oră; 6. Însuşirea unor metode şi tehnici privind educarea esteticii corporale prin fitness 1 oră; 7. Însuşirea unor tehnici pentru prelucrarea selectivă a aparatului locomotor 1 oră; 8. Însuşirea unor programe pentru optimizarea condiţiei fizice 1 oră; 9. Însuşirea unor rograme pentru educarea elasticităţii musculare şi supleţei articulare 1 oră; 10. Însuşirea unor rograme pentru combaterea stresului 1 oră; 11. Însuşirea unor rograme pentru combaterea obezităţii 1 oră; 12. Însuşirea unor rograme pentru corectarea atitudinilor vicioase 1 oră; 13. Însuşirea unor reguli privind practicarea unor sporturi colective: volei, handbal, fotbal, baschet 1 oră; 14. Verificare intermediară 1 oră;

Bibliografia	● Bocu Traian – Activitatea fizică în viaţa omului contemporan; ● Bota Aura – Activităţi fizice de timp liber; ● Ganciu Mihaela – Gimnastica aerobică-mijloc de îmbunătăţire a calităţii vieţii; ● Georgescu Florian – Cultura fizică-fenomen social; ● Dumitrescu Remus– Didactica educaţiei fizice; ● N.I.Ponomariov – Funcţiile sociale ale culturii fizice şi sportului;
Lista materialelor didactice necesare	Cărţi şi materiale de specialitate; Laptop – retroproiector, cronometru, cântar, combină muzicală Fileu volei, Mingi volei, Mingi medicinale, Saltele de gimnastica, Lada de gimnastica, Capra de gimnastica, Alte obiecte specifice invatarii jocului de volei

La stabilirea notei finale se iau în considerare	Ponderea în notare, exprimată in % {Total=100%}
- răspunsurile la examen / colocviu (evaluarea finală)	50%
- testarea continuă pe parcursul semestrului	10 %
- activităţile gen teme / referate / eseuri / traduceri / proiecte etc	20%

- alte activităţi *(precizaţi)* . .organizare competiţii sportive	20%

Descrieţi modalitatea practică de evaluare finală, E/V. *{de exemplu: lucrare scrisă (descriptivă şi/sau test grilă şi/sau probleme etc.), examinare orală cu bilete, colocviu individual ori în grup, proiect etc.}.colocviu individual*

Verificare individuală:
- verificarea cunoştinţelor teoretice
- Trecerea probelor şi testelor de motricitate
- Alcătuirea unui program de activitate independentă

Cerinţe minime pentru nota 5 (sau cum se acordă nota 5)	Cerinţe pentru nota 10 (sau cum se acordă nota 10)
- Participarea la 50 % din numărul total de lecţii - Participarea la o competiţie sportivă - să dovedească însuşirea minimă a noţiunilor generale ale managementului şi marchetingului în educaţia fizică	- frecvenţă săptămânală 100% - participarea la 2 competiţii sportive - capacitatea de a aplica cunoştinţele dobândite - capacitatea de a crea programe(proiecte) care vizează managementul sportiv

Data completării: 05.04.2016

Semnătura titularului:

Asist. univ. dr. Cătălin Serban

DFC.113.F.EN Organic Chemistry

1. Study program

1.1. University	University of Bucharest
1.2. Faculty	Faculty of Physics
1.3. Department	Department of Electricity, Solid State Physics and Biophysics
1.4. Field of study	Exact and natural sciences / Physics
1.5. Course of study	Undergraduate/Bachelor of Science
1.6. Study program	Physics (in English)
1.7. Study mode	Full-time study

2. Course unit

2.1. Course unit title	**Organic Chemistry**							
2.2. Teacher				Lect. dr. Marcela Elisabeta BĂRBÎNŢĂ PĂTRAŞCU				
2.3. Tutorials/Practicals instructor(s)				Lect. dr. Marcela Elisabeta BĂRBÎNŢĂ PĂTRAŞCU				
2.4. Year of study	1	2.5. Semester	2	2.6. Type of evaluation	C	2.7. Type of course unit	Content[1)]	**DC**
							Type[2)]	DFac

[1)] fundamental (DF), speciality (DS), complementary (DC); [2)] compulsory (DI), elective (DO), optional (DFac)

3. Total estimated time (hours/semester)

3.1. Hours per week in curriculum	**4**	distribution: Lecture	**2**	Tutorials/ Practicals	**2**
3.2. Total hours per semester	**56**	distribution: lecture	**28**	Tutorials/ Practicals	**28**

Distribution of estimated time for study	**hours**
3.2.1. Learning by using one's own course notes, manuals, lecture notes, bibliography	**20**
3.2.2. Research in library, study of electronic resources, field research	**10**
3.2.3. Preparation for practicals/tutorials/projects/reports/homeworks	**10**
3.2.4. Examination	**4**
3.2.5. Other activities	**0**

3.3. Total hours of individual study	**40**
3.4. Total hours per semester	**100**
3.5. ECTS	**4**

4. Prerequisites (if necessary)

4.1. curriculum	
4.2. competences	

5. Conditions/Infrastructure (if necessary)

5.1. for lecture	Multimedia infrastructure (videoprojector, PC), Internet access
5.2. for practicals/ tutorials	Interactive equipments, Phywe experimental setups, computers with internet connection, projector, whiteboard; instruments and modern accessories: laboratory glassware, pipettes and micropipettes, magnetic stirrers, mechanical stirrer (VIBRAX stirrer), pH meter InoLab 7110, ultrasound bath (Branson 1210), ovens, system for purifying water Milli-Q system (conductivity ≤ 0.1 mS cm^{-1}), Perkin Elmer Lambda 2S spectrophotometer, specific reagents.

6. Specific competences acquired

Professional competences	• C1 – Identification and correct use of physical laws and principles in given contexts • C6 - Interdisciplinary approach of topics in physics.
Transversal competences	• CT3 – Efficient use of the sources of scientific information and communication of scientific data in English

7. Course objectives

7.1. General objective	Understanding the fundamental concepts of Organic Chemistry
7.2. Specific objectives	Knowledge of specific physical theories and models used in organic chemistry; Developing the ability to creatively use specific concepts to solve *organic chemistry* problems and analyze experimental data.

8. Contents

8.1. Lecture [chapters]	Teaching techniques	Observations
Introduction to organic chemistry. General notions. The bioelements.	Systematic exposition - lecture. Examples	2 hours
Organic compounds (chemical composition, classification, general chemical formulas, nomenclature; biomolecules-molecules of life)	Systematic exposition - lecture. Examples	7 hours
The structure of organic compounds. Isomerism. Resonance structures. Electronic effects. Empirical, molecular and structural formula of organic compounds.	Systematic exposition - lecture. Examples	4 hours
Types of chemical bonds in organic compounds.	Systematic exposition - lecture. Examples	4 hours
Types of reactions in organic chemistry; reaction mechanisms.	Systematic exposition - lecture. Examples	4 hours
Green Chemistry. Principles and applications in engineering, nanotechnology, materials science.	Systematic exposition - lecture. Examples	7 hours

Bibliography:

1. Anne E. Marteel-Parish and Martin A. Abraham, *Green Chemistry and Engineering: A Pathway to Sustainability*, 376 pages, Published by Wiley, 2013 http://eu.wiley.com/WileyCDA/WileyTitle/productCd-0470413263.html
2. Popa, N., *General Chemistry*, course, Editura Universităţii din Bucureşti, 2000
3. Ebbing, De Darrell D., Gammon, S. D., *General Chemistry*, Cengage Learning, 2009
4. Neniţescu, C. D., *General Chemistry*, Didactic and Pedagogic Publishing House, Bucharest, 1978
5. Neniţescu, C. D., *Organic Chemistry* (vol. I and II), Didactic and Pedagogic Publishing House, Bucharest, 1984.
6. Linus Pauling, *General Chemistry*, Scientific Publishing House, Bucureşti, 1988
7. Lower, S. K., *General Chemistry*, 1999
8. Parotă, A., Vasile, A. D., *Problems of applied chemistry*, vol. 1, Editura Tehnică, Bucureşti, 1988
9. Arsene, P., Popescu, Şt., *Chemistry and problems of organic chemistry*, Editura Tehnică, Bucureşti, 1979
10. Stryer, L., *Biochemistry*, Academic Press, New York, 1995

8.2. Tutorials [main themes]	Teaching and learning techniques	Observations
Bibliography:		
8.3. Practicals [practical activities, projects, etc.]	Teaching and learning techniques	Observations
Instructions for safety and health at work for activities in organic chemistry lab. Familiarization with laboratory equipment and accessories.	Systematic exposition - lecture. Conversations. Examples	2 hours
Types of concentrations; measurement units. Solving problems.	Systematic exposition - lecture. Conversations. Examples. Applications.	2 hours
Preparation of solutions of a certain concentration. Successive dilutions. Mixtures.	Guided practical activity	2 hours
Organic chemical reactions	Guided practical activity	4 hours
Qualitative analysis of food	Guided practical activity	7 hours
Preparation and characterization of aqueous plant extracts	Guided practical activity	8 hours
Discussing laboratory reports. Solving problems and tests of organic chemistry Applications of nanotechnology in organic chemistry in the development of biomaterials (discussions, examples).	Systematic exposition - lecture. Conversations. Examples. Applications.	3 hours

Bibliography:

1. Parotă, A., Vasile, A. D., *Problems of applied chemistry*, vol. 1 and 2, Editura Tehnică, Bucureşti, 1988
2. Arsene, P., Popescu, Şt., *Chemistry and problems of organic chemistry*, Editura Tehnică, Bucureşti, 1979
3. Berger, D., *Organic Chemistry Laboratory Manual*, 157 pages, 2010.
4. **Elisabeta Barbinta-Patrascu**, Nicoleta Badea, Camelia Ungureanu, Marioara Constantin, Cristian Pirvu, Ileana Rau. Silver-based biohybrids “green” synthesized from *Chelidonium majus* L., *Opt. Mat*., 56 (2016) 94–99.
5. **M. E. Barbinta-Patrascu**, I.R. Bunghez, S. M.Iordache, N. Badea, R.C. Fierascu, R.M. Ion, Antioxidant Properties of Biohybrids Based on Liposomes and Sage Silver Nanoparticles, *Journal of Nanoscience and Nanotechnology*, 13, 2051 – 2060, 2013**.**
6. R. Bunghez, **M. E. Barbinta Patrascu**, N. Badea, S. M. Doncea, A. Popescu, R. M. Ion, Antioxidant silver nanoparticles green synthesized using ornamental plants, *Journal of Optoelectronics and Advanced Materials*, Vol. 14 (11-12), 1016 -1022, 2012.
7. **Bărbînţă-Pătraşcu, M. E.,** *Chemistry for students*. Laboratory Manual.

http://chemistry.ucdavis.edu/undergraduate/chemistry_2_series.html
http://www.crcnetbase.com/isbn/9781439840771
http://www.bluffton.edu/~bergerd/classes/cem221/handouts/labmanual.pdf
http://chemistry.harvard.edu/files/chemistry/files/2012_1_9_safetymanual1.pdf
http://www.acs.org/content/acs/en/greenchemistry/students-educators/textbooks.html
http://www.chem.uiuc.edu/weborganic/organictutorials.htm
http://www.learnchem.net/practice/
https://www2.chemistry.msu.edu/faculty/reusch/virttxtjml/Questions/problems/indexam.htm

8.4. Project [only if included in syllabus]	Teaching and learning	Observations

	techniques	
Bibliography:		

9. Compatibility of the course unit contents with the expectations of the representatives of epistemic communities, professional associations and employers (in the field of the study program)

This course unit aims at developing specific theoretical and practical competences and abilities in the field of organic chemistry, corresponding to national and european/international standards. The contents and teaching methods were selected after a thorough analysis of the contents of similar course units in the syllabus of other universities from Romania (Babes Boyai University, http://www.phys.ubbcluj.ro/invatamant/syllabus/pdf/FLR1104.pdf) or the European Union (University of Coimbra, https://apps.uc.pt/courses/EN/unit/8360/10828/2016-2017?common_core=true&type=ram&id=352; Rutgers University, http://chem.rutgers.edu/spring2016undergradcourses; University of Southampton, http://www.southampton.ac.uk/biosci/undergraduate/courses, University of Cambridge, http://www.undergraduate.study.cam.ac.uk/courses/natural-sciences/part1b#chemistry-a). The contents are in line with the requirements/expectations of the main employers of the graduates (industry, research – e.g. the National R&D Institute for Materials Physics, secondary school teaching).

10. Assessment

Activity type	10.1. Assessment criteria	10.2. Assessment methods	10.3. Weight in final mark
10.4. Lecture	- coherence and clarity of exposition - correct use of equations/and theories - ability to indicate/analyse specific examples	Written test	60%
10.5.1. Tutorials			
10.5.2. Practicals	- ability to perform specific experiments - ability to present and discuss the results - ability to use specific problem solving methods - ability to analyse the results	Lab reports; practical evaluation	40%
10.5.3. Project [only if included in syllabus]			
10.6. Minimal requirements for passing the exam All practical activities must be finalized.			
Requirements for mark 5 (10 points scale) - Performing all experiments and presentation of Lab reports - Correct solution for indicated subjects in the final test			

Date

Teacher's name and signature
Lect. dr. Marcela Elisabeta BĂRBÎNŢĂ PĂTRAŞCU

Practicals/Tutorials instructor(s) name(s) and signature(s)
Lect. dr. Marcela Elisabeta BĂRBÎNŢĂ PĂTRAŞCU

Date of approval

Head of Department,
Assoc. Prof. Petrică CRISTEA

DFC114F.EN Complements of Mathematics

1. Study program

1.1. University	University of Bucharest
1.2. Faculty	Faculty of Physics
1.3. Department	Department of Theoretical physics, Mathematics, Optics, Plasma, and Lasers
1.4. Field of study	Physics
1.5. Course of study	Undergraduate/Bachelor of Science
1.6. Study program	Physics (in English)
1.7. Study mode	Full-time study

2. Course unit

2.1. Course unit title	**Complements of Mathematics**							
2.2. Teacher				**Prof. dr. Claudia Timofte**				
2.3. Tutorials/Practicals instructor(s)				**Prof. dr. Claudia Timofte**				
2.4. Year of study	1	2.5. Semester	II	2.6. Type of evaluation	E	2.7. Type of course unit	Content[1)]	**DC**
							Type[2)]	**DFac**

[1)] fundamental (DF), speciality (DS), complementary (DC); [2)] compulsory (DI), elective (DO), optional (DFac)

3. Total estimated time (hours/semester)

3.1. Hours per week in curriculum	**4**	distribution: Lecture	**2**	Practicals/Tutorials	**2**
3.2. Total hours per semester	**56**	distribution: Lecture	**28**	Practicals/Tutorials	**28**

Distribution of estimated time for study	**hours**
3.2.1. Learning by using one's own course notes, manuals, lecture notes, bibliography	**15**
3.2.2. Research in library, study of electronic resources, field research	**10**
3.2.3. Preparation for practicals/tutorials/projects/reports/homeworks	**15**
3.2.4. Examination	**4**
3.2.5. Other activities	**0**

3.3. Total hours of individual study	**40**
3.4. Total hours per semester	**100**
3.5. ECTS	**4**

4. Prerequisites (if necessary)

4.1. curriculum	Real and Complex Analysis. Algebra, Geometry, and Differential equations.
4.2. competences	Programming skills.

5. Conditions/Infrastructure (if necessary)

5.1. for lecture	Multimedia infrastructure (video projector, PC). Lecture notes. Recommended bibliography.

5.2. for practicals/tutorials	Video projector. PC.

6. Specific competences acquired

Professional competences	C1. The identification and the appropriate use of the main physical laws and principles in a given context. C2. The use of suitable software packages for data analysis and processing. C3. Solving physics problems under given conditions using analytical, numerical and statistical methods. C5. The ability to analyse and to communicate the didactic, scientific and popularization information of Physics.
Transversal competences	CT3. The efficient use of the information sources and of the communication and professional development resources in Romanian and in a widely used foreign language (English), as well.

7. Course objectives

7.1. General objective	• Knowledge and understanding: knowledge and appropriate use of the specific notions of mathematical analysis. • Achieving a thorough theoretical knowledge. • Gaining computation skills.
7.2. Specific objectives	• Knowledge and appropriate use of the fundamental concepts of mathematical analysis. • Developing computational skills. • The use of MATHEMATICA software for dealing with integral calculus problems. • Developing the ability to use appropriate models for dealing with physical phenomena.

8. Contents

8.1. Lecture [chapters]	Teaching techniques	Observations
Line integrals. Paths. Line integrals of the first kind. Integration of differential forms of degree one. Mechanical work. Path-independence of line integrals. Poincaré lemma.	Systematic exposition – lecture. Examples.	3 hours
Multiple integrals. Change of *v*ariables in multiple integrals.	Systematic exposition - lecture. Examples.	4 hours
Area of a smooth surface. Surface integrals. Oriented surfaces. Flux of a field through a surface.	Systematic exposition - lecture. Examples.	3 hours
Integral formulas: Green-Riemann, Gauss-Ostrogradski, Stokes. Applications in physics.	Systematic exposition - lecture. Examples.	3 hours
Improper multiple integrals. Applications in quantum mechanics.	Systematic exposition - lecture. Examples.	2 hours
Holomorphic functions. C-derivable functions.	Systematic exposition -	3 hours

Cauchy-Riemann relations.	lecture. Critical analysis. Examples.	
Complex integral. Cauchy's theorem. Cauchy's integral formula and applications. Taylor expansion of holomorphic functions. Analytic continuation.	Systematic exposition - lecture. Examples.	4 hours
Residues and applications. Laurent.series. Singular points. Residue theorem. Applications to the evaluation of real-valued integrals. Conformal mappings. Applications in hydrodynamics.	Systematic exposition - lecture. Examples.	3 hours
Complex differential equations. Fuchs equations. Gauss hypergeometric equation. Gamma and Beta functions. Schrödinger equation.	Systematic exposition - lecture. Examples.	3 hours

Bibliography:

- G. Arfken, H. Weber, "Mathematical Methods for Physicists", Elsevier Academic Press, 2005.
- P. Bamberg, S. Sternberg, "A Course in Mathematics for Students of Physics", Cambridge University Press, 1990.
- N. Cotfas, L. Cotfas, "Elements of Mathematical Analysis" (in Romanian), Editura Universităţii din Bucureşti, 2010.
- R. Courant, "Differential and Integral Calculus", Wiley, New York, 1992.
- A. Halanay, V. Olariu, S. Turbatu, "Mathematical Analysis" (in Romanian), E.D. P., 1983.
- W. Rudin, "Principles of Mathematical Analysis", McGraw-Hill, New York, 1964.
- C. Timofte, ''Complex Analysis '', Editura Universităţii din Bucureşti, 2014.

8.2. Tutorials	Teaching and learning techniques	Observations
The seminar follows the course content. The issues to be discussed are meant to provide the student with a deep understanding of the theoretical concepts presented during the course, to develop computing skills and the appropriate use of the basic concepts of real and complex analysis.	Exposition. Guided work.	

Bibliography:

- L. Aramă, T. Morozan, "Problems of Differential and Integral Calculus" (in Romanian), Ed.Tehnică, Bucureşti, 1978.
- Armeanu, D. Blideanu, N. Cotfas, I. Popescu, I. Şandru, ''Problems of Complex Analysis'' (in Romanian), Ed.Tehnică, 1995.
- Gh. Bucur, E. Câmpu, S. Găină, "Problems of Differential and Integral Calculus" (in Romanian), vol. I- III, Ed.Tehnică, Bucureşti, 1978.
- Demidovich, B., "Problems in Mathematical Analysis", Mir Publishers, Moscow, 1977.
- N. Donciu, D. Flondor, "Mathematical Analysis. Problems" (in Romanian), Editura ALL, 1998.
- D. Stefănescu, S. Turbatu, ''Analytical Functions. Problems'' (in Romanian), Universitatea din

București, 1986.		
8.3. Practicals	Teaching and learning techniques	Observations
8.4. Project	Teaching and learning techniques	Observations

9. Compatibility of the course unit contents with the expectations of the representatives of epistemic communities, professional associations and employers (in the field of the study program)

This course unit develops some theoretical and practical competences and abilities, which are important for an undergraduate student in the field of modern Physics, corresponding to national and international standards. The contents and teaching methods were selected after a thorough analysis of the contents of similar course units in the syllabus of other universities from Romania or the European Union. The contents are in line with the requirements of the main employers of the graduates (industry, research, secondary school teaching).

10. Assessment

Activity type	10.1. Assessment criteria	10.2. Assessment methods	10.3. Weight in final mark
10.4. Lecture	- coherence and clarity of exposition; - correct use of mathematical methods and techniques; - ability to analyse specific examples.	Written test/oral examination	80%
10.5.1. Tutorials	- ability to use specific problem solving methods; - ability to analyse the results; - ability to present and discuss the results.	Homeworks/written tests	20%
10.5.2. Practicals			
10.5.3. Project			
10.6. Minimal requirements for passing the exam **Requirements for mark 5 (10 points scale)** Fulfillment of at least 50% of each of the criteria that determine the final grade.			

	Teacher's name and signature	
Date		Practicals/Tutorials instructor(s) name(s) and signature(s)
29.04.2016	Prof. dr. Claudia Timofte	Prof. dr. Claudia Timofte

Date of approval

Head of Department

Prof. dr. Virgil Băran

DFC 115 F.EN PSIHOLOGIA EDUCAȚIEI

1. Date despre program

1.1 Instituţia de învăţământ superior	UNIVERSITATEA DIN BUCUREȘTI
1.2 Facultatea	PSIHOLOGIE ȘI ȘTIINȚELE EDUCAȚIEI
1.3 Departamentul	FORMAREA PROFESORILOR
1.4 Domeniul de studii	Formarea profesorilor
1.5 Ciclul de studii	Nivelul I (Licență)
1.6 Programul de studii/Calificarea	Profesor de specialitate pentru gimnaziu

2. Date despre disciplină

2.1 Denumirea disciplinei				**PSIHOLOGIA EDUCAȚIEI**			
2.2 Titularul activităţilor de curs				Conf. univ. dr. Maria NEAGOE			
2.3 Titularul activităţilor de seminar				Conf. univ. dr. Maria NEAGOE			
2.4 Anul de studiu	I	2.5 Semestrul	I	2.6 Tipul de evaluare	Examen scris	2.7 Regimul disciplinei	Opțional

3. Timpul total estimat (ore pe semestru al activităţilor didactice)

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

Distribuţia fondului de timp	ore
Studiul după manual, suport de curs, bibliografie și notițe	22
Documentare suplimentară în bibliotecă, pe platformele electronice de specialitate si pe teren	10
Pregătire seminarii/laboratoare, teme, referate, portofolii și eseuri	9
Tutoriat	13
Examinări	10
Alte activităţi	5

3.7 Total ore studiu individual	69
3.9 Total ore pe semestru	125
3. 10 Numărul de credite	5

4. Precondiţii (acolo unde este cazul)

4.1 de curriculum	- Nu există
4.2 de competenţe	- Nu există

5. Condiţii (acolo unde este cazul)

5.1 de desfăşurare a cursului	Studenții se vor prezenta la prelegeri cu telefoanele mobile înschise. De asemenea, nu vor fi tolerate convorbirile telefonice în timpul cursului, nici părăsirea de către studenți a sălii de curs în vederea preluării apelurilor telefonice personale
5.2 de desfăşurare a seminarului/laboratorului	

6. Competenţe specifice acumulate

Competenţe profesionale	**1. Cunoaştere şi înţelegere** • Cunoașterea și utilizarea adecvată a noțiunilor referitoare la stadialitatea dezvoltării psihice, mecanismele psihice ale învățării școlare, modelul lui Zimmerman al învățarea autoreglată, personalitatea profesorului și competența psihopedagogică, particularitățile elevilor cu tulburări de comportament și ADHD; • Cunoasterea și utilizarea adecvată a implicațiilor pentru practica educațională a teoriilor învățării (behavioriste, cognitiviste și socio-constructiviste) • Cunoasterea și utilizarea adecvată a implicațiilor practice ale teoriilor asupra inteligenței: inteligențele multiple, inteligența emoțională, inteligența socială; **2. Explicare şi interpretare** • Explicarea și interpretarea particularităților învățării la elevii de vârstă gimnazială, pornind de la teoria psihogenezei cunoștințelor și operațiilor intelectuale, teoria dezvoltării psiho-sociale și teoria dezvoltării psihomorale; • Explicarea și interpretarea unor modalități concrete de stimulare a procesării informaționale în cadrul învățării școlare (crearea de situații de învățare care să stimuleze atât gândirea algoritmică și convergentă, cât și gândirea productivă, euristică, critică, divergentă, laterală, pozitivă; eficientizarea memoriei prin folosirea de mnemotehnici; creșterea capacității de concentrare a resurselor atenționale și depășirea obstacolelor interne) • Explicarea si interpretarea demersurilor didactice pentru stimularea învățării autoreglate și metacogniției elevilor; • Explicarea și interpretarea rolului factorilor nonintelectuali în învățare (structurile afectiv-motivaționale, reglatorii, personalitatea) • Explicarea si interpretarea impactului asupra învățării ale unor aspecte psihice (caracteristici și fenomene) cum ar fi: autoeficacitatea, imaginea de sine, optimismul, starea de bine psihic, auto-împlinirea profețiilor, neajutorarea învățată. **3. Instrumental – aplicative** • Utilizarea modalităților de stimulare a memoriei, gândirii, imaginației, motivației cognitive, intrinseci, pozitive, emoțiilor intelectuale, voinței, atenției elevilor; • Aplicarea cunoștințelor asimilate pentru stimularea autocunoașterii și intercunoașterii elevilor, dezvoltarea competențelor socio-emoționale ale acestora și gestionarea situațiilor dificile în mediul școlar. **4. Atitudinale** • Formarea unei atitudini pozitive și responsabile față de cariera didactică • Valorificarea optimă și creativă a propriului potențial în activitățile științifice • Participarea la propria dezvoltare profesională
Competenţe transversale	• Preocuparea pentru perfecţionarea profesională, prin antrenarea abilităţilor de gândire critică • Valorificarea concepției despre educație fundamentată psihologic în cadrul disciplinelor pedagogice, precum și în activitățile de practică pedagogică

7. Obiectivele disciplinei (reieşind din grila de competenţe specifice acumulate)

7.1 Obiectivul general al disciplinei	Explorarea principalelor abordări și modele explicative referitoare la aspectele psihologice specifice procesului de predare-învățare-evaluare
4.2 Obiective specifice	• Analiza și evaluarea implicațiilor practice ale teoriilor învățării și stadialității dezvoltării psihice • Aplicarea cunoștințelor asimilate referitoare la dezvoltarea competențelor socio-emoționale ale elevilor în rezolvarea unor studii de caz • Identificarea și alegerea metodelor optime de intervenție în lucrul cu elevii cu comportament opozițional, deficit de atenție (ADHD) și dificultăți emoționale • Dezvoltarea abilităţilor argumentative ale studenţilor, pornind de la topicile fundamentale din psihologia educației

8. Conţinuturi

8.1 Curs	Metode de predare	Observaţii
Cursul 1. Probleme general-teoretice ale psihologiei educației – obiectul de studiu al psihologiei educației	Prelegerea	
Cursul 2. Stadialitatea dezvoltării psihice : teoria psihogenezei cunoștințelor și operațiilor intelectuale (*Jean Piaget*), teoria dezvoltării psihomorale (*Lawrence Kohlberg*), teoria dezvoltării psihosociale (*Erik Erikson*)	Prelegerea	
Cursul 3. Tipuri, forme și niveluri ale învățării. Metacogniție și învățare. Modelul ciclic al învățării autoreglate. Beneficiile autoreglării învățării și modalitățile de stimulare a acesteia în școală.	Prelegerea	
Cursul 4. Contribuția teoriilor învățării și instruirii la eficientizarea activității didactice: conexionismul și legitățile învățării (*Eduard Thorndike*), condiționarea instrumentală și instruirea programată (*Burrhus Skinner*), teoria genetic-cognitivă și structurală a învățării (*Jerome Bruner*), teoria socioculturală a învățării (*Lev Vîgotski*), rolul organizatorilor cognitivi și anticipativi de progres (*David Ausubel* și *Floyd Robinson*).	Prelegerea	
Cursul 5. Procesarea informațională în învățarea școlară – modalități de stimulare a gândirii, memoriei și imaginației în activitatea de predare-învățare	Prelegerea	
Cursul 6. Rolul mecanismelor energizante în învățarea școlară – motivația cognitivă, afectivă, extrinsecă și intrinsecă ; relația dintre afectivitate, implicare și persistență în învățare, anxietatea în situațiile de evaluare	Prelegerea	
Cursul 7. Mecanismele volitive și atenționale ale învățării școlare. Comunicare și limbaj în context educațional.	Prelegerea	
Cursul 8. Personalitatea – mecanismul integrativ al învățării școlare. Relația dintre temperament și implicarea în învățare. Rolul aptitudinilor în obținerea performanțelor școlare. Atitudinile și autoreglarea preferențială. Importanța stimulării creativității în școală.	Prelegerea	
Cursul 9. Perspective moderne asupra inteligenței, aplicate în mediul educațional. Programul SPECTRE de stimulare a inteligențelor multiple (aplicație a teoriei lui Howard Gardner). Programul CASEL de stimulare a inteligenței emoționale (aplicație a teoriei lui Daniel Goleman).	Prelegerea	
Cursul 10. Elemente de psihologie socială aplicabile grupurilor	Prelegerea	

școlare. Tehnici sociometrice de investigare a relațiilor dintre elevi.		
Cursul 11. Modalităţi de stimulare a competenţelor sociale ale elevilor și prevenirea fenomenului de bullying în mediul școlar. Stimularea autocunoașterii și intercunoașterii elevilor.	Prelegerea	
Cursul 12. Particularitățile psihologice ale generației digitale. Efectul Flynn asupra copiilor de azi. Impactul noilor tehnologii și rețelelor de socializare asupra intereselor, valorilor și atitudinilor elevilor.	Prelegerea	
Cursul 13. Modalităţi de lucru cu elevii care au comportament opoziţional, tulburări de atenţie, anxietate în situaţii de evaluare, autoeficacitate scăzută și teama de inadecvare.	Prelegerea	
Cursul 14. Rolul personalităţii profesorului în eficientizarea activităţii didactice. Calitatea relației profesor-elev. Competența didactică, stilul empatic, aptitudinea și vocația pedagogică.	Prelegerea	

Bibliografie

1. Ausubel, D.P. și Robinson, F.G. (1981). *Învățarea în școală. O introducere în psihologia pedagogică.* București: Editura Didactică și Pedagogică.
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11. Woolfolk, A. (2004). *Educational Psychology.* New Dehli: Pearson Education (Singapore).
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8.2 Seminar	Metode de predare	Observaţii
Seminarul 1. Un nou mod de a privi educația: aplicații ale psihologiei pozitive și umaniste în mediul școlar.	Conversația Problematizarea	
Seminarul 2. Factorii dezvoltării psihice – educabilitatea. Ereditatea psihică; influențele de mediu și diferențele individuale; rolul educației în dezvoltarea psihică.	Dezbaterea Discuţii panel	
Seminarul 3. Implicațiile practice ale teoriei psihogenezei cunoștințelor și operațiilor intelectuale. Modelul piagetian de predare (Eggen și Kauchack). Studii de caz: accesibilizarea conținuturilor predate și exercițiilor aplicative în funcție de nivelul de dezvoltare a operațiilor intelectuale.	Exerciţiul Studiul de caz	
Seminarul 4. Modalităţi de intervenţie pentru stimularea imaginii de sine pozitive, autoeficacităţii, eliminarea stilului ego-defensiv în învăţare – studii de caz.	Modelarea Exerciţiul Studiul de caz	
Seminarul 5. Modalităţi de stimulare a gândirii și conduitei morale a elevilor. Programul EQUIP bazat pe abordarea peer-helping (Gibbs și Potter). Importanța stimulării în școală a altruismului, toleranței și grijii față de nevoile celorlalți.	Jocul de rol Discuţii panel	
Seminarul 6. Studii de caz – stimularea cunoștințelor și strategiilor metacognitive ale elevilor. Strategii de stimulare a autoreglării învățării în școală: instruirea directă și modelarea, practica ghidată și independentă, suportul social și practica reflexivă.	Demonstraţia Exerciţiul Jocul de rol	
Seminarul 7. Rolul temelor pentru acasă în dezvoltarea autoreglării învățării. Comportamentele disfuncționale și dezadaptative ale elevilor în realizarea temelor pentru acasă – modalităţi de prevenţie	SINELG Brainstorming	

și intervenție.		
Seminarul 8. Aplicații ale teoriei lui Bruner în educație – explorarea narativă. Studii de caz – propunerea unor teme de predare care să evidențieze concepția recentă a psihologului britanic referitoare la stimularea curiozității și motivației intrinseci în învățare.	Ghidul de anticipație Cubul	
Seminarul 9. Modalități de stimulare a gândirii euristice, productive, critice, laterale, divergente în contextul învățării școlare. Exersarea capacității elevilor de a folosi mnemotehnici în învățare. Tehnici de stimulare a imaginației elevilor.	Metoda analizei comparative Jocul pălăriilor gânditoare	
Seminarul 10. Aplicații practice ale teoriei inteligențelor multiple în activitatea de predare-învățare-evaluare – studii de caz.	Metoda mozaicului Jocul de rol Brainstorming	
Seminarul 11. Aplicații practice ale teoriei inteligenței emoționale – studii de caz.	Studiul de caz Jocul de rol	
Seminarul 12. Tehnici sociometrice – instrumente de investigare a aspectelor psihosociale ale grupurilor de elevi – aplicații.	Studiul de caz Problematizarea	
Seminarul 13. Studii de caz – elevii cu deficit de atenție, comportament opozițional și dificultăți emoționale.	Studiul de caz Metoda proiectului	
Seminarul 14. Modalități de stimulare a optimismului și stării de bine psihic a elevilor.	Harta conceptuală Problematizarea	

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9. Seligman, M., Ernst, R. M., Gillham, J., Reivich, K. și Linkins, M. (2009). Positive education: positive psychology and classroom interventions. *Oxford Review of Education*, 35, 3, 293-311.
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9. Coroborarea conţinuturilor disciplinei cu aşteptările reprezentanţilor comunităţii epistemice, asociaţiilor profesionale si angajatori reprezentativi din domeniul aferent programului

Conținuturile disciplinei au fost selectate ținându-se cont de nevoile și așteptările angajatorilor viitorilor absolvenți ai modulului psiho-pedagogic. Profesorii în formare au nevoie atât de cunoștințe instrumentale, cât și de abilități care să le permită adaptarea la situațiile imprevizibile cu care se vor confrunta în mod inerent când vor lucra cu elevii. Prin intermediul teoriilor și modelelor asimilate la curs, precum și prin aplicațiile realizate în cadrul activităților de seminar, studenții vor gestiona mai ușor clasa de elevi atunci când vor preda pentru prima dată (la practica pedagogică) și când vor deveni profesori debutanți. Cunoștințele de psihologia educației îi vor ajuta să-și explice diverse situații educative, comportamente și atitudini ale elevilor. Vor avea astfel posibilitatea de a găsi cele mai bune modalități de lucru cu elevii, pornind de la o cunoaștere adecvată a acestora.

10. Evaluare

Tip activitate	10.1 Criterii de evaluare	10.2 Metode de evaluare	10.3 Pondere în nota finală
10.4 Curs	- Cunoașterea principalelor aspecte psihologice care fundamentează activitatea de predare-învățare-evaluare	Evaluare formativă	80%
	- Explicarea implicațiilor practice ale teoriilor stadialității dezvoltării psihice, învățării, inteligențelor multiple și inteligenței emoționale		
	- Explicarea și interpretarea principalelor modalități de lucru cu elevii care au dificultăți emoționale, deficit de atenție și comportament opozițional		
10.5 Seminar	- participarea activă în analiza și dezbaterea subiectelor și temelor prevăzute în curriculum	Evaluare formativă	20%
	Elaborarea unui portofoliu care să conțină: - un eseu pornind de la o temă de reflecție din suportul de curs - o fișă de autocaracterizare în care să surprindă calitățile care îl recomandă pe student pentru profesia didactică - trei studii de caz referitoare la elevii cu dificultăți emoționale, deficit de atenție sau comportament opozițional.		
10.6 Standard minim de performanţă			
Participarea la cursurile și seminarele de ”Psihologia educației” și acumularea a cel puțin 50% din punctajul obținut prin cele două tipuri de evaluare practicat la seminarii.			

Data completării Semnătura titularului de curs Semnătura titularului de aplicaţii

Conf. univ. dr. Maria NEAGOE Conf. univ. dr. Maria NEAGOE

.....

Data avizării în catedră Semnătura sefului de departament

Prof. univ. dr. ION OVIDIU PÂNIŞOARĂ

DFC 116 F.EN Pedagogie I

1. Date despre program

1.1 Instituţia de învăţământ superior	UNIVERSITATEA DIN BUCUREȘTI
1.2 Facultatea	PSIHOLOGIE ȘI ȘTIINȚELE EDUCAȚIEI
1.3 Departamentul	FORMAREA PROFESORILOR
1.4 Domeniul de studii	Formarea profesorilor
1.5 Ciclul de studii	Nivelul I (Licență)
1.6 Programul de studii/Calificarea	Profesor de specialitate pentru gimnaziu

2. Date despre disciplină

2.1 Denumirea disciplinei				**Pedagogie I** (Modulul I: *Fundamentele pedagogiei* + Modulul II: *Teoria și metodologia curriculumului*)			
2.2 Titularul activităţilor de curs				Lector univ. dr. Anca POPOVICI			
2.3 Titularul activităţilor de seminar				Lector univ. dr. Anca POPOVICI			
2.4 Anul de studiu	I	2.5 Semestrul	II	2.6 Tipul de evaluare	Examen scris	2.7 Regimul disciplinei	Opțional

3. Timpul total estimat (ore pe semestru al activităţilor didactice)

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

Distribuţia fondului de timp	ore
Studiul după manual, suport de curs, bibliografie și notițe	20
Documentare suplimentară în bibliotecă, pe platformele electronice de specialitate si pe teren	27
Pregătire seminarii/laboratoare, teme, referate, portofolii și eseuri	18
Tutoriat	2
Examinări	2
Alte activităţi	0

3.7 Total ore studiu individual	69
3.9 Total ore pe semestru	125
3. 10 Numărul de credite	5

4. Precondiţii (acolo unde este cazul)

4.1 de curriculum	- Nu există
4.2 de competenţe	- Nu există

5. Condiţii (acolo unde este cazul)

5.1 de desfăşurare a cursului	Cursurile se desfășoară la sediul facultatilor din cadrul UB care asigură toate condițiile materiale (spațiu și utilități). Dar nu și condiții de *timp* educațional. Există dificultăți de ordin conceptual și curricular pentru atingerea obiectivelor. Disciplina ***Pedagogie I*** reprezintă doar un procent infim din curriculumul de specialitate pentru realizarea competenței

	pedagogice depline a viitorilor profesori. De aceea cursul nu poate ținti decât inițierea teoretică a studenților viitori.
5.2 de desfăşurare a seminarului/laboratorului	Seminariile se desfășoară la sediul facultăților din cadrul UB care asigură toate condițiile materiale (spațiu și utilități). Dar partea din curriculum este restrânsă și nu permite atingerea unor obiective mai ambițioase de formare a competenței pedagogice a viitorului profesor. Seminariile nu pot realiza decât un minimum de *abilități pedagogice* care nu acoperă integral necesitățile de formare a *competenței pedagogice*.

6. Competenţe specifice acumulate

Competenţe profesionale	Absolvenții cursului Pedagogie I (Modulul I:Fundamentele pedagogiei; și modulul II: Teoria și metodologia curriculumului) vor fi capabili: - să stăpânească și să folosească terminologia și limbajul de specialitate al științelor pedagogice; - să aprecieze corect valoarea principalelor teorii și modele științifice referitoare la morfologia educației, potențialul educativ uman, dezvoltarea curriculară, principiile universale ale educației, importanța educației în procesul formării și dezvoltarea personalității umane.
Competenţe transversale	Absolvenții cursului Pedagogie I (Modulul I:Fundamentele pedagogiei; și modulul II: Teoria și metodologia curriculumului) vor fi capabili: - să evalueze corect statutul epistemologic al pedagogiei și teoriei curriculumului ca domenii teoretice și tehnologice transdisciplinare; - să înțeleagă necesitatea fundamentării multidisciplinare a demersurilor teoretice și practice ale științelor educației; - să utilizeze teorii fundamentale și modele de bază în abordarea fenomenelor și proceselor educaționale.

7. Obiectivele disciplinei (reieşind din grila de competenţe specifice acumulate)

7.1 Obiectivul general al disciplinei	Inițierea studenților în problematica teoretică a pedagogiei generale și a teoriei curriculumului educațional.
	Stăpânirea conceptelor, principiilor, teoriilor și modelelor de bază ale pedagogiei generale și teoriei curriculumului

8. Conţinuturi

8.1 Curs	Metode de predare	Observaţii
FUNDAMANTELE PEDAGOGIEI 1.Statutul epistemologic al pedagogiei (clarificări conceptuale și decriptări etimologice; pedagogia ca știință artă și tehnologie a educației; contestarea statutului de știință al pedagogiei; apologetica pedagogiei ca știință)	Prelegere + suport electronic de curs	
2. *Paideia*, pedagogia *perennis* și pedagogia *temporalis.* Sistemul științelor educației.	Prelegere + suport electronic de curs	
3. Educația ca obiect de studiu al pedagogiei.	Prelegere + suport electronic de curs	
4.Valorile, principiile universale și formele educației	Prelegere + suport electronic de curs	
5. Specificul fenomenelor și proceselor educaționale	Prelegere + suport electronic de curs	
6. Educabilitatea (clarificări conceptuale)	Prelegere + suport electronic de curs	

7. Paradigme teoretice privind educabilitatea	Prelegere + suport electronic de curs	
8. Teoria epigenetică a educabilității	Prelegere + suport electronic de curs	
9. Teoria pentadică a factorilor dezvoltării și formării personalității umane. Educația ca factor fundamental al formării personalității umane. Normativitatea pedagogică și principiile universale ale educației	Prelegere + suport electronic de curs	
TEORIA ŞI METODOLOGIA CURRICULUMULUI 10. Curriculumul educațional (clarificări conceptuale și decriptări etimologice)	Prelegere + suport electronic de curs + studiul lucrării *Teoria generală a curriculumului educațional* (Polirom, 2008)	
11. Evoluția și metamorfozele curriculumului de-a lungul Civilizației euro-atlantice	Prelegere + suport electronic de curs + studiul lucrării *Teoria generală a curriculumului educațional* (Polirom, 2008	
12. Metodologia dezvoltării curriculumului modern	Prelegere + suport electronic de curs + studiul lucrării *Teoria generală a curriculumului educațional* (Polirom, 2008	
13. Modele moderne și postmoderne de dezvoltare curriculară	Prelegere +studiu de caz	
14. *Hidden curricula* și evoluția curriculumului în *after*-postmodernism	Prelegere + simulare didactică	

Bibliografie

SORIN CRISTEA, *Fundamentele pedagogiei*, Polirom, 2010

ION NEGREȚ-DOBRIDOR, *Teoria generală a curriculumului educațional*, Polirom, 2008.

ION NEGREȚ-DOBRIDOR, *Istoria universală a curriculumului educațional*, documentar electronic, FPSE, 2012.

ION NEGREȚ-DOBRIDOR, *Probleme de epistemologie pedagogică*, suport electronic de curs, FPSE, 2010

ION NEGREȚ-DOBRIDOR, *Teoria generală a educabilității*, suport de curs electronic, FPSE, 2012

ION NEGREȚ-DOBRIDOR, *Accelerarea psihogenezei*, Aramis, 2001.

ION NEGREȚ-DOBRIDOR, *Modele curriculare moderne și contemporane* , documentar electronic, FPSE, 2013.

DANIEL J. ELAZAR- *World History Curriculum* , Jerusalem Center for Public Affairs, 2010

DOUNE MACDONALD, *Curriculum change and the postmodern world: is the school curriculum-reform movement an anachronism?*

H. M. KLIEBARD, *The Struggle for the American Curriculum 1893 - 1958*, New York: Routledge, 1987.

JEAN PIAGET, *Dimensiuni interdisciplinare ale psihologiei*, EDP,1972.

JEAN PIAGET, *Biologie şi cunoaştere*, Dacia, Cluj, 1971.

8.2 Seminar	Metode de predare	Observaţii
1.Decriptarea, clarificarea și definirea conceptelor fundamentale ale științelor educației (pedagogie, educație, paideia, forme ale educației etc.)	Dezbatere și conversație euristică	

2.Contestarea statutului epistemologic al pedagogiei. Critica poziţiilor lui Popper, Kuhn şi Piaget	Referat şi dezbatere	
3. Formele educaţiei	Aplicaţie practică	
4. Normativitatea pedagogică. Principiile universale ale educaţiei	Dezbatere	
5. Educabilitatea. Teoria psihogenetică piagetiană	Dezbatere pe bază de studiu de caz	
6. Conceptul de curriculum şi problematica optimizării curriculare	Conversaţie maieutică	
7. Modele curriculare moderne şi postmoderne. Forme de hidden curricula		

Bibliografie

SORIN CRISTEA, *Fundamentele pedagogiei*, Polirom, 2010

ION NEGREŢ-DOBRIDOR, *Teoria generală a curriculumului educaţional*, Polirom, 2008.

ION NEGREŢ-DOBRIDOR, *Istoria universală a curriculumului educaţional*, documentar electronic, FPSE, 2012.

ION NEGREŢ-DOBRIDOR, *Teoria generală a educabilităţii*, suport de curs electronic, FPSE, 2012

ION NEGREŢ-DOBRIDOR, *Accelerarea psihogenezei*, Aramis, 2001.

9. Coroborarea conţinuturilor disciplinei cu aşteptările reprezentanţilor comunităţii epistemice, asociaţiilor profesionale si angajatori reprezentativi din domeniul aferent programului

Conţinuturile abordate la cursuri şi la seminarii vizează strict înarmarea studenţilor cu concepte esenţiale pentru abordarea teoretică a problematicii ştiinţelor educaţiei şi, de asemenea, pentru înţelegerea bazală a fenomenelor şi proceselor educaţionale; asimilarea acestor conţinuturi constituie *conditio sine-qua-non* pentru formarea, în etapele următoare, ***competenţei pedagogice*** a viitorilor profesori.

10. Evaluare

Tip activitate	10.1 Criterii de evaluare	10.2 Metode de evaluare	10.3 Ponderre în nota finală
10.4 Curs	- Stăpânirea deplină a conceptelor, teoriilor şi modelelor fundamentale	Test docimologic sumativ	60%
	- Aprecierea corectă a importanţei ştiinţelor educaţiei în formarea competenţei pedagogice a educatorului		
	-cunoaşterea adecvată a problematicii cuprinse în bibliografia obligatorie		
10.5 Seminar	- participarea activă în analiza şi dezbaterea subiectelor şi temelor prevăzute în curriculum	Evaluare formativă	40%
	-folosirea corectă în analize şi dezbateri a terminologiei de specialitate		
10.6 Standard minim de performanţă			
Acumularea a cel puţin 60% din punctajul obţinut prin cele două tipuri de evaluare practicat la seminarii şi cu prilejul testării sumative finale.			

Data completării Semnătura titularului de curs Semnătura titularului de aplicaţii

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Data avizării în catedră Semnătura sefului de departament
Prof. univ. dr. ION OVIDIU PÂNIŞOARĂ

DI 201F.EN OPTICS

1. Study program

1.1University	University of Bucharest
1.2. Faculty	Faculty of Physics
1.3Department	Department of Theoretical Physics, Mathematics, Optics, Plasma, Lasers
1.4. Field of study	Physics
1.5. Course of study	Undergraduate/Bachelor of Science
1.6. Study program	Physics (in English)
1.7. Study mode	Full-time study

2. Course unit

2.1. Course unit title	**OPTICS**							
2.2. Teacher				**Conf. Dr. Mircea BULINSKI, Lect. Dr. Ing. Ovidiu Toma**				
2.3. Tutorials/Practicals instructor(s)				**Conf. Dr. Mircea BULINSKI, Lect. Dr. Ing. Ovidiu Toma**				
2.4. Year of study	2	2.5. Semester	I	2.6. Type of evaluation	E	2.7. Type of course unit	Content[1)]	**DF**
							Type[2)]	**DI**

[1)] fundamental (DF), speciality (DS), complementary (DC); [2)] compulsory (DI), elective

(DO), optional (DFac)

3. Total estimated time (hours/semester)

3.1. Hours per week in curriculum	**8**	distribution: Lecture	**4**	Practicals/Tutorials	**4**
3.4. Total hours per semester	**112**	distribution: Lecture	56	Practicals/Tutorials	56
Distribution of estimated time for study					hours
3.4.1. Learning by using one's own course notes, manuals, lecture notes, bibliography					**30**
3.4.2. Research in library, study of electronic resources, field research					**20**
3.4.3. Preparation for practicals/tutorials/projects/reports/homeworks					**30**
3.4.4. Preparation for exam					**8**
3.4.5. Other activities					
3.7. Total hours of individual study	**80**				
3.8. Total hours per semester	**200**				
3.9. ECTS	**8**				

4. Prerequisites (if necessary)

4.1. curriculum	Geometry, Trigonometry, Mathematical analysis, Classic mechanics, Equations of mathematical physics, Electricity

4.2. competences	Knowledge of the trigonometrical functions and relations. Knowledge and use of the harmonic oscillator equations and the mechanical waves equations. Capability of mathematical (computational) modelling of oscillating phenomenon.

5. Conditions/Infrastructure (if necessary)

5.1. for lecture	Multimedia equipped class (videoprojector) Lecture notes Recommended bibliography
5.2. for practicals/tutorials	Laboratory of optics with experimental works of geometrical optics, photometry, interference, diffraction, polarization, thermal radiation.

6. Specific competences acquired

Professional competences	C1 - Identification and appropriate use of main laws and principles of physics in a given context. C3 - Solving problems of physics in imposed conditions, using numerical and statistical methods C4 – Applying knowledges from the field of physics both in concrete situations from related fields, as well as in some experiments, using the standard laboratory equipment. C5 - Communication and analysis of information with didactic, scientific and popularization character in the field of Physics.
Transversal competences	CT1 – Achievement of professional tasks in efficient and responsible way with the compliance of ethics legislation specific to the field, under qualified assistance. CT2 - Application of efficient working techniques in multidisciplinary team on different hierarchical levels. CT3 - Efficient use of information sources and of resources of communication and formation in a foreign language.

7. Course objectives

7.1. General objective	Knowing the laws and principles of light propagation, notions of geometrical optics image formation and understanding of optical instruments. Knowledge of fundamental phenomena in physical optics (wave-particle duality, interference, diffraction, polarization, emission and light detection) and understanding the functioning of simple optical devices based on these phenomena.
7.2. Specific objectives	Objective 1: Fundamental knowledge. Students will be competent in physical phenomena, mathematics and computing applications from physical optics, such that to allow them to approach optics problems from conceptual, analitical, numerical, and experimental point of view. Objective 2: Applicative. Students will gain skills related to optical techniques and an understanding of abilities necessary to adapt at the scientifical challenges of the future. Objective 3: Design and development. Students will be capable to solve problems of optics in a multidisciplinary environment, of team. Objective 4: Communication.

	Students will be capable to communicate scientific information orally, written and in graphic form. Objective 5: Behavioral. Students will act ethical and will appreciate the impact of optics on society, economy and environment.

8. . Contents

8.1. Lecture [chapters]	Teaching techniques	Observations
Evolution of optics knowledge. Induction and deduction in knowledge.	Systematic exposition - lecture. Heuristic conversation. Critical analysis. Examples.	2 hours
Experimental laws of geometrical optics. Reflection. Refraction. Total reflection.	Systematic exposition - lecture. Heuristic conversation. Experiment. Examples.	2 hours
Principles of geometrical optics.Deduction of reflection and refraction laws based on corpuscular model and Huygens construction (”wave model”). Wave – particle duality. Discussion of Huygens principle. Helmholtz equation.	Systematic exposition - lecture. Heuristic conversation. Critical analysis. Examples.	2 hours
Optical path. Fermat principle. Deduction of refraction law based on Fermat principle. Fermat – Descartes dispute. Maupertuis principle. Induction and deduction in knowledge. Malus theorem.	Systematic exposition - lecture. Heuristic conversation. Critical analysis. Examples.	2 hours
Light propagation in unhomogeneous media. Eikonal. Ray equation and eikonal equation (wave front), connection with analytical mechanics and quantum mechanics. Mirage, looming, optical fibers.	Systematic exposition - lecture. Heuristic conversation. Examples.	2 hours
Rigurous stigmatism. Tautocronism principle in image formation. Perfect stigmatic surfaces.	Systematic exposition - lecture. Heuristic conversation. Examples.	2 hours
Approximated stigmatism. Plane diopter, planar wave guides. Spherical diopter in paraxial approximation. Spherical mirrors, thin lenses.	Systematic exposition - lecture. Examples.	2 hours
Astigmatism. Aberrations. Linear systems – Point spread function (Optical transfer function).	Systematic exposition - lecture. Examples.	2 hours
Elements of matrix optics. Translation matrix. Refraction matrix. Centered optical systems. Principal planes, focal planes şi antiprincipal planes. Applications.	Systematic exposition - lecture. Heuristic conversation. Examples.	5 hours
Elements of photometry. Images illumination in optics. Elements of colorimetry.	Systematic exposition - lecture. Heuristic conversation. Critical analysis. Examples.	3 hours
Instruments with virtual images. Magnifying lens. Compounded microscope. Refraction telescope. Grosisment. Instruments with real images. Projection device. Photographic camera. Human eye as optical instrument.	Systematic exposition - lecture. Heuristic conversation. Critical analysis. Examples.	4 hours
Oscillations. Oscillations compositions. Synoptic	Systematic exposition -	2 hours

table.	lecture. Heuristic conversation. Modelling (TIC). Examples	
Plane waves and spherical waves. Waves interference. The generic, universal character of the interference phenomenon.	Systematic exposition - lecture. Heuristic conversation. Modelling (TIC). Case studies. Examples	2 hours
Young double slit experiment. Interfringe calculus. Interference in white light. „Photon by photon experiments”. The correlation of the light beam fluctuations. Wave – particle duality.	Systematic exposition - lecture. Heuristic conversation. Modelling (TIC). Examples	2 hours
Interference by wave-front division. Interference devices.	Systematic exposition - lecture. Heuristic conversation.. Examples	2 hours
Interference by amplitude division. Interference devices. Fringes classification (equal thickness, equal inclination, groove spectrum). Newton rings.	Systematic exposition - lecture. Heuristic conversation. Modelling (TIC). Examples	2 hours
Two beams interferometers (Rayleigh, Michelson, Mach-Zehnder, Jamin, Fizeau) and applications (OCT).	Systematic exposition - lecture. Heuristic conversation. Critical analyzes. Examples	2 hours
Multiple beam interference. Fabry-Perot interferometer, Tolansky interferometer.	Systematic exposition - lecture. Heuristic conversation. Examples	2 hours
Light diffraction. Fresnel diffraction and Fraunhofer diffraction. Diffraction on filiform slit, rectangular and circular slit. Resolution of optical instruments (Abbe’s relation). Fourier transform in optics. "Photon by photon experiments", wave – particle duality.	Systematic exposition - lecture. Heuristic conversation. Critical analyzes. Examples	5 hours
Light dispersion.	Systematic exposition - lecture. Examples	1 hour
Waves group. Group velocity and phase velocity.	Systematic exposition - lecture. Examples	1 hour
Light polarization. Light – transverse wave. Birefringence. Polarization devices. "Photon by photon experiments", eigenstates of a polarization device. Matrix and operator for a polarization device. Applications.	Systematic exposition - lecture. Heuristic conversation. Modelling (TIC). Critical analyzes. Examples	4 hours
Light as electromagnetic wave. Maxwell equations în optical media. Transversality. Electromagnetic waves spectrum.	Systematic exposition - lecture. Critical analyzes. Examples	1 hour
Thermal radiation. Deduction of Rayleigh-Jeans law and Wien radiation law from Planck’s law. Deduction of Wien displacement law and Stefan-Boltzmann law.	Systematic exposition - lecture. Heuristic conversation. Modelling (TIC). Critical analyzes. Examples	2 hours
Bibliography: I.I. Popescu, "*Optica geometrica*" Vol. I Tipografia Universitatii din Bucuresti (1988). St.Levai, M.Bulinski, O.Toma, "*Optica*", Editura Universitatii din Bucuresti (2005)		

Iulian Ionita – *Optica ondulatorie*, http://www.fizica.unibuc.ro/Fizica/Studenti/Cursuri/Main.php-
F. Pedrotti, L. Pedrotti, *Introduction to Optics*, Prentice Hall, New Jersey, 1993
E. Hecht, *Optics*, Addison-Wesley, 2002
M. Born, E.Wolf, "*Principles of Optics*", Cambridge University Press (1998)
M. Giurgea, L.Nasta, *Optica* Editura Academiei Române, Bucuresti, 1998.
G. Brătescu, *Optica*, Editura Didactica şi Pedagogica, Bucuresti, 1982
I. Iova**,** *Elemente de optica aplicata*, Editura stiintifica si enciclopedica, Bucureşti, 1977

8.2. Tutorials [main themes]	Teaching and learning techniques	Observations
Bibliography:		
8.3. Practicals [practical activities, projects, etc.]	Teaching and learning techniques	Observations
1) Lab works presentation. Labor protection rules instructing.		2 hours
2) Reflection and refraction laws	Guided practical activity	2 hours
3) Measurement of focal distance at converging lenses, diverging lense and concave mirrors.	Guided practical activity	4 hours
4) The determination of cardinal elements of centered optical systems.	Guided practical activity	2 hours
5) Spherical aberration. Measurement of focal distance at a lens with high convergence.	Guided practical activity	4 hours
6) Astigmatism aberration and chromatic aberration.	Guided practical activity	2 hours
7) The study of optical prism; measurement of refractive index by minimum deviation method.	Guided practical activity	2 hours
8) Measurement of the refractive index at liquids with Abbe refractometer.	Guided practical activity	2 hours
9) Optical microscope – measurement of angular magnification (grosisment). Refracting telescope – measurement of grosisment.	Guided practical activity	2 hours
10) Laws of photometry.	Guided practical activity	2 hours
11) Measurement of integral light flux of a light source using Ulbricht integrating sphere.	Guided practical activity	2 hours
12) Determination of transmission curve with Pulfrich spectrophotometer.	Guided practical activity	2 hours
13) Examination of laboratory works (colloquim)		2 hours
14) Interference study using Young, Meslin and Fresnel devices.	Guided practical activity	2 hours
15) Newton rings; equal thickness interference.	Guided practical activity	2 hours
16) Michelson interferometer; equal inclination interference.	Guided practical activity	2 hours
17) Diffraction on rectangular slit. Uncertainty relation.	Guided practical activity	2 hours
18) The study of the diffraction grating.	Guided practical activity	2 hours
19) Light polarization by reflection, refraction, birefringence. Malus law. Determination of the polarization degree at a laser diode.	Guided practical activity	2 hours

20) The study of rotatory polarization at solids.	Guided practical activity	2 hours
21) The study of rotatory polarization at liquids. Laurent polarimeter.	Guided practical activity	2 hours
22) Interference in polarized light.	Guided practical activity	2 hours
23) Thermal radiation; Stefan-Boltzmann law.	Guided practical activity	2 hours
24) Thermal radiation; Wien law.	Guided practical activity	2 hours
25) The study of optical detectors. Determination of spectral sensitivity.	Guided practical activity	2 hours
26) Lab colloquium.		2 hours
Bibliografie: D.Bejan, M.Bazavan, I.Ionita, O.Toma, M.Bulinski, I.Gruia, "*Lucrari practice de optica geometrica*", Editura Universitatii din Bucuresti (2013). D Bejan, M. Bazavan, I. Ionita, O. Toma - *Lucrari Practice de Optica Ondulatorie*, Ed. Unibuc. Buc, Bucuresti, 2013. St.Levai, A.Ioan, L.Nasta, *Optica. Exercitii si probleme*, Tipografia Universitatii din Bucuresti (1984)		
8.4. Project [only if included in syllabus]	Teaching and learning techniques	Observations
Bibliography:		

9. Compatibility of the course unit contents with the expectations of the representatives of epistemic communities, professional associations and employers (in the field of the study program)

The discipline content is based on a tradition of over 150 years of teaching Optics at University of Bucharest, improved and correlated with todays directions of development in optics as presented in the papers and conferences of international societies OSA and SPIE. The contents and teaching methods were selected after a thorough analysis of the contents of similar course units in the syllabus of other universities from Romania or the European Union (Rochester Institute of Optics, Rochester University). The contents are in line with the requirements/expectations of the main employers of the graduates (industry, research, secondary school teaching – INFLPR, INFM, INOE, IOR as the main employers of our graduates with competences in Optics).

10. Assessment

Activity type	10.1. Assessment criteria	10.2. Assessment methods	10.3. Weight in final mark
10.4. Lecture	- coherence and clarity of exposition - correct use of equations/mathematical methods/physical models and theories - ability to indicate/analyse specific examples	Final written evaluation: Test of theoretical knowledges and applied problems.	50%
		Continue evaluation	20%
		Attendance	10%
10.5.1. Tutorials			
10.5.2. Practicals	- Applying specific methods of solving the given problem;	Evaluation by practical test	20%

	- Results interpretation;		
10.5.3. Project [only if included in syllabus]			
10.6. Minimal requirements for passing the exam			
Requirements for mark 5 (10 points scale) - Mandatory attendance: 50% from lectures and all practicals completed. - At least mark 5 at the end of evaluation.			

Teacher's name and signature

Date
6.05.2016

Conf. Dr. Mircea BULINSKI
Lect. Dr. Ing. Ovidiu TOMA

Practicals/Tutorials instructor(s) name(s) and signature(s)

Conf. Dr. Mircea BULINSKI
Lect. Dr. Ing. Ovidiu TOMA

Date of approval

Head of Department
Prof. Dr. Ing. Virgil Băran

DI 202 F.EN Analytical Mechanics

1. Study program

1.1. University	University of Bucharest
1.2. Faculty	Faculty of Physics
1.3. Department	Theoretical Physics, Mathematics, Optics, Plasma, Lasers
1.4. Field of study	Physics
1.5. Course of study	Undergraduate/Bachelor of Science
1.6. Study program	Physics (in English)
1.7. Study mode	Full-time study

2. Course unit

2.1. Course unit title	**Analytical Mechanics**							
2.2. Teacher				**Lect.dr. Iulia Ghiu**				
2.3. Tutorials/Practicals instructor(s)				**Asist.dr. Victor Dinu**				
2.4. Year of study	2	2.5. Semester	III	2.6. Type of evaluation	E	2.7. Type of course unit	Content[1)]	**DS**
							Type[2)]	**DI**

[1)] fundamental (DF), speciality (DS), complementary (DC); [2)] compulsory (DI), elective (DO), optional (DFac)

3. Total estimated time (hours/semester)

3.1. Hours per week in curriculum	**4**	distribution: Lecture	**2**	Tutorials	**2**
3.2. Total hours per semester	**56**	lectures	**28**	tutorials	**28**

Distribution of estimated time for study	**hours**
3.2.1. Learning by using one's own course notes, manuals, lecture notes, bibliography	**30**
3.2.2. Research in library, study of electronic resources, field research	**15**
3.2.3. Preparation for practicals/tutorials/projects/reports/homeworks	**20**
3.2.4. Examination	**4**
3.2.5. Other activities	**0**

3.3. Total hours of individual study	**65**
3.4. Total hours per semester	**125**
3.5. ECTS	**5**

4. Prerequisites (if necessary)

4.1. curriculum	Mechanics, Electricity and magnetism, Algebra, Equations of mathematical physics
4.2. competences	Not applicable

5. Conditions/Infrastructure (if necessary)

5.1. for lecture	
5.2. for practicals/tutorials	

6. Specific competences acquired

Professional competences	• C1 – Using the law of physics in a proper way for a given problem • C3 – Solving physics problems • C5 – To be able to communicate and analyze the information from the lectures, from the scientific literature, as well as the information for popularization of physics
Transversal competences	• CT3 – Using in an efficient way the informational and communication resources in a foreign language

7. Course objectives

7.1. General objective	Introduction to the Lagrangian and Hamiltonian formalisms
7.2. Specific objectives	- understanding the basic concepts in analytical mechanics: the Lagrange function, Lagrange equations, the Hamilton function, the Hamilton equations - the ability to solve problems of analytical mechanics

8. Contents

8.1. Lecture [chapters]	Teaching techniques	Observations
Lagrangian formalism. Systems with constraints	Systematic exposition - lecture. Heuristic conversation. Critical analysis. Examples	2 h
D'Alembert principle. Lagrange equations	Systematic exposition - lecture. Heuristic conversation. Critical analysis. Examples	2 h
Hamilton principle	Systematic exposition - lecture. Heuristic conversation. Critical analysis. Examples	2 h
The theory of small oscillations	Systematic exposition - lecture. Heuristic conversation. Critical analysis. Examples	2 h
Motion in a central field of forces	Systematic exposition - lecture. Heuristic conversation. Critical analysis. Examples	2 h
Kepler problem	Systematic exposition - lecture. Heuristic conversation. Critical analysis. Examples	2 h
Classical theory of collision	Systematic exposition - lecture. Heuristic conversation. Critical analysis. Examples	2 h
Rigid body mechanics	Systematic exposition - lecture. Heuristic conversation. Critical analysis. Examples	2 h
Euler equations	Systematic exposition - lecture. Heuristic conversation. Critical analysis. Examples	2 h
Rigid body in a free rotation. Motion of a symmetric heavy top about a fixed point	Systematic exposition - lecture. Heuristic conversation. Critical analysis. Examples	2 h
Hamiltonian formalism. Canonical equations	Systematic exposition - lecture. Heuristic conversation. Critical analysis. Examples	2 h
Poisson brackets	Systematic exposition - lecture. Heuristic conversation. Critical analysis. Examples	2 h
Canonical transformations	Systematic exposition - lecture. Heuristic conversation. Critical analysis. Examples	2 h
Hamilton – Jacobi equation	Systematic exposition - lecture. Heuristic	2 h

	conversation. Critical analysis. Examples	
Bibliography: - Herbert Goldstein, *Classical Mechanics*, Addison-Wesley, Mass., 1980. - Grant R. Fowles and George L. Cassiday, *Analytical Mechanics*, Publisher: Brooks Cole; 7 edition, 2004. - John G Papastavridis, *Analytical Mechanics - A Comprehensive Treatise on the Dynamics of Constrained Systems*, World Scientific, 2014.		
8.2. Tutorials [main themes]	Teaching and learning techniques	Observations
1. Lagrangian formalism 2. Small oscillations 3. Hamiltonian formalism 4. Central field	Guided work	8 h 4 h 8 h 8 h
Bibliography: - L. Burlacu, D. G. David, *Culegere de probleme de mecanica analitica*, Universitatea din Bucuresti, 1988. - John G Papastavridis, *Analytical Mechanics - A Comprehensive Treatise on the Dynamics of Constrained Systems*, World Scientific, 2014.		
8.3. Practicals [practical activities, projects, etc.]	Teaching and learning techniques	Observations
Bibliography: .		
8.4. Project [only if included in syllabus]	Teaching and learning techniques	Observations
Bibliography:		

9. Compatibility of the course unit contents with the expectations of the representatives of epistemic communities, professional associations and employers (in the field of the study program)

This course unit develops some theoretical competences and abilities which are important for an undergraduate student in the field of modern Physics, corresponding to national and european/international standards. The contents and teaching methods were selected after a thorough analysis of the contents of similar course units in the syllabus of other universities from Romania or the European Union. The contents are in line with the requirements/expectations of the main employers of the graduates (industry, research, secondary school teaching).

10. Assessment

Activity type	10.1. Assessment criteria	10.2. Assessment methods	10.3. Weight in final mark
10.4. Lecture	- coherence and clarity of exposition - correct use of equations/mathematical methods/physical models and theories - ability to indicate/analyse specific examples	Written test and oral examination	90 %
10.5.1. Tutorials	- ability to use specific problem solving methods - ability to analyse the results	Homeworks/written tests	10 %

10.5.2. Practicals			
10.5.3. Project [only if included in syllabus]			
10.6. Minimal requirements for passing the exam			
Requirements for mark 5 (10 points scale) - to know and understand the basic concepts in analytical mechanics			

	Teacher's name and signature	Practicals/Tutorials instructor(s) name(s) and signature(s)
Date 24.03.2016	Associate professor dr. Iulia Ghiu	Teaching assistant dr. Victor Dinu

Date of approval

Head of Department
Professor dr. Virgil Baran

DI 203F.EN Electronics

1. Study program

1.1. University	University of Bucharest
1.2. Faculty	Faculty of Physics
1.3. Department	Department of Electricity, Solid State Physics and Biophysics
1.4. Field of study	Physics
1.5. Course of study	Undergraduate/Bachelor of Science
1.6. Study program	Physics (in English)
1.7. Study mode	Full-time study

2. Course unit

2.1. Course unit title	**ELECTRONICS**							
2.2. Teacher				**Conf. Dr. Andrei BARBORICA**				
2.3. Tutorials/Practicals instructor(s)				**Conf. Dr. Andrei BARBORICA**				
2.4. Year of study	2	2.5. Semester	II	2.6. Type of evaluation	E	2.7. Type of course unit	Content[1)]	**DD**
							Type[2)]	**DI**

[1)] fundamental (DF), speciality (DS), complementary (DC); [2)] compulsory (DI), elective (DO), optional (DFac)

3. Total estimated time (hours/semester)

3.1. Hours per week in curriculum	**4**	distribution: Lecture	**2**	Practicals/Tutorials	**2**
3.2. Total hours per semester	**56**	distribution: 1-st semester	**56**	2-nd semester	**0**

Distribution of estimated time for study	**hours**
3.2.1. Learning by using one's own course notes, manuals, lecture notes, bibliography	**25**
3.2.2. Research in library, study of electronic resources, field research	**15**
3.2.3. Preparation for practicals/tutorials/projects/reports/homeworks	**25**
3.2.4. Examination	**4**
3.2.5. Other activities	**0**

3.3. Total hours of individual study	**65**
3.4. Total hours per semester	**125**
3.5. ECTS	**5**

4. Prerequisites (if necessary)

4.1. curriculum	Real and Complex Mathematical Analysis, Electricity and Magnetism
4.2. competencies	C2 Use of software packages for data analysis and visualization

5. Conditions/Infrastructure (if necessary)

5.1. for lecture	Course room, projector, screen
5.2. for practicals/tutorials	Lab room, experimental setups, power supplies, measurement instruments, oscilloscopes

6. Specific competences acquired

Professional competences	C1.2 Ability to describe physical systems, using theoretical approaches and appropriate instruments C2.4 Ability to compare the results of numerical models and simulations with literature data or experimental measurements. C4.4 Critical evaluation of the results of the implementation of physical models, including the uncertainity in experimental data. C4.5 Ability to implement, improve and extend the use of a physical model. Ability to design and implement experimental setups and devices capable of validating a physical model.
Transversal competences	CT1 Efficient and responsible fulfillment of the professional duties, while respecting the deontological laws of the domain, under qualified supervision. CT3 Efficient use of informational, communication and guided professional development resources in Romanian and another widespread foreign language.

7. Course objectives

7.1. General objective	An introduction to electronics
7.2. Specific objectives	Study of the most frequently used semiconductor devices Study of the basic circuits using semiconductor devices. An introduction to the applications of the devices and circuits.

8. Contents

8.1. Lecture [chapters]	Teaching techniques	Observations
Physical properties of semiconductors. Fermi-Dirac Distribution, Density of charge carriers in intrinsic semicondactors, Physical Phenomena in semiconductors, P and N tipe semiconductors, P-N Junction.	Systematic exposition - lecture. Heuristic conversation. Critical analysis. Examples	2-4 hours
Physical Phenomena in semiconductors. Continuity equation	Systematic exposition - lecture. Heuristic conversation. Critical analysis. Examples	2-4 hours
P-N Junction. Physical phenomena at the P-N junction. Diodes. I-V characteristic of a diode	Systematic exposition - lecture. Heuristic conversation. Critical analysis. Examples	2-4 hours
Applications of P-N Junction. Zener diode. Varicap diode, Photodiode, LED, Tunnel Diode, Multi Junctions Devices (Diac, Triac, Thiristor)	Systematic exposition - lecture. Heuristic conversation. Critical analysis. Examples	2-4 hours
Bipolar transistor Currents of bipolar transistor, Static characteristics (Common emitter(CE), Common Base (CB)), Temperature Sensitivity, Static working point of CE and CB connections for bipolar transistor , Ebers-Moll equations.	Systematic exposition - lecture. Heuristic conversation. Critical analysis. Examples	2-4 hours
Field effect transistor JFET, MOSFET. Amplifier circuits using FETs.	Systematic exposition - lecture. Heuristic conversation. Critical analysis. Examples	2-4 hours
Feedback Amplifiers.	Systematic exposition - lecture. Heuristic conversation. Critical analysis. Examples	2-4 hours
Operationa Amplifiers.	Systematic exposition - lecture. Heuristic conversation. Critical analysis. Examples	2-4 hours

Bibliography: - Razvan BOBULESCU, Andrei BARBORICA Introduction to Electronics, Editura Universitatii din Bucuresti, 2002. - P. Horowitz and W. Hill, "The art of electronics", 2nd edition, Cambridge Unversity Press,1994 - Mihai P Dinca, "Electronica - Manualul studentului", vol1, Editura Universitatii din Bucuresti, 2003. - J. COX, Fundamentals of Linear Electronics, Ed. Delmar, 2001		
8.2. Tutorials [main themes]	Teaching and learning techniques	Observations
Some specific theme	Guided work	2-4-6 hours
Bibliography: ...whatever you decide to indicate...		
8.3. Practicals [practical activities, projects, etc.]	Teaching and learning techniques	Observations
1. Static characteristics of semiconductor diodes (Si, Ge, LED, Zener)	Guided practical activity	2-4 hours
2. Static characteristics of bipolar transistor in common emitter configuration	Guided practical activity	2-4 hours
Static characteristics of bipolar transistor in common base configuration	Guided practical activity	2-4 hours
The oscilloscope	Guided practical activity	2-4 hours
Rectifiers, unregulated and regulated power supplies. Voltage multiplier.	Guided practical activity	2-4 hours
Static characteristics of JFET	Guided practical activity	2-4 hours
Static characteristics of MOSFET	Guided practical activity	2-4 hours
Constant current, constant voltage sources	Guided practical activity	2-4 hours
Diac, Triac, Thiristor	Guided practical activity	2-4 hours
Temperature dependence of semiconductor diode and bipolar transistor	Guided practical activity	2-4 hours
Bibliography: - Razvan BOBULESCU, Andrei BARBORICA Introduction to Electronics, Editura Universitatii din Bucuresti, 2002. - P. Horowitz and W. Hill, "The art of electronics", 2nd edition, Cambridge Unversity Press,1994 - Mihai P Dinca, "Electronica - Manualul studentului", vol1, Editura Universitatii din Bucuresti, 2003.		
8.4. Project N/A	Teaching and learning techniques	Observations
Bibliography: N/A		

9. Compatibility of the course unit contents with the expectations of the representatives of epistemic communities, professional associations and employers (in the field of the study program)

This course unit forms/develops basic theoretical and practical competencies and abilities in the field of electronics, which are fundamental for an undergraduate student in the field of modern Physics, corresponding to national and european/international standards. The contents and teaching methods were selected after a thorough analysis of the contents of similar course units in the syllabus of other

universities from Romania or the European Union. The contents are in line with the requirements/expectations of the main employers of the graduates (industry, research, secondary school teaching, see e.g. http://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-071j-introduction-to-electronics-signals-and-measurement-spring-2006/calendar/).

10. Assessment

Activity type	10.1. Assessment criteria	10.2. Assessment methods	10.3. Weight in final mark
10.4. Lecture	- coherence and clarity of exposition - correct use of equations/mathematical methods/physical models and theories - ability to indicate/analyze specific examples	Written test/oral examination	
10.5.1. Tutorials	N/A	N/A	
10.5.2. Practicals	- ability to use specific experimental methods/apparatus - ability to perform/design specific experiments - ability to present and discuss the results	Lab reports	
10.5.3. Project [only if included in syllabus]	N/A	N/A	
10.6. Minimal requirements for passing the exam 80% of the practical activities must be finalized, mark 5 for the lab examination			
Requirements for mark 5 (10 points scale) A mimimum grade of 5 for the lab examination Answering the theoretical exam questions and solving the exercises with grade 5			

	Teacher's name and signature	Practicals/Tutorials instructor(s) name(s) and signature(s)
Date 01.05.2016	Conf. univ. dr. Andrei BARBORICA	Conf. univ. dr. Andrei BARBORICA

Date of approval

Head of Department
Conf. univ. dr. Petrica Cristea

DI 204F.EN Fundamentals of Atomic Physics

1. Study program

1.1. University	University of Bucharest
1.2. Faculty	Faculty of Physics
1.3. Department	Department of Electricity, Solid State Physics and Biophysics
1.4. Field of study	Physics
1.5. Course of study	Undergraduate/Bachelor of Science
1.6. Study program	Physics (in English)
1.7. Study mode	Full-time study

2. Course unit

2.1. Course unit title	**Fundamentals of Atomic Physics**							
2.2. Teacher				**Lect. univ. dr. Vasile BERCU**				
2.3. Tutorials/Practicals instructor(s)				**Conf. univ. dr. Mircea BERCU**				
2.4. Year of study	2	2.5. Semester	III	2.6. Type of evaluation	E	2.7. Type of course unit	Content[1)]	**DF**
							Type[2)]	**DI**

[1)] fundamental (DF), speciality (DS), complementary (DC); [2)] compulsory (DI), elective (DO), optional (DFac)

3. Total estimated time (hours/semester)

3.1. Hours per week in curriculum	**4**	distribution: Lecture	**2**	Practicals/Tutorials	**1/1**
3.2. Total hours per semester	**56**	Lecture	**28**	Practicals/Tutorials	**28**

Distribution of estimated time for study	**hours**
3.2.1. Learning by using one's own course notes, manuals, lecture notes, bibliography	**25**
3.2.2. Research in library, study of electronic resources, field research	**10**
3.2.3. Preparation for practicals/tutorials/projects/reports/homeworks	**30**
3.2.4. Examination	**4**
3.2.5. Other activities	**0**

3.3. Total hours of individual study	**65**
3.4. Total hours per semester	**125**
3.5. ECTS	**5**

4. Prerequisites (if necessary)

4.1. curriculum	Mechanics Physics, Electricity and Magnetism, Eequations of mathematical physics
4.2. competences	Knowledge of mathematics

5. Conditions/Infrastructure (if necessary)

5.1. for lecture	Amphytheatee equipped with multimedia devices
5.2. for practicals/tutorials	X ray tube and detector, gama ray source and scintillation detector , Hg lamp, fotoelectric cell, high voltage source, electron difraction aparatus

6. Specific competences acquired

Professional competences	**C1**: Identification and appropriate use of main physical laws and principles in a given context. **C1.1**: Deduction of working formulas for calculations of physical quantities using appropriate principles and laws of physics. **C1.2**: description of physical systems, using theories and specific tools (theoretical and experimental models, algorithms, schemes, etc.) **C1.3**: Applying the principles and laws of physics in problem solving theoretical or practical, in terms of qualified assistance. **C1.4**: Correct application of methods of analysis and criteria for the selection of appropriate solutions to achieve specified performance **C3**: Troubleshooting the physical conditions required using numerical and statistical methods **C3.1**: Use adequate data analysis and processing of numerical methods specific physics and mathematical statistics **C3.3**: Linking problematic methods of statistical analysis to date (to obtain measurements / calculations, data processing, interpretation). **C 3.4**: Evaluating the reliability of results and comparing them to bibliographic data or theoretical values calculated using statistical methods validation and / or numerical methods
Transversal competences	CT1: Professional tasks effectively and responsibly with domain-specific ontology compliance under qualified assistance. CT3: Effective use of information sources and communication resources and training assistance, both in Romanian and in a foreign language.

7. Course objectives

7.1. General objective	Assimilation of the basics concept of atomic physics
7.2. Specific objectives	- knowledge of specific physical theories/models used în atomic physics - developing the ability to work in a team - knowledge and use of specific experimental methods used în atomc physics

8. Contents

8.1. Lecture [chapters]	Teaching techniques	Observations
The electron - deviation in magnetic and electric field of electron and ion beans - the parabolic method - the specific charge - the variation of electron mass with velocity - the classical radius of electron	Systematic exposition - lecture. Heuristic conversation. Critical analysis. Examples	2 hours
Thermal radiation and the hypothesis of quantum energy - the blackbody radiation(the Wien and Stefan–Boltzmann radiation laws) - the Rayleigh-Jeans law – „the ultraviolet catastrophe” - The Planck radiation law	Systematic exposition - lecture. Critical analysis.	4 hours
The corpuscular proprieties of radiation	Systematic exposition -	3 hours

- photoelectric effect - Compton effect - continuum spectra of X ray	lecture. Heuristic conversation.	
The wavelike behavior of particles - de Broglie iphothesis - electron diffraction - Wave–particle duality: the wave packet	Systematic exposition - lecture. Heuristic conversation.	3 hours
The atomic structure - scattering cross section - the Rutherford experiment - alpha particle in nuclear field	Systematic exposition - lecture.Examples.	4 hours
Atomic models - Thomson model - Rutherford model - Bohr model - Bohr-Sommerfeld model	Systematic exposition - lecture. Heuristic conversation.	4 hours
Atoms in magnetic fields - Stern-Gerlach experiment - orbital magnetic moment - the electron spin - the Zeeman effect	Systematic exposition - lecture. Heuristic conversation.	4 hours
Spin-orbit interaction **The vector model of atom**	Systematic exposition - lecture. Heuristic conversation.	4 hours

Bibliography:
- Fizica atomica: note de curs, Florin Popescu si Florin Marica ; Ars Docendi, 1998
-Fizica atomului si a moleculei B. H. Bransden si C. J. Joachain, Bucuresti, 1998
- Fizica atomică - Vol I, V. Spolschi, Editura Tehnica, 1953
- Atkins' physical chemistry - Peter Atkins, Julio de Paula, Oxford University Press, 2010
- Atoms, Molecules and Photons: An Introduction to Atomic-, Molecular- and Quantum Physics -Wolfgang Demtröder Springer; 2nd ed. 2010
- Quantum physics of atoms, molecules, solids, nuclei and particles Robert Martin Eisberg and Robert Resnick, New York ; John Wiley & Sons, 1974
- The physics of atoms and quanta : introduction to experiments and theory Haken, Hermann Wolf, Hans Christoph Berlin; Springer, 1994

8.2. Tutorials [main themes]	Teaching and learning techniques	Observations
Types of radiation. Mechanisms of interaction. Sources of ionizing radiation. Ionizing radiation detection techniques.	Guided work	2 hours
The movement of the electron in an electric and magnetic field. Methods for determining the specific charge of the electron. Problems	Guided work	2 hours
Laws of blackbody radiation. Problems	Guided work	2 hours
Central forces. The kinetic energy in polar coordinates. Movement in the central field. The movement of an electron around the nucleus. Problems	Guided work	2 hours
The spectrometry of gamma rays: photon-crystal interaction, the photomultiplier principles. Processing signals generated by gamma photons: the amplitude	Guided work	2 hours

spectrum, calibration and determination of photon energy.		
Continuous and discrete spectrum of X rays. Problems.	Guided work	2 hours
Wave-particle duality. Problems. Atomic models. Problems	Guided work	2 hours
Bibliography: - Atkins' physical chemistry - Peter Atkins, Julio de Paula, Oxford University Press, 2010 -Atoms, Molecules and Photons: An Introduction to Atomic-, Molecular- and Quantum Physics -Wolfgang Demtröder Springer; 2nd ed. 2010 - Fizica atomică - Vol I, V. Spolschi, Editura Tehnica, 1953 - Quantum physics of atoms, molecules, solids, nuclei and particlesRobert Martin Eisberg and Robert Resnick, New York ; John Wiley & Sons, 1974 - The physics of atoms and quanta : introduction to experiments and theory Haken, Hermann Wolf, Hans Christoph Berlin; Springer, 1994		
8.3. Practicals [practical activities, projects, etc.]	Teaching and learning techniques	Observations
Presenting the practical works. Protection rules in atomic physics laboratory.	Guided practical activity	2 hours
Determining the specific charge of the electron	Guided practical activity	2 hours
The photoelectric effect – determining the Planck constant	Guided practical activity	2 hours
Continuous spectrum emitted by the X-ray tube. Determination of Planck constant	Guided practical activity	2 hours
The Millikan experiment – determination of the elementary charge	Guided practical activity	2 hours
The electron diffraction	Guided practical activity	2 hours
Bibliography: - Fizica atomica : lucrari practice , colectiv de autori: Elena Borca, et al.Tipografia Universitatii din Bucuresti], 1984 - Lucrari practice de fizica atomica, care se gasesc pe site-ul : http://brahms.fizica.unibuc.ro/atom/atom/LabAtom.php		
8.4. Project [only if included in syllabus]	Teaching and learning techniques	Observations
Bibliography: ...whatever you decide to indicate...		

9. Compatibility of the course unit contents with the expectations of the representatives of epistemic communities, professional associations and employers (in the field of the study program)

This course unit forms/develops some theoretical and practical competences and abilities which are fundamental for an undergraduate student in the field of modern Physics, corresponding to national and european/international standards. The contents and teaching methods were selected after a thorough analysis of the contents of similar course units in the syllabus of other universities from Romania or the European Union. The contents are in line with the requirements/expectations of the main employers of the graduates (industry, research, secondary school teaching).

10. Assessment

Activity type	10.1. Assessment criteria	10.2. Assessment methods	10.3. Weight in final mark

10.4. Lecture	- coherence and clarity of exposition - correct use of equations/mathematical methods/physical models and theories - ability to indicate/analyse specific examples	Written test/oral examination	60%
10.5.1. Tutorials	- ability to use specific problem solving methods - ability to analyse the results	oral examination	10 %
10.5.2. Practicals	- ability to use specific experimental methods/apparatus - ability to perform/design specific experiments - ability to present and discuss the results	oral examination	15 %
10.5.3 Homework	- resolve the assignment	Report	10%
10.5.4 Activity during the course	- answeres during the lectures, laboratory and tutorials	Answeres during the year	5%
10.5.3. Project [only if included in syllabus]	- coherence and clarity of exposition - correct use of mathematical and physical methods/models - ability to use specific experimental methods/apparatus - ability to present and discuss the results	Report	
10.6. Minimal requirements for passing the exam			
Requirements for mark 5 (10 points scale) The obligation to perform all laboratory work. To obtain minimum the mark 5 from evaluation criteria.			

Date	Teacher's name and signature Lect. univ. dr. Vasile BERCU	Practicals/Tutorials instructor(s) name(s) and signature(s) Conf. univ. dr. Mircea BERCU

Date of approval

Head of Department

Prof. univ. dr. Alexandru JIPA

DO205F.1.EN Simulation Methods in Physics

1. Study program

1.1. University	University of Bucharest
1.2. Faculty	Faculty of Physics
1.3. Department	Department of Theoretical Physics, Mathematics, Optics, Plasma, Lasers
1.4. Field of study	Physics
1.5. Course of study	Undergraduate/Bachelor of Science
1.6. Study program	Physics (in English)
1.7. Study mode	Full-time study

2. Course unit

2.1. Course unit title	**Simulation Methods in Physics**							
2.2. Teacher				**Conf.Dr.Mircea BULINSKI, Lect. Dr. Roxana ZUS**				
2.3. Tutorials/Practicals instructor(s)				**Lect. Dr. Roxana ZUS, Asist.univ. Adrian STOICA**				
2.4. Year of study	2	2.5. Semester	1	2.6. Type of evaluation	E	2.7. Type of course unit	Content[1)]	**DS**
							Type[2)]	**DO**

[1)] fundamental (DF), speciality (DS), complementary (DC); [2)] compulsory (DI), elective (DO), optional (DFac)

3. Total estimated time (hours/semester)

3.1. Hours per week in curriculum	**4**	distribution: Lecture	**2**	Practicals/Tutorials	**2**
3.2. Total hours per semester	**56**	distribution: Lecture	**28**	Practicals/Tutorials	**28**

Distribution of estimated time for study	**hours**
3.2.1. Learning by using one's own course notes, manuals, lecture notes, bibliography	**20**
3.2.2. Research in library, study of electronic resources, field research	**20**
3.2.3. Preparation for practicals/tutorials/projects/reports/homeworks	**25**
3.2.4. Examination	**4**
3.2.5. Other activities	

3.3. Total hours of individual study	**65**
3.4. Total hours per semester	**125**
3.5. ECTS	**5**

4. Prerequisites (if necessary)

4.1. curriculum	Programming Languages, Algebra, Analysis, Differential Equations
4.2. competences	Knowledge of programming, linear algebra, analysis, differential equations

5. Conditions/Infrastructure (if necessary)

5.1. for lecture	Computer, Video projector Lecture notes Bibliography
5.2. for practicals/tutorials	Computer network Lecture notes

	Bibliography

6. Specific competences acquired

Professional competences	• C2 – Using of dedicated software for data analysis and processing. • C3 – Solving physics problems in given conditions, using numerical and statistical methods. • C5 – Communication and analysis of information for didactics, scientific and outreach in physics. • C6 – Interdisciplinary approach of some physics topics.
Transversal competences	• CT3 - Effective use of information sources, communication and training resources in a foreign language

7. Course objectives

7.1. General objective	Learning techniques of numerical simulation for solving of problems and data analysis
7.2. Specific objectives	- Understanding specific problematic and correlation between analytic and applicative aspects; - Developing abilities for numerical simulation; - Developing abilities for adapting numerical algorithms to physics problems; - Developing abilities for data analysis and interpretation from numerical estimations and to formulate rigorous theoretical conclusions.

8. Contents

8.1. Lecture [chapters]	Teaching techniques	Observations
1. Modeling and simulation of physical systems Fundamental concepts - system; the structure of systems modeling and simulation; measurement and experimental data processing. Linear systems in physics - OTF and PSF. Linear prediction - Fourier transform, convolution and de-convolution signals. Modeling and simulation in contemporary knowledge.	Systematic exposition - lecture. Critical analysis. Examples	4 hours
2. Theory of modeling and simulation Basic concepts; specification systems formalism. Formalisms of modelling and their simulators: DT (Discrete Time); DEQ (Differential Equation); DEV (Discrete Event); Verification, Validation, Approximate morphisms. Complexity theory.	Systematic exposition - lecture. Critical analysis. Examples	4 hours
3. Ordinary Differential Equations (ODE) Modeling with ODE. Geometric meaning of the solutions of differential equations. Solutions of differential equations. Finite differences. Cellular automata. Nonlinear physical systems - Phase space, maps and flows, autonomous and non-autonomous systems; deterministic chaotic systems. Applications in physics.	Systematic exposition - lecture. Critical analysis. Examples	4 hours
4. Monte Carlo simulation methods Applications in physics	Systematic exposition - lecture. Critical analysis. Examples	4 hours

5. Partial Differential Equations Finite difference methods; Spectral methods; Relaxation methods**;** Applications in physics: heat equation, diffusion, Navier-Stokes etc.	Systematic exposition - lecture. Critical analysis. Examples	6 hours
6. Presenting sample problems from physics (mechanics, thermodynamics, electromagnetics, atomic physics etc.) for project	Systematic exposition - lecture. Case study. Examples	2 hours
7. Integral Equations Fredholm Equations, Volterra Equations, Integro-Differential Equations, Inverse problems	Systematic exposition - lecture. Examples	4 hours
Bibliography: - Bernard P. Zeigler, Herbert Praehofer, Tag Gon Kim, „Theory of Modeling and Simulation”, Academic Press (2000); - William H. Press, Saul A. Teukolsky, William T. Vetterling, Brian P. Flannery, “Numerical Recipes: The Art of Scientific Computing”, 3rd ed.,Cambridge University Press, 2007 - R. Burden, J. D. Faires, "Numerical Analysis", Thomson Brooks/Cole, 2010- George W. Collins , “Fundamental Methods and Data Analysis”, 2003 - Morten Hjorth-Jensen , “Computational Physics”, University of Oslo, 2006 - Sheldon M. Ross, “Simulation”, Academic Press (2002) - Stephen Wolfram, A New Kind of Science (http://www.wolframscience.com/nksonline/toc.html) - Roxana Zus, Lecture notes		
8.2. Tutorials [main themes]	Teaching and learning techniques	Observations
8.3. Practicals [practical activities, projects, etc.]	Teaching and learning techniques	Observations
Environment for programming the numerical and simulation methods exposed in the lecture	Systematic exposition. Heuristic conversation. Guided practical activity	2 hours
Modeling, simulation and prediction of physical systems: DES (Differential Equation System); DTS (Discrete Time System); Devs (Discrete Event System). Applications in physics.	Guided practical activity	4 hours
Programming the methods for numerical solution of ordinary differential equations. Applications in physics.	Guided practical activity	4 hours
Monte-Carlo simulation. Applications in physics.	Guided practical activity	4 hours
Programming the methods for numerical solution of partial differential equations. Applications in physics.	Guided practical activity	4 hours
Linear systems in physics. Linear prediction. Applications in physics.	Guided practical activity	3 hour
Nonlinear systems in physics. Time-series analysis. Analysis of phase space. Applications in physics.	Guided practical activity	3 hours
Stochastic and deterministic modeling of complex systems. Applications in physics.	Guided practical activity	2 hours
Programming the methods for numerical solution of integral equations. Applications in physics.	Guided practical activity	2 hours

Bibliography: - Bernard P. Zeigler, Herbert Praehofer, Tag Gon Kim, „Theory of Modeling and Simulation”, Academic Press (2000); - William H. Press, Saul A. Teukolsky, William T. Vetterling, Brian P. Flannery, “Numerical Recipes: The Art of Scientific Computing”, 3rd ed.,Cambridge University Press, 2007 - R. Burden, J. D. Faires, "Numerical Analysis", Thomson Brooks/Cole, 2010- George W. Collins , “Fundamental Methods and Data Analysis”, 2003 - Morten Hjorth-Jensen , “Computational Physics”, University of Oslo, 2006 - Sheldon M. Ross, “Simulation”, Academic Press (2002) - Stephen Wolfram, A New Kind of Science (http://www.wolframscience.com/nksonline/toc.html) - Roxana Zus, Lecture notes - Roxana Zus, Adrian Stoica, Practical activities notes		
8.4. Project [only if included in syllabus]	Teaching and learning techniques	Observations

9. Compatibility of the course unit contents with the expectations of the representatives of epistemic communities, professional associations and employers (in the field of the study program)

For the elaboration of the contents, of the teaching and learning methods, the teachers have consulted the corresponding lectures from national and international universities. The content is in agreement with the research topics of the R&D institutes that use numerical methods for solving specific problems, simulations and/or processing of physical data.

10. Assessment

Activity type	10.1. Assessment criteria	10.2. Assessment methods	10.3. Weight in final mark
10.4. Lecture	- coherence and clarity of exposition - correct use of methods - ability to indicate/analyse specific examples	Written test and oral examination	50%
10.5.1. Tutorials			
10.5.2. Practicals	- ability to apply specific methods for given problems - ability to present and discuss the results	Evaluation through practical activity	50%
10.5.3. Project [only if included in syllabus]			
10.6. Minimal requirements for passing the exam			
Requirements for mark 5 (10 points scale) Correct exposition of 50% from the theoretical topics at the final exam. Correct numerical solution of one problem at the final exam.			

	Teacher’s name and signature	Practicals/Tutorials instructor(s) name(s) and signature(s)
Date 25.03.2016	Conf.Dr. Mircea Bulinski Lect. Dr. Roxana ZUS	Lect. Dr. Roxana ZUS Asist.univ. Adrian STOICA

Date of approval

Head of Department

Prof. Dr. Virgil BĂRAN

DO 205 F.2.EN Applications of Group Theory in Physics

1. Study program

1.1. University	University of Bucharest
1.2. Faculty	Faculty of Physics
1.3. Department	Department of Theoretical physics, Mathematics, Optics, Plasma, and Lasers
1.4. Field of study	Physics
1.5. Course of study	Undergraduate/Bachelor of Science
1.6. Study program	Physics (in English)
1.7. Study mode	Full-time study

2. Course unit

2.1. Course unit title	***Applications of Group Theory in Physics***							
2.2. Teacher				**Prof.Dr. Ion Armeanu/ Conf.Dr.Iulia Ghiu**				
2.3. Tutorials/Practicals instructor(s)				**Asist. Dr. Victor DINU**				
2.4. Year of study	II	2.5. Semester	III	2.6. Type of evaluation	E	2.7. Type of course unit	Content[1)]	**DS**
							Type[2)]	**CO**

[1)] fundamental (DF), speciality (DS), complementary (DC); [2)] compulsory (DI), elective (DO), optional (DFac)

3. Total estimated time (hours/semester)

3.1. Hours per week in curriculum	**4**	distribution: Lecture	**2**	Practicals/Tutorials	**2**
3.2. Total hours per semester	**56**	Lecture	**28**	Practicals/Tutorials	**28**

Distribution of estimated time for study	**hours**
3.2.1. Learning by using one's own course notes, manuals, lecture notes, bibliography	**25**
3.2.2. Research in library, study of electronic resources, field research	**20**
3.2.3. Preparation for practicals/tutorials/projects/reports/homeworks	**20**
3.2.4. Examination	**4**
3.2.5. Other activities	**0**

3.3. Total hours of individual study	**65**
3.4. Total hours per semester	**125**
3.5. ECTS	**5**

4. Prerequisites (if necessary)

4.1. curriculum	Algebra, Geometry, and Differential equations.
4.2. competences	

5. Conditions/Infrastructure (if necessary)

5.1. for lecture	Multimedia room (with video projector). Lecture notes.

	Recommended bibliography.
5.2. for practicals/tutorials	Video projector. Computers.

6. Specific competences acquired

Professional competences	C1. The identification and the appropriate use of the main physical laws and principles in a given context. C3. Solving physics problems under given conditions using analytical, numerical and statistical methods. C5. The ability to analyse and communicate the didactic, scientific and popularization information of Physics.
Transversal competences	CT3. The efficient use of the information sources and of the communication and professional development resources in Romanian and in a widely used foreign language, as well.

7. Course objectives

7.1. General objective	**Knowledge and understanding** • Knowledge, understanding and appropriate use of the specific notions of group theory. • Understanding the relevance of representations. • Understanding the role of symmetries in quantum physics.
7.2. Specific objectives	• Developing the ability to use appropriate mathematical models for modelling physical phenomena. • Developing an interest for the field; • Understanding the importance of group theory in contemporary physics.

8. Contents

8.1. Lecture [chapters]	Teaching techniques	Observations
General Properties of Groups and Mappings: Group. Group morphisms. Subgroup. Normal (invariant) subgroup. Factor group. The Isomorphism Theorem for groups. Lagrange Theorem. Conjugacy classes. Direct product of groups.	Systematic exposition – lecture. Examples.	4 hours
Examples Groups of transformations. The General Linear Group. Cyclic groups. Dihedral groups. Permutation groups. The Quaternion Group.	Systematic exposition - lecture. Examples.	2 hours
The rotation group *SO*(3). The rotation group *SU*(2).	Systematic exposition - lecture. Critical analysis. Examples.	2 hours
Group Representations Linear representations and matrix representations of a group. Equivalence of representations. Irreducible representations and complete reducible representations.	Systematic exposition - lecture. Critical analysis. Examples.	4 hours
Unitary representations. Maschke Theorem.	Systematic exposition -	2 hours

	lecture. Examples.	
Characters. Schur's Lemmas.	Systematic exposition - lecture. Examples.	2 hours
Similarity between finite groups and compact Lie groups. Hurwitz' integral.	Systematic exposition - lecture. Examples.	4 hours
The regular representation. The Orthogonality Theorem for irreducible representations. Orthogonality of characters. Character table of a finite group.	Systematic exposition - lecture. Critical analysis. Examples.	2 hours
Direct products of representations. The Clebsch-Gordan series and coefficients.	Systematic exposition - lecture. Critical analysis. Examples.	2 hours
Lie Algebras Lie algebra. Morphisms of Lie algebras. Lie subalgebra. Linear representations of a Lie algebra. Classical examples.	Systematic exposition - lecture. Critical analysis. Examples.	4 hours

Bibliography:

- T. Albu, N. Manolache, *19 Lecții de Teoria grupurilor*, Univ. București, 1987 (in Romanian).
- J. L. Alperin, Rowen B. Bell, *Groups and Representation*, Springer, 1995.
- J. F. Cornwell, *Group Theory in Physics, An introduction*, Academic Press, 1997.
- N. Cotfas, L. A. Cotfas, *Complemente de matematic*, Ed. Univ. București, 2009 (in Romanian).
- H. F. Jones, *Groups, Representations and Physics* (Second Edition), Taylor and Francis Group, 1998.
- Joseph J. Rotman, *An Introduction to the Theory of Groups* (Fourth Edition), Springer, 1995.
- J.J. Sakurai, *Modern quantum mechanics*, Addison-Wesley, 1990.
- Wu-Ki Tung, *Group Theory in Physics*, World Scientific Publishing, 1985.
- E. B. Vinberg, *A Course in Algebra*, (Graduate studies in Mathematics, vol. 56) AMS (2003).
- E. Wigner, *Group Theory and its applications to atomic spectra*, Academic Press, 1959.

8.2. Tutorials	Teaching and learning techniques	Observations
The rotation group *SO*(3). Irreducible representations. The rotation groups SU(3), *SU*(2). Unitary irreducible representations.	Exposition. Guided work.	
Bibliography: as for Lecture		

8.3. Practicals	Teaching and learning techniques	Observations
8.4. Project	Teaching and learning techniques	Observations

9. Compatibility of the course unit contents with the expectations of the representatives of epistemic communities, professional associations and employers (in the field of the study program)

This course unit develops some theoretical and practical competences and abilities, which are important for an undergraduate student in the field of modern Physics, corresponding to national and international standards. The contents and teaching methods were selected after a thorough analysis of the contents of similar course units in the syllabus of other universities from Romania or the European Union. The contents are in line with the requirements of the main employers of the graduates (industry, research, secondary school teaching).

10. Assessment

Activity type	10.1. Assessment criteria	10.2. Assessment methods	10.3. Weight in final mark
10.4. Lecture	- coherence and clarity of exposition; - correct use of mathematical methods and techniques; - ability to analyse specific examples.	Written test/oral examination	80%
10.5.1. Tutorials	- ability to use specific problem solving methods; - ability to analyse the results; - ability to present and discuss the results.	Homeworks/written tests	20%
10.5.2. Practicals			
10.5.3. Project			
10.6. Minimal requirements for passing the exam **Requirements for mark 5 (10 points scale)** Fulfillment of at least 50% of each of the criteria that determine the final grade.			

Date	Teacher's name and signature	Practicals/Tutorials instructor(s)
29 .04 .2016	Prof. Dr. Ion ARMEANU Conf. Dr. Iulia GHIU	Asist. Dr. Victor DINU

Date of approval

Head of Department

Prof. dr. Virgil Băran

DI 206F.EN - PRACTICA LIMBII ENGLEZE

1.Date despre program

1.1 Instituţia de învăţământ superior	**Universitatea din Bucureşti**
1.2 Facultatea/Departamentul	**Facultatea de Fizica**
1.3 Catedra	**Limbi Moderne**
1.4 Domeniul de studii	**Fizica**
1.5 Ciclul de studii	**Licenţă - 3 ani/180 credite (ECTS)**
1.6 Programul de studii/Calificarea	**FIZICA**
	An II, ZI

2.Date despre disciplină

2.1 Denumirea disciplinei						**PRACTICA LIMBII ENGLEZE**			
2.2 Titularul activităţilor de curs						-			
2.3 Titularul activităţilor de seminar						**Profesor Asociat dr. Teleoaca Anca Irinel**			
2.4 Anul de studiu	**II**	2.5 Semestrul	**I**	2.6 Tipul de evaluare	**V**	2.7 Regimul disciplinei	Conţinut	**DC**
							Obligativitate	**DI**

3.Timpul total estimat (ore pe semestru al activităţilor didactice)

3.1 Număr de ore pe săptămână	**1**	din care: 3.2 curs	-	3.3 seminar	**1**
3.4 Total ore din planul de învăţământ	-	din care: 3.5 curs	-	3.6 seminar	**14**

3.7 Distribuţia fondului de timp	**Ore**
Studiul după manual, suport de curs, bibliografie şi notiţe	4
Documentare suplimentară în bibliotecă, pe platformele electronice de specialitate	2
Pregătire seminarii, teme, referate, portofolii şi eseuri	1
Tutoriat	
Examinări	2
Alte activităţi/ Conferinte	-
3.7 Total ore studiu individual	**7**
3.8 Total ore pe semestru (3.4. + 3.7)	**14**
3.9 Numărul de credite	**1**

4.Precondiţii (acolo unde este cazul)

5.Condiţii (acolo unde este cazul)

5.1 de desfăşurare a cursului	
5.2 de desfăşurare a seminarului	• Nivel B1

6.Competenţe specifice acumulate

Competenţe profesionale	• Recunoasterea şi folosirea unor structuri gramaticale complexe. • Abilitatea de *a descrie* şi de *a argumenta* teorii stiintifice intr-un limbaj stiintific adecvat. • Utilizarea corecta a notiunilor nou dobandite in dezvoltarea paragrafelor. • Dezvoltarea capacitatii de a reda in mod creativ informatia dobandita ca urmare a unei secvente didactice de *listening* sau *reading*.
Competenţe transversale	• Îndeplinirea la termen, în mod riguros, eficient şi responsabil, a unor sarcini profesionale cu grad ridicat de complexitate, în condiţii de autonomie decizională, cu respectarea riguroasă a deontologiei profesionale.

7.Obiectivele disciplinei (reieşind din grila competenţelor specifice acumulate)

7.1 Obiectivul general al disciplinei	• Studentii trebuie să deprindă abilitatea de a traduce un text stiintific. • Studentii vor dobandi abilitatea de a gandi critic un text din limba sursa si de a face conexiuni intre diferitele mecanisme de formare a cuvintelor si de evitare a ambiguitatii lexico-semantice.
7.2 Obiectivele specifice	• Studentii trebuie să deprindă abilitatea de a identifica mecanismele specifice analizei structurii unei fraze, sa utilizeze in contexte proprii vocabularul de specialitate, a idiomurilor si a conectorilor la nivel sintactic corespunzator. ▪ Dezvoltarea gândirii critice şi analitice, a competenţelor de argumentare logică pe suport oral şi în scris

8.Conţinuturi

PROGRAMA SEMESTRIALA (I)	**General Issues**	**Conversational Topics**	**Grammar**	**Projects**
I.STRUCTURI MORFO-SINTACTICE FIXE	Machine Translation. Artificial Languages	*New Concepts in the 21st Century versus Louis Pascal*	Phrasal Verbs (II)	I.Modern Avatars
II. FRAZA si STRUCTURA FRAZEI	Conceptual Relations. Bits of Semantics	*The Web Developers' Role versus the Apple Technologies. The Terrabite*	The Complex and the Compound Sentences	II. *Dreaming about a Life on Mars*
III.CONECTORII SI ROLUL LOR IN GV/GN	*Conceptual Approach on the Concepts of Space & Containment*	*The History of the Internet* (II) *The Highway Scientific Metaphors*	The sequence of tenses; Expressing the containment relation.	III. *The Perfect Educational Environment*
IV. VALORI TEMPORALE	A Cognitive World	*Common Uses of Magnets* (II)	Expressing Modality. The Temporal Clauses	IV. *The Internet and the Cloud Adventures*
V. VIITORUL SI VALORILE SALE		Lasers (II)	Expressing Futurity	V. *Blending universes*
VI.	Functional	Albert Einstein's	Questioning:	

SUBSTANTIVUL IN DISCURSUL STIINTIFIC.	Categories in English	Scientific Theories (II)	Past and Future; Abstract Phrases in Science	
VI. LIMBAJUL SI TIPURILE DE DISCURS	Discourse as Structure and Process	Top Romanian Scientists	Discourse Markers Linking Words	
VII. FUNCTIILE LIMBII SUBSTANTIVUL SI CONSTRUCTIILE '-ING'	British versus American English	*Varieties of English.*	That-Clause Language functions.	
VIII. STILURILE FUNCTIONALE ALE LIMBII	Variety and Style in English. Calques and False Friends	*A Survey on Electronic Media* (II)	More on Clipping and Blending. Acronyms and abbreviations.	**References** **1.**Anca Irinel Teleoaca *English 4 Physics*, 2005 **2**.M. J. Clugston, *Dictionary of Science*, Penguin Reference Library, 2009
IX. IDIOMURILE DIN LIMBA ENGLEZA	The Power of Words. Ambiguity	Translator's Role in Reproducing a scientific text	Translation and Interpretation	**3.**John Cullerne, *Penguin Dictionary of Physics*, 2009 **4.** Teun Van Dijk, *Discourse as Structure and Process*, Sage Publications, 1998
X. COEZIUNE. CONECTORI. TIPURI DE PARAGRAF	Improving Coherent Essay in Writing	*How to Write a Scientific Thesis Proposal* (II)	Style: levels of English usage; economy, consistency, logic; coordination & subordination.	**5.** *English Phrasal Verbs* Michael McCarthy and Felicity O'Dell, CUP, 2009
	Conceiving. Creative Writing: planning, topic, providing motivation, development and stating personal	*Working on a Project. Theory and Practice in Translation*	Machine Translation. General Issues.	**6.** Virginia Evans, *Successful Writing – Proficiency*, Express Publishing, 2000 **7.**Collins Cobuild, *English Guide., Linking Words*

	opinions.			**8.***International Business and Professional Communication*, Ccsison, Buc., 2003
	EVALUARE	**CRITERII**	**METODE APLICATIVE**	**PONDERE din NOTA FINALA**
		-nivelurile de intelegere si calitatea argumentării prin folosirea structurilor sintactice si gramaticale in mod corespunzator. -participarea la discuţii prin exprimare coerenta si argumentare analitica - capacitatea de intelegere a unui text din limba sursa si redarea corecta a informatiei in limba tinta.	Sarcini aplicative Texte scrise Exprimare orala. Dezbatere a unui punct de vedere. Portofoliu lingvistic.	**50%** **50%**

9.Coroborarea conţinuturilor disciplinei cu aşteptările reprezentanţilor comunităţii epistemice, asociaţiilor profesionale şi angajatori reprezentativi din domeniul aferent programului

- Seminarul dezvoltă competenţe care le permit studenţilor accesul la literatura de specialitate in limba engleza.
- În elaborarea sarcinilor de lucru s-a ţinut seama de codurile etice şi de standardele de cunoaştere specifice comunităţii academice a UVT.

10.Standard minim de performanţă

- Parcurgerea lecturilor obligatorii. Contributii personale la seminarii.
- Înţelegerea şi aplicarea corecta a conceptelor morfo-sintactice de bază/metodelor de analiză a unui text stiintific discutate la curs.
- Prezenţa la cel puţin 70% din cursuri.

Data completării
20 mai 2014

Semnătura titularului de curs
.....

Semnătura titularului de seminar
Profesor Asociat dr. Teleoaca Anca Irinel

Data avizării în departament
5 mai 2016
.....

Semnătura şefului departament
Conf dr Diana Ionita

DI 207F.EN - EDUCAŢIE FIZICĂ ȘI SPORT

Denumirea disciplinei	**EDUCAŢIE FIZICĂ**						
Anul de studiu	II	Semestrul	**I**	Tipul de evaluare finală (**E / V / C**)			**V**
Categoria formativă a disciplinei **DF** - fundamentală, **DG** - generală, **DS** - de specialitate, **DE** - economică/managerială, **DU** - umanistă							**DG**
Regimul disciplinei {**Ob**-obligatorie, **Op**-opţională, **F**-facultativă}					**Ob**.	Numărul de credite	**2**
Total ore din planul de învăţământ	**14**	Total ore studiu individual		**14**		Total ore pe semestru	**14**
Titularul disciplinei	***Asist. univ. dr. Cătălin Serban***						

** Daca disciplina are mai multe semestre de studiu, se completează câte o fişă pentru fiecare semestru*

Facultatea	**FIZICĂ**
Departamentul	DEPARTAMENTUL DE EDUCAŢIE FIZICĂ ŞI SPORT
Domeniul fundamental de ştiinţă, artă, cultură	Educaţie fizică şi sport
Domeniul pentru studii universitare de licenţă	**Discipline de pregătire în domeniul licenţei**
Direcţia de studii	

Numărul total de ore (pe semestru) din planul de învăţământ
(Ex: 28 la C dacă disciplina are curs de 14_saptămâni x 2_h_curs pe săptămână)

Total	**C****	**S**	**L**	**P**
14				**14**

*** C-curs, S-seminar, L-activităţi de laborator, P-proiect sau lucrări practice*

Discipline anterioare	**Obligatorii** (condiţionate)	---
	Recomandate	

Estimaţi **timpul total (ore pe semestru)** al activităţilor de **studiu individual** pretinse studentului *(completaţi cu zero activităţile care nu sunt cerute)*

1. Descifrarea şi studiul notiţelor de curs	**2 h**	8. Pregătire prezentări orale	
2. Studiu după manual, suport de curs		9. Pregătire examinare finală	**2 h**
3. Studiul bibliografiei minimale indicate	**1 h**	10. Consultaţii	**2 h**
4. Documentare suplimentară în bibliotecă		11. Documentare pe teren	
5. Activitate specifică de pregătire		12. Documentare pe	**2 h**

SEMINAR şi/sau LABORATOR			INTERNET	
6. Realizare teme, referate, eseuri, traduceri etc.	**2 h**		13. Alte activităţi: Participare la competiţii sportive	**2 h**
7. Pregătire lucrări de control			14. Alte activităţi: Participare la organizare evenimente sportive	**1 h**
		TOTAL ore studiu individual (pe semestru) = 14h		

Competenţe generale (competenţele generale sunt menţionate în fişa domeniului de licenţă şi fişa specializării)	
Competenţe specifice disciplinei	**1. <u>Cunoaştere şi înţelegere</u>** *(cunoaşterea şi utilizarea adecvata a noţiunilor specifice disciplinei)* - Acumularea de cunoştiinţe privind activităţile motrice; - Cunoştinţe privind efectele activităţilor motrice asupra organismului; - Cunoştiinţe privind metodologia conceperii programelor de activ. motrice de timp liber; - Cunoştiinţe privind solicitările funcţionale în vederea solicitării efortului;
	2. <u>Explicare şi interpretare</u> *(explicarea şi interpretarea unor idei, proiecte, procese, precum şi a conţinuturilor teoretice şi practice ale disciplinei)* ▪ Definirea obiectivelor, sarcinilor specifice activităţilor desfăşurate; ▪ Mijloace de implementare a programelor de timp liber; ▪ Comunicarea în sport şi relaţiile publice (integrarea socială); ▪ Promovarea interdisciplinarităţii ştiinţelor motrice; ▪ Capacitatea de a înţelege,opera şi extinde activ. motrică în timpul liber si recreere; ▪ Capacitatea de a valorifica efectele pozitive ale activ. motrice asupra personalităţii şi calităţii vieţii;
	3. <u>Instrumental – aplicative</u> *(proiectarea, conducerea şi evaluarea activităţilor practice specifice; utilizarea unor metode, tehnici şi instrumente de investigare şi de aplicare)* ▪ Să conceapă programe sportive de timp liber pentru recreere; ▪ Să conceapă şi să aplice programe sportive de pregătire sau perfecţionare; ▪ Să coordoneze, să se integreze şi să participe la activităţile sportive ; ▪ Să identifice soluţii privind optimizarea timpului liber; ▪ Să mobilizeze resursele umane în acţiunea de voluntariat; ▪ Să cunoască modalităţile de evaluare a stării de sănătate (capacităţii de efort);
	4. <u>Atitudinale</u> *(manifestarea unei atitudini pozitive şi responsabile faţă de domeniul ştiinţific / cultivarea unui mediu ştiinţific centrat pe valori şi relaţii democratice / promovarea unui sistem de valori culturale, morale şi civice / valorificarea optima şi creativa a propriului potenţial în activităţile ştiinţifice / implicarea în dezvoltarea instituţională şi în promovarea inovaţiilor ştiinţifice / angajarea în relaţii de parteneriat cu alte persoane - instituţii cu responsabilităţi similare / participarea la propria dezvoltare profesională)* ▪ Să se integreze şi să participe la activităţile sportive promovând valorile fair-play-ului; ▪ Să dezvolte relaţii principale şi constructive cu partenerii sociali; ▪ Să se adapteze la situaţii noi; ▪ Să dezvolte atitudini pro-active, gândire pozitivă şi relaţii interpersonale.

Conţinutul programei	*LUCRĂRI PRACTICO-METODICE – 14 ore :* 15. Evaluarea somato-funcţională 1 oră; 16. Evaluarea motrică 1 oră; 17. Perfecţionarea tehnicilor de joc în sporturile colective: volei, handbal, fotbal, baschet 1 oră; 18. Consolidarea metodelor şi tehnicilor privind dezvoltarea fizică armonioasă 1 oră; 19. Perfecţionarea practicării unor exerciţii fizice folosind propria greutate1 oră; 20. Consolidarea unor programe pentru educarea esteticii mişcării 1 oră; 21. Consolidarea metodelor de prelucrare selectivă a aparatului locomotor 1 oră; 22. Consolidarea cunoştinţelor şi tehnicilor privind optimizarea condiţiei fizice 1 oră; 23. Consolidarea cunoştinţelor şi tehnicilor privind educarea elasticităţii musculare şi supleţei articulare 1 oră; 24. Consolidarea cunoştinţelor şi tehnicilor privind combaterea stresului 1 oră; 25. Consolidarea cunoştinţelor şi tehnicilor privind combaterea obezităţii 1 oră; 26. Consolidarea cunoştinţelor şi tehnicilor privind corectarea atitudinilor vicioase în postura corporală 1 oră; 27. Perfecţionarea tehnicilor în sporturile colective: volei, handbal, fotbal, baschet 1 oră; 28. Verificare intermediară 1 oră;

Bibliografia	● Bocu Traian – Activitatea fizică în viaţa omului contemporan; ● Bota Aura – Activităţi fizice de timp liber; ● Ganciu Mihaela – Gimnastica aerobică-mijloc de îmbunătăţire a calităţii vieţii; ● Georgescu Florian – Cultura fizică-fenomen social; ● Dumitrescu Remus – Didactica educaţiei fizice; ● N.I.Ponomariov – Funcţiile sociale ale culturii fizice şi sportului;
Lista materialelor didactice necesare	Cărţi şi materiale de specialitate; Laptop – retroproiector, cronometru, combină muzicală, cântar Fileu volei, Mingi volei, Mingi de baschet, Mingi de handbal, Mingi de fotbal, Mingi medicinale, Saltele de gimnastica, Alte obiecte specifice invatarii jocurilor colective.

La stabilirea notei finale se iau în considerare	Ponderea în notare, exprimată in % {Total=100%}
- răspunsurile la examen / colocviu (evaluarea finală)	50%
- testarea continuă pe parcursul semestrului	10 %
- activităţile gen teme / referate / eseuri / traduceri / proiecte etc	20%
- alte activităţi *(precizaţi)* . .organizare competiţii sportive	20%

Descrieţi modalitatea practică de evaluare finală, E/V. *{de exemplu: lucrare scrisă (descriptivă şi/sau test grilă şi/sau probleme etc.), examinare orală cu bilete, colocviu individual ori în grup, proiect etc.}.colocviu individual* Verificare individuală: - verificarea cunoştinţelor teoretice - Trecerea probelor şi testelor de motricitate - Alcătuirea unui program de activitate independentă	
Cerinţe minime pentru nota 5 (sau cum se acordă nota 5)	Cerinţe pentru nota 10 (sau cum se acordă nota 10)
- Participarea la 50 % din numărul total de lecţii - Participarea la o competiţie sportivă - să dovedească însuşirea minimă a noţiunilor generale ale managementului şi marchetingului în educaţia fizică	- frecvenţă săptămânală 100% - participarea la 2 competiţii sportive - capacitatea de a aplica cunoştinţele dobândite - capacitatea de a crea programe(proiecte) care vizează managementul sportiv - trecerea probelor de motricitate

Data completării: 05.04.2016

Semnătura titularului:

Asist. univ. dr. Cătălin Serban

DI 208 F.EN Electrodynamics and Theory of Relativity

1. Study program

1.1. University	University of Bucharest
1.2. Faculty	Faculty of Physics
1.3. Department	Department of Theoretical Physics, Mathematics, Optics, Plasma and Lasers
1.4. Field of study	Physics
1.5. Course of study	Undergraduate/Bachelor of Science
1.6. Study program	Physics (in English)
1.7. Study mode	Full-time study

2. Course unit

2.1. Course unit title	**Electrodynamics and Theory of Relativity**							
2.2. Teacher	**Prof.dr. Virgil Baran**							
2.3. Tutorials/Practicals instructor(s)	**Lect.dr. Roxana Zus**							
2.4. Year of study	II	2.5. Semester	IV	2.6. Type of evaluation	E	2.7. Type of course unit	Content[1)]	**DF**
							Type[2)]	**DI**

[1)] fundamental (DF), speciality (DS), complementary (DC); [2)] compulsory (DI), elective (DO), optional (DFac)

3. Total estimated time (hours/semester)

3.1. Hours per week in curriculum	**8**	distribution: Lecture	**4**	Practicals/Tutorials	**4**
3.2. Total hours per semester	**112**	distribution: 1-st semester	**0**	2-nd semester	**112**

Distribution of estimated time for study	**hours**
3.2.1. Learning by using one's own course notes, manuals, lecture notes, bibliography	**34**
3.2.2. Research in library, study of electronic resources, field research	**19**
3.2.3. Preparation for practicals/tutorials/projects/reports/homeworks	**6**
3.2.4. Preparation for exam	**4**
3.2.5. Other activities	**0**

3.3. Total hours of individual study	**59**
3.4. Total hours per semester	**175**
3.5. ECTS	**7**

4. Prerequisites (if necessary)

4.1. curriculum	Real and Complex Analysis , Algebra , Geometry and Differential Equations , Equations of Mathematical Physics , Electricity and Magnetism
4.2. competences	Knowledge about : - Phenomenological basics of electromagnetism - Differential and integral calculus , partial differential equations ,special functions , orthogonal polynomials -Nonrelativistic kinematics and dynamics of particle; Annalytical formalism of classical mechanics.

5. Conditions/Infrastructure (if necessary)

5.1. for lecture	Lecture hall, lecture notes, recommended reading.
5.2. for practicals/tutorials	Lecture hall, lecture notes, recommended reading.

6. Specific competences acquired

Professional competences	- C1 Identify and proper use of the main physical laws and principles in a given context. - Deduction of working formulas for calculations of physical quantities using appropriate principles and laws of physics. - Description of physical systems , using theories and specific tools (theoretical and experimental models , algorithms , schemes , etc.)
Transversal competences	-Accomplish of Professional duties in an efficient and responsible ethics complying specific legislation under qualified assistance . - Applying the techniques of effective multidisciplinary team working on various hierarchical levels . - Efficient use sources of information and communication resources and training assistance , both in Romanian and in a foreign language .

7. Course objectives

7.1. General objective	-Understanding the fundamental aspects related to the study of electromagnetic field both in stationary and variable cases, based on the laws of electromagnetism . Training capacities to approach and solve specific problems . Developing analytics skills of calculation. -Understanding fundamental aspects concerning Special Theory of Relativity (STR). Aquiering knowledge concerning the various application of the theory of electromagnetic field to physical systems of interest. Training capacities to approach and solve specific problems .
7.2. Specific objectives	- Knowledge of specific physical theories/models - Developing the ability to work in a team -Assimilation of fundamental laws of electromagnetism, of conservation laws of electric charge, of electromagnetic energy and momentum, of the electromagnetic potentials notion, electric charge and currents, multipole fields. - Understanding the influence of matter on the electromagnetic field. -Acquire the skills to describe and calculate the electromagnetic field associated to various systems of charges and currents, by use of specific mathematical techniques. -Aquire the notion of electromagnetic radiation and the support knowledge for describing and calculating the angular distribution and the total radiated power. Various types of radiative systems (antennas). -Understanding the propagation phenomenon of electromagnetic field as waves, their specific physical quantities, the polarization, reflection and refraction of waves. Understanding and study of optical phenomena on the basis of electromagnetic laws. -Aquiering the principles of STR, the basic notions concerning space and time, the Lorentz transformations, the relativistic kinematics and dynamics,the kinematics of relativistic collisions. - Covariant formulation of the laws of electromagnetic field (EMF). -Applying the theory of EMF to the study of some physical systems: Radiation of accelerated point charge. Propagation of EM waves in guides.

8. Contents

8.1. Lecture [chapters]	Teaching techniques	Observations/ hours
1. Electric fied of charge distributions. Fenomenological introduction of notions of electric and magnetic fenomena.Coulomb Law. Intensity of electrostatic field. Flux law of electrostatic field. Electrostatic potential. Circulation law of electrostatic field. Discrete and Continuous charge distributions. Boundary value problems for Poisson equation. Uniqueness theorem for electrostatic potential. Various methods of solving the potential problem. Green function method. Electric charge conservation law. Continuity equation.	Systematic exposition - lecture. Heuristic conversation. Critical analysis. Examples	5
2. Magnetic field of current distributions. Biot-Savart law. Induction of magnetic field. Flux law of magnetic field. Ampere law of magnetostatic field circulation. Continuous space distribution of charge currents. Filiform currents. Vector potential of magnetostatic field . Lorentz force.		2
2. Fundamental laws of electromagnetism. Generalization of stationary field equations to the case of variable field. Maxwell displacement current. Faraday law of magnetic induction. Complete system of Maxwell eqs. for electromagnetic field in vacuo. Local (differential) and integral formulation of the laws of electromagnetism.		2
4. Electromagnetic potentials. Gauge transformations. Potentials eqs. Coulomb and Lorenz gauge. Retarded and advanced potentials.		2
5. General theorems of electromagnetic field. Energy theorem (Poynting) and momentum theorem of electromagnetic field in vacuo.Teoreme generale ale campului electromagnetic.		3
6. Multipolar analysis of electromagnetic field. Multipolar expansion of retarded potentials. Electric and magnetic multipoles. The average of the microscopic fields and fields eqs. Maxwell eqs. in polarizable matter. $\vec{P}, \vec{D}, \vec{M}$ si $\vec{H}$ vectors. Boundary conditions. Energy, force and torque exerted by an external field on a localized system of charges and currents. Energy and momentum theorems of Macroscopic field.		7
7. Radiation of localized systems of charges and currents. The field and radiation of simple systems Dipole approximation. Various types of antennas.		2
8. Propagation of electromagnetic field. Plane waves, properties. Monochromatic plane waves, properties (phase, wavelenght, frequency, polarization). Reflection and refraction laws. Total internal reflection. Fresnel relations for arbitrary incident angle. Polarization by reflection. Reflection and transmisssion coefficients. Polarization of monochromatic wave. Stokes parameters.		5
9.Physical basis of Theory of Relativity (TR). Relativity principles. Frames of reference. Space and time. Simultaneity		2

and lenght measuring. Lorentz transformations and their consequences. Relativistic formula of velocity addition.		
10.Minkovski space. Lorentz transformations as orthogonal transformations in Minkovski space. The matrix of a special Lorentz transformation (boost) and its properties. Scalars, 4-vectors and 4-tensors. Scalar product and norm of 4-vectors. Differential 4-vector operators. (4-gradiant, 4-divergence). Wigner rotation.		4
11. The relativistic invariant interval, classification and properties. Geometrical representation of Lorentz transformations.		1
12.Elements of relativistic kinematics. Proper time. 4-velocity, 4-acceleraton and their properties. Norms and relativistic transformations.		2
13. Covariant eqs. of dynamics of the relativistic particle. 4-force and 4-momentum. Covariant formulation of momentum and energy theorems. Energy-momentum relativistic relation. Relativistic transformations relations for momentum and energy. Relativistic Lagrange and Hamilton functions of the free particle and for the particle in external field. Motion of a relativistic particle in an external EMF. Special cases		4
14.Relativistic kinematics of particles collisions (interactions). Center of mass frame of two of particles, total mass and the center of mass velocity. Energy, momentum and velocity of one particle in the proper frame of one other and in the Center of mass frame. Applications. Laboratory frame. Independent in-variant parameters of binary elestic collisions. Compton effect.		3
15. Covariant formulation of the laws of EMF. Covariant formulation of electric charge conservation (continuity eq.) . 4-current of electric charge. Covariant formulation of EM potentials in Lorenz gauge. 4-potential. Relativistic transformations of 4-current and 4-potential. Covariant formulation of Lorenz cndition. Electromagnetic Field 4-tensor. Covariant formulation of Maxwell es. in vacuo. Relativistic invariants of EMF. Relativistic transformations of electric and magnetic field.		4
16. Covariant formulation of EMF in ponderable media (laws of macroscopic field). Average of eqs. of microscopic field. Polarization and excitation 4-tensors. Relativistic transformations of $\vec{P}, \vec{D}, \vec{M}$ and $\vec{H}$ vectors. Covariant formulation of EMF energy and momentum theorems. Energy-momentum tensor of EMF.		4
17. EMF of a point charge in arbitrary motion. Lienard-Wiechert potentials. Electric and magnetic field vectors. The field of the charge in uniform motion. Radiation field. Intensity (angular distribtion) and total radiated power. Special cases. General formula of total radiated power . (Lienard)		4

Bibliography:

1. **C. Vrejoiu** , *Electrodinamica si teoria relativitatii* , Editura didactica si pedagogica, Bucuresti ,1993
2. **J . D . Jackson** , *Classical electrodynamics* , 3-rd ed. , John Wiley & Sons , 1998
3. **L . D . Landau , E .M. Lifshitz** , *The Classical Theory of Fields* , ed. 4, Butterworth

-Heinemann, 2003
4. **L . D . Landau , E . Lifshitz** , *Electrodynamics of Continuous Media* , ed.2, Pergamon Press, 1984
5. **W.K.H. Panofski, M. Phillips**, " Classical Electricity and Magnetism " , 2-nd ed. , Addison-Wesley, Reading, Mass., 1962
6. **F.E. Low**, *Classical Field Theory. Electromagnetism and Gravitation* Wiley-VCH Verlag 2004
7. **W.Greiner**, *Classical Electrodynamics*, Springer Verlag, 1998
8. **D.J. Griffiths**, *Introduction to Electrodynamics*, 4-th ed., Pearson, 2013
9. **J. Schwinger, L. DeRaad jr., K.A. Milton, Wu-Yang Tsai**, *Classical electrodynamics* , Perseus Books, 1998
10. **R.M. Fano, L.J.Chu, R.B.Adler**, *Electromagnetic Fields, Energy and Forces*, John Wiley&Sons, 1963
11. **O.D. Jefimenko**, *Electricity and Magnetism: An Introduction to the Theory of Electric and Magnetic Fields*, ed.2, Appleton-Century-Crofts, 1989
12. **R. Becker,** *Electromagnetic Fields and Interactions*, Dover Publications, 1982
13. **F. Melia,** *Electrodynamics*, University of Chicago Press, 2001
14. **H. C. Ohanian ,** *Classical Electrodynamics*, *1988*, Allyn and Bacon, 1988
15. **J.L. Synge**, *Relativity: The Special Theory*, Elsevier Science Ltd; 2nd ed. 1980
16. **C. Møller**, *The Theory of Relativity*, Clarendon Press, 1955
17. **R. Hagedorn**, *Relativistic Kinematics*, W.A. Benjamin, 1964
18. **C. Stoica,** *Note de curs*,in format electronic, pe site-ul departamentului.

8.2. Tutorials [main themes]	Teaching and learning techniques	Observations/hours
Elements of field theory and vector and differential calculus (grad, div, rot and Laplacean). Curvilinear orthogonal coordinates. Differential operators in curvilinear coordinates (Spherical, cylindrical, polar).	Guided work	4
Electrostatic field of simple charge distributions (discrete and continuous). The case of symmetrical charge distributions. Linear and superficial charge distributions expressed as generalized (Dirac) volume distribuions.		2
Electrostatics of conductor systems. Electric field near the surface of conductors. Solving the potential problem with conductive bodies by means of expansions in terms of complete orthogonal functions and polynomials. Spherical functions, Legendre polynomials, Bessel functions. Green function method. Method of image charges. Green function method for Poisson problem in spherical and cylindrical coordinates.		5
Multipole expansion of electrostatic and magnetic potential. Electric and magnetic multipoles. Electric field of electric point charge and dipole near a spherical conductor. Induced surface charges. Energy, force and torque exerted by an external field on a multipolar system. Dipole approximation. Spherical multipoles.		5
Means of calculating the magnetic field of curent systems based on the method of scalar and vector potentials. Circular loop. Electrodynamics of quasistationary currents. Self induction and		4

mutual induction of linear currents.		
Electrostatic problems with dielectric bodies. Polarization of a spherical dielectric in external homogenuous and point charge field. Surface charge polarization. Electric charge near plane interface of two different adjacent dielectrics. Screening of electric and magnetic charge by ponderable bodies. Spherical screen.		4
Study of monochromatic waves properties. Polarization. Stokes parameters.		2
Dipole radiation. Line and circular antenna. Radiation field, angular distribution and total radiated power. Polarization of radiated field.		2
Presentation of Michelson-Morley and Fizeau experiments. Applications of Lorentz transformation relation and of relativistic formula of velocities addition. Lorentz contraction. Stellar aberration .Thomas precession, calculation of Thomas angular velocity. Thomas factor in spin-orbit coupling. Doppler shift.		6
Light hyper-cone, proper time, time dilation. Applications of relativistic formula of velocities addition. Relativistic addition of accelerations.		2
Motion of particle under the action of a constant and quasielastic force. Motion of a point charge in homogenuous constant electric and magnetic fields (various cases).		4
Study of relativistic collisions of particles and of disintegrations of particles.		2
Applications of relativistic formulae of EMF transformations in vacuo and in ponderable media. Transformation relations of dipole electric and magnetic moments of polarizable bodies.		4
Calculation of electric and magnetic field vectors of a point charge in accelerated arbitrary motion. The field of the uniform moving charge. Cerenkov effect. Bremsstrahlung. Angular distribution and total radiated power of point charge in arbitrary motion. The cases of uniform linear acceleration and of circular uniform motion (synchrotron radiation). Calculation of Lienard formula of total radiated power.		3
Radiation reaction. Abraham-Lorentz eq. Relativistic Dirac-Lorentz eq. Landau Lifshitz eq.		2
Wave guides. EM field near the surface and inside a conductor. Transversal magnetic (TM) and transversal magnetic (TE) propagation modes. Cutoff frequencies. Rectangular waveguides.		5
Bibliography: 1. **V. Novacu**, *Culegere de probleme de electrodinamica*, Editura tehnica , Bucuresti , 1964 2. **V.V. Batygine, I.N. Toptygine, D. TerHaar**, *Problems in Electrodynamics* , Ed.2, Academic Press , 1978 3. **Lim Yung-kuo** (ed.), *Problems and Solutions on Electromagnetism* , World Scientific, 2005 4. **C. Brau,** *Modern Problems in Classical Electrodynamics*, Oxford University Press, 2004		

9. Compatibility of the course unit contents with the expectations of the representatives of

epistemic communities, professional associations and employers (in the field of the study program)

This course unit develops some theoretical competences and abilities which are fundamental for an undergraduate student in the field of modern Physics, corresponding to national and european/international standards. The contents and teaching methods were selected after a thorough analysis of the contents of similar course units in the syllabus of other universities from Romania or the European Union. The contents are in line with the requirements/expectations of the main employers of the graduates (industry, research, secondary school teaching).

10. Assessment

Activity type	10.1. Assessment criteria	10.2. Assessment methods	10.3. Weight in final mark
10.4. Lecture	- coherence and clarity of exposition - correct use of equations/mathematical methods/physical models and theories - ability to indicate/analyse specific examples	Written test/oral examination	60%
10.5.1. Tutorials	- ability to use specific problem solving methods - ability to analyse the results	Homeworks/written tests	40%
10.6. Minimal requirements for passing the exam ...for example: all practical activities must be finalized, etc.			
Requirements for mark 5 (10 points scale) At least 50% of exam score and 50% of total score.			

Date 06.05.2016

Teacher's name and signature

Prof.dr. Virgil Baran

Practicals/Tutorials instructor(s) name(s) and signature(s)

Lect.dr. Roxana Zus

Date of approval

Head of Department
Prof.dr. Virgil Baran

DI 209 F.EN Quantum mechanics

1. Study program

1.1. University	University of Bucharest
1.2. Faculty	Faculty of Physics
1.3. Department	Department of Theoretical Physics, Mathematics, Optics, Plasma and Lasers
1.4. Field of study	Physics
1.5. Course of study	Undergraduate/Bachelor of Science
1.6. Study program	Physics (in English)
1.7. Study mode	Full-time study

2. Course unit

2.1. Course unit title	**Quantum mechanics**							
2.2. Teacher				Prof.dr. Virgil Baran				
2.3. Tutorials/Practicals instructor(s)				Lect.dr. Roxana Zus				
2.4. Year of study	II	2.5. Semester	IV	2.6. Type of evaluation	E	2.7. Type of course unit	Content[1)]	**DF**
							Type[2)]	**DI**

[1)] fundamental (DF), speciality (DS), complementary (DC); [2)] compulsory (DI), elective (DO), optional (DFac)

3. Total estimated time (hours/semester)

3.1. Hours per week in curriculum	**8**	distribution: Lecture	**4**	Practicals/Tutorials	**4**
3.2. Total hours per semester	**112**	Lecture	**56**	Practicals/Tutorials	**56**

Distribution of estimated time for study	**hours**
3.2.1. Learning by using one's own course notes, manuals, lecture notes, bibliography	**30**
3.2.2. Research in library, study of electronic resources, field research	**24**
3.2.3. Preparation for practicals/tutorials/projects/reports/homeworks	**30**
3.2.4. Preparation for exam	**4**
3.2.5. Other activities	**0**

3.3. Total hours of individual study	**84**
3.4. Total hours per semester	**200**
3.5. ECTS	**8**

4. Prerequisites (if necessary)

4.1. curriculum	Real and Complex Analysis, Algebra, Differential Equations, Equations of Mathematical Physics, Classical mechanics, Fundamentals of Atomic Physics
4.2. competences	Knowledge about : - Phenomenology of microscopic behaviour of physical systems - Differential and integral calculus, partial differential equations, special functions, orthogonal polynomials -Analytical formalism of classical mechanics; classical electrodynamics

5. Conditions/Infrastructure (if necessary)

5.1. for lecture	Computer, Video projector Lecture notes

	Bibliography
5.2. for practicals/tutorials	Lecture notes Bibliography

6. Specific competences acquired

Professional competences	**C1** Identify and proper use of the main physical laws and principles in a given context. C1.1 Deduction of working formulas for calculations of physical quantities using appropriate principles and laws of physics. C1.2 Description of physical systems, using theories and specific tools (theoretical and experimental models, algorithms, schemes, etc.) C1.3 Use of the physical principles and laws for solving theoretical or practical problems with qualified tutoring. - Rigorous knowledge of quantum theory, concepts, notions and problems in this area. - Ability to use this knowledge in various branches of physics.
Transversal competences	**CT3** Efficient use of sources of information and communication resources and training assistance in a foreign language.

7. Course objectives

7.1. General objective	-Understanding the fundamental aspects related to the study of quantum mechanics. Training capacities to approach and solve specific problems. Developing analytics skills of calculation.
7.2. Specific objectives	- Describing and understanding of specific physical theories/models for quantum systems. -Assimilation of formalism of quantum mechanics: the principles of quantum mechanics, states, observables, measurement. - Understanding the peculiar behavior of microscopic physical systems: energy quantization, nonlocality and superposition principle, incompatibility of observables and Heisenberg uncertainty principle. -Acquire the skills to describe and calculate the physical properties of quantum systems. - Developing the ability to work in a team

8. Contents

8.1. Lecture [chapters]	Teaching techniques	Observations/ hours
1. The principles of quantum mechanics *The superposition principle of the states in quantum mechanics* The state concept in quantum mechanics. Hilbert space. Dirac bra-ket formalism. *The physical observables in quantum mechanics.* Hermitian operators. Eigenvalues and eigenvectors of Hermitian operators (discrete case). The spectral theorem. Eigenvalues and eigenvectors of Hermitian operators (continuous case). *The measurement postulate in quantum mechanics.* Compatible observables. Physical interpretation of transition	Systematic exposition - lecture. Heuristic conversation. Critical analysis. Examples	12 hours

amplitude. Incompatible observables. Heisenberg uncertainty relation. Interpretation. Position observable and position measurement. Linear momentum and momentum measurement. *Fundamental quantum relations.* Dirac approach. The commutator in quantum mechanics. The spatial translation in quantum mechanics. Translation operator. The generator of the translations: the linear momentum. Interpretation of the results of Stern-Gerlach experiment. The Hilbert space of the spin one-half systems. The spin one-half operator components. Commutation relations. Pauli Matrices. *The dynamical evolution in quantum mechanics.* Time evolution operator: properties. The Hamiltonian of a quantum system. Eigenvalues and eigenvectors of the Hamiltonian. Stationary states. Schrodinger equation for evolution operator. Schrodinger equation for ket vectors.		
2. Coordinates representation of quantum mechanics Position representation of quantum mechanics: quantum wave mechanics. Physical interpretation of the wave function. Position and linear momentum operators in coordinate representation. The time-dependent Schrodinger equation for the wave function. The continuity equation of the density of probability in quantum mechanics. Time independent Schrodinger equation for the wave function. Physical boundary conditions and energy quantization for a system in a potential well.	Systematic exposition - lecture. Heuristic conversation. Critical analysis. Examples	4 hours
3. Harmonic oscillator in quantum mechanics The harmonic oscillator in quantum mechanics. The Hamiltonian. The creation and annihilation operators (ladder operators) for harmonic oscillator. Commutation relations, number operator, the Hamiltonian. The eigenvalues and eigenvectors of the harmonic oscillator Hamiltonian. Coherent states. Definition. Basic properties. The harmonic oscillator in coordinate representation. The coordinate representation of energy eigenfunctions. Polynomial method.		4 hours
4. Angular momentum in quantum mechanics The orbital angular momentum. Basic definitions, commutation relations, a set of compatible observables. General angular momentum: definition. The ladder operators in the algebra of angular momentum. Eigenvalues and eigenvectors of general angular momentum. The rotation operator. The angular momentum as generator of rotations. The Wigner functions: physical interpretation.The spin one-half system. Pauli two-components formalism.		6 hours
5. Kepler problem in quantum mechanics Formulation of the problem. System of compatible observables. Coordinates representation of time independent Schrodinger equation. Coulomb potential. Eigenvalues and eigenvectors for		5 hours

hydrogen atom.		
6. The addition of angular momenta The quantum mechanical description of combination of two physical systems. Two spin one-half systems. General discussion. Maximal sets of mutually compatible observables. Possible bases in the Hilbert space of total system. The formal theory of angular momentum addition. Clebsch-Gordon coefficients. Interpretation. Basic properties of Clebsch-Gordon coefficients. Recursion relations for Clebsch-Gordan coefficients. Clebsch-Gordan series. Addition of orbital angular momentum with the spin one-half angular momentum. Spherical tensors. Definition. Products of spherical tensor operators. Wigner-Eckart theorem.		5 hours
7. The time-independent perturbation theory General discussion and setting of the problem: non-degenerate case. Zero-order approximation and first order approximation for the state ket and energy The second order correction to the ket vector and energy. Perturbation theory for the degenerate case. Variational method for ground state and excited states. Ritz approach.		6 hours
8. Theory of time-dependent perturbations Schrödinger, Heisenberg and interaction (Dirac) pictures of quantum mechanics. Time evolution operator: definition, properties, Dyson perturbative expansion for time evolution operator. Transition amplitude. Transition probability. Step pertubation and Fermi's golden rule for transition rate. The case of a periodic perturbation:stimulated electromagnetic transitions. Dipole approximation. The scattering theory. The scattering amplitude and cross section. The perturbative approach and the relation with time-dependent perturbation theory.		6 hours
9. The Pauli equation The Hamiltonian of a charged particle in the electromagnetic field. Spin zero case. The Schrodinger equation. The kinematical momentum. The spin one-half case. The magneton Bohr-Procopiu. The Pauli equation. The vector potential in quantum mechanics. The gauge invariance in quantum mechanics. Bohm-Aharonov effect. Modern Applications : Landau levels and integral quantum Hall effect		4 hours
10. **Systems of identical particles in quantum mechanics** The principle of identity of like-particles in microscopic world; exchange degeneracy. Permutation operator; symmetrization and antisymmetrization operators for systems of two identical particles.The symmetrisation postulate: bosons and fermions.The state ket for a system of three bosons. The state ket for a system of three fermions. Slater determinants. Systems of two electrons:		4 hours

singlet and triplet states. Occupation number representation of quantum mechanics.		

Bibliography:

1. **J.J. Sakurai, J.J. Napolitano,** *Modern quantum mechanics***,** Addison-Wesley, 2011
2. **D . H . McIntyre** , *Quantum mechanics. A paradigms approach*, Pearson Education Ltd , 2014
3. **L . D . Landau , E .M. Lifshitz** , *Quantum mechanics*, Butterworth -Heinemann, 2003
4. **PAM Dirac,** *Principles of Quantum Mechanics*, Oxford, 1982
5. **W. Greiner,** *Quantum mechanics: an introduction***,** Springer, 2001
6. **L.E. Ballentine,** *Quantum Mechanics : A Modern Development (2nd Edition)*, World Scientific Publishing Company; 2014
7. **V. Baran, R. Zus,** *Lecture notes on quantum mechanics*
8. **S. Titeica**, *Mecanica Cuantica***,** Editura Academiei, 1984

8.2. Tutorials [main themes]	Teaching and learning techniques	Observations/hours
Dirac bra-ket formalism. Hermitian operators. Eigenvalues and eigenvectors of Hermitian operators (discrete case). The spectral theorem. Eigenvalues and eigenvectors of Hermitian operators (continuous case).	Problem solving. Guided work. Case study. Examples.	4 hours
The principles of quantum mechanics – applications.	Problem solving. Guided work. Case study. Examples.	6 hours
Applications in coordinate's representation of quantum mechanics. Infinite and finite potential well. Potential barrier. Tunnelling effect.	Problem solving. Guided work. Case study. Examples.	8 hours
Harmonic oscillator in quantum mechanics – statistics of position and momentum. Applications	Problem solving. Guided work. Case study. Examples.	4 hours
Orbital and general angular momentum in quantum mechanics. Applications	Problem solving. Guided work. Case study. Examples.	4 hours
The spin one-half systems. Pauli two-components formalism. Applications	Problem solving. Guided work. Case study. Examples.	2 hours
Intermediate evaluation	Problem solving.	2 hours
Hydrogen atom. Applications	Problem	5 hours

	solving. Guided work. Case study. Examples.	
The addition of angular momenta – applications for particles with spin ½ and 1. Addition of orbital angular momentum with the spin one-half angular momentum.	Problem solving. Guided work. Case study. Examples.	6 hours
The time-independent perturbation theory – nondegenrate and degenerate case. Applications: anharmonic oscillator, Stark effect etc.	Problem solving. Guided work. Case study. Examples.	5 hours
Theory of time-dependent perturbations – applications	Problem solving. Guided work. Case study. Examples.	4 hours
The Pauli equation. Applications : Landau levels and integral quantum Hall effect	Problem solving. Guided work. Case study. Examples.	4 hours
Systems of identical particles in quantum mechanics – applications	Problem solving. Guided work. Case study. Examples.	2 hours

Bibliography:

1. **J.J. Sakurai, J.J. Napolitano,** *Modern quantum mechanics***,** Addison-Wesley, 2011
2. **D . H . McIntyre** , *Quantum mechanics. A paradigms approach*, Pearson Education Ltd , 2014
3. **L . D . Landau , E .M. Lifshitz** , *Quantum mechanics*, Butterworth -Heinemann, 2003
4. **PAM Dirac,** *Principles of Quantum Mechanics*, Oxford, 1982
5. **W. Greiner,** *Quantum mechanics: an introduction***,** Springer, 2001
6. **N. Zettili,** *Quantum Mechanics Concepts and Applications*, second edition, John Wiley & Sons, 2009
7. **V. Baran, R. Zus,** *Lecture notes on quantum mechanics*
8. **R. Zus, V. Băran,** *Quantum Mechanics – Applications* – notes

9. Compatibility of the course unit contents with the expectations of the representatives of epistemic communities, professional associations and employers (in the field of the study program)

This course unit develops some theoretical competences and abilities which are fundamental for an undergraduate student in the field of modern physics, corresponding to national and european/international standards. The contents and teaching methods were selected after a thorough analysis of the contents of similar course units in the syllabus of other universities from Romania or

the European Union. The contents are in line with the requirements/expectations of the main employers of the graduates (industry, research, academic, secondary school teaching).

10. Assessment

Activity type	10.1. Assessment criteria	10.2. Assessment methods	10.3. Weight in final mark
10.4. Lecture	- coherence and clarity of exposition - correct use of equations/mathematical methods/physical models and theories - ability to indicate/analyse specific examples	Written test/oral examination	60%
10.5.1. Tutorials	- ability to use specific problem solving methods - ability to analyse the results	Homeworks/written tests	40%
10.6. Minimal requirements for passing the exam			
Requirements for mark 5 (10 points scale) At least 50% of exam score and 50% of total score.			

Date 10.05.2016

Teacher's name and signature

Prof.dr. Virgil Baran

Practicals/Tutorials instructor(s) name(s) and signature(s)

Lect.dr. Roxana Zus

Date of approval

Head of Department
Prof.dr. Virgil Baran

DI 210 F.EN Nuclear Physics

1. Study program

1.1. University	University of Bucharest
1.2. Faculty	Faculty of Physics
1.3. Department	Department of MatterStructure, Atmospheric and Earth Physics, Astrophysics
1.4. Field of study	Physics
1.5. Course of study	Undergraduate/Bachelor of Science
1.6. Study program	Physics (in English)
1.7. Study mode	Full-time study

2. Course unit

2.1. Course unit title	***Nuclear Physics***							
2.2. Teacher				**Prof. Dr. Mihaela Sin**				
2.3. Tutorials/Practicals instructor(s)				Instructor name(s) **Lecturer dr. Oana Ristea** **Lecturer dr. Marius Călin**				
2.4. Year of study	2	2.5. Semester	2	2.6. Type of evaluation	E	2.7. Type of course unit	Content[1)]	**DF**
							Type[2)]	**DI**

[1)] fundamental (DF), speciality (DS), complementary (DC); [2)] compulsory (DI), elective (DO), optional (DFac)

3. Total estimated time (hours/semester)

3.1. Hours per week in curriculum	**4**	distribution: Lecture	**2**	Practicals/Tutorials	**2**
3.2. Total hours per semester	**56**	distribution: 1-st semester	**0**	2-nd semester	**56**

Distribution of estimated time for study	**hours**
3.2.1. Learning by using one's own course notes, manuals, lecture notes, bibliography	**35**
3.2.2. Research in library, study of electronic resources, field research	**10**
3.2.3. Preparation for practicals/tutorials/projects/reports/homeworks	**20**
3.2.4. Preparation for exam	**4**
3.2.5. Other activities	**0**

3.3. Total hours of individual study	**65**
3.4. Total hours per semester	**125**
3.5. ECTS	**5**

4. Prerequisites (if necessary)

4.1. curriculum	The equations of mathematical physics, atomic physics
4.2. competences	Knowledge of mathematics, physics atomic, programming languages and numerical methods, etc.

5. Conditions/Infrastructure (if necessary)

5.1. for lecture	Amphytheatee equipped with multimedia devices
5.2. for practicals/tutorials	Radioactive isotopesources, experimental set-up for nuclear spectroscopy, gas, scintillation and semiconductordetectors,

	multichannel analyzers (emulation software), radiation monitors

6. Specific competences acquired

Professional competences	**C1**: Identification and appropriate use of main physical laws and principles in a given context. **C1.1**: Deduction of working formulas for calculations of physical quantities using appropriate principles and laws of physics. **C1.2**: description of physical systems, using theories and specific tools (theoretical and experimental models, algorithms, schemes, etc.) **C1.3**: Applying the principles and laws of physics in problem solving theoretical or practical, in terms of qualified assistance. **C1.4**: Correct application of methods of analysis and criteria for the selection of appropriate solutions to achieve specified performance **C3**: Troubleshooting the physical conditions required using numerical and statistical methods **C3.1**: Use adequate data analysis and processing of numerical methods specific physics and mathematical statistics **C3.3**: Linking problematic methods of statistical analysis to date (to obtain measurements / calculations, data processing, interpretation). **C 3.4**: Evaluating the reliability of results and comparing them to bibliographic data or theoretical values calculated using statistical methods validation and / or numerical methods
Transversal competences	CT2: Applying the techniques of effective multidisciplinary team working on various hierarchical levels. CT3: Effective use of information sources and communication resources and training assistance, both in Romanian and in a foreign language.

7. Course objectives

7.1. General objective	Presenting the fundamentals of nuclear physics and possible applications in various fields.
7.2. Specific objectives	Understanding the specific aspects of the physics at subatomic and subnuclear scale Ability to operate with these concepts and phenomena. Development of experimental skills specific to the field. Knowlege of the the structure and specific models for nuclei decays. Understanding of the specificity experiments search of the structure, elementarity and fundamental interactions of matter. Understanding main classes of applications in everyday life.

8. Contents

8.1. Lecture [chapters]	Teaching techniques	Observations
General introductory issues related to nuclear physics (purpose and role of subatomic physics, forces and interactions; historic steps in discovering the structure of matter and the fundamental constituents)	Systematic exposition - lecture. Heuristic conversation. Critical analysis. Examples	2 hours
The intrinsic properties of the nucleus (mass, mass and stability Energy liaison liaison nucleon energy, core	Systematic exposition - lecture.	5 hours

size, electric charge, thistle and when magnetic moments quadrupolare)	Examples	
Radioactive decay (General Law of radioactive decay, disintegration series, classic applications). Disintegration processes (decays alpha, beta, gamma characteristic aspects, related processes). Nuclear models for decay processes	Systematic exposition - lecture. Heuristic conversation. Critical analysis. Examples	5 hours
Classes of nuclear structure models: collective models, models of independent particles, unified models. a) The semiclassical droplet of liquid. Explaining stability and disintegration. b) The nuclear Fermi gas. c) Models of nuclear shells. d) Mottelshon Bohr model. Comparing predictions with experimental results; limits of the models for nuclear structure. New ideas.	Systematic exposition - lecture. Heuristic conversation.. Examples	8 hours
Nuclear forces: experimental informations, interactions, properties. The deuteron and nucleon-nucleon interactions.	Systematic exposition - lecture. Heuristic conversation.. Examples	4 hours
Nuclear reactions: definitions, specific sizes; classification criteria; conservation laws; kinematics. Reaction mechanisms.	Systematic exposition - lecture.. Critical analysis. Examples	4 hours

Bibliography:

1. A Das and T. Ferbel, Introduction to Nuclear and Particle Physics, World Scientific, Second edition, 2005
2. Raymond Serway, Clement Moses, Curt Moyer, Modern Physics, Third Edition, Thomson Books/Cole, 2005 (13 Nuclear structure, 14 Nuclear physics applications, 15 Elementary particles; other only by selection)
3. http://hyperphysics.phy-astr.gsu.edu/hbase/HFrame.html
4. http://ocw.mit.edu/OcwWeb/Nuclear-Engineering/22-101Fall-2006/LectureNotes/index.htm
5. K Heyde, Basic Ideas and Concepts in Nuclear Physics (An Introduction approach) (Graduate student series in physics, Series Editor: Douglas F Brewer), IOP Publishing Ltd, Second edition 1999
6. K. Gottfried, V. Weisskopf Concepts of particle physics Clarendon Press, 1984
7. Brian R Martin, Nuclear and Particle Physics – An Introduction, 2nd_Edition, 2009
8. WR Leo, Techniques for nuclear and particle physics experiments, 2nd Edition Springer-Verlag , 1994
9. http://ocw.mit.edu/courses/nuclear-engineering/22-55j-principles-of-radiation-interactions-fall-2004/lecture-notes/
10. Manuale scrise de membrii Catedrei de Fizica atomica si nucleara, autori diferiti, diferite editii
11. Fizica nucleara – Culegere de probleme (Catedra de fizica atomica si nucleara), Editura All, 1994
12 Îndrumător de laborator, Catedra de Fizică atomicăşi nucleară, Ed.Univ. Bucureşti, diverse ediţii

8.2. Tutorials [main themes]	Teaching and learning techniques	Observations
Nuclear electronic elements and set-ups used in nuclear physics lab Problems	Guided work	2hours 6 hours

Bibliography:
...whatever you decide to indicate...

8.3. Practicals [practical activities, projects, etc.]	Teaching and learning techniques	Observations

1.Dosimetry 2. Experimental study of the probabilistic nature of the processes of radioactive decays 3. The study of the interactions of alpha particles in air 4. The absorption of the beta particles in various materials 5. Bakscattering of the beta particles 6.Gamma atenuation in different materials 7. Gamma spectroscopy 8. Determination of the gamma ray source 9. Determination of half-life from beta decay curves Examination	Guided practical activity	9x2 hours 2 hours
Bibliography: ...whatever you decide to indicate...		
8.4. Project [only if included in syllabus]	Teaching and learning techniques	Observations
Bibliography: ...whatever you decide to indicate...		

9. Compatibility of the course unit contents with the expectations of the representatives of epistemic communities, professional associations and employers (in the field of the study program)

This course unit forms/develops some theoretical and/or practical competences and abilities which are important/fundamental/something else for an undergraduate student in the field of modern Physics, corresponding to national and european/international standards. The contents and teaching methods were selected after a thorough analysis of the contents of similar course units in the syllabus of other universities from Romania or the European Union străinătate (University of Oxford https://www.ox.ac.uk/admissions/undergraduate/courses-listing?wssl=1, Universityof Parma http://www.difest.unipr.it/it/didattica/laurea-triennale-fisica/calendario-didattico, Universitatea Padova, http://en.didattica.unipd.it/didattica/2015/SC1158/2014). The contents are in line with the requirements/expectations of the main employers of the graduates (industry, research, secondary school teaching).

10. Assessment

Activity type	10.1. Assessment criteria	10.2. Assessment methods	10.3. Weight in final mark
10.4. Lecture	- coherence and clarity of exposition - correct use of equations/mathematical methods/physical models and theories - ability to indicate/analyse specific examples	Oral examination	60%
10.5.1. Tutorials	- ability to use specific problem solving methods - ability to analyse the results	Homeworks/written tests	10%

10.5.2. Practicals	- ability to use specific experimental methods/apparatus - ability to perform/design specific experiments - ability to present and discuss the results	Lab reports	30%
10.5.3. Project [only if included in syllabus]	- coherence and clarity of exposition - correct use of mathematical and physical methods/models - ability to use specific experimental methods/apparatus - ability to present and discuss the results	Report	
10.6. Minimal requirements for passing the exam Correct understanding of the concepts and phenomena, the ability to work with them and obtain accurate numerical results on topics imposed.			
Requirements for mark 5 (10 points scale) Completion of all laboratory and minimal 5 score to the examination of the knowlege of the laboratory The correct answers of the subjects indicated to obtain the score 5 at the final exam.			

Date

Teacher's name and signature
Prof. Dr. Mihaela Sin

Practicals/Tutorials instructor(s) name(s) and signature(s)
Lecturer dr. Oana Ristea
Lecturer dr. Marius Călin

Date of approval

Head of Department

Prof. Dr. Alexandru Jipa

DI 211 F.EN Thermodynamics and Statistical Physics

1. Study program

1.1. University	University of Bucharest
1.2. Faculty	Faculty of Physics
1.3. Department	Department of Electricity, Solid State Physics and Biophysics
1.4. Field of study	Physics
1.5. Course of study	Undergraduate/Bachelor of Science
1.6. Study program	Physics (in English)
1.7. Study mode	Full-time study

2. Course unit

2.1. Course unit title	**Thermodynamics and Statistical Physics**							
2.2. Teacher				**Conf. Radu Paul LUNGU**				
2.3. Tutorials/Practicals instructor				**Conf. Radu Paul LUNGU**				
2.4. Year of study	2	2.5. Semester	2	2.6. Type of evaluation	E	2.7. Type of course unit	Content[1)]	**DF**
							Type[2)]	**DI**

[1)] fundamental (DF), speciality (DS), complementary (DC); [2)] compulsory (DI), elective (DO), optional (DFac)

3. Total estimated time (hours/semester)

3.1. Hours per week in curriculum	**6**	distribution: Lecture	**3**	Practicals/Tutorials	**3**
3.2. Total hours per semester	**84**	distribution: 1-st semester	42	2-nd semester	**42**

Distribution of estimated time for study	**hours**
3.2.1. Learning by using one's own course notes, manuals, lecture notes, bibliography	**27**
3.2.2. Research in library, study of electronic resources, field research	**15**
3.2.3. Preparation for practicals/tutorials/projects/reports/homeworks	**20**
3.2.4. Preparation for exam	**4**
3.2.5. Other activities	

3.3. Total hours of individual study	**62**
3.4. Total hours per semester	**150**
3.5. ECTS	**6**

4. Prerequisites (if necessary)

4.1. curriculum	Real and Complex mathematical analysis, Algebra, Differential equations; Molecular Physics, Analytical mechanics
4.2. competences	Knowledges of Mthematics, Molecular physics and Analytical mechanics

5. Conditions/Infrastructure (if necessary)

5.1. for lecture	Course notes Recommended literature

5.2. for practicals/tutorials	Seminar notes Recommended literature

6. Specific competences acquired

Professional competences	C1 – Identification and suitable use of the principal laws and principles of physics in a given context C3 – Solution of physics pronblems in imposed conditions C5 – Comunication and analysis of didactic, scientific and popular informations in the physical domain
Transversal competences	CT3 – The efficient use of informational sources and of the communication re-sources and of profesional formation in an international language

7. Course objectives

7.1. General objective	Presentation of the general notions and methods of the neo-gibbsian thermodynamics; presentation of the general concepts and the fundamental applications of the classical and quantum statistical mechanics.
7.2. Specific objectives	- Presentation of th eentropic and energetic thermodynamical representations. - General discution of the thermodynamic equilibrium conditions. - Presentation of the principal properties of phase transitions. - Presentation of the most important tquilibrium statistical ensemblies: micro-canonical, caqnonical and grand-canonical (în clasiical and quantum variants). - Presentation of some approximation methods în statistical mechanics. - Deduction of the specific properties of the phase transitions using methods of statistical mechanics. - Discution of the specific properties of the ideal quantum gases.

8. Contents

8.1. Lecture [chapters]	Teaching techniques	Observations
Fundamental problems of the neo-gibsian thermodynamics	Systematic exposition - lecture. Examples	3 hours
Thermodynamic representations	Systematic exposition - lecture. Examples	3 hours
Thermodynamic coefficients and Conditions for thermodynamic equilibrium	Systematic exposition - lecture. Examples	3 hours
Phase transitions	Systematic exposition - lecture. Examples	3 hours
The fundamentals of the classical statistical mechanics	Systematic exposition - lecture. Examples	3 hours
The fundamentals of the quantum statistical mechanics	Systematic exposition - lecture. Examples	3 hours
Equilibrium statistical ensemblies	Systematic exposition - lecture. Examples	9 hours
Special topics of the classical statistical	Systematic exposition -	7 hours

mechanics	lecture. Examples	
Special topics of the quantum statistical mechanics	Systematic exposition - lecture. Examples	8 hours
Bibliography: - R. P. Lungu „Termodinamica si Fizica statistica clasica", Editura Universitatii din Bucuresti 2014. - R. P. Lungu „Thermodynamics and Statistical Phbysice – course and seminar notes" - given to the students în electrronic format		
8.2. Tutorials [main themes]	Teaching and learning techniques	Observations
Mathematical complements for thermodynamics	Theoretical presentation and problem solving	3 hours
Thermodynamics of neutral fluid	Theoretical presentation and problem solving	4 hours
Thermodynamics of van der Waals gas	Theoretical presentation and problem solving	4 hours
Thermodynamics of thermal radiation	Theoretical presentation and problem solving	1 hours
Mathematical complements for classical and quantum statistical mechanics	Theoretical presentation and problem solving	3 hours
Micro-canonical statistical ensemble	Theoretical presentation and problem solving	3 hours
Canonical statistical ensemble	Theoretical presentation and problem solving	3 hours
Grand-canonical statistical ensemble	Theoretical presentation and problem solving	3 hours
Ideal quantum gases	Theoretical presentation and problem solving	3 hours
Special topics of classical statistical mechanics	Theoretical presentation and problem solving	3 hours
Bibliography: - R. P. Lungu „Termodinamica si Fizica statistica clasica", Editura Universitatii din Bucuresti 2014. - R. P. Lungu „Thermodynamics and Statistical Phbysice – course and seminar notes" - given to the students în electrronic format		
8.3. Practicals [practical activities, projects, etc.]	Teaching and learning techniques	Observations
8.4. Project [only if included in syllabus]	Teaching and learning techniques	Observations

9. Compatibility of the course unit contents with the expectations of the representatives of epistemic communities, professional associations and employers (in the field of the study program)

This course unit forms/develops some theoretical competences and abilities which are important and fundamental for an undergraduate student in the field of modern Physics, corresponding to national and european/international standards. The contents and teaching methods were selected after a thorough analysis of the contents of similar course units in the syllabus of other universities from Romania or the European Union. The contents are in line with the requirements/expectations of the main employers of the graduates (industry, research, secondary school teaching) and the possibility to continue the studies with doctoral programs.

10. Assessment

Activity type	10.1. Assessment criteria	10.2. Assessment methods	10.3. Weight in final mark
10.4. Lecture	- coherence and clarity of exposition - correct use of equations/mathematical methods/physical models and theories - ability to indicate/analyse specific examples	Written test/oral examination	50 %
10.5.1. Tutorials	- ability to use specific problem solving methods - ability to analyse the results	Homeworks/written tests	50 %
10.5.2. Practicals			
10.5.3. Project [only if included in syllabus]			
10.6. Minimal requirements for passing the exam merk 5			
Requirements for mark 5 (10 points scale) Presentation of a theoretical subject at final examenul Correct solving of a problem at final exam.			

Date	Teacher's name and signature	Practicals/Tutorials instructor name and signature
24.04.2016	Conf. dr. Radu Paul Lungu	Conf. dr. Radu Paul Lungu

Date of approval

Head of Department

Prof. dr. Virgil Baran

DI 212 F.EN Research Activity

1. Study program

1.1. University	University of Bucharest
1.2. Faculty	Faculty of Physics
1.3. Department	Department of Electricity, Solid State Physics and Biophysics
1.4. Field of study	Physics
1.5. Course of study	Undergraduate/Bachelor of Science
1.6. Study program	Physics (in English)
1.7. Study mode	Full-time study

2. Course unit

2.1. Course unit title	**Research activity**							
2.2. Teacher								
2.3. Tutorials/Practicals instructor(s)				**Prof. Ştefan ANTOHE, Prof. Lucian ION, Lect. Vasile BERCU**				
2.4. Year of study	2	2.5. Semester	II	2.6. Type of evaluation	C	2.7. Type of course unit	Content[1)]	**DS**
							Type[2)]	**DI**

[1)] fundamental (DF), speciality (DS), complementary (DC); [2)] compulsory (DI), elective (DO), optional (DFac)

3. Total estimated time (hours/semester)

3.1. Hours per week in curriculum	**30**	distribution: Lecture		Tutorials/Practicals	**30**
3.2. Total hours per semester	**90**	distribution: Lecture		Tutorials/Practicals	**90**
Distribution of estimated time for study					**hours**
3.2.1. Learning by using one's own course notes, manuals, lecture notes, bibliography					
3.2.2. Research in library, study of electronic resources, field research					
3.2.3. Preparation for practicals/tutorials/projects/reports/homeworks					**6**
3.2.4. Examination					**4**
3.2.5. Other activities					**0**
3.3. Total hours of individual study					
3.4. Total hours per semester	**100**				
3.5. ECTS	**4**				

4. Prerequisites (if necessary)

4.1. curriculum	Cover the courses from the first and the second year
4.2. competences	Knowledge of mathematics, physics

5. Conditions/Infrastructure (if necessary)

5.1. for lecture	
5.2. for practicals/tutorials	Laborator

6. Specific competences acquired

Professional competences	• C1- Identify and make appropriate use of the main laws and principles of physics, in a given context. • C4 – Carry out basic experiments in physics by using specific laboratory equipment. • C5 – Analize and communicate basic scientific, educational and popular information on physics.
Transversal competences	• CT3- Efficient use of trousted sources of scientific information and profficient communication of scientific data in English

7. Course objectives

7.1. General objective	To present the basic concepts of the field and to familiarize the students with the specific aspect of a research activity
7.2. Specific objectives	- Understandig the specific aspects and the ability to work with different phenomena; - Developing the capacity to work within a research team using laboratory equipment. -Development of experimental skills specific to the field.

8. Contents

8.1. Lecture [chapters]	Teaching techniques	Observations
Recommended lectures:		
8.2. Tutorials [main themes]	Teaching and learning techniques	Observations
In agreement with the subject chosen for research activity	Guided practical activity	
8.3. Practicals [practical activities, projects, etc.]	Teaching and learning techniques	Observations
In agreement with the subject chosen for research activity	Guided practical activity	
Recommended lectures: 1. I.		
8.4. Project [only if included in syllabus]	Teaching and learning techniques	Observations
Bibliography:		

9. Compatibility of the course unit contents with the expectations of the representatives of epistemic communities, professional associations and employers (in the field of the study program)

10. Assessment

Activity type	10.1. Assessment criteria	10.2. Assessment methods	10.3. Weight in final mark
10.2 Tutorials	- coherence and clarity of exposition - correct use of equations/mathematical methods/physical models and theories - ability to indicate/analyse specific examples	examination	0-100% (if applicable)
10.5.2. Practicals	- ability to use specific experimental methods/apparatus - ability to perform/design specific experiments - ability to present and discuss the results	examination	0-100% (if applicable)
10.6. Minimal requirements for passing the exam Correct understanding of the concepts and phenomena, the ability to work with them and obtain accurate numerical results on topics imposed.			
Requirements for mark 5 (10 points scale) - Carrying out all mandatory request - Correct answer to basic questions indicated în order to obtain the mark 5.			

Date
05.05.2016

Teacher's name and signature

Practical instructor, name(s) and signature(s)
Prof. Ştefan ANTOHE
Prof. Lucian ION
Lect. Vasile BERCU

Date of approval

Head of Department,
Associate Professor Petrică CRISTEA

DFC 213 F.EN Parallel systems architecture

1. Study program

1.1. University	University of Bucharest
1.2. Faculty	Faculty of Physics
1.3. Department	Department of Electricity, Solid State Physics and Biophysics
1.4. Field of study	Physics
1.5. Course of study	Undergraduate/Bachelor of Science
1.6. Study program	Physics (in English)
1.7. Study mode	Full-time study

2. Course unit

2.1. Course unit title	**Parallel systems architecture**							
2.2. Teacher				Conf.Dr. George Alexandru NEMNES				
2.3. Tutorials/Practicals instructor(s)				Conf.Dr. George Alexandru NEMNES				
2.4. Year of study	2	2.5. Semester	IV	2.6. Type of evaluation	C	2.7. Type of course unit	Content[1])	**DC**
							Type[2)]	**DFac**

[1)] fundamental (DF), speciality (DS), complementary (DC); [2)] compulsory (DI), elective (DO), optional (DFac)

3. Total estimated time (hours/semester)

3.1. Hours per week in curriculum	**4**	distribution: Lecture	**2**	Practicals/Tutorials	**2**
3.2. Total hours per semester	**56**	Lecture	**28**	Practicals/Tutorials	**28**

Distribution of estimated time for study	**hours**
3.2.1. Learning by using one's own course notes, manuals, lecture notes, bibliography	**5**
3.2.2. Research in library, study of electronic resources, field research	**5**
3.2.3. Preparation for practicals/tutorials/projects/reports/homework	**5**
3.2.4. Preparation for exam	**4**
3.2.5. Other activities	**0**

3.3. Total hours of individual study	**15**
3.4. Total hours per semester	**75**
3.5. ECTS	**3**

4. Prerequisites (if necessary)

4.1. curriculum	Processing of Physical Data and Numerical Methods/ Simulation Methods in Physics, Quantum Mechanics, Programming Languages
4.2. competences	Knowledge about Linux operating system, C/C++ programming

5. Conditions/Infrastructure (if necessary)

5.1. for lecture	Computer, Video projector Lecture notes Bibliography
5.2. for practicals/tutorials	Computer network Lecture notes Bibliography

6. Specific competences acquired

Professional competences	• C2 – Using of dedicated software for data analysis • C3 – Solving physics problems in given conditions, using numerical and statistical methods • C6 – Interdisciplinary approach of some physics problems
Transversal competences	• CT1 – Solving professional tasks in an efficient and responsible way, under qualified assistance, in compliance with ethics requirements • CT3 -Efficient use of information and communication resources available.

7. Course objectives

7.1. General objective	Parallel computing and Parallel arhitectures
7.2. Specific objectives	Parallel computing using Message Passing Interface (MPI). Description of parallel arhitectures and administration of multi-processor systems

8. Contents

8.1. Lecture [chapters]	Teaching techniques	Observations
General concepts of parallel computing. Flynn's taxonomy.	Systematic exposition – lecture. Critical analysis. Examples	2 h
Parallelism at instruction level. Pipelined arhitectures. Scalar and super-scalar arhitectures.	Systematic exposition – lecture. Critical analysis. Examples	4 h
Parallel programming models. Shared memory model. Distributed memory model. Threads.	Systematic exposition – lecture. Critical analysis. Examples	4 h
Parallel programming using MPI. Examples.	Systematic exposition – lecture. Critical analysis. Examples	4 h
Description of master-worker, producer-consumer, client-server schemes.	Systematic exposition – lecture. Critical analysis. Examples	4 h
Interconnecting networks. Static and dynamic networks.	Systematic exposition – lecture. Critical analysis. Examples	4 h
Administration of parallel computing cluster.	Systematic exposition – lecture. Critical analysis. Examples	6 h
Bibliography: 1. MPI: A Message Passing Interface Standard Version 3.0		
8.2. Tutorials [main themes]	Teaching and learning techniques	Observations
8.3. Practicals [practical activities, projects, etc.]	Teaching and learning techniques	Observations
Elements of numerical system administration.	Guided practical	4 h

	activity	
Introducing the MPI interface.	Guided practical activity	4 h
Applications to processes and threads.	Guided practical activity	6 h
Applications to point-to-point communication operations.	Guided practical activity	4 h
Parallel computing with groups of communicators.	Guided practical activity	4 h
Collective communications operations.	Guided practical activity	4 h
	Guided practical activity	2 h
Bibliography: 1. MPI: A Message Passing Interface Standard Version 3.0		
8.4. Project [only if included in syllabus]	Teaching and learning techniques	Observations

9. Compatibility of the course unit contents with the expectations of the representatives of epistemic communities, professional associations and employers (in the field of the study program)

This course contents and teaching methods were selected in such that they are in agreement with the main topics studied in previous numerical methods courses. The contents are in line with the requirements/expectations of the main employers of the graduates (research institutes, secondary school teaching).

10. Assessment

Activity type	10.1. Assessment criteria	10.2. Assessment methods	10.3. Weight in final mark
10.4. Lecture	- coherence and clarity of exposition - correct use of methods - ability to indicate/analyse specific examples - ability to present and discuss the results	Written test/oral examination, including presentation of a numerical code	50%
10.5.1. Tutorials			
10.5.2. Practicals	- ability to use specific numerical solving methods - ability to analyze the results - coherence and clarity of exposition - ability to present and discuss the results	Lab reports	50%
10.5.3. Project [only if included in syllabus]			
10.6. Minimal requirements for passing the exam			

Requirements for mark 5 (10 points scale) Completed practical activities, presentation of the subjects required for the mark 5

	Teacher's name and signature	Practicals/Tutorials instructor(s) name(s) and signature(s)
Date 25th of April 2016	Conf.Dr. George Alexandru NEMNES	Conf.Dr. George Alexandru NEMNES

Date of approval

Head of Department

Conf. univ. dr. Petrica Cristea

DFC214 F.EN System theory

1. Study program

1.1. University	University of Bucharest
1.2. Faculty	Faculty of Physics
1.3. Department	Department of Electricity, Solid State Physics and Biophysics
1.4. Field of study	Physics
1.5. Course of study	Undergraduate/Bachelor of Science
1.6. Study program	Physics (in English)
1.7. Study mode	Full-time study

2. Course unit

2.1. Course unit title	**System theory**							
2.2. Teacher				**Conf. Dr. Mihai P. Dinca**				
2.3. Tutorials/Practicals instructor(s)				**Conf. Dr. Mihai P. Dinca**				
2.4. Year of study	2	2.5. Semester	2	2.6. Type of evaluation	C	2.7. Type of course unit	Content[1)]	**DC**
							Type[2)]	**Dfac**

[1)] fundamental (DF), speciality (DS), complementary (DC); [2)] compulsory (DI), elective (DO), optional (DFac)

3. Total estimated time (hours/semester)

3.1. Hours per week in curriculum	**4**	distribution: Lecture	**2**	Practicals/Tutorials	**2**
3.2. Total hours per semester	**56**	distribution: 1-st semester	**56**	2-nd semester	**0**

Distribution of estimated time for study	**hours**
3.2.1. Learning by using one's own course notes, manuals, lecture notes, bibliography	5
3.2.2. Research in library, study of electronic resources, field research	5
3.2.3. Preparation for practicals/tutorials/projects/reports/homeworks	5
3.2.4. Examination	**4**
3.2.5. Other activities	**0**

3.3. Total hours of individual study	**15**
3.4. Total hours per semester	**75**
3.5. ECTS	**3**

4. Prerequisites (if necessary)

4.1. curriculum	Calculus
4.2. competences	IT compentences

5. Conditions/Infrastructure (if necessary)

5.1. for lecture	Teaching hall, LCD projector
5.2. for practicals/tutorials	Computers, laboratory

6. Specific competences acquired

Professional competences	C2 Using of dedicated software for data analysis and processing. C4 Carry out basic experiments in physics by using specific laboratory equipment.
Transversal competences	CT2 Applying the techniques of effective multidisciplinary team working on various hierarchical levels. CT3 Efficient use of information and communication resources available.

7. Course objectives

7.1. General objective	Introduction in System Theory, focused on control systems
7.2. Specific objectives	- Ability to modeland simulate continuous time and discrete time systems. - Stability analysis for controlsystems - Controller design - Performance assesment for control systems

8. Contents

8.1. Lecture [chapters]	Teaching techniques	Observations
Mathematical foundations. Integral transforms, frequency response, transfer function	Systematic exposition - lecture. Heuristic conversation. Critical analysis. Examples	4 hours
Signals and systems. Definition, classification. Operations with signals. System models.	Systematic exposition - lecture. Heuristic conversation. Critical analysis. Examples	2 hours
State variable models	Systematic exposition - lecture. Heuristic conversation. Critical analysis. Examples	2 hours
Characteristics of Feedback control systems	Systematic exposition - lecture. Heuristic conversation. Critical analysis. Examples	2 hours
Performances of Feedback control systems	Systematic exposition - lecture. Heuristic conversation. Critical analysis. Examples	2 hours
Stability of Feedback control systems	Systematic exposition - lecture. Heuristic conversation. Critical analysis. Examples	2 hours
Root locus	Systematic exposition - lecture. Heuristic	2 hours

	conversation. Critical analysis. Examples	
Stability in the frequency domain	Systematic exposition - lecture. Heuristic conversation. Critical analysis. Examples	2 hours
Methods of control systems design	Systematic exposition - lecture. Heuristic conversation. Critical analysis. Examples	4 hours
Design of the state feedback systems	Systematic exposition - lecture. Heuristic conversation. Critical analysis. Examples	2 hours
Discrete time control systems	Systematic exposition - lecture. Heuristic conversation. Critical analysis. Examples	4 hours

Bibliography:

1. A. Oppenheim, Signals and systems, Prentice-Hall, 1997
2. Richard C. Dorf and Robert H. Bishop, Modern control systems, 12th ed., Pearson Education, Inc, 2011
3. G. Franklin, D. Powell, M. Workman, Digital control of dynamic systems, Ellis Kagle Press, 1998.
4. K. Astrom and T. Hagglund, PID controllers, 2nd ed, Instruments Society of America, 1995.
5. B. Kuo, Automatic control systems, Prentice Hall Inc. 1975
6. Mihai P. Dinca, Complemente de Electronica, Editura Universitatii din Bucuresti, 2000.
7. Adriana Teodorescu – Teoria sistemelor automate, Editura Politehnica, Timişoara, 2003.

8.2. Tutorials		
8.3. Practicals [practical activities, projects, etc.]	Teaching and learning techniques	Observations
Modeling of linear systems. Conversion between different representations	Group working using a dedicated software (Labview , Matlab or SciLab)	2 hours
The efeect on the poles and zeros location on the transient response of a SISO LTI system .	Group working using a dedicated software (Labview , Matlab or SciLab)	4 hours
The efeect on the poles and zeros location on	Group working using a	4 hours

the frequency response of a SISO LTI system.	dedicated software (Labview , Matlab or SciLab))	
The root locus method	Group working using a dedicated software (Labview , Matlab or SciLab)	4 hours
Stability study in the frequency domain	Group working using a dedicated software (Labview , Matlab or SciLab))	2 hours
System identification applied to an existing physical system (temperature control using Peltier thermoelectric modules)	Group working using a dedicated software (Labview , Matlab or SciLab) and the experimentalset-up	2 hours
Design and implementation of a PID controller for the temperature control system	Group working using a dedicated software (Labview , Matlab or SciLab))	4 hours
Performance assesment for the realized temperature control system	Group working using a dedicated software (Labview , Matlab or SciLab) and the experimentalset-up	6 hours
Bibliography: N. Nise Control systems engineering, Willey 2004 Astrom and T. Hagglund, PID controllers, 2nd ed, Instruments Society of America, 1995.		
8.4. Project [only if included in syllabus]	Teaching and learning techniques	Observations
Bibliography: ...whatever you decide to indicate...		

9. Compatibility of the course unit contents with the expectations of the representatives of epistemic communities, professional associations and employers (in the field of the study program)

This course unit forms/develops competences and abilities which are important for an undergraduate student in the field of modern Physics, corresponding to national and european/international standards. The contents and teaching methods were selected after a thorough analysis of the contents of similar course units in the syllabus of other universities from Romania or the United States. Following one of the most succesfull textbook (Dorf & Bishop) , the contents are in line with the requirements/expectations of the main employers of the graduates (industry, research, secondary school teaching .

10. Assessment

Activity type	10.1. Assessment criteria	10.2. Assessment methods	10.3. Weight in final mark
10.4. Lecture	- coherence and clarity of exposition - correct use of equations/mathematical methods/physical models and theories - ability to indicate/analyse specific examples	Written test	75%
10.5.1. Tutorials	- ability to use specific problem solving methods - ability to analyse the results	Homeworks/written tests	
10.5.2. Practicals	- ability to use specific experimental methods/apparatus - ability to perform/design specific experiments - ability to present and discuss the results	Lab reports, continuos assesment	25 %
10.5.3. Project [only if included in syllabus]	- coherence and clarity of exposition - correct use of mathematical and physical methods/models - ability to use specific experimental methods/apparatus - ability to present and discuss the results	Report	
10.6. Minimal requirements for passing the exam All practical activities must be finalized,			
Requirements for mark 5 (10 points scale) At least 5.0 poins (out of 10) for both written test and laboratory activities.			

Date	Teacher's name and signature	Practicals/Tutorials instructor(s) name(s) and signature(s)
	Conf. Dr. Mihai Dincă	Conf. Dr. Mihai Dincă

Date of approval

Head of Department
Conf. Dr. Petrică Cristea

DFC 215F.EN Pedagogie II

1. Date despre program

1.1 Instituţia de învăţământ superior	UNIVERSITATEA DIN BUCUREŞTI
1.2 Facultatea/Departamentul	Psihologie și Științe ale Educației.
1.3 Departamentul	D.F.P.
1.4 Domeniul de studii	ŞTIINŢE ALE EDUCAŢIEI
1.5 Ciclul de studii	LICENŢĂ
1.6 Programul de studii/Calificarea	PROGRAMUL DE FORMARE PSIHOPEDAGOGICĂ/Profesor pentru învăţământ gimnazial

2.Date despre disciplină

2.1 Denumirea disciplinei				TEORIAŞI METODOLOGIA INSTRUIRII. TEORIA ŞI METODOLOGIA EVALUĂRII			
2.2 Titularul activităţilor de curs				Lector univ. dr. Anca POPOVICI			
2.3 Titularul activităţilor de seminar				Lector univ. dr. Anca POPOVICI			
2.4 Anul de studiu	II	2.5 Semestrul	III	2.6 Tipul de evaluare	E	2.7 Regimul disciplinei	Ob.

3.Timpul total estimat (ore pe semestru al activităţilor 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
Studiul după manual, suport de curs, bibliografie şi notiţe	20
Documentare suplimentară în bibliotecă, pe platformele electronice de specialitate şi pe teren	27
Pregătire seminarii/laboratoare, teme, referate, portofolii şi eseuri	18
Tutoriat	2
Examinări	2
Alte activităţi	0
3.7 Total ore studiu individual	69
3.9 Total ore pe semestru	125
3.10 Numărul de credite	5

4.Precondiţii (acolo unde este cazul)

4.1 de curriculum	Psihologia educaţiei, Fundamentele pedagogiei, Teoria şi metodologia curriculumului

4.2 de competenţe	Competenţe specifice disciplinelor menţionate

5.Condiţii (acolo unde este cazul)

5.1 de desfăşurare a cursului	Sală de curs dotată cu: ✓ Videoproiector ✓ Tablă/flipchart ✓ Materiale pe suport CD/DVD sau fotocopiate
5.2 de desfăşurare a seminarului/laboratorului	Sală de seminar dotată cu: ✓ Videoproiector ✓ Tablă/flip-chart ✓ Fişe de lucru ✓ Materiale pe suport CD/DVD sau fotocopiate

6.Competenţe specifice acumulate

Competenţe profesionale	C 1. Proiectarea activităților didactice în contexte pedagogice deschise C 2. Conducerea managerială procesului de învăţământ la nivelul intedependenței dintre acțiunile de predare-învăţare-evaluare C 3. Evaluarea activităţilor didactice în perspectivă strategică formativă, autoformativă C 5. Cunoaşterea, consilierea şi tratarea diferențiată a a elevilor, la nivel conceptual, teleologic, tehnologic, docimologic
Competenţe transversale	CT3. Utilizarea metodelor şi tehnicilor eficiente de învăţare pe tot parcursul vieţii, în vedere formării şi dezvoltării profesionale şi personale continue în perspective autoeducației eficiente

7.Obiectivele disciplinei (reieşind din grila competenţelor specifice acumulate)

7.1 Obiectivul general al disciplinei	➢ Formarea-dezvoltarea unor competenţe cognitive superioare, funcţionale în contextul deschis, specific profesiei didactice
7.2 Obiectivele specifice	➢ Formarea-dezvoltarea competenţelor de abordare managerială / globală, optimă, strategică, inovatoare a procesului de învăţământ; ➢ Formarea-dezvoltarea unei concepţii sistemice despre activitatea de instruire, proiectată curricular la nivelul corelației predare – învăţare – evaluare, realizabilă și perfectibilă în contextul procesului de învățământ; ➢ Înțelegerea normativităţii pedagogice şi a modalităţilor strategic eși operaționale de respectare și valorificare a acesteia în practica didactică la nivel de principii de proiectare și realizare eficiente; ➢ Formarea-dezvoltarea deprinderilor de a proiecta şi aplica strategii de instruire eficiente în cadrul activităților didactice (lecții etc.) organizate în contextual procesului de învățământ ➢ Cunoaşterea, înțelegerea şi valorificarea optimă a strategiilor şi metodelor de evaluare, integrate efficient, optim, innovator, în activitatea didactică; ➢ Formarea-dezvoltarea capacităţii de proiectare a activităţilor de

	predare-învăţare-evaluare; ➢ Formarea-dezvoltarea atitudinii pozitive faţă de profesia didactică; ➢ Formarea-dezvoltarea unei conduite didactice eficiente.

8.Conţinuturi

8.1 Curs	Metode de predare	Observaţii
MODULUL I – TEORIA ŞI METODOLOGIA INSTRUIRII **1**. *Teoria şi metodologia instruirii / Didactica generală - știință fundamentală a educației* 1.1. Obiect de cercetare specific – activitatea de instruire în contextual procesului de învățământ 1.2. Metodologia de cercetare specifică 1.3. Normativitatea specifică	Prelegerea, discuţia colectivă	
2. *Activitata de instruire în contextual procesului de învățământ* 2.1. Delimitări conceptuale. Instruire, subsistem ale activității de educație. Proces de învățământ, subsistem al sistemului de învățământ 2.2. Structura de funcționare a sistemului de învățământ. Un model-ideal:Abordarea sistemică a procesului de învăţământ 2.2.1. Structura de bază – corelația professor-elev 2.2.2. Structura de organizare. Formele de organizare generale, specifice, concrete 2.2.3. Structura de planificare: obiective – conținuturi – metode- evaluare 2.2.4. Structura de acțiune / realizare-dezvoltare: predarea – învățarea - evaluarea	prelegerea-dezbatere, brainstorming-ul problematizarea, studiul de caz, metode şi tehnici de învăţare prin cooperare	
3. *Normativitatea instruirii / procesului de învăţământ* 3.1. Conceptul de normativitate pedagogică / didactică 3.2. Principii de proiectare: cunașterea pedagogică / comunicarea pedagogică – crerativitatea pedagogică 3.3. Principii de realizare. Principiile didactice 3.4. Evoluția normativității instruirii / procesului de învăţământ din perspectiva paradigmei curriculumului	prelegerea-dezbatere, studiul de caz, brainstorming-ul, exerciţiul, metode şi tehnici de învăţare prin cooperare	
4. *Forme de organizare a instruirii / procesului de învăţământ* 4.1. Definirea conceptului. Clasificarea formelor generale ale instruirii la nivel general, specific / particular, concret 4.2. Forma de instruire: a) frontală, b) grupală; c) individuală 4.3. Lecția formă principală de organizare a instruirii în cadrul procesului de învățământ. Istoric, concept actual, tipuri, variante de lecții. Relația cu alte forme de organizare a instruirii 4.4. Individualizarea instruirii în contextul procesului de învățământ. Concept. Modalități de realizare. Evoluții în contextul paradigmei *curriculumului*	prelegerea-dezbatere, brainstorming-ul, exerciţiul, reflecţia personală şi de grup, metode şi tehnici de învăţare prin cooperare	

5. *Conținutul instruirii în contextual procesului de învățământ* 5.1. Conceptul pedagogic de conținut al instruirii. Evoluții în perspectiva paradigmei curriculumului – răsturnarea triadei conținuturilor (atitudini – deprinderi și strategii cognitive – cunoștințe) 5.2. Factorii care determină calitatea conținuturilor instruirii: a) politica educației; b) concepția sociopedagogică despre cultură / cultură generală; c) teoriile psihologice adoptate ca modele de normative și prospective de instruire 5.3. Analiza documentelor curriculare fundamentale și operaționale: plan de învățământ, programe școlare, manuale școlare, materiale auxiliare	prelegerea-dezbatere, brainstorming-ul, exerciţiul, reflecţia personală şi de grup, metode şi tehnici de învăţare prin cooperare	
6. *Metodologia instruirii / procesului de învățământ* 6.1. Conceptul de metodologie a instruirii. Sens larg (tehnologia instruirii). Sens restrâns – ansamblu de metode, procedee, mijloace – didactice 6.2.Metodele de învăţământ – concept, clasificare clarificări terminologice 6.3. Sistemul metodelor de învăţământ. Caracterizarea principalelor metode didactice. 6.4. Evoluția metodologiei didactice. Promovarea strategiilor didactice **7.** *Instruirea ca activitate de predare-învățare-evaluare* 7.1 Analiza relației pedagogice dintre activitatea de instruire și acțiunile subordonate acesteia: a) predarea; b) învățarea; c) evaluarea 7.2. Predarea – acțiune de comunicare pedagogică / didactică 7.3. Învățarea – acțiune de receptare, interiorizare și valorificare de cunoștințe și capacități (atitudinale și aptitudinale) 7.3. Evaluarea – acțiuned e verificarea a rezultatelor acțiuniilor de predare-învățare cu funcție de reglare-autoreglare a activității de instruire	prelegerea-dezbatere, exerciţiul, studiul de caz, metode şi tehnici de învăţare prin cooperare	
MODULUL II – TEORIA ŞI METODOLOGIA EVALUĂRII **Teoria şi metodologia evaluării** **8**. *Teoria și metoologia evaluării în sistemul științelor educației* 8.1. Teoria și metodologia evaluării – subteorie a teoriei generale a instruirii și a teoriei generale a educației 8.2. Statut epistemologic: obiect de cercetare specific (evaluarea instruirii la toate nivelurile procesului de	prelegerea-dezbatere, studiul de caz, brainstorming-ul, exerciţiul, metode şi tehnici de învăţare prin cooperare	

învăţmât) – metodologie de cercetare specifică (de tip intradisciplinar) – normativitate specifică (prin valorificarea principiiilor instruirii în context docimologic) **9.** *Conceptul de evaluare*. 9.1 Funcţiile genrale ale evaluării. Funcţia centrală. Funcţiile principale la nivel socil, psihologic, pedagogic 9.2. Structura evaluării: măsurare – apreciere calitativă – decizie parţială şi finală 9.3. Conţinuturile şi formele evaluaării **10.** Metodologia acţiuni de evaluare 10.1 Specificul metodologiei evaluării 10.2. Strategii – metode – tehnici de evaluare 10.3. Rolul metodologiei evaluării ăn stimularea succesului şcolar / prevenirea insusccesului şcolar . **11**. Strategiile de evaluare 11. Definirea conceptului. Criterii de clasificare 11.2 Strategia de evaluare iniţială / diagnostică şi rpedictivă 11.3 Strategia de evaluare continuă / formativă, autoformativă 11.4. Strategia de evaluare finală / cumulativă, sumativă **12**. Metodele de evaluare 12.1. Definirea conceptului. Raportarea la metodele didactice. 12.2. Clasificarea metodelor de evaluare 12.3 Metode de evaluare clasică 12.4. Metode de evaluare alternative / complementare **MODUL FINAL** **13.** Proiectarea pedagogică de tip curricular. Modelul proiectării curriculare a lecţiei (activităţii didactice) **14**. Proiectarea pedagogică de tip curricular. Modelul proiectării curriculare a educative a profesorului-diriginte		

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6. Ciolan, Lucian, *Invăţarea integrată - fundamente pentru un curriculum transdisciplinar*, Iasi, Polirom, 2008.

7. Cristea, Sorin, *Dicționar de pedagogie*, Grupul Editorial Litera. Litera Internațional, Cuvurești, Chișinău, 2000. Cristea, Sorin, Studii de pedagogie generală, Editura Didactică și Pedagogică RA., București, 2004, 2009
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15. Oprea, Crenguța-Lăcrămioara, *Strategii didactice interactive,* E.D.P., Bucureşti, 2004.
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19. Radu, Ioan, T., *Evaluarea în procesul didactic*, Editura Didactică și Pedagogică, RA, Bucureşti, 2000
20. Toma, Steliana, *Profesorul – factor de decizie*, Editura Tehnică, Bucuresti, 1994.

8.2 Seminar/laborator	Metode de predare	Observaţii
1.Instruirea în contextul procesul de învăţământ. Modele de abordare în pedagogia modernă și postmodernă	Dezbatere, problematizare, lucrul pe grupe	Prezentare și analiza proiecte tematice, studii de caz
2. Analiza procesului de învățământ la nivelul structurii sale funcționare	Dezbatere, problematizare, lucrul pe grupe	Prezentare și analiza proiecte tematice, studii de caz
3. Modalităţi de creştere a eficienţei comunicării didactice prin perfecționarea mesajelor pedagogice. Resursele empatiei pedagogice	Dezbatere, problematizare, lucrul pe grupe, studiul de caz	Prezentare și analiza proiecte tematice, studii de caz
4. Modalităţi de aplicare a principiilor didactice în cadrul disciplinelor de specialitate **5.** Analiza unor taxonomii ale obiectivelor educației / instruirii	Brainstorming / Asalt de idei, dezbatere, problematizare, lucrul pe grupe, studiul de caz	Prezentare și analiza proiecte tematice, studii de caz
6. Evoluția conținuturilor instruirii în contextul paradigmei curriculumului. Relația competențe / obiective – conținuturi de bază **7.** Caracterizarea principalelor metode de învățământ. Implicații la nivelul creativității profesorului	Dezbatere, problematizare, lucrul pe grupe, studiul de caz	Prezentare și analiza proiecte tematice, studii de caz etc.

8. Mijloacele de învăţământ. Rolul lor în optimizarea metodelor şi sttrategiilor didactică şi stilul didactic.	Dezbatere, problematizare, lucrul pe grupe, studiul de caz	analiza proiecte tematice, studii de caz etc.
9. Evenimentele lecţiei- structură generică (referat, dezbatere). Tipuri şi variante de lecţie (prezentare de modele).	Dezbatere, problematizare, studiul de caz, lucrul pe grupe,în perechi	analiza proiecte didactice, studii de caz etc.
10. Proiectarea didactică – studiul documentelor curriculare. Proiectarea unităţilor de învăţare şi a lecţiilor (modele de proiectare, aplicaţii).	Dezbatere, problematizare, studiul de caz, lucrul pe grupe,în perechi	analiza proiecte didactice, studii de caz etc.
11. Relaţia predare-învăţare- evaluare în perspective paradigmei curriculumului **12.** Analiza strategiei de evaluare continuă / formativă / autoformativă / de progress **13.** Relația metode clasice – metode alternative de evaluare **14.** Cultivarea capacității de proeictare curriculară a lecțiilor în contexte pedagogice și sociale deschise	Dezbatere problematizare, studiul de caz, lucrul pe grupe,în perechi	analiza proiecte didactice, studii de caz, probe de evaluare etc.

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30. Toma, Steliana, *Profesorul – factor de decizie*, Editura Tehnică, Bucuresti, 1994.

9.Coroborarea conţinuturilor disciplinei cu aşteptările reprezentanţilor comunităţii epistemice, asociaţiilor profesionale şi angajatori reprezentativi din domeniul aferent programului

Disciplina asigură formarea-dezvoltarea competenţelor cognitive superioare, funcţionale în contextul integrării socioprofesionale a viitoarelor cadre didactice, în perspectiva adaptării acestora la solicitările specifice unui mediul pedagogic și social deschis.

10.Evaluare

Tip activitate	10.1 Criterii de evaluare	10.2 Metode de evaluare	10.3 Pondere din nota finală
10.4 Curs	Referinţe din suportul de curs şi din recomandările bibliografice	Examen scris	50%
	Participare sistematică, eficientă la activitatea didactică		10%
10.5 Seminar/laborator	Aplicarea cunoştinţelor, a deprinderilor/abilităţilor, strategiilor cognitive,	Portofoliu	30%

	direcţionate atitudinal în elaborarea şi prezentarea informaţiilor integrabile în portofoliu		
	Participare sistematică, eficientă la activitatea didactică. Intervenţii semnificative în plan teoretic, metodologic şi practic. Valorificarea experienţei personale dobândite în context formal şi nonformal, dar şi informal.	Evaluare orală	10%
10.6 Standard minim de performanţă			
• Operaţionalizarea conceptelor-cheie •Proiectarea unor secvenţe de activitate didactică/ lecţii bazate pe valorificarea cunoştinţelor teoretice şi metodologice, aplicabile în contextul respectării normativităţii pedagogice, pe fondul selectării unor strategii adecvate de predare-învăţare-evaluare etc. • Prezentarea unor informaţii, modele etc. semnificative din categoria celor integrate / integrabile în portofoliu în cadrul activităţii de seminar			

Data completării
.....

Semnătura titularului de curs
. Lector univ. dr. Anca POPOVICI

Semnătura titularului de seminar
Lector univ. dr. Anca POPOVICI.

Data avizării în departament
.....

Semnătura directorului de departament
.....

DFC 216F.EN DIDACTICA FIZICII

1. Date despre program

1.1 Instituţia de învăţământ superior	Universitatea din Bucureşti
1.2 Facultatea	Facultatea de Fizică
1.3 Departamentul	Structura materiei, Fizica atmosferei şi a pământului, Astrofizică / Electricitate, Fizica Solidului şi Biofizică
1.4 Domeniul de studii	Științele educației
1.5 Ciclul de studii	Licență
1.6 Programul de studii/Calificarea	Modulul Didactic - Profesor de fizică

2. Date despre disciplină

2.1 Denumirea disciplinei				**DIDACTICA FIZICII**			
2.2 Titularul activităţilor de curs				Lect. univ.dr. Cristina MIRON			
2.3 Titularul activităţilor de seminar				Lect. univ.dr. Cezar TĂZLĂOANU			
2.4 Anul de studiu	II	2.5 Semestrul	2	2.6 Tipul de evaluare	Ex	2.7 Regimul disciplinei	DF

3. Timpul total estimat (ore pe semestru al activităţilor didactice)

3.1 Număr de ore pe săptămână din care	4	3.2 curs	2	3.3 seminar/laborator	2
3.4 Total ore din planul de învăţământ din care	56	3.5 curs	28	3.6 seminar/laborator	28
Distribuţia fondului de timp					ore
Studiul după manual, suport de curs, bibliografie și notițe					28
Documentare suplimentară în bibliotecă, pe platformele electronice de specialitate si pe teren					28
Pregătire seminarii/laboratoare, teme, referate, portofolii și eseuri					28
Tutoriat					25
Examinări					10
Alte activităţi					

3.7 Total ore studiu individual	**84**
3.9 Total ore pe semestru	**175**
3. 10 Numărul de credite	**5**

4. Precondiţii (acolo unde este cazul)

4.1 de curriculum	Psihologia educaţiei; Pedagogie I şi II
4.2 de competenţe	Competenţe psiho-pedagogice

5. Condiţii (acolo unde este cazul)

5.1 de desfăşurare a cursului	Sală de curs cu tablă și videoproiector
5.2 de desfăşurare a seminarului/laboratorului	Sală de seminar cu tablă şi videoproiector

6. Competenţe specifice acumulate

Competenţe profesionale	**C1**. Analiza şi procesarea conţinutului ştiinţific în vederea realizării transpunerilor didactice care stau la baza activităţilor tipice sau specifice - semnificative pentru familiarizarea elevilor cu gândirea, metodele şi procesul cunoaşterii ştiinţifice prin intermediul fizicii; **C2.** Facilitarea unor procese inovatoare de învăţare şi predare centrate pe elev - proiectarea şi implementarea strategiilor didactice care să determine antrenarea elevilor în activităţi de învăţare variate ca formă de organizare a elevilor (frontale, în echipă şi independente) şi ca metode utilizate (bazate pe problematizare, investigaţie, modelare, rezolvare de probleme, proiect etc.); **C3.** Organizarea progresului cognitiv al elevilor (investigând şi utilizând concepţiile elevilor, anticipându-le dificultăţile şi sprijinindu-i să le depăşească, valorificând interesele şi abilităţile elevilor etc.); **C4.** Analiza, adaptarea sau proiectarea / realizarea materialelor şi mijloacelor de învăţământ necesare; **C5.** Evaluarea şi monitorizarea rezultatelor performanţei de predare şi învăţare (practicarea evaluării de proces şi de progres, utilizând forme de evaluare, metode şi instrumente adecvate); **C6.** elaborarea documentelor şcolare solicitate unui profesor de fizică;
Competenţe transversale	**C8.** Lucrul în echipă; **C9.** Reflecţia critică, reflecţia metacognitivă şi luarea deciziilor strategice asupra propriei activităţi de învăţare; **C10.** Organizarea şi autoreglarea/reglarea procesului de dezvoltare profesională.

7. Obiectivele disciplinei (reieşind din grila de competenţe specifice acumulate)

7.1 Obiectivul genral al disciplinei	Asimilarea cunoștințelor, dezvoltare de deprinderi/abilităţi și dezvoltarea competențelor din domeniul didacticii fizicii
4.2 Obiective specifice	✓ Asimilarea de către studenţi a cunoștințelor din domeniul didacticii fizicii; ✓ Formarea și exersarea competențelor studenților de proiectare și planificarea a unităților și activităților de învățare la fizică. ✓ Formarea și exersarea competențelor studenților de a proiecta, realiza și aplica o strategie didactică în demersul de predare/învățare la fizică. ✓ Dezvoltarea competențelor de evaluare, la nivel de proces și rezultate, a demersului de predare/învățare la fizică.

8. Conţinuturi

8.1 Curs	Metode de predare	Observaţii
I Documente curriculare specifice fizicii 1.1 Generalităţi; 1.2 Tipuri de curriculum; 1.3. Planurile cadru de învăţământ; 1.4. Programa şcolară; 1.5 Planificarea calendaristică; 1.6 Proiectarea unităţii de învăţare; 1.7 Etape şi operaţii specifice proiectării didactice a lecţiei; 1.8 Proiectul didactic – consideraţii metodologice; 1.9 Manualul şcolar;	Studiul de caz; Prelegerea; Dezbatere	2 ore
II Obiective educaţionale 2.1. Clasificări ale obiectivelor educaţionale; 2.2 Operaţionalizarea obiectivelor; 2.3 Taxonomia domeniului cognitive; 2.4 Taxonomia	Studiul de caz; Prelegerea; Dezbatere	2 ore

obiectivelor cognitive (după B.S. Bloom); 2.5 Taxonomia domeniului afectiv (atitudinal); 2.6 Taxonomia obiectivelor afective (după Krathwohl, Bloom, Hastings, Madaus); 2.7 Taxonomia domeniului psihomotor (acţional);		
III Metode şi mijloace didactice 3.1 Consideraţii metodologice şi delimitări conceptuale; 3.2 Metode didactice; 3.3 Caracterizarea principalelor metode de învăţământ; (Conversaţia didactică; Explicaţia; Prelegerea; Problematizarea; Demonstraţia;. Modelarea; Algoritmizarea;. Exerciţiul) 3.4. Caracterizarea principalelor metode didactice active; (Brainstorming -ul; Metoda Jigsaw; Inquiry based learning, Investigaţia experimentală; Organizatori grafici; Cubul); 3.5 Mijloace didactice; 3.5.1 Generalităţi; 3.5.2 Mijloace de învăţământ legate de descoperirea tiparului; 3.5.3 Mijloace audiovizuale; 3.5.4 Mijloace care asigură stabilirea unei legături între om şi maşină în procesul de instruire; 3.5.5 Calculatorul – mijloc de învăţământ în predarea fizicii;	Prelegere; Dezbatere; Demonstraţia	4 ore
IV Paradigma învăţării 4.1 Procesul de învăţământ ca relaţie dintre predare-învăţare şi evaluare; 4.2 Lecţia - concept şi tipologie; 4.2.1 Lecţia mixtă; 4.2.2 Lecţia de transmitere – însuşire de noi cunoştinţe ; 4.2.3 Lecţia de formare de deprinderi şi priceperi; 4.2.4 Lecţia de recapitulare şi sistematizare; 4.2.5 Lecţia de verificare, evaluare şi notare; 4.3 Forme complementare de predare – însuşire a cunoştinţelor de fizică; 4.4 Promovarea interdisciplinarităţii în învăţarea fizicii;	Prelegere; Dezbatere; Demonstraţia	4 ore
V Activitatea didactică în laboratorul de fizică 5.1 Lecţiile în laboratorul de fizică; 5.2 Obiectivele instruirii în laborator; 5.3 Comportamentul profesorului în laboratorul şcolar; 5.4 Experimentul de fizică în perspectiva AEL;	Prelegere; Dezbatere; Demonstraţia	4 ore
VI Utilizarea calculatorului în procesul de predare – învăţare la fizică 6.1 Importanţa utilizării calculatorului în învăţarea fizicii ; 6.2 Modalităţi de utilizare a calculatorului în procesul de predare – învăţare ; 6.2.1 Calculatorul – mijloc didactic ; 6.2.2 Program de instruire şi autoinstruire ; 6.3 Noi tehnologii pentru o didactică inovativă în predarea fizicii ; 6.4 Calculatorul – mijloc de evaluare la fizică ; 6.5 Avantaje şi dezavantaje ale utilizării calculatorului în procesul instructiv.	Prelegere; Dezbatere; Demonstraţia	2 ore
VII Metodica rezolvării problemelor de fizică 7.1 Generalităţi; 7.2 Tipuri de probleme de fizică; 7.2.1 Problemele calitative ; 7.2.2 Problemele cantitative (de calcul) ; 7.2.3 Probleme grafice; 7.2.4 Probleme experimentale ; 7.2.5 Problemele de extrem ; 7.3 Structura şi rezolvarea unei probleme de fizică;	Problematizarea Prelegere; Dezbatere	4 ore
VIII Evaluarea în procesul de învăţământ 8.1 Evaluarea: problematică, funcţii, tipologie; 8.2 Strategii de evaluare; 8.3 Termeni cheie; 8.4 Metode şi tehnici de evaluare; 8.4.1. Metode de evaluare tradiţionale; 8.4.2. Principalele metode complementare de evaluare; 8.5 Metode de apreciere a rezultatelor	Prelegere; Dezbatere	4 ore

şi performanţelor şcolare		
IX Proiectarea activităţilor extracurriculare	Prelegere	2 ore
Total		**28 ore**

Bibliografie

1. Anghel S., Malinovschi V., Iorga I., Stănescu C., *Metodica predării fizicii*, Editura Arg-Tempus, Piteşti 1995;
2. Bloomfield, L., *How Things Work: The Physics of Everyday Life, 2nd Ed.*, John Wiley & Sons, Inc., 2001.
3. Ciascai L., *Didactica fizicii*, Editura Corint, Bucureşti 2001;
4. Doran R., Chan F., Tamir P., Lenhart C., *Science Educator's Guide to Laboratory Assessment*, NSTA PRESS, 2002.
5. Gedgrave I., *Modern Teaching of Physics*. Global Media, Delhi, 2009.
6. Ionescu M., *Demersuri creative în predare şi învăţare*, Editura Presa Universitară Clujeană, Cluj Napoca, 2000;
7. Istrate E., *Metodica predării specialităţii*, Editura Academiei, Bucureşti, 2001;
8. Jinga I., (coord.), *Evaluarea performanţelor şcolare*, Editura ALL, Bucureşti, 1998;
9. Knight R.D., *An Instructor's Guide to Introductory Physics*, Addison Wesley, 2002.
10. Malinovschi V., *Didactica fizicii*, Editura Didactică și Pedagogică, Bucureşti, 2003;
11. Miron C., *Didactica fizicii – Note de curs*, Editura Universităţii din Bucureşti, 2008;
12. Oprea C., *Strategii didactice interactive: repere teoretice şi practice*, Editura Didactică şi Pedagogică, (ediţia a IV-a), Bucureşti, 2009.
13. Robardet G., Guillaud J.C., *Eléments de didactique des sciences physiques. De la rechèrche à la pratique: théories, modèles, conceptions et raisonnement spontané*, Presses Universitaires de France, Paris, 1997.
14. Stelzer T. and Gladding G.E, The evolution of web-based activities in physics at Illinois, *Newsletter of the Forum on Education of the American Physics Society*, Fall 2001.

8.2 Seminar	Metode de predare	Observaţii
Analiza conţinutului unei programe şcolare de gimnaziu la alegere.	Studiul de caz; Dezbaterea.	2 ore
Analiza unui manual şcolar de fizică la alegere.	Studiul de caz; Dezbaterea.	2 ore
Formularea operaţională a obiectivelor unei lecţii	Exerciţiul	2 ore
Proiectarea unei secvenţe dintr-o lecţie	Activitate individuală; Discuţie	2 ore
Proiectarea unei secvenţe dintr-o unitate de învăţare la alegerea studentului	Activitate pe grupe mici; Discuţie	2 ore
Testarea concepţiilor studenţilor din domeniul temei „Curentul electric".	Problematizarea; Ancheta scrisă.	4 ore
Prezentarea unei metode didactice prin care este stimulată creativitatea elevilor şi argumentarea utilităţii metodei din perspectiva contribuţiei la formarea/dezvoltarea competențelor prezentate în programa de gimnaziu.	Problematizarea; Studiul de caz.	4 ore
Realizarea unei fişe de activitate experimentală în care să fie prezentată teoria lucrării, descrierea montajul experimental, a modului de lucru şi etapele prelucrării datelor experimentale pentru unul din experimentele obligatorii din programa de gimnaziu	Dezbaterea; Exerciţiul.	2 ore
Ilustrarea demersului utilizării unui dispozitiv construit artizanal în lecţia de fizică.	Demonstraţia; Activităţi practice.	2 ore

Elaborarea de instrumente de evaluare formativă şi sumativă.	Problematizarea; Studiul de caz.	4 ore
Realizarea activităţilor extracurriculare	Proiectul. Dezbaterea rezultatelor.	2 ore
Total		**28 ore**

Bibliografie

1. Ailincăi M., Rădulescu L., *Probleme-întrebări de fizică pentru liceu.* Bucureşti, Editura Didactică şi Pedagogică (Biblioteca Facultăţii de Fizică), 1972.
2. Ciascai L., , *Didactica fizicii*, Bucureşti, Corint (Biblioteca Facultăţii de Fizică), 2000.
3. Ciascai L., Secara R., *Ghid de practică pedagogică. Un model pentru portofoliul studentului.* Oradea, Editura Universităţii din Oradea (Biblioteca Facultăţii de Fizică), 2001.
4. Malinovschi V., *Didactica fizicii*, Editura Didactică și Pedagogică, Bucureşti, 2003.
5. Miron C., *Didactica fizicii – Note de curs*, Editura Universităţii din Bucureşti, 2008.
6. Panaiotu L., Chelu I. şi colab., *Lucrări experimentale de fizică pentru liceu*, Bucureşti, Editura Didactică şi Pedagogică (Biblioteca Facultăţii de fizică), 1972.
7. *** Manualele școlare de fizică
8. *** Programele școlare de Fizică

9. Coroborarea conţinuturilor disciplinei cu asteptările reprezentanţilor comunităţii epistemice, asociaţiilor profesionale si angajatori reprezentativi din domeniul aferent programului

În vederea elaborării conţinuturilor, alegerii metodelor de predare/învățare titularii disciplinei au consultat conţinutul unor discipline similare predate la universitati din țară și străinătate. Conținutul disciplinei, prin centrarea pe practica profesională, este în acord cu solicitările angajatorilor din domeniul aferent programului de studii.

10. Evaluare

Tip activitate	10.1 Criterii de evaluare	10.2 Metode de evaluare	10.3 Pondere în nota finală
10.4 Curs	Calitatea conținuturilor științifice și metodice	examen scris	60%
	Claritatea, coerenta si concizia expunerii		
	Capacitatea de exemplificare.		
10.5 Seminar	Reliefarea caracterului aplicativ a tematicii abordate	calitatea produselor de portofoliu solicitate	30%
			10% din oficiu
10.6 Standard minim de performanţă			
Însușirea noţiunilor teoretice punctuale, formarea de abilităţi practice, comportamente şi atitudini dovedite în aplicaţii similare celor prezentate la curs. Prezența la curs și la seminar în proportie de 50%.			

Data completării	Semnătura titularului de curs	Semnătura titularului de aplicaţii
.....	.Lect. dr. Cristina MIRON	Lect. dr. Cezar TĂZLĂOANU

Data avizării în catedră	Semnătura sefului de departament
.....	Prof.dr. Alexandru JIPA / Conf. dr. Petrică CRISTEA

DI 301F.EN Atomic and Molecular Physics

1. Study program

1.1. University	University of Bucharest
1.2. Faculty	Faculty of Physics
1.3. Department	Department of Electricity, Solid State Physics and Biophysics
1.4. Field of study	Physics
1.5. Course of study	Undergraduate/Bachelor of Science
1.6. Study program	Physics (in English)
1.7. Study mode	Full-time study

2. Course unit

2.1. Course unit title	**Atomic and Molecular Physics**							
2.2. Teacher				**Conf. Dr. Mircea BERCU**				
2.3. Tutorials/Practicals instructor(s)				**Lect. Dr. Vasile BERCU**				
2.4. Year of study	3	2.5. Semester	V	2.6. Type of evaluation	E	2.7. Type of course unit	Content[1)]	**DF**
							Type[2)]	**DI**

[1)] fundamental (DF), speciality (DS), complementary (DC); [2)] compulsory (DI), elective (DO), optional (DFac)

3. Total estimated time (hours/semester)

3.1. Hours per week in curriculum	**5**	distribution: Lecture	**2**	Practicals/Tutorials	**2/1**
3.2. Total hours per semester	**70**	Lecture	**28**	Practicals/Tutorials	**42**

Distribution of estimated time for study	**hours**
3.2.1. Learning by using one's own course notes, manuals, lecture notes, bibliography	**30**
3.2.2. Research in library, study of electronic resources, field research	**10**
3.2.3. Preparation for practicals/tutorials/projects/reports/homeworks	**36**
3.2.4. Examination	**4**
3.2.5. Other activities	**0**

3.3. Total hours of individual study	**76**
3.4. Total hours per semester	**150**
3.5. ECTS	**6**

4. Prerequisites (if necessary)

4.1. curriculum	Fundamental of Atomic Physics, Mechanics Physics, Electricity and Magnetism, Optics, Analytical Mechanics, Equations of mathematical physics
4.2. competences	Knowledge of mathematics

5. Conditions/Infrastructure (if necessary)

5.1. for lecture	Amphytheatee equipped with multimedia devices
5.2. for practicals/tutorials	Laboratory, computers, multimedia devices

6. Specific competences acquired

Professional competences	**C1**: Identification and appropriate use of main physical laws and principles in a given context. **C1.1**: Deduction of working formulas for calculations of physical quantities using appropriate principles and laws of physics. **C1.2**: description of physical systems, using theories and specific tools (theoretical and experimental models, algorithms, schemes, etc.) **C1.3**: Applying the principles and laws of physics in problem solving theoretical or practical, in terms of qualified assistance. **C1.4**: Correct application of methods of analysis and criteria for the selection of appropriate solutions to achieve specified performance **C3**: Troubleshooting the physical conditions required using numerical and statistical methods **C3.1**: Use adequate data analysis and processing of numerical methods specific physics and mathematical statistics **C3.3**: Linking problematic methods of statistical analysis to date (to obtain measurements / calculations, data processing, interpretation). **C 3.4**: Evaluating the reliability of results and comparing them to bibliographic data or theoretical values calculated using statistical methods validation and / or numerical methods
Transversal competences	CT2: Applying the techniques of effective multidisciplinary team working on various hierarchical levels. CT3: Effective use of information sources and communication resources and training assistance, both in Romanian and in a foreign language.

7. Course objectives

7.1. General objective	Assimilation of the atomic and molecular physics concept.
7.2. Specific objectives	Quantum treatment of the electronic states of atoms - single electron atom - alkali atoms in dipole approximation - spin-orbit interaction and relativistic effects in single electron atom - the He atom - atoms in magnetic field – the Zeeman effect - the Hartree-Fock method for atomic orbitals - the molecular orbitals theory: the Huckel approximation - calculation of wave functions for H2+ and H2 - the Hartree-Fock approximation for polyatomic molecules - Orbital hybridization

8. Contents

8.1. Lecture [chapters]	Teaching techniques	Observations
The Schrödinger equation for one-electron atoms - the atomic orbitals for one-electron atom	Systematic exposition - lecture. Heuristic conversation. Examples	2 hours
Relativistic approximation for atomic orbitals and spin orbit interaction	Systematic exposition - lecture. Critical analysis.	4 hours
One-electron atoms in external magnetic	Systematic exposition -	2 hours

field. **Zeeman effect**	lecture. Heuristic conversation.	
Alkali metal atoms - dipole approximation	Systematic exposition - lecture. Heuristic conversation.	2 hours
Many-electron atoms -systems of fermions, the wave function, the Pauli principle - the He atom - the central field approximation - the Hartree-Fock theory, the self consistent field method - electronic configuration and the Mendeleev table	Systematic exposition - lecture.Examples.	6 hours
The Born Oppenheimer approximation - the H2+ molecular ion, the hydrogen molecule H2 - molecular orbital calculation for H2	Systematic exposition - lecture. Heuristic conversation.	4 hours
Molecular orbitals of polyatomic molecules - the Huckel method - the Valence electron approximation - Molecular orbital hybridization	Systematic exposition - lecture. Critical analysis. Examples	4 hours
Hartree Fock LCAO method for polyatomic molecules - Electronic configuration and molecular geometry in the ground state	Systematic exposition - lecture. Heuristic conversation. Examples	4 hours
Bibliography: -Fizica atomului si a moleculei B. H. Bransden si C. J. Joachain, Bucuresti, 1998 - Fizica atomică- Vol II, V. Spolschi, Editura Tehnica, 1953 - Molecular spectroscopy, Ira N. Levine, New York ; John Wiley &Sons, 1975 - Atkins' physical chemistry - Peter Atkins, Julio de Paula, Oxford University Press, 2010 - Introduction to quantum mechanics : with applications to chemistry, Linus Pauling and E. Bright Wilson, New York ; McGraw-Hill Book Company, 1935 - Introduction to infrared and Raman spectroscopy Norman B. Colthup, Lawrence H. Daly and Stephen E. Wiberley, New York ; Academic Press, 1964		
8.2. Tutorials [main themes]	Teaching and learning techniques	Observations
Principles of molecular spectroscopy	Guided work	2 hours
The molecular symmetry. The point group: elements and operations. Photon absorption processes, selection rules.	Guided work	6 hours
Magnetic resonance spectroscopy: NMR and EPR	Guided work	4 hours
Calculation methods for polyatomic molecules: HF and DFT methods	Guided work	2 hours
Bibliography: Atkins' physical chemistry - Peter Atkins, Julio de Paula, Oxford University Press, 2010 - Fizica atomică - Vol II, V. Spolschi, Editura Tehnica, 1953 - Introduction to infrared and Raman spectroscopy Norman B. Colthup, Lawrence H. Daly and Stephen E.		

Wiberley, New York ; Academic Press, 1964 - Molecular spectroscopy, Ira N. Levine, New York ; John Wiley &Sons, 1975 - Introduction to quantum mechanics : with applications to chemistry, Linus Pauling and E. Bright Wilson, New York ; McGraw-Hill Book Company, 1935		
8.3. Practicals [practical activities, projects, etc.]	Teaching and learning techniques	Observations
Principles and techniques on molecular spectrometry associated with electronic and vibrational transitions.	Guided practical activity	2 hours
Determination of the the spin-orbit interaction energy and optical transition probabilities for Na atoms	Guided practical activity	2 hours
Extraction of the rotation-vibration parameters from molecular spectra of diatomic molecules: HCl	Guided practical activity	2 hours
Calculation of the MO and the vibration frequencies for diatomic molecules	Guided practical activity	2 hours
Spectral identification and atomic configuration for AB3 molecules (the CO3 molecule) from IR spectra using irreducible representations of symmetry groups.	Guided practical activity	2 hours
Determining the C6H6 molecule configuration from Raman spectra using point symmetry group theory.	Guided practical activity	2 hours
The Zeeman effect	Guided practical activity	2 hours
Identification of the structure of organic molecules by high-resolution NMR spectra	Guided practical activity	2 hours
Electron paramagnetic resonance – determination of the EPR spectrum parameters	Guided practical activity	4hours
Analysis of free radicals by EPR	Guided practical activity	2 hours
Evaluation	Exams	2 hours
Bibliography: Fizica atomica : lucrari practice , colectiv de autori: Elena Borca, et al.Tipografia Universitatii din Bucuresti, 1984 - Lucrari practice de Fizica atomului și a moleculei, care se gasesc pe site-ul : http://brahms.fizica.unibuc.ro/atom/atom/LabAtom.php		
8.4. Project [only if included in syllabus]	Teaching and learning techniques	Observations
Bibliography: ...whatever you decide to indicate...		

9. Compatibility of the course unit contents with the expectations of the representatives of epistemic communities, professional associations and employers (in the field of the study program)

This course unit forms/develops some theoretical and practical competences and abilities which are fundamental for an undergraduate student in the field of modern Physics, corresponding to national and european/international standards. The contents and teaching methods were selected after a thorough analysis of the contents of similar course units in the syllabus of other universities from Romania or the European Union. The contents are in line with the requirements/expectations of the

main employers of the graduates (industry, research, secondary school teaching).

10. Assessment

Activity type	10.1. Assessment criteria	10.2. Assessment methods	10.3. Weight in final mark
10.4. Lecture	- coherence and clarity of exposition - correct use of equations/mathematical methods/physical models and theories - ability to indicate/analyse specific examples	Written test/oral examination	60%
10.5.1. Tutorials	- ability to use specific problem solving methods - ability to analyse the results	oral examination	10 %
10.5.2. Practicals	- ability to use specific experimental methods/apparatus - ability to perform/design specific experiments - ability to present and discuss the results	oral examination	15 %
10.5.3 Homework	- resolve the assignment	Report	10%
10.5.4 Activity during the course	- answeres during the lectures, laboratory and tutorials	Answeres during the year	5%
10.5.3. Project [only if included in syllabus]	- coherence and clarity of exposition - correct use of mathematical and physical methods/models - ability to use specific experimental methods/apparatus - ability to present and discuss the results	Report	
10.6. Minimal requirements for passing the exam Correct understanding of the concepts and phenomena, the ability to work with them and obtain accurate numerical results on topics imposed.			
Requirements for mark 5 (10 points scale) The obligation to perform all laboratory work. To obtain minimum the mark 5 from evaluation criteria.			

Date	Teacher's name and signature Conf. univ. dr. Mircea BERCU	Practicals/Tutorials instructor(s) name(s) and signature(s) Lect. Univ. dr. Vasile BERCU

Date of approval

Head of Department
Prof. univ. dr. Alexandru JIPA

DI 302 F.EN Elementary Particle Physics

1. Study program

1.1. University	University of Bucharest
1.2. Faculty	Faculty of Physics
1.3. Department	Department of MatterStructure, Atmospheric and Earth Physics, Astrophysics
1.4. Field of study	Physics
1.5. Course of study	Undergraduate/Bachelor of Science
1.6. Study program	Physics (in English)
1.7. Study mode	Full-time study

2. Course unit

2.1. Course unit title	***Elementary Particle Physics***							
2.2. Teacher				**Prof. Dr. Ionel Lazanu.**				
2.3. Tutorials/Practicals instructor(s)				Instructor name(s) **Lecturer dr. Oana Ristea** **Lecturer dr. Marius Călin**				
2.4. Year of study	3	2.5. Semester	1	2.6. Type of evaluation	E	2.7. Type of course unit	Content[1)]	**DS**
							Type[2)]	**DI**

[1)] fundamental (DF), speciality (DS), complementary (DC); [2)] compulsory (DI), elective (DO), optional (DFac)

3. Total estimated time (hours/semester)

3.1. Hours per week in curriculum	**4**	distribution: Lecture	**2**	Practicals/Tutorials	**2**
3.2. Total hours per semester	**56**	distribution: 1-st semester	**56**	2-nd semester	**0**

Distribution of estimated time for study	**hours**
3.2.1. Learning by using one's own course notes, manuals, lecture notes, bibliography	**35**
3.2.2. Research in library, study of electronic resources, field research	**10**
3.2.3. Preparation for practicals/tutorials/projects/reports/homeworks	**20**
3.2.4. Preparation for exam	**4**
3.2.5. Other activities	**0**

3.3. Total hours of individual study	**65**
3.4. Total hours per semester	**125**
3.5. ECTS	**5**

4. Prerequisites (if necessary)

4.1. curriculum	The equations of mathematical physics, physics of the atom and molecule
4.2. competences	Knowledge of mathematics, physics atomic, programming languages and numerical methods, etc.

5. Conditions/Infrastructure (if necessary)

5.1. for lecture	Amphytheatre equipped with multimedia devices
5.2. for practicals/tutorials	Radioactive isotopesources, experimental set-up for nuclear spectroscopy, gas, scintillation and semiconductordetectors, multichannel analyzers (emulation software), radiation monitors

6. Specific competences acquired

Professional competences	C1: The identification and appropriate use of main physical laws and principles in a given context. C1.1: The deduction of working formulae for calculations of physical quantities using appropriate principles and laws of physics. C1.2: The description of physical systems, using theories and specific tools (theoretical and experimental models, algorithms, schemes, etc.) C1.3: Applying the principles and laws of physics in solving theoretical or practical problems with qualified assistance. C1.4: The correct application of methods of analysis and criteria for the selection of appropriate solutions to achieve specified performance. C3: Troubleshooting the physical conditions required using numerical and statistical methods C3.1: Using adequate data analysis and processing of numerical methods specific physics and mathematical statistics C3.3: Linking methods of statistical analysis problems to date (to obtain measurements / calculations, data processing, interpretation). C 3.4: Evaluating the reliability of results and comparing them to bibliographic data or theoretical calculated values using statistical methods for validation and / or numerical methods C4: Applying knowledge in physics both in concrete situations from related fields, and in some experiments using standard laboratory equipment. C6: Addressing interdisciplinary themes from physics C6.1: Making connections necessary to use physical phenomena using basic knowledge of related fields (chemistry, biology, etc.) C6.4: Making connections between knowledge of physics and other fields (Chemistry, Biology, Computer Science, etc.).
Transversal competences	CT2: Applying the techniques of effective multidisciplinary team working on various hierarchical levels. CT3: Effective use of information sources and communication resources and training assistance, both in Romanian and in a foreign language.

7. Course objectives

7.1. General objective	Presenting the fundamentals of nuclear physics and possible applications in various fields.
7.2. Specific objectives	Understanding the specific aspects of the physics at subatomic and subnuclear scale Ability to operate with these concepts and phenomena. Development of experimental skills specific to the field. Knowlege of the the structure and specific models for nuclei decays. Understanding of the specificity experiments search of the structure, elementarity and fundamental interactions of matter. Understanding main classes of applications in everyday life.

8. Contents

8.1. Lecture [chapters]	Teaching techniques	Observations
Fundamental aspects of nuclear structure and	Systematic exposition -	2 hours

interactions. Items list.	lecture. Heuristic conversation. Critical analysis. Examples	
Physical principles of accelerating particles (charged particles in electric and magnetic fields, the constructive elements of an accelerator, electrostatic accelerators, resonance accelerators, synchrotron, other principles of acceleration and other subjects: experiments with fixed target colliders, accumulation rings, phase stability, strong focus, etc.)	Systematic exposition - lecture. Examples	6 hours
Detection. Physical phenomena used for detection. Energy loss in matter. Properties of detectors. Classes of detectors.	Systematic exposition - lecture. Heuristic conversation. Critical analysis. Examples	4 hours
Properties and interactions of elementary particles - phenomenological and experimental aspects. Forces, Experimental particle discoveries. Quantum numbers (baryon number, lepton numbers, strageness, isospin, other specific quantum numbers, Gell-Mann-Nishijima equation). How resonances are producted and how disintegrates. Determination of the spin. Violation of quantum numbers.	Systematic exposition - lecture. Heuristic conversation.. Examples	6 hours
Investigation of neutral kaon system - experiments and their interpretation. **Neutrinos**. Properties and consequences. The phenomenon of oscillation; experiments	Systematic exposition - lecture. Heuristic conversation.. Examples	4 hours
Systematics of elementary particles.Octet way model. Naive quark model. The concept of colour (as quantum number). Standard Model. Confruntation with experimental data.	Systematic exposition - lecture.. Critical analysis. Examples	6 hours

Bibliography:

1. D. Griffiths, Introduction to elementary particles, Wiley (1989) sau ulterioare
2. A Das and T. Ferbel, Introduction to Nuclear and Particle Physics, World Scientific, Second edition, 2005
3. Raymond Serway, Clement Moses, Curt Moyer, Modern Physics, Third Edition, Thomson Books/Cole, 2005 (13 Nuclear structure, 14 Nuclear physics applications, 15 Elementary particles; other only by selection)
4. http://hyperphysics.phy-astr.gsu.edu/hbase/HFrame.html
5. K. Gottfried, V. Weisskopf Concepts of particle physics Clarendon Press, 1984
6. Brian R Martin, Nuclear and Particle Physics – An Introduction, 2nd_Edition, 2009
7. I. Lazanu, Al. Mihul, Particule elementare, Ed. Univ. Bucureşti 2001
8. I. Lazanu, Spectroscopia hadronilor, Ed. Univ. Bucureşti 1998.
9. I. Lazanu, Cosmologie şi particule elementare, Ed. Univ. Bucureşti 1999
10. I. Lazanu, Particule elementare - probleme rezolvate, Ed. Univ. Bucureşti 2002
11. I. Lazanu, Acceleratori de particule, Ed. Univ. Bucureşti 1997
12. WR Leo, Techniques for nuclear and particle physics experiments, 2nd Edition Springer-Verlag , 1994
13. http://ocw.mit.edu/courses/nuclear-engineering/22-55j-principles-of-radiation-interactions-fall-2004/lecture-notes/
14. K.N.Muhin – Fizică nucleară experimentală – vol.I, II, Editura Tehnică, Bucureşti, 1981, 1982

15. M.Sin (editor) – Bazele Fizicii nucleare. Lucrări de laborator – Editura Universităţii din Bucureşti, 2003 16. C. Beşliu, Al.Jipa – Modele de structură nucleară şi mecanisme de recaţie – Editura Universităţii din Bucureşti, 2002		
8.2. Tutorials [main themes]	Teaching and learning techniques	Observations
Elements of electronic used in laboratory; temporal coincidences in experiments Problems	Guided work	2hours 6 hours
Bibliography: ...whatever you decide to indicate...		
8.3. Practicals [practical activities, projects, etc.]	Teaching and learning techniques	Observations
1. Activation law for neutrons 2. Slowing neutrons proces 3. Analysis of signals produced in different ionization detectors produced by different particles 4. Beta spectroscopy and internal conversion 5. The method of delayed coincidence for gamma – gamm rays. Determination of life time for excited nuclear states. 6. Moessbauer Effect. Determination of some parameters of nuclear structure 7. Identifiation of elementary particles and their interactions 8-9. The analysis of interaction processes of elementary particles. (2 weaks) Practical assessment (colloquium)	Guided practical activity	9x2 hours 2 hours

9. Compatibility of the course unit contents with the expectations of the representatives of epistemic communities, professional associations and employers (in the field of the study program)

This course unit forms/develops some theoretical and/or practical competences and abilities which are important/fundamental/something else for an undergraduate student in the field of modern Physics, corresponding to national and european/international standards. The contents and teaching methods were selected after a thorough analysis of the contents of similar course units in the syllabus of other universities from Romania or the European Union străinătate (University of Oxford https://www.ox.ac.uk/admissions/undergraduate/courses-listing?wssl=1, Universityof Parma http://www.difest.unipr.it/it/didattica/laurea-triennale-fisica/calendario-didattico, Universitatea Padova, http://en.didattica.unipd.it/didattica/2015/SC1158/2014). The contents are in line with the requirements/expectations of the main employers of the graduates (industry, research, secondary school teaching).

10. Assessment

Activity type	10.1. Assessment criteria	10.2. Assessment methods	10.3. Weight in final mark
10.4. Lecture	- coherence and clarity of exposition - correct use of equations/mathematical methods/physical models and theories - ability to indicate/analyse specific examples	Oral examination	60%
10.5.1. Tutorials	- ability to use specific problem solving methods - ability to analyse the results	Homeworks/written tests	10%
10.5.2. Practicals	- ability to use specific experimental methods/apparatus - ability to perform/design specific experiments - ability to present and discuss the results	Lab reports	30%
10.5.3. Project [only if included in syllabus]	- coherence and clarity of exposition - correct use of mathematical and physical methods/models - ability to use specific experimental methods/apparatus - ability to present and discuss the results	Report	
10.6. Minimal requirements for passing the exam Correct understanding of the concepts and phenomena, the ability to work with them and obtain accurate numerical results on topics imposed.			
Requirements for mark 5 (10 points scale) Completion of all laboratory and minimal 5 score to the examination of the knowlege of the laboratory The correct answers of the subjects indicated to obtain the score 5 at the final exam.			

Teacher's name and signature

Prof. Dr. Ionel Lazanu.

Practicals/Tutorials instructor(s) name(s) and signature(s)

Lecturer dr. Oana Ristea

Lecturer dr. Marius Călin

Date

Head of Department

Prof. Dr. Alexandru Jipa

Date of approval

DI 303 F.EN Solid State Physics

1. Study program

1.1. University	University of Bucharest
1.2. Faculty	Faculty of Physics
1.3. Department	Department of Electricity, Solid State Physics and Biophysics
1.4. Field of study	Exact and natural sciences / Physics
1.5. Course of study	Undergraduate/Bachelor of Science
1.6. Study program	Physics (in English)
1.7. Study mode	Full-time study

2. Course unit

2.1. Course unit title	**Solid state physics**							
2.2. Teacher				**Prof. Daniela Dragoman**				
2.3. Tutorials/Practicals instructor(s)				**Assoc. Prof. George Alexandru Nemneș, Lect. Sorina Iftimie**				
2.4. Year of study	3	2.5. Semester	5	2.6. Type of evaluation	E	2.7. Type of course unit	Content[1)]	**DF**
							Type[2)]	**DI**

[1)] fundamental (DF), speciality (DS), complementary (DC); [2)] compulsory (DI), elective (DO), optional (DFac)

3. Total estimated time (hours/semester)

3.1. Hours per week in curriculum	**6**	distribution: Lecture	**3**	Tutorials/ Practicals	**1/2**
3.2. Total hours per semester	**84**	distribution: lecture	**42**	Tutorials/ Practicals	**14/28**

Distribution of estimated time for study	**hours**
3.2.1. Learning by using one's own course notes, manuals, lecture notes, bibliography	**32**
3.2.2. Research in library, study of electronic resources, field research	**30**
3.2.3. Preparation for practicals/tutorials/projects/reports/homeworks	**25**
3.2.4. Examination	**4**
3.2.5. Other activities	**0**

3.3. Total hours of individual study	**87**
3.4. Total hours per semester	**175**
3.5. ECTS	**7**

4. Prerequisites (if necessary)

4.1. curriculum	Lectures: Electricity and magnetism, Optics, Equations of mathematical physics
4.2. competences	• Use of software packages for data analysis

5. Conditions/Infrastructure (if necessary)

5.1. for lecture	Multimedia infrastructure (videoprojector, PC)
5.2. for practicals/tutorials	Equipments for electrical, optical and magnetic characterizations

6. Specific competences acquired

Professional competences	• C1 – Identification and correct use of physical laws and principles in given contexts • C3 – Solving of physics problems in imposed conditions • C4 – Performing of physics experiments by using standard laboratory equipments • C5 – Analysis and communication/presentation of scientific data
Transversal competences	• CT3 – Efficient use of the sources of scientific information and communication of scientific data in English

7. Course objectives

7.1. General objective	Study of Physical properties of crystalline solids
7.2. Specific objectives	- knowledge of specific physical theories and models used in solid state physics - developing the ability to creatively use specific physical models to solve problems and analyze experimental data - knowledge and use of specific experimental characterization methods

8. Contents

8.1. Lecture [chapters]	Teaching techniques	Observations
Crystalline structure. Introduction to crystallography. Symmetry properties of crystalline solids. Structural defects.	Systematic exposition - lecture. Examples	6 hours
Normal modes of vibration of crystalline structures. Phonons. Dispersion laws. Thermodynamical properties.	Systematic exposition - lecture. Examples	6 hours
Electronic structure of crystalline solids. Energy bands. Bloch's functions. Tight binding model. Effective mass.	Systematic exposition - lecture. Examples	8 hours
Statistics of charge carriers in crystalline solids. Classification of solids. Metals. Semiconductors. Doped semiconductors.	Systematic exposition - lecture. Examples	6 hours
Charge transport. Boltzmann's approach. Relaxation time approximation. Electrical conductivity.	Systematic exposition - lecture. Examples	6 hours
Charge transport in magnetic fields. Hall effect. Magnetoresistance. Applications.	Systematic exposition - lecture. Examples	4 hours
Magnetic properties of solids. Ferromagnetism.	Systematic exposition - lecture. Examples	6 hours
Bibliography: 1. D. Dragoman, Course notes on solid state physics 2. N.W. Ashcroft, N.D. Mermin, Solid State Physics (Harcourt, 1976). 3. Y.M. Galperin, Introduction to Modern Solid State Physics (CreateSpace Publishing Platform, 2014)		
8.2. Tutorials [main themes]	Teaching and learning techniques	Observations
Symmetry of crystalline solids. Matter tensors.	Guided work	4 hours
Electronic structure of crystalline solids. Densities of states.	Guided work	2 hours

Fermi-Dirac statistics. Degenerate and non-degenerate electronic systems.	Guided work	3 hours
Relaxation time approximation. Scattering mechanisms. Electrical conductivity. Applications.	Guided work	3 hours
Magnetic properties. Paramagnetism. Applications	Guided work	2 hours
Bibliography: 1. N.W. Ashcroft, N.D. Mermin, Solid State Physics (Harcourt, 1976). 2. Y.M. Galperin, Introduction to Modern Solid State Physics (CreateSpace Publishing Platform, 2014).		
8.3. Practicals [practical activities, projects, etc.]	Teaching and learning techniques	Observations
Crystallography. X-ray diffraction	Guided practical activity	4 hours
Electrical conductivity of metals	Guided practical activity	4 hours
Electrical conductivity of semiconductors. Determination of the bandgap.	Guided practical activity	2 hours
Disrodered semiconductors. Hopping conduction mechanism.	Guided practical activity	2 hours
Hall effect in doped semiconductors	Guided practical activity	4 hours
Magnetoresistance	Guided practical activity	2 hours
Seebeck effect	Guided practical activity	2 hours
Optical properties of semiconductors	Guided practical activity	4 hours
Photoconduction	Guided practical activity	2 hours
Magnetic hysteresis cycle	Guided practical activity	2 hours
Bibliography: 1. L. Ion, Solid state physics – Laboratory manual		
8.4. Project [only if included in syllabus]	Teaching and learning techniques	Observations
Bibliography:		

9. Compatibility of the course unit contents with the expectations of the representatives of epistemic communities, professional associations and employers (in the field of the study program)

This course unit aims at developing specific theoretical and practical competences and abilities in the field of solid state physics, corresponding to national and european/international standards. The contents and teaching methods were selected after a thorough analysis of the contents of similar course units in the syllabus of other universities from Romania or the European Union. The contents are in line with the requirements/expectations of the main employers of the graduates (industry, research – e.g. the National R&D Institute for Materials Physics, secondary school teaching).

10. Assessment

Activity type	10.1. Assessment criteria	10.2. Assessment methods	10.3. Weight in final mark
10.4. Lecture	- coherence and clarity of exposition - correct use of equations/mathematical methods/physical models and theories	Written exam	50%

	- ability to indicate/analyse specific examples		
10.5.1. Tutorials	- ability to use specific problem solving methods - ability to analyse the results	Homeworks	20%
10.5.2. Practicals	- ability to perform specific experiments - ability to present and discuss the results	Lab reports	30%
10.5.3. Project [only if included in syllabus]			
10.6. Minimal requirements for passing the exam All practical activities must be finalized.			
Requirements for mark 5 (10 points scale) - Performing all experiments and presentation of Lab reports - Correct solution for indicated subjects in homeworks and the final exam			

Date
03/24/2016

Teacher's name and signature

Prof. Daniela Dragoman

Practicals/Tutorials instructor(s) name(s) and signature(s)

Assoc. Prof. George Alexandru

Nemneș, Lect. Sorina Iftimie

Date of approval

Head of Department,

Assoc. Prof. Petrică Cristea

DI 304 F.EN Spectroscopy and Lasers

1. Study program

1.1. University	University of Bucharest
1.2. Faculty	Faculty of Physics
1.3. Department	Department of Theoretical Physics, Mathematics, Optics, Plasma, Lasers
1.4. Field of study	Physics
1.5. Course of study	Undergraduate/Bachelor of Science
1.6. Study program	Physics (in English)
1.7. Study mode	Full-time study

2. Course unit

2.1. Course unit title	**Spectroscopy and Lasers**							
2.2. Teacher				**Lector Dr. Iulian Ionita and Lector Dr. Ion Gruia**				
2.3. Tutorials/Practicals instructor(s)				**Lector Dr. Iulian Ionita and Lector Dr. Ion Gruia**				
2.4. Year of study	3	2.5. Semester	V	2.6. Type of evaluation	E	2.7. Type of course unit	Content[1)]	**DS**
							Type[2)]	**DI**

[1)] fundamental (DF), speciality (DS), complementary (DC); [2)] compulsory (DI), elective (DO), optional (DFac)

3. Total estimated time (hours/semester)

3.1. Hours per week in curriculum	**4**	distribution: Lecture	**2**	Practicals/Tutorials	**2**
3.2. Total hours per semester	**56**	distribution: 1-st semester	**0**	2-nd semester	**56**

Distribution of estimated time for study	**hours**
3.2.1. Learning by using one's own course notes, manuals, lecture notes, bibliography	**20**
3.2.2. Research in library, study of electronic resources, field research	**20**
3.2.3. Preparation for practicals/tutorials/projects/reports/homeworks	**25**
3.2.4. Examination	**4**
3.2.5. Other activities	**0**

3.3. Total hours of individual study	**65**
3.4. Total hours per semester	**125**
3.5. ECTS	**5**

4. Prerequisites (if necessary)

4.1. curriculum	Geometry, Trigonometry, Mathematical analysis, Classical Mechanics, Analytical Mechanics, Equations of mathematical physics, Basic of Atom Physics, Electricity, Quantum Mechanics
4.2. competences	Data procesing and numerical methods

5. Conditions/Infrastructure (if necessary)

5.1. for lecture	Multimedia equipped class (videoprojector) Lecture notes Recommended bibliography
5.2. for practicals/tutorials	Laboratory of Atomic Spectroscopy with spectral instruments and computers. Laboratory of Lasers.

6. Specific competences acquired

Professional competences	C1 - Identification and appropriate use of main laws and principles of physics in a given context. C3 - Solving problems of physics in imposed conditions, using numerical and statistical methods C4 – Applying knowledges from the field of physics both in concrete situations from related fields, as well as in some experiments, using the standard laboratory equipment. C5 - Communication and analysis of information with didactic, scientific and popularization character in the field of physics..
Transversal competences	CT1 – Achievement of professional tasks in efficient and responsible way with the compliance of ethics legislation specific to the field, under qualified assistance. CT2 - Application of efficient working techniques in multidisciplinary team on different hierarchical levels CT3 - Efficient use of information sources and of resources of communication and formation in a foreign language

7. Course objectives

7.1. General objective	Knowledge of fundamental phenomena of spectroscopy and lasers physics, understanding of operation of both spectral instruments and lasers.
7.2. Specific objectives	- Study of spectral terms and of mono and divalent atom spectra. study of diferrent laser types. - Highlighting of essential issues at each topic in order to undertstand the involved phenomena and to develop an creative and correct thinking mode.

8. Contents

8.1. Lecture [chapters]	Teaching techniques	Observations
1. Spectral Instruments.	Systematic exposition - lecture. Critical analysis. Examples	2 hours
2. Spectral series of Hydrogen atom and like Hydrogen atoms. Spectral term of fundamental state of atom.	Systematic exposition - lecture. Examples	2 hours
3. Spectral terms of monovalent and divalent excitated atoms. Grotrian diagram.Energy levels of He-Ne laser.	Systematic exposition - lecture. Examples	4 hours
4. Electromagnetic Radiation and its Interaction with Atoms. Dipolar aproximation. Selection rules.	Systematic exposition - lecture. Examples	2 hours
5. Spectra of alkali metal ions. Zeeman effect. Lorentz theory of normal Zeeman effect. Quantum theory of Zeeman effect.	Systematic exposition - lecture. Examples	2 hours
6. Ti:sapphire laser energy levels.	Systematic exposition - lecture. Examples	2 hours
7. Laser radiation and its properties. Einstein coefficients. Light propagation in a medium, absorption, diffusion, optical gain.	Systematic exposition - lecture. Critical analysis. Examples	2 hours

8. Conditions for laser operation. First condition of operation – high density of radiation using resonant optical cavity. Finding out of second condition of operation – population inversion using optical pumping. More than two levels necessity for continuous operation. Pumping methods. Optical pumping. Pumping by atomic/molecular collissions.	Systematic exposition - lecture. Examples	2 hours
9. Optical cavity and oscillating modes. Laser amplification. Laser gain. Types of lasers and their characteristics.	Systematic exposition - lecture. Examples	2 hours
10. Three-level system. Ruby laser. Energy levels, transitions, building up, properties. Four-level system. Advantage versus three-level system. Neodymium laser. Energy levels, transitions, building up, properties.	Systematic exposition - lecture. Examples	2 hours
11. He-Ne laser. Pumping, Energy levels, transitions, building up, properties.	Systematic exposition - lecture. Examples	2 hours
12. Ionic lasers. Argon laser. Metallic vapor laser. Molecular lasers. Carbon dioxide laser.	Systematic exposition – lecture. Examples	2 hours
13. Semiconductor laser. Principles of operation, properties.Tunable lasers. Dye laser, excimer laser, color centers laser, semiconductor lasers. Applications of lasers	Systematic exposition – lecture. Critical analysis. Examples	2 hours
Bibliography: 1. Iulian Ionita, „Condensed matter optical spectroscopy”, CRC Press, 2014. 2. H. E. White, “Introduction to atomic spectra”, McGraw-Hill Book Company, New York and London, 1934. 3. M. Csele, „Fundamentals of light sources and lasers” (Wiley, 2004)		
8.2. Tutorials [main themes]	Teaching and learning techniques	Observations
Bibliography:		
8.3. Practicals [practical activities, projects, etc.]	Teaching and learning techniques	Observations
1. Laboratory works presentation. Work safety rules instructing		2 hours
2. Prism based spectral instruments	Guided practical activity	2 hours
3. Difraction gratting based spectral instruments	Guided practical activity	2 hours
4. Balmer series of Hydrogen atom	Guided practical activity	2 hours
5. Observing the normal Zeeman effect of Cadmium ion in transverse and longitudinal configuration	Guided practical activity	2 hours
6. Measurements of Zeeman effect of Cadmium ion	Guided practical activity	2 hours
7. UV-Vis Spectrophotometry	Guided practical activity	2 hours
8. Study and alignement of a He-Ne laser	Guided practical activity	2 hours

9. Analyses and characterization of active media of lasers.	Guided practical activity	2 hours
10. Study and characterization of diode lasers (808.5 nm)	Guided practical activity	2 hours
11. Study of solid state Nd:YAG laser	Guided practical activity	2 hours
12. He-Ne laser operation in visible	Guided practical activity	2 hours
13. Analyses of longitudinal modes	Guided practical activity	2 hours
14. Laboratory colloquium		2 hours
Bibliography: Laboratory Guides		
8.4. Project [only if included in syllabus]	Teaching and learning techniques	Observations
Bibliography:		

9. Compatibility of the course unit contents with the expectations of the representatives of epistemic communities, professional associations and employers (in the field of the study program)

This course unit develops some practical competences and abilities which are important for an undergraduate student in the field of modern Physics, corresponding to national and european/international standards. The contents and teaching methods were selected after a thorough analysis of the contents of similar course units in the syllabus of other universities from Romania or the European Union. The contents are in line with the requirements/expectations of the main employers of the graduates (industry, research, secondary school teaching – National Institute for Laser, Plasma and Radiation Physics., National Institute of Materials Physics, National Institute for Opto-Electronics, IOR, Apel Laser SRL).

10. Assessment

Activity type	10.1. Assessment criteria	10.2. Assessment methods	10.3. Weight in final mark
10.4. Lecture	- coherence and clarity of exposition - correct use of equations/mathematical methods/physical models and theories - ability to indicate/analyse specific examples	Final written evaluation: Test of theoretical knowledges and applied problems.	50%
		Continue evaluation	20%
		Attendance	10%
10.5.1. Tutorials			
10.5.2. Practicals	- ability to use specific experimental methods/apparatus - Applying specific methods of solving the given problem; - Results interpretation;	Evaluation by practical test	20%

10.5.3. Project [only if included in syllabus]			
10.6. Minimal requirements for passing the exam			
Requirements for mark 5 (10 points scale) - Mandatory attendance: 50% from lectures and all practicals completed. - At least mark 5 at the end of evaluation.			

	Teacher's name and signature	Practicals/Tutorials instructor(s) name(s) and signature(s)
Date April 18th, 2016	Lecturer Dr. Iulian Ionita	Lecturer Dr. Iulian Ionita
	Lecturer Dr. Ion Gruia	Lecturer Dr. Ion Gruia

Date of approval

Head of Department

Prof. Dr. Ing. Virgil Baran

DO 305 F1.EN Methods and techniques of presenting the results in physics

1. Study program

1.1. University	University of Bucharest
1.2. Faculty	Faculty of Physics
1.3. Department	Department of Theoretical Physics, Mathematics, Optics, Plasma, Lasers
1.4. Field of study	Physics
1.5. Course of study	Undergraduate/Bachelor of Science
1.6. Study program	Physics (in English)
1.7. Study mode	Full-time study

2. Course unit

2.1. Course unit title	**Methods and techniques of presenting the results in physics**							
2.2. Teacher				**Lect.Dr. Roxana ZUS, Lect.Dr. Mădălina BOCA**				
2.3. Tutorials/Practicals instructor(s)				**Lect.Dr. Roxana ZUS, Lect.Dr. Mădălina BOCA**				
2.4. Year of study	3	2.5. Semester	1	2.6. Type of evaluation	C	2.7. Type of course unit	Content[1)]	**DC**
							Type[2)]	**DO**

[1)] fundamental (DF), speciality (DS), complementary (DC); [2)] compulsory (DI), elective (DO), optional (DFac)

3. Total estimated time (hours/semester)

3.1. Hours per week in curriculum	**3**	distribution: Lecture	**1**	Practicals/Tutorials	**2**
3.2. Total hours per semester	**42**	distribution: Lecture	**14**	Practicals/Tutorials	28

Distribution of estimated time for study	**hours**
3.2.1. Learning by using one's own course notes, manuals, lecture notes, bibliography	9
3.2.2. Research in library, study of electronic resources, field research	10
3.2.3. Preparation for practicals/tutorials/projects/reports/homeworks	10
3.2.4. Examination	**4**
3.2.5. Other activities	**0**

3.3. Total hours of individual study	**29**
3.4. Total hours per semester	**75**
3.5. ECTS	**3**

4. Prerequisites (if necessary)

4.1. curriculum	
4.2. competences	

5. Conditions/Infrastructure (if necessary)

5.1. for lecture	Lecture hall with computer and video projector, computers network Lecture notes Bibliography
5.2. for practicals/tutorials	laboratory with computer and video projector, computers network

	Lecture notes Bibliography

6. Specific competences acquired

Professional competences	• C2 – Using of software for data analysis and visualization • C5 – Communication and analysis of didactic, scientific and popularization information in physics • C6 – Interdisciplinary approach of some topics in physics
Transversal competences	• CT3 - Effective use of information sources, communication and training resources in a foreign language

7. Course objectives

7.1. General objective	Acquiring the techniques of redaction, processing and presentation of the results in physics
7.2. Specific objectives	Understanding the specific problems and of structure of different types of scientific works and presentations Forming of DTP skills Forming of skills of processing and graphical presentation of scientific data Forming of skills of presenting results in a scientific work

8. Contents

8.1. Lecture [chapters]	Teaching techniques	Observations
Structure of a scientific work; examples in physics **Scientific report** – characteristics and main elements **Extended scientific works :** – characteristics and main elements of a thesis **Scientific paper** characteristics and main elements	Case study/Guided work	3 hours
Examples of themes in physics for the project	Case study/Guided work	1 hour
Techniques of redaction presentation of the editing software for scientific works.		1 hour
Introduction in LaTeX Installing basic instructions math symbols, tables, graphics packages, classes, documents	Case study/Guided work	4 hours
Graphical representation, animations, videos; applications in physics	Case study/Guided work	3 hours
Structure of a scientific presentation installing and using beamertex designing a poster presentation	Case study/Guided work	2 hours
Bibliography:		

- Helmut Kopka, Patrick W. Daly, “A Guide to LATEX” (Fourth edition), Addison-Wesley, 2003
- Donald Knuth, „The TEXbook”, Addison-Wesley, Reading MA, 1984
- Tobias Oetiker, Hubert Partl, Irene Hyna, Elisabeth Schlegl, „The Not So Short Introduction to LATEX 2ε’’
- Harold Rabinowitz; Suzanne Vogel „The manual of scientific style : a guide for authors, editors, and researchers” Academic Press/Elsevier 2009
- Michael Alley The Craft of Scientific Presentations Springer2007
- John M. Swales, Christine B. Feak, Academic Writing for Graduate Students: Essential Tasks and Skills - A Course for Nonnative Speakers of English University of Michigan Press, 1994

8.2. Tutorials [main themes]	Teaching and learning techniques	Observations
Structure of a scientific work; examples in physics **Scientific report** – characteristics and main elements **Extended scientific works :** – characteristics and main elements of a thesis **Scientific paper**characteristics and main elements	Case study/Guided work	3 hours
Examples of themes in physics for the project	Case study/Guided work	1 hour
Introduction in LaTeX Installing basic instructions math symbols, tables, graphics packages, classes, documents	Case study/Guided work	5 hours
Graphical representation, animations, videos; applications in physics	Case study/Guided work	3 hours
Structure of a scientific presentation installing and using beamertex designing a poster presenattion	Case study/Guided work	2 hours

Bibliography:
- Helmut Kopka, Patrick W. Daly, “A Guide to LATEX” (Fourth edition), Addison-Wesley, 2003
- Donald Knuth, „The TEXbook”, Addison-Wesley, Reading MA, 1984
- Tobias Oetiker, Hubert Partl, Irene Hyna, Elisabeth Schlegl, „The Not So Short Introduction to LATEX 2ε’’
- Roxana Zus, Madalina Boca - Note de curs in format electronic

8.3. Practicals [practical activities, projects, etc.]	Teaching and learning techniques	Observations

8.4. Project [only if included in syllabus]	Teaching and learning techniques	Observations
Installing latex and other editing software	Documentation/case study/guided practical work	2 hours
Choosing of themes for the scientific paper and the presentation	Documentation/case study/guided practical work	2 hours

Writing a scientific paper	Documentation/case study/guided practical work	5 hours
Designing of a scientific presentation	Documentation/case study/guided practical work	3 hours
Analysis of the results	Documentation/case study/guided practical work	2 hours

Bibliografie:

- Helmut Kopka, Patrick W. Daly, “A Guide to LATEX” (Fourth edition), Addison-Wesley, 2003
- Donald Knuth, „The TEXbook”, Addison-Wesley, Reading MA, 1984
- Tobias Oetiker, Hubert Partl, Irene Hyna, Elisabeth Schlegl, „The Not So Short Introduction to LATEX 2ε’’
- Harold Rabinowitz; Suzanne Vogel „The manual of scientific style : a guide for authors, editors, and researchers” Academic Press/Elsevier 2009
- Michael Alley The Craft of Scientific Presentations Springer2007
- John M. Swales, Christine B. Feak, Academic Writing for Graduate Students: Essential Tasks and Skills - A Course for Nonnative Speakers of English University of Michigan Press, 1994

9. Compatibility of the course unit contents with the expectations of the representatives of epistemic communities, professional associations and employers (in the field of the study program)

The contents and teaching methods were selected after a thorough analysis of the contents of similar course units in the syllabus of other universities from Romania or the European Union. The contents are in line with the requirements of the University of Bucharest and of other national/international requirements for presentation of scientific works.

10. Assessment

Activity type	10.1. Assessment criteria	10.2. Assessment methods	10.3. Weight in final mark
10.4. Lecture	- coherence and clarity of exposition - ability to indicate/analyze specific examples	Written test/oral examination	40%
10.5.1. Tutorials			
10.5.2. Practicals			
10.5.3. Project [only if included in syllabus]	- coherence and clarity of exposition - correct use of techniques/ methods - ability to present and discuss the scientific paper and presentation	Report	60%
10.6. Minimal requirements for passing the exam			
Requirements for mark 5 (10 points scale) Correct presentation of 50% of theoretical subjects at the final examination Passing the project presentation			

	Teacher’s name and signature	Practicals/Tutorials instructor(s) name(s) and signature(s)
Date 27.04.2016	Lect.Dr. Roxana ZUS	Lect.Dr. Roxana ZUS
	Lect.Dr. Mădălina BOCA	Lect.Dr. Mădălina BOCA

Date of approval

Head of Department

Prof. Dr. Virgil BĂRAN

DO 305 F.2.EN History of Physics

1. Study program

1.1. University	University of Bucharest
1.2. Faculty	Faculty of Physics
1.3. Department	Department of Theoretical Physics, Mathematics, Optics, Plasma, Lasers
1.4. Field of study	Physics
1.5. Course of study	Undergraduate/Bachelor of Science
1.6. Study program	Physics (in English)
1.7. Study mode	Full-time study

2. Course unit

2.1. Course unit title	**Methods and techniques of presenting the results in physics**							
2.2. Teacher				Prof. dr. Virgil Baram				
2.3. Tutorials/Practicals instructor(s)				Prof. dr.Virgil Baran				
2.4. Year of study	3	2.5. Semester	1	2.6. Type of evaluation	C	2.7. Type of course unit	Content[1)]	**DC**
							Type[2)]	**DO**

[1)] fundamental (DF), speciality (DS), complementary (DC); [2)] compulsory (DI), elective (DO), optional (DFac)

3. Total estimated time (hours/semester)

3.1. Hours per week in curriculum	**3**	distribution: Lecture	**1**	Practicals/Tutorials	**2**
3.2. Total hours per semester	**42**	distribution: Lecture	**14**	Practicals/Tutorials	28

Distribution of estimated time for study	**hours**
3.2.1. Learning by using one's own course notes, manuals, lecture notes, bibliography	9
3.2.2. Research in library, study of electronic resources, field research	10
3.2.3. Preparation for practicals/tutorials/projects/reports/homeworks	10
3.2.4. Examination	**4**
3.2.5. Other activities	**0**

3.3. Total hours of individual study	**29**
3.4. Total hours per semester	**75**
3.5. ECTS	**3**

4. Prerequisites (if necessary)

4.1. curriculum	
4.2. competences	

5. Conditions/Infrastructure (if necessary)

5.1. for lecture	Lecture hall with computer and video projector, computers network Lecture notes Bibliography
5.2. for practicals/tutorials	laboratory with computer and video projector, computers network

	Lecture notes Bibliography

6. Specific competences acquired

Professional competences	• C5 – Communication and analysis of didactic, scientific and popularization information in physics • C6 – Interdisciplinary approach of some topics in physics
Transversal competences	• CT1 - Solving professional tasks in an efficient and responsible manner, in compliance with specific ethics and la requirements, under qualified assistance. • CT3 - Effective use of information sources, communication and training resources in a foreign language

7. Course objectives

7.1. General objective	Understanding the development of the main ideas in physics
7.2. Specific objectives	The connection of physics with other sciences The stages of developpment from antiquity toward modern physics

8. Contents

8.1. Lecture [chapters]	Teaching techniques	Observations
Introductory lecture: why physics is a key science. The connection of physics with other sciences and branches of human knowledge.	Case study/Guided work	1 hours
The history of mechanics: -the main stages from antiquity to present time -the transition from classical to relativistic mechanics	Case study/Guided work	2 hour
The evolution of optics: -the stages towards the present understanding of the light	Case study/Guided work	2 hour
The history of electrodynamics -the main stages of evolution until the Maxwell theory -light as an electromagnetic wave and the transition to Einstein relativity	Case study/Guided work	2 hours
The history of quantum mechanics -the experimental revolution at the beginning of twenty century; -the stages towards the rigorous theory of the quantum phenomena -the interplay between quantum mechanics and relativity and the antiparticle concept	Case study/Guided work	3 hours
The development of thermodynamics and statistical mechanics	Case study/Guided work	2 hours

-the crystallization of the principles of thermodynamics - from classical to quantum statistical mechanics - the phase transitions from Andrews to K. Wilson		
Physics in the XX-th century: the physics of the fundamental interactions and of the elementary particles, condensed matter physics, nuclear physics, cosmology and astrophysics, the physics of earth, biophysics and medical physics.	Case study/Guided work	2 hours
Bibliography: 1. The Cambridge Companion to Galileo Galilei, Isaac Newton, G. Leibniz, Cambridge University Press 2. P. Mittelstaedt, P. A. Weingartner, *Laws of Nature*, Springer Verlag, Berlin Heidelberg, 2005 3. E. Mach, *Mecanica. Expunere istorica si critica a dezvoltarii ei*, Editura All 4. C. Cercignani, *Ludwig Boltzmann*, Editura tehnica 5. F. Wilczek, *The lightness of being: mass, ether and the unification of forces*, Perseus, 2008 6. M. von Laue, *History of Physics,* Pergamonn Press 7. J. Baggott, *The quantum story,* Oxford University Press, 2011 8.W. Applebaum, *The scientific revolution and the foundations of modern science*.Greenwood Press, 2005 9. T.S. Kuhn, *Structura Revolutiilor Stiintifice*, Editura Humanitas 10. M. Born, *Physics in my generation*, 11. Virgil Baran - Note de curs in format electronic		
8.2. Tutorials [main themes]	Teaching and learning techniques	Observations
Development of mechanics: the contributions of Galileo Galilei, Isaac Newton, Henry Poincare, Albert Eistein	Case study/Guided work	3 hours
Development of optics and electrodynamics: The milestones towards the first important unification in physics.	Case study/Guided work	1 hour
Development of thermodynamics and statistical mechanics: The contributions of L. Boltzmann, J.C. Maxwell, J. W. Gibbs, L. Landau, K. Wilson	Case study/Guided work	5 hours
Development of quantum mechanics: The contributions of M,Plank, N. Bohr, M. Born, W. Heisenberg, P.A. M. Dirac	Case study/Guided work	3 hours
The path towards the unification of fundamental interactions	Case study/Guided work	2 hours
Bibliography: 1. The Cambridge Companion to Galileo Galilei, Isaac Newton, G. Leibniz, Cambridge University Press 2. P. Mittelstaedt, P. A. Weingartner, Laws of Nature, Springer Verlag, Berlin Heidelberg, 2005 3. E. Mach, Mecanica. Expunere istorica si critica a dezvoltarii ei, Editura All 4. C. Cercignani, Ludwig Boltzmann, Editura tehnica		

5. F. Wilczek, The lightness of being: mass, ether and the unification of forces, Perseus, 2008
6. M. von Laue, History of Physics
7. J. Baggott, The quantum story, Oxford University Press, 2011
8.W. Applebaum, The scientific revolution and the foundations of modern science.Greenwood Press, 2005
9.Virgil Baran - Note de curs in format electronic

8.3. Practicals [practical activities, projects, etc.]	Teaching and learning techniques	Observations

8.4. Project [only if included in syllabus]	Teaching and learning techniques	Observations
The development of the important concepts in physics: physical system, physical law, mass, charge, interaction, measurement, elementary particle.	Documentation/case study/guided practical work	2 hours
The interplay between the theory and the experiment along various stages of the development of physics.	Documentation/case study/guided practical work	2 hours
Significant discoveries in physics during the last century.	Documentation/case study/guided practical work	5 hours
The interpretations of quantum mechanics: a historical evolution.	Documentation/case study/guided practical work	3 hours
The role of the symmetries in the development of modern physics	Documentation/case study/guided practical work	2 hours

Bibliografie:
1. *The Cambridge Companion* to Galileo Galilei, Isaac Newton, G. Leibniz, Cambridge University Press
2. P. Mittelstaedt, P. A. Weingartner, *Laws of Nature*, Springer Verlag, Berlin Heidelberg, 2005
3. E. Mach, *Mecanica. Expunere istorica si critica a dezvoltarii ei*, Editura All
4. C. Cercignani, *Ludwig Boltzmann*, Editura tehnica
5. F. Wilczek, *The lightness of being: mass, ether and the unification of forces*, Perseus, 2008
6. M. von Laue, *History of Physics*
7. J. Baggott, The quantum story, Oxford University Press, 2011
8.W. Applebaum, *The scientific revolution and the foundations of modern science.*Greenwood Press, 2005

9. Compatibility of the course unit contents with the expectations of the representatives of epistemic communities, professional associations and employers (in the field of the study program)

The contents and teaching methods were selected after a thorough analysis of the contents of similar course units in the syllabus of other universities from Romania or the European Union. The contents are in line with the requirements of the University of Bucharest and of other national/international requirements for presentation of scientific works.

10. Assessment

Activity type	10.1. Assessment criteria	10.2. Assessment methods	10.3. Weight in final mark
10.4. Lecture	- coherence and clarity of exposition - ability to indicate/analyze specific examples	Written test/oral examination	40%
10.5.1. Tutorials			
10.5.2. Practicals			
10.5.3. Project [only if included in syllabus]	- coherence and clarity of exposition - correct use of techniques/ methods	Report	60%
10.6. Minimal requirements for passing the exam			
Requirements for mark 5 (10 points scale) Correct presentation of 50% of theoretical subjects at the final examination Passing the project presentation			

	Teacher's name and signature	Practicals/Tutorials instructor(s) name(s) and signature(s)
Date 15.05.2016	Prof.Dr. Virgil BĂRAN	Prof.Dr. Virgil BĂRAN

Date of approval

Head of Department
Prof. Dr. Virgil BĂRAN

DO306 F.1.EN Virtual instrumentation and data acquisition

1. Study program

1.1. University	University of Bucharest
1.2. Faculty	Faculty of Physics
1.3. Department	Department of Electricity, Solid State Physics and Biophysics
1.4. Field of study	Exact and natural sciences / Physics
1.5. Course of study	Undergraduate/Bachelor of Science
1.6. Study program	Physics (in English)
1.7. Study mode	Full-time study

2. Course unit

2.1. Course unit title	**Virtual instrumentation and data acquisition**							
2.2. Teacher				**Prof. Lucian Ion**				
2.3. Tutorials/Practicals instructor(s)				**Asist. Vlad Antohe**				
2.4. Year of study	3	2.5. Semester	5	2.6. Type of evaluation	E	2.7. Type of course unit	Content[1)]	**DS**
							Type[2)]	**DO**

[1)] fundamental (DF), speciality (DS), complementary (DC); [2)] compulsory (DI), elective (DO), optional (DFac)

3. Total estimated time (hours/semester)

3.1. Hours per week in curriculum	**4**	distribution: Lecture	**2**	Tutorials/ Practicals	**2**
3.2. Total hours per semester	**56**	distribution: lecture	**28**	Tutorials/ Practicals	**28**

Distribution of estimated time for study	**hours**
3.2.1. Learning by using one's own course notes, manuals, lecture notes, bibliography	**15**
3.2.2. Research in library, study of electronic resources, field research	**10**
3.2.3. Preparation for practicals/tutorials/projects/reports/homeworks	**15**
3.2.4. Examination	**4**
3.2.5. Other activities	**0**

3.3. Total hours of individual study	**40**
3.4. Total hours per semester	**100**
3.5. ECTS	**4**

4. Prerequisites (if necessary)

4.1. curriculum	Lectures: Electricity and magnetism, Computer programming
4.2. competences	

5. Conditions/Infrastructure (if necessary)

5.1. for lecture	Multimedia infrastructure (videoprojector, PC)
5.2. for practicals/tutorials	PCs, Equipments for electrical, optical characterizations

6. Specific competences acquired

Professional competences	• C4 – Development of software applications and virtual instruments for data acquisition and performing of physics experiments by using standard laboratory equipments • C5 – Analysis and communication/presentation of scientific data
Transversal competences	• CT3 – Efficient use of the sources of scientific information and communication of scientific data in English

7. Course objectives

7.1. General objective	At the end of the course, it is desired that the student will be able to develop and use LabVIEW software applications for controlling physical experiments and for data acquisition.
7.2. Specific objectives	The student will be able to: - use specific LabVIEW programming techniques - develop modules for data acquisition/processing

8. Contents

8.1. Lecture [chapters]	Teaching techniques	Observations
Experimental techniques in modern physics. Sensors and data acquisition	Systematic exposition - lecture. Examples	2 hours
Software applications – LabVIEW programming package. Virtual instruments. G programming language: data types, structures, I/O operations.	Systematic exposition - lecture. Examples	12 hours
VISA architecture. GPIB and RS485 buses.	Systematic exposition - lecture. Examples	6 hours
Data acquisition and processing in physics experiments. Hardware configurations.	Systematic exposition - lecture. Examples	8 hours
Bibliography: 1. G Programming Reference Manual, National Instruments. 2. L. Ion, Course notes (slides) 3. R.Baican, D.S. Necsulescu, Applied Virtual Instrumentation (WIT Press, Southampton, UK, 2000).		
8.2. Tutorials [main themes]	Teaching and learning techniques	Observations
Bibliography:		
8.3. Practicals [practical activities, projects, etc.]	Teaching and learning techniques	Observations
Introduction to graphical programming. Front panel and diagrams.	Guided practical activity	4 hours
Virtual instruments. Design and configuration.	Guided practical activity	2 hours
Graphics and text. I/O operations.	Guided practical activity	10 hours
Data acquisition and processing modules	Guided practical activity	12 hours
Bibliography:		

8.4. Project [only if included in syllabus]	Teaching and learning techniques	Observations
Bibliography:		

9. Compatibility of the course unit contents with the expectations of the representatives of epistemic communities, professional associations and employers (in the field of the study program)

This course unit aims at developing specific practical competences and abilities in the field of data acquisition and processing in physics experiments. The contents are in line with the requirements/expectations of the main employers of the graduates (industry, research – e.g. the National R&D Institute for Materials Physics, secondary school teaching).

10. Assessment

Activity type	10.1. Assessment criteria	10.2. Assessment methods	10.3. Weight in final mark
10.4. Lecture	- ability to use specific programming and data processing techniques	Design and implementation of a virtual instrument	70%
10.5.1. Tutorials			
10.5.2. Practicals	- ability to use specific programming techniques - ability to present and discuss the results	Development of specific modules	30%
10.5.3. Project [only if included in syllabus]			
10.6. Minimal requirements for passing the exam All practical activities must be finalized.			
Requirements for mark 5 (10 points scale) - Performing all Lab tasks - Partial fulfillment of the tasks (for indicated tasks) for final exam			

Date 03/24/2016	Teacher's name and signature Prof. Lucian Ion	Practicals/Tutorials instructor(s) name(s) and signature(s) Lect. Adrian Radu

Date of approval

Head of Department,
Assoc. Prof. Petrică Cristea

DO 306 F.2.EN Introduction to cosmology and elements of astrophysics

1. Study program

1.1. University	University of Bucharest
1.2. Faculty	Faculty of Physics
1.3. Department	Department of Electricity, Solid State Physics and Biophysics
1.4. Field of study	Physics
1.5. Course of study	Undergraduate / Bachelor of Science
1.6. Study program	Physics (in English)
1.7. Study mode	Full-time study

2. Course unit

2.1. Course unit title	**Introduction to cosmology and elements of astrophysics**							
2.2. Teacher				**Prof. Dr. Ionel Lazanu**				
2.3. Tutorials/Practicals instructor(s)				**Prof. Dr. Ionel Lazanu**				
2.4. Year of study	3	2.5. Semester	5	2.6. Type of evaluation	E	2.7. Type of course unit	Content[1)]	**DS**
							Type[2)]	**DO**

[1)] fundamental (DF), speciality (DS), complementary (DC); [2)] compulsory (DI), elective (DO), optional (DFac)

3. Total estimated time (hours/semester)

3.1. Hours per week in curriculum	**4**	distribution: Lecture	**2**	Practicals/Tutorials	**2**
3.2. Total hours per semester	**56**	distribution: 1-st semester	**28**	2-nd semester	**28**

Distribution of estimated time for study	**hours**
3.2.1. Learning by using one's own course notes, manuals, lecture notes, bibliography	**15**
3.2.2. Research in library, study of electronic resources, field research	**10**
3.2.3. Preparation for practicals/tutorials/projects/reports/homeworks	**15**
3.2.4. Examination	**4**
3.2.5. Other activities	**0**

3.3. Total hours of individual study	**40**
3.4. Total hours per semester	**100**
3.5. ECTS	**4**

4. Prerequisites (if necessary)

4.1. curriculum	Pre-requirements: Mathematical analysis, Algebra, The equations of mathematical physics, Physics of the atom and molecule, Nuclear physics,
4.2. competences	Knowledge of Mathematics, Programming languages and numerical methods etc.

5. Conditions/Infrastructure (if necessary)

5.1. for lecture	Amphitheatre equipped with multimedia devices (video)
5.2. for practicals/tutorials	Laboratory with PC

6. Specific competences acquired

Professional competences	C1: The identification and appropriate use of main physical laws and principles in a given context. C1.1: The deduction of working formulae for calculations of physical quantities using appropriate principles and laws of physics. C1.2: The description of physical systems, using theories and specific tools (theoretical and experimental models, algorithms, schemes, etc.) C1.3: Applying the principles and laws of physics in solving theoretical or practical problems with qualified assistance. C1.4: The correct application of methods of analysis and criteria for the selection of appropriate solutions to achieve specified performance. C3: Troubleshooting the physical conditions required using numerical and statistical methods C3.1: Using adequate data analysis and processing of numerical methods specific physics and mathematical statistics C3.3: Linking methods of statistical analysis problems to date (to obtain measurements / calculations, data processing, interpretation). C 3.4: Evaluating the reliability of results and comparing them to bibliographic data or theoretical calculated values using statistical methods for validation and / or numerical methods C4: Applying knowledge in physics both in concrete situations from related fields, and in some experiments using standard laboratory equipment. C6: Addressing interdisciplinary themes from physics C6.1: Making connections necessary to use physical phenomena using basic knowledge of related fields (chemistry, biology, etc.) C6.4: Making connections between knowledge of physics and other fields (Chemistry, Biology, Computer Science, etc.).
Transversal competences	CT2: Applying the techniques of effective multidisciplinary team working on various hierarchical levels. CT3: Effective use of information sources and communication resources and training assistance, both in Romanian and in a foreign language.

7. Course objectives

7.1. General objective	Presentation of fundamental concepts related to the birth and evolution of the Universe în the primordial Big Bang model, using information and data from obsevational measurements. Presentation of the elements of particle physics and nuclear physics used in în this field..
7.2. Specific objectives	Understanding of global phenomena specific ofwhole Universe and linking them with issues at microcosmic scale. Develop the ability to work with these concepts and phenomena. Understand the main consequences of scientific results and their applications in everyday life.

8. Contents

8.1. Lecture [chapters]	Teaching techniques	Observations
1. Observational aspects about the Universe	Systematic exposition -	**2 hours**

2. Universe in expansion. Omogenity, isotropy and cosmological principle. Calssical and relativistic Doppler effect. Hubble law.	lecture. Examples Systematic exposition - lecture	**4 hours**
3. Newtonian cosmic dynamic. Fridmann and fluid equation. The curvature. Estimations of the cosmological parameters. Phase transitions in Early Universe. Elements of the primordial nucleosynthesis. Other elemets (asymmetry matter-antimatter).	Systematic exposition - lecture. Examples	**8 hours**
4. Cosmic particles. Spectra and composition. Detection. Cosmic accelation. Neutrinos and gravitational waves.	Systematic exposition - lecture. Examples	**6 hours**
5. Nuclear physics in stars. Supernovae and neutrinos. Neutron stars. Classical black holes and quantum aspects. Hawking radiation. Unruh-davies effect.	Systematic exposition - lecture. Examples	**6 hours**
6. Free subjects.	Systematic exposition - lecture. Discussions	**2 hours**
Bibliography: 1. I. Lazanu, Cosmologie şi particule elementare, Ed. Univ. Bucureşti 1999 2. Brian R Martin, Nuclear and Particle Physics – An Introduction, 2nd_Edition, 2009 3. WR Leo, Techniques for nuclear and particle physics experiments, 2nd Edition Springer-Verlag , 1994 4 RD Peccei, Physics at the interface of particle physics and cosmology, arxiv;9808418 6. A. Liddle, An Introduction to Modern Cosmology, Willey 2003 7. C. Grupen, B. A. Swartz, Particle Detectors, Cambridge University Press 2008 8. C Grupen, Astroparticle Physics, Springer 2005		
8.2. Tutorials [main themes]	Teaching and learning techniques	Observations
Some specific theme	Guided work	2-4-6 hours
Bibliography: ...whatever you decide to indicate...		
8.3. Practicals [practical activities, projects, etc.]	Teaching and learning techniques	Observations
Bibliography: ...whatever you decide to indicate...		
8.4. Project [only if included in syllabus]	Teaching and learning techniques	Observations
Bibliography: ...whatever you decide to indicate...		

9. Compatibility of the course unit contents with the expectations of the representatives

of epistemic communities, professional associations and employers (in the field of the study program)

This course unit forms/develops some theoretical and/or practical competences and abilities which are important/fundamental/something else for an undergraduate student in the field of modern Physics, corresponding to national and european/international standards. The contents and teaching methods were selected after a thorough analysis of the contents of similar course units in the syllabus of other universities from Romania or the EU (University of Oxford https://www.ox.ac.uk/admissions/undergraduate/courses-listing?wssl=1, Universityof Parma http://www.difest.unipr.it/it/didattica/laurea-triennale-fisica/calendario-didattico, Universitatea Padova, http://en.didattica.unipd.it/didattica/2015/SC1158/2014). The contents are in line with the requirements/expectations of the main employers of the graduates (industry, research, secondary school teaching).

10. Assessment

Activity type	10.1. Assessment criteria	10.2. Assessment methods	10.3. Weight in final mark
10.4. Lecture	- coherence and clarity of exposition - correct use of equations/mathematical methods/physical models and theories - ability to indicate/analyse specific examples	Oral examination	60%
10.5.1. Tutorials	- ability to use specific problem solving methods - ability to analyse the results	Homeworks/written tests	10%
10.5.2. Practicals	- ability to use specific experimental methods/apparatus - ability to perform/design specific experiments - ability to present and discuss the results	Lab reports	30%
10.5.3. Project [only if included in syllabus]	- coherence and clarity of exposition - correct use of mathematical and physical methods/models - ability to use specific experimental methods/apparatus - ability to present and discuss the results	Report	
10.6. Minimal requirements for passing the exam Correct understanding of the concepts and phenomena, the ability to work with them and obtain accurate numerical results on topics imposed.			
Requirements for mark 5 (10 points scale) All laboratories finished and 5 score at the examination of the laboratory The correct exposure of the subjects indicated to derive the score 5 final exam.			

Date	Teacher’s name and signature Prof. dr. Ionel Lazanu	Practicals/Tutorials instructor(s) name(s) and signature(s) Prof. dr. Ionel Lazanu

Date of approval

Head of Department

Prof. dr. Alexandru Jipa

DI 307 F.EN Plasma Physics and Applications

1. Study program

1.1. University	University of Bucharest
1.2. Faculty	Faculty of Physics
1.3. Department	Department of Theoretical Physics, Mathematics, Optics, Plasma, Lasers
1.4. Field of study	Physics
1.5. Course of study	Undergraduate/Bachelor of Science
1.6. Study program	Physics (in English)
1.7. Study mode	Full-time study

2. Course unit

2.1. Course unit title	**Plasma Physics and Applications**							
2.2. Teacher				**PhD Lecturer Iulian Ionita, PhD Lecturer Madalina Boca**				
2.3. Tutorials/Practicals instructor(s)				**PhD Lecturer Marian Bazavan, PhD Lecturer Madalina Boca**				
2.4. Year of study	3	2.5. Semester	2	2.6. Type of evaluation	E	2.7. Type of course unit	Content[1)]	**DS**
							Type[2)]	**DI**

[1)] fundamental (DF), speciality (DS), complementary (DC); [2)] compulsory (DI), elective (DO), optional (DFac)

3. Total estimated time (hours/semester)

3.1. Hours per week in curriculum	**4**	distribution: Lecture	**2**	Practicals/Tutorials	**2**
3.2. Total hours per semester	**40**	Lecture	**20**	Practicals/Tutorials	**20**

Distribution of estimated time for study	**hours**
3.2.1. Learning by using one's own course notes, manuals, lecture notes, bibliography	**30**
3.2.2. Research in library, study of electronic resources, field research	**30**
3.2.3. Preparation for practicals/tutorials/projects/reports/homeworks	**21**
3.2.4. Examination	**4**
3.2.5. Other activities	**0**

3.3. Total hours of individual study	**81**
3.4. Total hours per semester	**125**
3.5. ECTS	**5**

4. Prerequisites (if necessary)

4.1. curriculum	Geometry, Algebra, Mathematical Analysis, Classical Mechanics, Analytical Mechanics, Molecular Physics, Equations of Mathematical Physics, Classical Statistics, Atomic Physics
4.2. competences	Computer programming

5. Conditions/Infrastructure (if necessary)

5.1. for lecture	Multimedia equipped class (videoprojector)

	Lecture notes Recommended bibliography
5.2. for practicals/tutorials	Laboratory of Plasmas Physics with discharge tubes, vacuum equipement, HV supply, spectral instruments, electrical istruments and computers.

6. Specific competences acquired

Professional competences	C1 - Identification and appropriate use of main laws and principles of physics in a given context. C3 - Solving problems of physics in imposed conditions, using numerical and statistical methods C4 – Applying knowledges from the field of physics both in concrete situations from related fields, as well as in some experiments, using the standard laboratory equipment. C5 - Communication and analysis of information with didactic, scientific and popularization character in the field of physics..
Transversal competences	CT1 – Achievement of professional tasks in efficient and responsible way with the compliance of ethics legislation specific to the field, under qualified assistance. CT2 - Application of efficient working techniques in multidisciplinary team on different hierarchical levels CT3 - Efficient use of information sources and of resources of communication and formation in a foreign language

7. Course objectives

7.1. General objective	Knowledge of place of plasma phenomena in fundamental and applied physics
7.2. Specific objectives	Objectiv 1: Fundamental knowledge. The students will be competent in the physical and mathematical fundamentals of plasma applications, enabling them to address the issues of plasma physics conceptual, analytical, numerical and experimental. Objectiv 2: Practical. Studentii vor capata deprinderi de tehnici cu plasma și o înțelegere a abilităților necesare pentru provocarile tehnice ale viitorului. Students will get skills on plasma techniques needed to overcome the technical challenges of the future. Objectiv 3: Design and development. Students will be able to project a new plasma discharge experimental set-up in a multidisciplinary team. Objectiv 4: Communication. Students will be able to communicate scientific and technical information orally or in written and graphic form Objectiv 5: Behavior. Students will act ethically and will assess the impact of plasma sciencies on society, economy and environment.

8. Contents

8.1. Lecture [chapters]	Teaching techniques	Observations
Introduction. The plasmas in space and in the laboratory.	Systematic exposition - lecture. Heuristic conversation. Examples	2 hours

What is plasma? Plasma vs ionized gases.		
The elementary processes and the plasma equilibrium.. Transport phenomena in plasma	Systematic exposition - lecture	4 hours
The physical models for plasmas. Fluid models. Kinetic description of plasmas	Systematic exposition - lecture Critical analysis.	2 hours
Breakdown and ignition Electrical breakdown. Optical breakdown	Systematic exposition - lecture Critical analysis.	2 hours
Plasma Sources Glow discharge plasma. RF plasma. Microwaves plasma. Fusion plasma. Other plasma sources.	Systematic exposition - lecture Heuristic conversation. Critical analysis Examples	4 hours
Plasma Diagnostics Electrical Methods. Optical Methods	Systematic exposition - lecture Heuristic conversation. Critical analysis Examples	4 hours
The plasma & technologies.	Systematic exposition - lecture Heuristic conversation. Examples	2 hours

Bibliography:

I.I. Popescu, D. Ciobotaru.- Bazele fizicii plasmei, Editura Tehnică. Bucureşti 1987

I.I.Popescu, I.Iova E.I. Toader, - Fizica plasmei şi aplicaţii, Editura Ştiinţifică şi Enciclopedică.Bucureşti, 1981

I.Iova , I.I.Popescu, E.I. Toader, - Bazele spectroscopiei plasmei, Editura Stiintifica si Enciclopedica, Bucuresti, 1983

Gh. Popa,-Fizica plasmei, www.phys.uaic.ro

M. A. Lieberman, A. J. Lichetenberg - Principles of Plasma Discharges and Materials Processing, John Wiley, New York, 2005 (second edition).

B. Chapman, - Glow Discharges Processes – Sputtering and Plasma Etching. John Wiley & Sons, New York, 1980

Y.P.Raizer - Gas Discharge Physics, Springer-Verlag, Berlin, 1991

R.Dendy (editor) Plasma Physics: an Introductory Course,Cambridge University Press, 1999

R. Huddlestone, S. L. Leonard (editors) - Plasma Diagnostic . Techniques, Academic Press, New York, 1965

Lochte Holtgreven (editor) - Plasma Diagnostics, Amsterdam, North-Holland,1968

Charles K. Birdsall, A. Bruce Langdon, Plasma Physics via Computer Simulation, McGraw-Hill, 1985

Andrea Macchi, A Superintense Laser–Plasma Interaction Theory Primer, Springer, 2012

Paul M. Bellan, Fundamentals of Plasma Physics, Cambridge University Press, 2008

8.2. Tutorials [main themes]	Teaching and learning techniques	Observations

8.3. Practicals [practical activities, projects, etc.]	Teaching and learning techniques	Observations
Vacuum Technology	Guided practical activity	2 hours
Electrical Breakdown. Paschen’s Law;	Guided practical activity	4 hours
Glow Discharge Plasma;	Guided practical activity	4 hours
Arc Plasmas	Guided practical activity	2 hours
Plasma Diagnostics	Guided practical activity	4 hours

Reflex plasma reactor	Guided practical activity	4 hours
Bibliography: V. Covlea, H. Andrei - Diagnosticarea plasmei - Lucrări de laborator, Editura Universităţii din Bucureşti, 2001 D. Ciobotaru, V. Covlea, C. Biloiu - Gaze ionizate - lucrări de laborator, Editura Universităţii din Bucureşti, Bucureşti, 1992 (in romanian) C. Negrea,V. Manea,C. Vancea, A. Tudorica and V. Covlea – Ingineria plasmei, Editura Universitatii din Bucuresti, Bucuresti, 2011 Charles K. Birdsall, A. Bruce Langdon, Plasma Physics via Computer Simulation, McGraw-Hill, 1985 Andrea Macchi, A Superintense Laser–Plasma Interaction Theory Primer, Springer, 2012 Paul M. Bellan, Fundamentals of Plasma Physics, Cambridge University Press, 2008		
8.4. Project [only if included in syllabus]	Teaching and learning techniques	Observations

9. Compatibility of the course unit contents with the expectations of the representatives of epistemic communities, professional associations and employers (in the field of the study program)

This course unit develops some theoretical and practical competences and abilities which are important for an undergraduate student in the field of modern Physics, corresponding to national and european/international standards. The contents and teaching methods were selected after a thorough analysis of the contents of similar course units in the syllabus of other universities from Romania or the European Union (Cambridge University). The contents are in line with the requirements/expectations of the main employers of the graduates (industry, research, secondary school teaching - National Institute for Laser, Plasma and Radiation Physics, National Institute of Materials Physics, National Institute for Nuclear Physics, National Institute for Opto-Electronics).

10. Assessment

Activity type	10.1. Assessment criteria	10.2. Assessment methods	10.3. Weight in final mark
10.4. Lecture	- coherence and clarity of exposition - correct use of equations/mathematical methods/physical models and theories - ability to indicate/analyse specific examples	Final written evaluation: Test of theoretical knowledges and applied problems.	50%
		Continue evaluation	20%
		Attendance	10%
10.5.1. Tutorials			
10.5.2. Practicals	- ability to use specific experimental methods/apparatus - ability to perform/design specific experiments - ability to present and discuss the results	Evaluation by practical test	20%
10.5.3. Project [only if			

included in syllabus]			
10.6. Minimal requirements for passing the exam.			
Requirements for mark 5 (10 points scale) - Mandatory attendance: 50% from lectures and all practicals completed. - At least mark 5 at the end of evaluation.			

	Teacher's name and signature	Practicals instructor name and signature
Date April 18th, 2016	Lecturer Iulian Ionita Lecturer Madalina Boca	Lecturer Marian Bazavan Lecturer Madalina Boca

Date of approval

Head of Department

Prof. Dr. Virgil Baran

DO 308 F.1.EN Numerical Methods in Quantum Mechanics

1. Study program

1.1. University	University of Bucharest
1.2. Faculty	Faculty of Physics
1.3. Department	Department of Theoretical Physics and Mathematics, Optics, Plasma and Lasers
1.4. Field of study	Physics
1.5. Course of study	Undergraduate/Bachelor of Science
1.6. Study program	Physics (in English)
1.7. Study mode	Full-time study

2. Course unit

2.1. Course unit title	**Numerical Methods in Quantum Mechanics**							
2.2. Teacher				**Lect.Dr. Roxana Zus**				
2.3. Tutorials/Practicals instructor(s)				**Asist.Dr.Victor Dinu**				
2.4. Year of study	3	2.5. Semester	VI	2.6. Type of evaluation	E	2.7. Type of course unit	Content[1)]	**DS**
							Type[2)]	**DO**

[1)] fundamental (DF), speciality (DS), complementary (DC); [2)] compulsory (DI), elective (DO), optional (DFac)

3. Total estimated time (hours/semester)

3.1. Hours per week in curriculum	**4**	distribution: Lecture	**2**	Practicals/Tutorials	**2**
3.2. Total hours per semester	**40**	Lecture	**20**	Practicals/Tutorials	**20**

Distribution of estimated time for study	**hours**
3.2.1. Learning by using one's own course notes, manuals, lecture notes, bibliography	**16**
3.2.2. Research in library, study of electronic resources, field research	**20**
3.2.3. Preparation for practicals/tutorials/projects/reports/homework	**20**
3.2.4. Preparation for exam	**4**
3.2.5. Other activities	**0**

3.3. Total hours of individual study	**56**
3.4. Total hours per semester	**100**
3.5. ECTS	**4**

4. Prerequisites (if necessary)

4.1. curriculum	Processing of Physical Data and Numerical Methods/ Simulation Methods in Physics, Quantum Mechanics, Programming Languages
4.2. competences	Solving/study of the properties of solutions of differential equations met in Quantum mechanics problems.

5. Conditions/Infrastructure (if necessary)

5.1. for lecture	Computer, Video projector Lecture notes Bibliography
5.2. for practicals/tutorials	Computer network

	Lecture notes Bibliography

6. Specific competences acquired

Professional competences	• C1 – Identifying and adequately using of physics laws and principles in a given context • C2 – Using of dedicated software for data analysis • C3 – Solving physics problems in given conditions, using numerical and statistical methods • C6 – Interdisciplinary approach of some physics problems
Transversal competences	• CT1 – Solving professional tasks in an efficient and responsible way, under qualified assistance, in compliance with ethics requirements • CT3 -Efficient use of information and communication resources available.

7. Course objectives

7.1. General objective	Numerical solving of problems of Quantum mechanics
7.2. Specific objectives	Numerical solving of some differential equations Calculation of observables from numerical values of the wave-function Methods of interpretation and graphical representation of numerical results

8. Contents

8.1. Lecture [chapters]	Teaching techniques	Observations
Numerical solution of the time independent Schrodinger equation (TISE) for 1D systems. Finding of bound, antibound and resonances states	Systematic exposition – lecture. Critical analysis. Examples	2 h
Numerical study of the time evolution of a wavepacket in 1D under the influence of a potential field; numerical calculation of the transmission and reflection coefficients	Systematic exposition – lecture. Critical analysis. Examples	2 h
The stationary and nonstationary states of the harmonic linear oscillator; coherent states	Systematic exposition – lecture. Critical analysis. Examples	2 h
The eigenvalue problem of the perturbed harmonic linear oscillator; numerical solution of the TISE vs. perturbation method.	Systematic exposition – lecture. Critical analysis. Examples	4 h
The stationary and nonstationary states of the hydrogen atom; graphical representation	Systematic exposition – lecture. Critical analysis. Examples	4 h
The stationary perturbation theory for the case of the Hydrogen atom in an external field; the Dalgarno-Lewis method	Systematic exposition – lecture. Critical analysis. Examples	4 h
Generation of aleatory numbers according to a given statistical law.	Systematic exposition – lecture. Critical analysis. Examples	2 h
Bibliography: 1. D. H. McIntyre, *Quantum mechanics. A paradigms approach*, Pearson Education Ltd, 2014		

<table>
<tr><td colspan="3">2. N. Zettili, Quantum Mechanics Concepts and Applications, second edition, John Wiley & Sons, 2009
3. Bernd Thaller, “Advanced Visual Quantum Mechanics”, Springer 2005
4. William H. Press, Saul A. Teukolsky, William T. Vetterling, Brian P. Flannery, “Numerical Recipes: The Art of Scientific Computing”, 3rd ed.,Cambridge University Press, 2007
5. George W. Collins , “Fundamental Methods and Data Analysis”, 2003
6. Morten Hjorth-Jensen , “Computational Physics”, University of Oslo, 2006</td></tr>
<tr><td>8.2. Tutorials [main themes]</td><td>Teaching and learning techniques</td><td>Observations</td></tr>
<tr><td colspan="3"></td></tr>
<tr><td>8.3. Practicals [practical activities, projects, etc.]</td><td>Teaching and learning techniques</td><td>Observations</td></tr>
<tr><td>Numerical codes in Mathematica for solving the time independent Schrodinger equation (TISE) for 1D systems.</td><td>Guided practical activity</td><td>2 h</td></tr>
<tr><td>Numerical codes in Mathematica for integration of the time dependent Schrodinger equation for a particle in 1D motion under the influence of a potential field; numerical calculation of the transmission and reflection coefficients</td><td>Guided practical activity</td><td>4 h</td></tr>
<tr><td>Graphical representation (animation/movies) of the stationary and nonstationary states of the harmonic linear oscillator</td><td>Guided practical activity</td><td>2 h</td></tr>
<tr><td>Numerical codes in Mathematica for solving the eigenvalue problem of the perturbed harmonic linear oscillator</td><td>Guided practical activity</td><td>2 h</td></tr>
<tr><td>Graphical representation (animation/movies) of the stationary and nonstationary states of the hydrogen atom</td><td>Guided practical activity</td><td>4 h</td></tr>
<tr><td>Numerical codes in Mathematica using the stationary perturbation theory for the case of the Hydrogen atom in an external field</td><td>Guided practical activity</td><td>4 h</td></tr>
<tr><td>Numerical codes in Mathematica for generation of aleatory numbers according to a given statistical law.</td><td>Guided practical activity</td><td>2 h</td></tr>
<tr><td colspan="3">Bibliography:
1. Bernd Thaller, “Advanced Visual Quantum Mechanics”, Springer 2005
2. William H. Press, Saul A. Teukolsky, William T. Vetterling, Brian P. Flannery, “Numerical Recipes: The Art of Scientific Computing”, 3rd ed.,Cambridge University Press, 2007
3. Robert L. Zimmerman, Fredrick I. Olness, “Mathematica For Physics: 2nd Edition”, Addison-Wesley Publishing Company, 2002</td></tr>
<tr><td>8.4. Project [only if included in syllabus]</td><td>Teaching and learning techniques</td><td>Observations</td></tr>
<tr><td colspan="3">Bibliography:</td></tr>
</table>

9. Compatibility of the course unit contents with the expectations of the representatives

of epistemic communities, professional associations and employers (in the field of the study program)

This course contents and teaching methods were selected in such that they are in agreement with the main problems studied in the quantum mechanics course. The contents are in line with the requirements/expectations of the main employers of the graduates (research institutes, secondary school teaching).

10. Assessment

Activity type	10.1. Assessment criteria	10.2. Assessment methods	10.3. Weight in final mark
10.4. Lecture	- coherence and clarity of exposition - correct use of methods - ability to indicate/analyse specific examples - ability to present and discuss the results	Written test/oral examination, including presentation of a numerical code	70%
10.5.1. Tutorials			
10.5.2. Practicals	- ability to use specific numerical solving methods - ability to analyze the results - coherence and clarity of exposition - ability to present and discuss the results	Lab reports	30%
10.5.3. Project [only if included in syllabus]			
10.6. Minimal requirements for passing the exam			
Requirements for mark 5 (10 points scale) Completed practical activities, presentation of the subjects required for the mark 5			

Date
25th of April 2016

Teacher's name and signature

Lect.Dr. Roxana Zus

Practicals/Tutorials instructor(s) name(s) and signature(s)

Asist.Dr.Victor DINU

Date of approval

Head of Department

Prof. univ. dr. Virgil Baran

DO 308 F.2.EN Elements of Quantum Optics

1. Study program

1.1. University	University of Bucharest
1.2. Faculty	Faculty of Physics
1.3. Department	Department of Theoretical Physics and Mathematics, Optics, Plasma and Lasers
1.4. Field of study	Physics
1.5. Course of study	Undergraduate/Bachelor of Science
1.6. Study program	Physics (in English)
1.7. Study mode	Full-time study

2. Course unit

2.1. Course unit title	**Elements of Quantum Optics**							
2.2. Teacher				Conf.dr. Iulia Ghiu, Lect.dr. Madalina Boca				
2.3. Tutorials/Practicals instructor(s)				Conf.dr. Iulia Ghiu, Lect.dr. Madalina Boca				
2.4. Year of study	3	2.5. Semester	VI	2.6. Type of evaluation	E	2.7. Type of course unit	Content[1)]	DS
							Type[2)]	**DO**

[1)] fundamental (DF), speciality (DS), complementary (DC); [2)] compulsory (DI), elective (DO), optional (DFac)

3. Total estimated time (hours/semester)

3.1. Hours per week in curriculum	**4**	distribution: Lecture	**2**	Practicals/Tutorials	**2**
3.2. Total hours per semester	**40**	Lecture	**20**	Practicals/Tutorials	**20**

Distribution of estimated time for study	**hours**
3.2.1. Learning by using one's own course notes, manuals, lecture notes, bibliography	**16**
3.2.2. Research in library, study of electronic resources, field research	**20**
3.2.3. Preparation for practicals/tutorials/projects/reports/homeworks	**20**
3.2.4. Examination	**4**
3.2.5. Other activities	**0**

3.3. Total hours of individual study	**56**
3.4. Total hours per semester	**100**
3.5. ECTS	**4**

4. Prerequisites (if necessary)

4.1. curriculum	Optics, Quantum Mechanics, Atomic Physics
4.2. competences	

5. Conditions/Infrastructure (if necessary)

5.1. for lecture	Computer, Video projector
5.2. for practicals/tutorials	Numerical Laboratory, computers with Mathematica and internet access

6. Specific competences acquired

Professional competences	• C1 – Identifying and adequately using of physics laws and principles in a given context • C6 – Interdisciplinary approach of some physics problems
Transversal competences	• CT1 – Solving professional tasks in an efficient and responsible way, under qualified assistance, in compliance with ethics requirements • CT3 -Efficient use of information and communication resources available.

7. Course objectives

7.1. General objective	The quantum description of the electromagnetic field and the study of the interaction of the electromagnetic field with matter
7.2. Specific objectives	Description of some optical phenomena that have no classical analogue. Modeling of atomic systems interactions with photons Using simple models for some applications in theoretical and experimental physics (laser cooling/trapping)

8. Contents

8.1. Lecture [chapters]	Teaching techniques	Observations
Quantisation of the electromagnetic field.	Systematic exposition - lecture. Heuristic conversation. Critical analysis. Examples	2 hours
First and higher order correlation functions. Photon bunching and antibunching	Systematic exposition - lecture. Heuristic conversation. Critical analysis. Examples	2 hours
Quasidistribution in phase-space: Glauber-Sudarshan representation, Husimi function and Wigner function	Systematic exposition - lecture. Heuristic conversation. Critical analysis. Examples	2 hours
Interference fenomena in one or two photodetectors. The Hong, Ou, Mandel experiment. Interferometry of coherent states.	Systematic exposition - lecture. Heuristic conversation. Critical analysis. Examples	2 hours
Bell inequalities in quantum optics and their experimental verification	Systematic exposition - lecture. Heuristic conversation. Critical analysis. Examples	2 hours
Introduction, two level systems, one photon transitions in two level systems	Systematic exposition - lecture. Heuristic conversation. Critical analysis. Examples	2 hours
Description in quantum mechanics formalism of open systems, density operator method, the master equation	Systematic exposition - lecture. Heuristic conversation. Critical analysis. Examples	3 hours
Laser cooling and laser trapping	Systematic exposition - lecture. Heuristic conversation. Critical analysis. Examples	2 hours
Elements of quantum control	Systematic exposition - lecture. Heuristic conversation. Critical analysis. Examples	3 hours
Bibliography: 1. C. Gerry, P. Knight, *Introductory Quantum Optics*, Cambridge University Press, 2005.		

2. M. Fox, *Quantum Optics: an introduction*, Oxford University Press, 2006 (Oxford master series in physics).
3. M. O. Scully, M. S. Zubairy, *Quantum Optics*, Cambridge University Press, 2002.
4. Cohen-Tannoudji, Dupont-Roc, and Grynberg, *Atom-Photon Interactions*, Wiley, 1998.
5. G. Grynberg, A. Aspect, C. Fabre , *Introduction to Quantum Optics*, Cambridge University Press, 2010.
6. Harold J. Metcalf Peter van der Straten, *Laser Cooling and Trapping*, Springer, 1999.

8.2. Tutorials [main themes]	Teaching and learning techniques	Observations

8.3. Practicals [practical activities, projects, etc.]	Teaching and learning techniques	Observations
Study using numerical simulations in Mathematica of:		
Coherent states: definitions, properties, phase-space representation	Guided practical activity	2 hours
Mono-mode squeezed states: definitions, properties, phase-space representation. Two-mode squeezed states.	Guided practical activity	1 hour
Mono-mode thermal state: the quasidistribution functions	Guided practical activity	2 hours
The quantum description of the beam splitter. The Grangier's experiment	Guided practical activity	2 hours
Optical implementations of quantum gates	Guided practical activity	1 hours
The quantum eraser. Franson's experiment	Guided practical activity	2 hours
Two and three level systems in quantum mechanics	Guided practical activity	2 hours
Atom-photon interaction/Jaynes-Cummings model	Guided practical activity	2 hours
Light propagation in a resonant medium	Guided practical activity	3 hours
Coherent phenomena in multilevel systems; dressed states, electromagnetically induced transparency	Guided practical activity	3 hours

Bibliography:
1. C. Gerry, P. Knight, *Introductory Quantum Optics*, Cambridge University Press, 2005.
2. M. Fox, *Quantum Optics: an introduction*, Oxford University Press, 2006 (Oxford master series in physics).
3. *Modern Atomic and Optical Physics* course by Mikhail Lukin, Harvard University (available at http://lukin.physics.harvard.edu/teaching/)

8.4. Project [only if included in syllabus]	Teaching and learning techniques	Observations
Bibliography:		

9. Compatibility of the course unit contents with the expectations of the representatives of epistemic communities, professional associations and employers (in the field of the study program)

The content of the course was chosen after consulting the contents of similar courses at other universities (LMU, KTH). The contents are in line with the requirements/expectations of the main employers of the graduates (research institutes, secondary school teaching).

10. Assessment

Activity type	10.1. Assessment criteria	10.2. Assessment methods	10.3. Weight in final mark
10.4. Lecture	- coherence and clarity of exposition - correct use of equations/mathematical methods/physical models and theories - ability to indicate/analyse specific examples	Written test/oral examination	70%
10.5.1. Tutorials			
10.5.2. Practicals	- ability to use specific experimental methods/apparatus - ability to perform/design specific experiments - ability to present and discuss the results	Lab reports	30%
10.5.3. Project [only if included in syllabus]			
10.6. Minimal requirements for passing the exam			
Requirements for mark 5 (10 points scale) Completed practical activities, presentation of the subjects required for the mark 5			

	Teacher's name and signature	Practicals/Tutorials instructor(s) name
Date 23.03.2016	Assoc. prof. Dr. Iulia Ghiu Lect. Dr. Madalina Boca	Assoc. prof. Dr. Iulia Ghiu Lect. Dr. Madalina Boca

Date of approval

Head of Department
Prof. dr. Virgil Baran

DO 309 F.1.EN Detectors, dosimetry and radioprotection

1. Study program

1.1. University	University of Bucharest
1.2. Faculty	Faculty of Physics
1.3. Department	Department of MatterStructure, Atmospheric and Earth Physics, Astrophysics
1.4. Field of study	Physics
1.5. Course of study	Undergraduate/Bachelor of Science
1.6. Study program	Physics (in English)
1.7. Study mode	Full-time study

2. Course unit

2.1. Course unit title	***Detectors, dosimety and radioprotection***							
2.2. Teacher				Teacher's name: **Prof. Dr. Ionel Lazanu, Prof. Dr. Alexandru Jipa**				
2.3. Tutorials/Practicals instructor(s)				Instructor name(s): **Lecturer dr. Oana Ristea** **Lecturer dr. Marius Călin**				
2.4. Year of study	3	2.5. Semester	2	2.6. Type of evaluation	E	2.7. Type of course unit	Content[1)]	**DS**
							Type[2)]	**DO**

[1)] fundamental (DF), speciality (DS), complementary (DC); [2)] compulsory (DI), elective (DO), optional (DFac)

3. Total estimated time (hours/semester)

3.1. Hours per week in curriculum	**4**	Distribution: Lecture	**2**	Practicals/Tutorials	**2**
3.2. Total hours per semester	**40**	distribution: 1-st semester	**20**	2-nd semester	**20**

Distribution of estimated time for study	**hours**
3.2.1. Learning by using one's own course notes, manuals, lecture notes, bibliography	35
3.2.2. Research in library, study of electronic resources, field research	20
3.2.3. Preparation for practicals/tutorials/projects/reports/homeworks	26
3.2.4. Exam	4
3.2.5. Other activities	

3.3. Total hours of individual study	**81**
3.4. Total hours per semester	**125**
3.5. ECTS	**5**

4. Prerequisites (if necessary)

4.1. curriculum	Pre-requirements: The equations of mathematical physics, Physics of the atom and molecule, Nuclear and particle physics, Electronics
4.2. competences	Knowledge of Mathematics, Atomic and Nuclear Physics, Quantum mechanics, Programming languages and numerical methods etc.

5. Conditions/Infrastructure (if necessary)

5.1. for lecture	Amphytheatre equipped with multimedia devices (video)

5.2. for practicals/tutorials	Radioactive isotopic sources, experimental set up for nuclear spectroscopy, radiation detectors (gas scintillators, semiconductors), multichannel analyzers (emulation software), radiation monitors

6. Specific competences acquired

Professional competences	C1: The identification and appropriate use of main physical laws and principles in a given context. C1.1: The deduction of working formulae for calculations of physical quantities using appropriate principles and laws of physics. C1.2: The description of physical systems, using theories and specific tools (theoretical and experimental models, algorithms, schemes, etc.) C1.3: Applying the principles and laws of physics in solving theoretical or practical problems with qualified assistance. C1.4: The correct application of methods of analysis and criteria for the selection of appropriate solutions to achieve specified performance. C3: Troubleshooting the physical conditions required using numerical and statistical methods C3.1: Using adequate data analysis and processing of numerical methods specific physics and mathematical statistics C3.3: Linking methods of statistical analysis problems to date (to obtain measurements / calculations, data processing, interpretation). C 3.4: Evaluating the reliability of results and comparing them to bibliographic data or theoretical calculated values using statistical methods for validation and / or numerical methods C4: Applying knowledge in physics both in concrete situations from related fields, and in some experiments using standard laboratory equipment. C6: Addressing interdisciplinary themes from physics C6.1: Making connections necessary to use physical phenomena using basic knowledge of related fields (chemistry, biology, etc.) C6.4: Making connections between knowledge of physics and other fields (Chemistry, Biology, Computer Science, etc.).
Transversal competences	CT2: Applying the techniques of effective multidisciplinary team working on various hierarchical levels. CT3: Effective use of information sources and communication resources and training assistance, both in Romanian and in a foreign language.

7. Course objectives

7.1. General objective	Presentation of fundamental concepts related to radiation interactions with matter, including living matter, radiation sources, mechanisms of interaction for their detection, classes of detectors, properties, the principles of dosimetry, specific calculations
7.2. Specific objectives	Understanding of the specific aspects of subnuclear phenomena, at the subatomic level and for whole system; the ability to operate with these concepts and phenomena. Development of experimental skills specific to understanding the main classes of applications in everyday life.

8. Contents

8.1. Lecture [chapters]	Teaching techniques	Observations

1. Fundamental processes of the interaction of radiation with substance: (a) energy losses by ionization and excitation of the heavy charged particles, ions and electrons; (b) interactions of photons; (c) neutrons; (d) muons		5 hours
2. Radiation Sources: Isotopic sources, particle accelerators, nuclear reactors, cosmic rays	Systematic exposition - lecture. Examples	2 hours
3. General properties of detectors. The main physical phenomena used to detect particles. Classes constructive detectors. Operating Principles	Systematic exposition - lecture. Examples	4 hours
4. Dosimetry. Basic quantities and units. Dosimetric calculation depending on the type of radiation (external / internal) and the spatial dimensions of the source.	Systematic exposition - lecture. Examples	3 hours
5. Dosimetric measurement. Dosimetry methods. Radioprotection. Dosimetry and radiation protection standards.	Systematic exposition - lecture. Examples	3 hours
6. Elements of medical dosimetry. Dosimetry at particle accelerators and high power lasers		3 hours

Bibliography:
1. F. Attix, Introduction to radiological physics and radiation dosimetry, John Whiley &Sons, 1986
2. Brian R Martin, Nuclear and Particle Physics – An Introduction, 2nd_Edition, 2009
3. WR Leo, Techniques for nuclear and particle physics experiments, 2nd Edition Springer-Verlag , 1994
4. Manuale scrise de membrii Catedrei de Fizica atomica si nucleara, autori diferiti, diferite editii
5. Fizica nucleara – Culegere de probleme (Catedra de fizica atomica si nucleara), Editura All, 1994
6. G.F. Knoll, Radiation Detection and Measurement, Wiley, 2000
7. C. Grupen, B. A. Swartz, Particle Detectors, Cambridge University Press 2008

8.2. Tutorials [main themes]	Teaching and learning techniques	Observations
Numerical applications in dosimetry and radioprotection	Guided work	2 hours
Bibliography: ...whatever you decide to indicate...		
8.3. Practicals [practical activities, projects, etc.]	Teaching and learning techniques	Observations
1. Calibration in the energy and efficiency of the detection systems. Spectra processing and extracting the relevant physics information 2. Study interactions with matter photon energy gamma and X	Guided practical activities	

3. Neutron interactions with matter (Nuclear reactions induced by slow and fast neutrons) 4. Study of the energy losses of ions in matter. Application for alpha and beta particles 5. Backscattering of the beta particles 6. Gamma and beta radiation attenuation in matter 7. MC simulation (TRIM, GEANT4) of heavy ions in matter interactions and biological tissues 8. Calibration of dosimetry systems Examination		8 x 2 hours 2 hours
Bibliography: ...whatever you decide to indicate...		
8.4. Project [only if included in syllabus]	Teaching and learning techniques	Observations
Bibliography: ...whatever you decide to indicate...		

9. Compatibility of the course unit contents with the expectations of the representatives of epistemic communities, professional associations and employers (in the field of the study program)

This course unit forms/develops some theoretical and/or practical competences and abilities which are important/fundamental/something else for an undergraduate student in the field of modern Physics, corresponding to national and european/international standards. The contents and teaching methods were selected after a thorough analysis of the contents of similar course units in the syllabus of other universities from Romania or the EU (University of Oxford https://www.ox.ac.uk/admissions/undergraduate/courses-listing?wssl=1, Universityof Parma http://www.difest.unipr.it/it/didattica/laurea-triennale-fisica/calendario-didattico, Universitatea Padova, http://en.didattica.unipd.it/didattica/2015/SC1158/2014). The contents are in line with the requirements/expectations of the main employers of the graduates (industry, research, secondary school teaching).

10. Assessment

Activity type	10.1. Assessment criteria	10.2. Assessment methods	10.3. Weight in final mark
10.4. Lecture	- coherence and clarity of exposition - correct use of equations/mathematical	Oral examination	60%

	methods/physical models and theories - ability to indicate/analyse specific examples		
10.5.1. Tutorials	- ability to use specific problem solving methods - ability to analyse the results	Homeworks/written tests	10%
10.5.2. Practicals	- ability to use specific experimental methods/apparatus - ability to perform/design specific experiments - ability to present and discuss the results	Lab reports	30%
10.5.3. Project [only if included in syllabus]	- coherence and clarity of exposition - correct use of mathematical and physical methods/models - ability to use specific experimental methods/apparatus - ability to present and discuss the results	Report	
10.6. Minimal requirements for passing the exam Correct understanding of the concepts and phenomena, the ability to work with them and obtain accurate numerical results on topics imposed.			
Requirements for mark 5 (10 points scale) All laboratories finished and 5 score at the examination of the laboratory The correct exposure of the subjects indicated to derive the score 5 final exam.			

	Teacher's name and signature	Practicals/Tutorials instructor(s) name(s) and signature(s)
Date	Prof. Dr. Ionel Lazanu	Lecturer dr. Oana Ristea
	Prof. Dr. Alexandru Jipa	Lecturer dr. Marius Călin

Date of approval

Head of Department

Prof. Dr. Alexandru Jipa

DO 309 F.2.EN Radiation sources, natural and artificial radioactivity

1. Study program

1.1. University	University of Bucharest
1.2. Faculty	Faculty of Physics
1.3. Department	Department of MatterStructure, Atmospheric and Earth Physics, Astrophysics
1.4. Field of study	Physics
1.5. Course of study	Undergraduate/Bachelor of Science
1.6. Study program	Physics (in English)
1.7. Study mode	Full-time study

2. Course unit

2.1. Course unit title	***Radiation sources, natural and artificial radioactivity***							
2.2. Teacher				Teacher's name: **Prof. Dr. Ionel Lazanu, Prof. Dr. Alexandru Jipa**				
2.3. Tutorials/Practicals instructor(s)				Instructor name(s): **Lecturer dr. Oana Ristea** **Lecturer dr. Marius Călin**				
2.4. Year of study	3	2.5. Semester	2	2.6. Type of evaluation	E	2.7. Type of course unit	Content[1)]	**DS**
							Type[2)]	**DO**

[1)] fundamental (DF), speciality (DS), complementary (DC); [2)] compulsory (DI), elective (DO), optional (DFac)

3. Total estimated time (hours/semester)

3.1. Hours per week in curriculum	**4**	Distribution: Lecture	**2**	Practicals/Tutorials	**2**
3.2. Total hours per semester	**40**	distribution: 1-st semester	**20**	2-nd semester	**20**

Distribution of estimated time for study	**hours**
3.2.1. Learning by using one's own course notes, manuals, lecture notes, bibliography	35
3.2.2. Research in library, study of electronic resources, field research	20
3.2.3. Preparation for practicals/tutorials/projects/reports/homeworks	26
3.2.4. Exam	4
3.2.5. Other activities	

3.3. Total hours of individual study	**81**
3.4. Total hours per semester	**125**
3.5. ECTS	**5**

4. Prerequisites (if necessary)

4.1. curriculum	Pre-requirements: The equations of mathematical physics, Physics of the atom and molecule, Nuclear and particle physics, Electronics
4.2. competences	Knowledge of Mathematics, Atomic and Nuclear Physics, Quantum mechanics, Programming languages and numerical methods etc.

5. Conditions/Infrastructure (if necessary)

5.1. for lecture	Amphytheatre equipped with multimedia devices (video)

5.2. for practicals/tutorials	Radioactive isotopic sources, experimental set up for nuclear spectroscopy, radiation detectors (gas scintillators, semiconductors), multichannel analyzers (emulation software), radiation monitors

6. Specific competences acquired

Professional competences	C1: The identification and appropriate use of main physical laws and principles in a given context. C1.1: The deduction of working formulae for calculations of physical quantities using appropriate principles and laws of physics. C1.2: The description of physical systems, using theories and specific tools (theoretical and experimental models, algorithms, schemes, etc.) C1.3: Applying the principles and laws of physics in solving theoretical or practical problems with qualified assistance. C1.4: The correct application of methods of analysis and criteria for the selection of appropriate solutions to achieve specified performance. C3: Troubleshooting the physical conditions required using numerical and statistical methods C3.1: Using adequate data analysis and processing of numerical methods specific physics and mathematical statistics C3.3: Linking methods of statistical analysis problems to date (to obtain measurements / calculations, data processing, interpretation). C 3.4: Evaluating the reliability of results and comparing them to bibliographic data or theoretical calculated values using statistical methods for validation and / or numerical methods C4: Applying knowledge in physics both in concrete situations from related fields, and in some experiments using standard laboratory equipment. C6: Addressing interdisciplinary themes from physics C6.1: Making connections necessary to use physical phenomena using basic knowledge of related fields (chemistry, biology, etc.) C6.4: Making connections between knowledge of physics and other fields (Chemistry, Biology, Computer Science, etc.).
Transversal competences	CT2: Applying the techniques of effective multidisciplinary team working on various hierarchical levels. CT3: Effective use of information sources and communication resources and training assistance, both in Romanian and in a foreign language.

7. Course objectives

7.1. General objective	Presentation of fundamental concepts related to radiation interactions with matter, including living matter, radiation sources, mechanisms of interaction for their detection, classes of detectors, properties, the principles of dosimetry, specific calculations
7.2. Specific objectives	Understanding of the specific aspects of subnuclear phenomena, at the subatomic level and for whole system; the ability to operate with these concepts and phenomena. Development of experimental skills specific to understanding the main classes of applications in everyday life.

8. Contents

8.1. Lecture [chapters]	Teaching techniques	Observations

1. Fundamental processes of interaction of the radiation with matter. Effects of radiation on the population and environment.	Systematic exposition - lecture. Examples	5 hours
2. Radiation sources. Cosmic radiation. Primary and secondary sources. Cosmogenic radionuclides. Radioactive series. Their distributions in nature. Analysis of the Ra-226 and K-40 . Air radioactivity (Rn-222, R-220 and their descendants). Distribution of radon in the atmosphere and housing.	Systematic exposition - lecture. Examples	5 hours
3. Artificial radioactivity. Particle accelerators, nuclear reactors, neutron sources (Spallation), medical and industrial sources, high power lasers, nuclear weapons.	Systematic exposition - lecture. Examples	4 hours
4. The nuclear reactor as a source of radioactivity.	Systematic exposition - lecture. Examples	2 hours
5. Elements of the dosimetry. Basic quantities and units. Dosimetric measurement. Dosimetry methods. The principles of radiation protection. Dosimetry and radiation and the protection standards.	Systematic exposition - lecture. Examples	4 hours
Bibliography: 1. F. Attix, Introduction to radiological physics and radiation dosimetry, John Whiley &Sons, 1986 2. Brian R Martin, Nuclear and Particle Physics – An Introduction, 2nd_Edition, 2009 3. WR Leo, Techniques for nuclear and particle physics experiments, 2nd Edition Springer-Verlag , 1994 4. M. L. Anunziata, Handbook of radioactivity analysis, Academic Press 2012 5. O. Sima, Note de curs Radioactivitatea mediului 6. G.F. Knoll, Radiation Detection and Measurement, Wiley, 2000		
8.2. Tutorials [main themes]	Teaching and learning techniques	Observations
Numerical applications in dosimetry and radioprotection	Guided work	4 hours
Bibliography: ...whatever you decide to indicate...		
8.3. Practicals [practical activities, projects, etc.]	Teaching and learning techniques	Observations
1. Gamma spectrometry using scintillation and semiconductor detectors	Guided practical activities	2hours
2. Calibration of germanium spectrometer for environmental samples measurements (matrix effects and coincidence effects are considered)		2 hours
3. Alpha and beta spectrometry on thick		2 hours

samples 4. Radon flux measurements of ambient concentration and dose calculations (4 hours) 5. Thermoluminescence dosimetry 6.Calibration of a dosimetry system Examination		4 hours 2 hours 2 hours 2 hours
Bibliography: ...whatever you decide to indicate...		
8.4. Project [only if included in syllabus]	Teaching and learning techniques	Observations
Bibliography: ...whatever you decide to indicate...		

9. Compatibility of the course unit contents with the expectations of the representatives of epistemic communities, professional associations and employers (in the field of the study program)

This course unit forms/develops some theoretical and/or practical competences and abilities which are important/fundamental/something else for an undergraduate student in the field of modern Physics, corresponding to national and european/international standards. The contents and teaching methods were selected after a thorough analysis of the contents of similar course units in the syllabus of other universities from Romania or the EU (University of Oxford https://www.ox.ac.uk/admissions/undergraduate/courses-listing?wssl=1, Universityof Parma http://www.difest.unipr.it/it/didattica/laurea-triennale-fisica/calendario-didattico, Universitatea Padova, http://en.didattica.unipd.it/didattica/2015/SC1158/2014). The contents are in line with the requirements/expectations of the main employers of the graduates (industry, research, secondary school teaching).

10. Assessment

Activity type	10.1. Assessment criteria	10.2. Assessment methods	10.3. Weight in final mark
10.4. Lecture	- coherence and clarity of exposition - correct use of equations/mathematical methods/physical models and theories - ability to indicate/analyse specific examples	Oral examination	60%
10.5.1. Tutorials	- ability to use specific problem solving methods - ability to analyse the results	Homeworks/written tests	10%
10.5.2. Practicals	- ability to use specific experimental	Lab reports	30%

	methods/apparatus - ability to perform/design specific experiments - ability to present and discuss the results		
10.5.3. Project [only if included in syllabus]	- coherence and clarity of exposition - correct use of mathematical and physical methods/models - ability to use specific experimental methods/apparatus - ability to present and discuss the results	Report	
10.6. Minimal requirements for passing the exam Correct understanding of the concepts and phenomena, the ability to work with them and obtain accurate numerical results on topics imposed.			
Requirements for mark 5 (10 points scale) All laboratories finished and 5 score at the examination of the laboratory The correct exposure of the subjects indicated to derive the score 5 final exam.			

Date	Teacher's name and signature Prof. Dr. Ionel Lazanu Prof. Dr. Alexandru Jipa	Practicals/Tutorials instructor(s) name(s) and signature(s) Lecturer dr. Oana Ristea Lecturer dr. Marius Călin

Date of approval

Head of Department
Prof. Dr. Alexandru Jipa

DO 310 F.1.EN INTRODUCTION IN POLYMER PHYSICS

1. Study program

1.1. University	University of Bucharest
1.2. Faculty	Faculty of Physics
1.3. Department	Department of Structure of the Matter, Earth and Atmospheric Physics, Astrophysics
1.4. Field of study	Physics
1.5. Course of study	Undergraduate/Bachelor of Science
1.6. Study program	Physics (in English)
1.7. Study mode	Full-time study

2. Course unit

2.1. Course unit title	**INTRODUCTION IN POLYMER PHYSICS**							
2.2. Teacher				**Lect. Dr. Cristina Miron, Lector Dr. Catalin Berlic**				
2.3. Tutorials/Practicals instructor(s)				**Lect. Dr. Cristina Miron, Lector Dr. Catalin Berlic**				
2.4. Year of study	3	2.5. Semester	6	2.6. Type of evaluation	E	2.7. Type of course unit	Content[1)]	**DS**
							Type[2)]	**DO**

[1)] fundamental (DF), speciality (DS), complementary (DC); [2)] compulsory (DI), elective (DO), optional (DFac)

3. Total estimated time (hours/semester)

3.1. Hours per week in curriculum	**4**	distribution: Lecture	**2**	Practical/Tutorials	**0/20**
3.2. Total hours per semester	**40**	distribution: 1-st semester	**40**	2-nd semester	**0**

Distribution of estimated time for study	**hours**
3.2.1. Learning by using one's own course notes, manuals, lecture notes, bibliography	**20**
3.2.2. Research in library, study of electronic resources, field research	**20**
3.2.3. Preparation for practical/tutorials/projects/reports/homework	**16**
3.2.4. Examination	**4**
3.2.5. Other activities	**0**

3.3. Total hours of individual study	**56**
3.4. Total hours per semester	**100**
3.5. ECTS	**4**

4. Prerequisites (if necessary)

4.1. curriculum	Mechanics, Algebra, geometry and differential equations, Real and complex analysis, Thermodynamics and statistical physics, Physical chemistry
4.2. competences	Good level of understanding of mechanics, thermodynamics and statistical physics. Understanding and using of algebraic calculation, of analytical geometry and mathematical analysis. Learning to properly use laboratory equipment.

5. Conditions/Infrastructure (if necessary)

5.1. for lecture	Multimedia room equipped with computer and video-projector. Lecture Notes. Recommended reading.
5.2. for practicals/tutorials	Laboratory facilities necessary for carrying out practical works. Computer, video-projector, software packages for data analysis and processing.

	Internet connection. Seminar room.

6. Specific competences acquired

Professional competences	C1 - Identification and proper use of the key laws and principles of physics in a given context. - 2 credits C2 – Solving imposed condition physics problems - 2 credits C4 - Apply knowledge of physics in experiments using standard laboratory equipment - 1 credit C5 – Communication and analysis of didactic, scientific and dissemination of information - 1 credit
Transversal competences	CT1- Achievement of the professional duties in an efficient and responsible way with compliance with deontological legislation specific to the domain under qualified assistance. - 1 credit CT3 - Effective use of information, communication and training assistance, both in Romanian and in a foreign language. - 1 credit

7. Course objectives

7.1. General objective	Assimilation of the concepts in the domains, develop the ability to perform and interpret experimental works and solving specific problems in classical mechanics.
7.2. Specific objectives	- Understanding the fundamental concepts of polymer physics. - Correct characterization of theoretical and practical aspects of a macromolecular system. - Acquiring the ability to solve problems in the field and to formulate theoretical conclusions rigorous and substantiated; - Developing the capacity to perform and/or design experiments in the physics of polymers; - Develop the ability to carry out a project presentation to a specific theme. - Acquisition of a correct understanding of the theoretical and practical topics studied.

8. Contents

8.1. Lecture [chapters]	Teaching techniques	Observations
1. Introduction. Definition of polymers. Macromolecular systems. Physicochemical and structural particularities of polymers.	Systematic exposition - lecture. Heuristic conversation. Critical analysis. Examples	2 hours
2. Classification of macromolecular compounds. Organic carbochain polymers. Saturated hydrocarbons and their derivatives: polyols, polyacids, polyether, polyester. Unsaturated hydrocarbons and their derivatives. Organic hetero-polymers with oxygen, nitrogen, sulphur in the chain.	Systematic exposition - lecture. Heuristic conversation. Critical analysis. Examples	2 hours
3. Average molecular weights of polymers. Macromolecular size and polydispersity. Average molecular weight. The molecular weight distribution. Functions of molecular weight distribution.	Systematic exposition - lecture. Heuristic conversation. Critical analysis. Examples	2 hours
4. Synthesis of macromolecules. Theoretical principles of polymer production processes. Polymerization. Fundamental features of radical polymerization chains. Reaction Mechanism. Reaction kinetics.	Systematic exposition - lecture. Heuristic conversation. Critical analysis. Examples	2 hours
5. Configurational structure of polymers. Regularity of the structure of macromolecular	Systematic exposition - lecture. Heuristic	2 hours

chains. Geometric stereoisomery. Optic stereoisomery. Methods for studying stereoregularity of polymers. Determination of the polymeric structure. Spectroscopic methods.	conversation. Critical analysis. Examples	
6. Theory of polymer solutions. The Flory and Huggins method. Theta temperature. The solubility of the polymers. Phase transitions	Systematic exposition - lecture. Heuristic conversation. Critical analysis. Examples	2 hours
7. The rheology of the polymers. Phenomenological theory of the mechanical behavior of polymers. Specific mechanical properties of polymers. High elasticity. Origin of the high elasticity. The ideal rubber. Thermodynamic analysis of the elasticity of the rubber.	Systematic exposition - lecture. Heuristic conversation. Critical analysis. Examples	2 hours
8. **Viscometry of the diluted macromolecular solutions.** Polymers in solution. Viscosity techniques and methods. Physico-structural features revealed in viscosimetry of the dilute polymer solutions.	Systematic exposition - lecture. Heuristic conversation. Critical analysis. Examples	2 hours
9. Simulation and computer model of polymeric systems. Monte Carlo and Molecular dynamics in polymer physics. Metropolis algorithm. Reptation method. The pearl necklace model. Verdier-Stockmayer generalized algorithm.	Systematic exposition - lecture. Heuristic conversation. Critical analysis. Examples	2 hours
10. Methods for determining the average molecular weight and molecular weight distribution of polymers. Osmometry. Elastic scattering of light on dilute solutions of the polymers. Determination of the average molecular weight. Gel permeation chromatography (size exclusion chromatography).	Systematic exposition - lecture. Heuristic conversation. Critical analysis. Examples	2 hours
Total		**20 hours**
Bibliography: 1. L.M.Constantinescu, C.Berlic, V.Barna, "Fizico-chimia polimerilor. Aplicaţii", Ed. Univ. din Bucureşti, 2006. 2. L. Georgescu, L.M. Constantinescu, E. Barna, C. Miron, C. Berlic, "Introducere in fizica polimerilor.", Ed. Credis, Bucureşti, 2004; 3. L.M. Constantinescu, C. Berlic, "Structura polimerilor. Metode de studiu", Ed. Univ. din Bucureşti, 2003; 4. G. Champetier, L. Monnerie, "Introduction à la chimie macromoléculaire", Masson&Cie., Paris (1969). 5. L.M.Constantinescu, "Structura polimerilor", Ed. Univ. din Bucureşti, 1989. 6. Lecture notes in electronic format that will be available on the faculty web-site		
8.2. Tutorials [main themes]	Teaching and learning techniques	Observations
Some specific theme	Guided work	2-4-6 hours
Bibliography: ...whatever you decide to indicate...		
8.3. Practicals [practical activities, projects, etc.]	Teaching and learning techniques	Observations
Identification of the polymer structure: FT-IT and Raman spectroscopy	Guided practical activity	4 hours
Phase transition. Thermo-differential analysis, DSC, TG	Guided practical activity	4 hours

Thermo-mechanical analysis	Guided practical activity	4 hours
Viscosity of the polymeric solutions.	Guided practical activity	2 hours
Characterization of the composite materials with polymeric matrix.	Guided practical activity	2 hours
Rheology of polymers.	Guided practical activity	2 hours
Molecular weights of the polymers, DLS	Guided practical activity	2 hours
Total		**20 hours**
Bibliography: 1. L.M.Constantinescu, C.Berlic, "Metode experimentale în fizica polimerilor. Aplicaţii", Editura Universităţii din Bucureşti (1999). 2. L.M. Constantinescu, C. Berlic, "Structura polimerilor. Metode de studiu", Ed. Univ. din Bucureşti, 2003; 3. User manual of the laboratory equipment.		
8.4. Project [only if included in syllabus]	Teaching and learning techniques	Observations
Bibliography: ...whatever you decide to indicate...		

9. Compatibility of the course unit contents with the expectations of the representatives of epistemic communities, professional associations and employers (in the field of the study program)

This course unit forms/develops some theoretical and/or practical competences and abilities which are fundamental for an undergraduate student in the field of modern Physics, corresponding to national and european/international standards. The contents and teaching methods were selected after a thorough analysis of the contents of similar course units in the syllabus of other universities from Romania or the European Union. The contents are in line with the requirements/expectations of the main employers of the graduates (industry, research, secondary school teaching).

10. Assessment

Activity type	10.1. Assessment criteria	10.2. Assessment methods	10.3. Weight in final mark
10.4. Lecture	- coherence and clarity of exposition - correct use of equations/mathematical methods/physical models and theories - ability to indicate/analyse specific examples	1. Partial examination. Written test examination of theoretical competences. 2. Final examination. Written and oral test examinations of theoretical competences.	20% 50%
10.5.1. Tutorials	- ability to use specific problem solving methods - ability to analyse the results	Homeworks/written tests	
10.5.2. Practicals	- ability to use specific experimental methods/apparatus - ability to perform/design specific experiments - ability to present and discuss the results	1. Lab reports 2. Examination	20% 10%
10.5.3. Project [only if included in syllabus]	- coherence and clarity of exposition - correct use of mathematical and physical methods/models - ability to use specific experimental methods/apparatus	Report	

	- ability to present and discuss the results		
10.6. Minimal requirements for passing the exam ...for example: all practical activities must be finalized, etc.			
Requirements for mark 5 (10 points scale) ...whatever you decide....			

	Teacher's name and signature	Practicals/Tutorials instructor(s) name(s) and signature(s)
Date	Lect. Dr. Cristina MIRON	Lect. Dr. Cristina MIRON
	Lector Dr. Catalin BERLIC	Lector Dr. Catalin BERLIC

Date of approval

Head of Department
Prof. univ. dr. Alexandru JIPA

DO 310 F.2.EN Introduction to Environmental Physics

1. Study program

1.1. University	University of Bucharest
1.2. Faculty	Faculty of Physics
1.3. Department	Department of Matter Structure, Physics of Atmosphere and Earth, Astrophysics
1.4. Field of study	Physics
1.5. Course of study	Undergraduate/Bachelor of Science
1.6. Study program	Physics (in English)
1.7. Study mode	Full-time study

2. Course unit

2.1. Course unit title	**Introduction to Environmental Physics**							
2.2. Teacher				**Prof. Dr. Mihai Dima**				
2.3. Tutorials/Practicals instructor(s)				**Prof. Dr. Mihai Dima**				
2.4. Year of study	3	2.5. Semester	VI	2.6. Type of evaluation	E	2.7. Type of course unit	Content[1)]	**DS**
							Type[2)]	**DO**

[1)] fundamental (DF), speciality (DS), complementary (DC); [2)] compulsory (DI), elective (DO), optional (DFac)

3. Total estimated time (hours/semester)

3.1. Hours per week in curriculum	**4**	distribution: Lecture	**2**	Practicals/Tutorials	**2**
3.2. Total hours per semester	**40**	distribution: 1-st semester	**40**	2-nd semester	**0**

Distribution of estimated time for study	**hours**
3.2.1. Learning by using one's own course notes, manuals, lecture notes, bibliography	**20**
3.2.2. Research in library, study of electronic resources, field research	**16**
3.2.3. Preparation for practicals/tutorials/projects/reports/homeworks	**20**
3.2.4. Preparation for exam	**4**
3.2.5. Other activities	**0**

3.3. Total hours of individual study	**60**
3.4. Total hours per semester	**100**
3.5. ECTS	**4**

4. Prerequisites (if necessary)

4.1. curriculum	
4.2. competences	A good level of understanding for algebra, mathematical analysis and physics equations

5. Conditions/Infrastructure (if necessary)

5.1. for lecture	Lecture hall with multimedia devices (Computer, video-projector) Course notes Bibliography
5.2. for practicals/tutorials	Lab hall Computer, video-projector, software to analyse and visualize the data

6. Specific competences acquired

Professional competences	• C1 – Identification and correct use of physical laws and principles in given contexts • C3 – Solving of physics problems in imposed conditions • C4 – Performing of physics experiments by using standard laboratory equipments • C5 – Analysis and communication/presentation of scientific data
Transversal competences	• CT3 – Efficient use of the sources of scientific information and communication of scientific data in English

7. Course objectives

7.1. General objective	Asimilating the concepts, developing the capacity to analyze and interpret experimental data and to solve environmental physics problems.
7.2. Specific objectives	- Developing the capacity to model the environmental physical processes; - Learning from simple to complex, in complementarity with the simplification of complex problems, by dividing them in several relativ simpler problems; - Developing the capacity to solve environmental problems and to formulate theoretical conclusions based on arguments; - Developing the capacity to project and perform experiments in order to test physical laws; - Developing the abilities to create a project to present a specific topic; - Aquairing a deep theoretical understanding of environmental topics.

8. Contents

8.1. Lecture [chapters]	Teaching techniques	Observations
1. **Introduction**. The components of the environmental syste,. General characteristics. Approaching theenvironmental problems.	Systematic exposition - lecture. Heuristic conversation. Critical analysis. Examples	2 hours
2. Atmosphere: general characteristics, the structure of the static atmosphere. Composition of the atmosphere. Gazous compounds of the atmosphere. The CO_2 cycle.	Systematic exposition - lecture. Heuristic conversation. Critical analysis. Examples	2 hours
3. Solar, terrestrial and atmospheric: the sun and solar radiation. Radiation laws. Spectral composition of solar radiation.	Systematic exposition - lecture. Heuristic conversation. Critical analysis. Examples	2 hours
4. Atmospheric thermodynamics: measuring the air humidity. The potential temperature. The dry adiabatic gradient.	Systematic exposition - lecture. Heuristic conversation. Critical analysis. Examples	2 hours
5. Atmosphere dynamics: Forces acting on an air particle. The geostrophic approximation. The system of fundamental equations.	Systematic exposition - lecture. Heuristic conversation. Critical analysis. Examples	2 hours
6. General circulation of the atmosphere: Decomposing the circulation. The structure of the general circulation of the atmosphere. The Hadley, Ferrel, polar and Walker Cells.	Systematic exposition - lecture. Heuristic conversation. Critical analysis. Examples	2 hours
7. The angular momentum of the atmosphere: the cycle of angular momentum.	Systematic exposition - lecture. Heuristic conversation. Critical analysis. Examples	2 hours

8. The El Nino Southern Oscillation phenomenon (ENSO): manifestation and associated physical processes. Global teleconnections of ENSO	Systematic exposition - lecture. Heuristic conversation. Critical analysis. Examples	2 hours
9. The thermohaline circulation. Description, properties and associated physical processes.	Systematic exposition - lecture. Heuristic conversation. Critical analysis. Examples	2 hours
10. Methods of investigate the environment. Passive and active methods.	Systematic exposition - lecture. Heuristic conversation. Critical analysis. Examples	2 hours
Total		20 hours

Bibliografie:

1. Holton J., 1996: Introduction in atmospheric dynamics, Ed. Tehnica, Bucharest, 425pg.
2. Ştefan, S., 2004: Atmospheric physics, weather and climate. Ed. Bucharest University, Bucharest, 425 pg.
3. Dima, M., Stefan, S., 2008: Physics of climate changes, Ed Ars Docendi, Bucharest, 200pg.
4. Borsan, D., 1988: Atmospheric thermodynamics, ed. Bucharest University.

8.2. Seminar [only if included in syllabus]		
8.3. Lab [only if included in syllabus]	Teaching and learning techniques	Observations
1. Specific aspects related to air monitoring.	Exposition. Debate. Examples.	2 hours
2. Methods to measure temperature and pressure	Exposition. Debate. Examples.	2 hours
3. Methods to measure air humidity and velocity	Exposition. Debate. Examples.	2 hours
4. Solar radiation: albedometer, heliograph, devices to measure the direct, difuse and global solar radiation	Exposition. Debate. Examples.	2 hours
5. Automatic meteorological station	Exposition. Debate. Examples.	2 hours
6. Meteorological and climatic data types	Exposition. Debate. Examples.	2 hours
7. Applications used to visualize meteorological and climatical data	Exposition. Debate. Examples.	2 hours
8. Unidimensional and bidimensional meteorological and climatic data	Exposition. Debate. Examples.	2 hours
9. Metods used to analyse meteorological and climatic data	Exposition. Debate. Examples.	2 hours
10 Colocvium	Exposition. Debate. Examples.	2 hours
Total		

Bibliography:

1. Ştefan S., Rîmbu N., Atmospheric dynamics -problems, Ed. Univ. of Bucharest, Bucharest, 275 pg.
2. Ştefan Sabina, Physics of atmospheric aerosol, 1998, ed. ALL educational. 200pg.

8.3. Project [only if included in syllabus]

Bibliography:

9. Compatibility of the course unit contents with the expectations of the representatives of

epistemic communities, professional associations and employers (in the field of the study program)

This course unit forms/develops some theoretical and/or practical competences and abilities which are important/fundamental/something else for an undergraduate student in the field of modern Physics, corresponding to national and european/international standards. The contents and teaching methods were selected after a thorough analysis of the contents of similar course units in the syllabus of other universities from Romania or the European Union. The contents are in line with the requirements/expectations of the main employers of the graduates (industry, research, secondary school teaching).

10. Assessment

Activity type	10.1. Assessment criteria	10.2. Assessment methods	10.3. Weight in final mark
10.4. Lecture	- coherence and clarity of exposition - correct use of equations/mathematical methods/physical models and theories - ability to indicate/analyse specific examples	Written test/oral examination	50%
10.5.1. Tutorials	- ability to use specific problem solving methods - ability to analyse the results	Homeworks/written tests	20%
10.5.2. Practicals	- ability to use specific experimental methods/apparatus - ability to perform/design specific experiments - ability to present and discuss the results	Lab reports	30%
10.5.3. Project [only if included in syllabus]	- coherence and clarity of exposition - correct use of mathematical and physical methods/models - ability to use specific experimental methods/apparatus - ability to present and discuss the results	Report	
10.6. Minimal requirements for passing the exam ...for example: all practical activities must be finalized, etc.			
Obtaining the grade 5: **Correct exposure of a theoretical subject at the final exam.** **Correct approach of an environmental problem at the final exam.** **Performing all lab work.** **Presence at 50% of all courses.**			

Date	Teacher’s name and signature	Practicals/Tutorials instructor(s) name(s) and signature(s)
	Prof. Dr. Mihai DIMA	Prof. Dr. Mihai DIMA

Date of approval

Head of Department
Prof. dr. Alexandru JIPA

DO 311 F.1.EN Physics of semiconductors

1. Study program

1.1. University	University of Bucharest
1.2. Faculty	Faculty of Physics
1.3. Department	Department of Electricity, Solid State Physics and Biophysics
1.4. Field of study	Exact and natural sciences / Physics
1.5. Course of study	Undergraduate/Bachelor of Science
1.6. Study program	Physics (in English)
1.7. Study mode	Full-time study

2. Course unit

2.1. Course unit title	**Physics of semiconductors**							
2.2. Teacher				**Prof. Lucian Ion, Prof. Ștefan Antohe**				
2.3. Tutorials/Practicals instructor(s)				**Lect. dr. Sorina Iftimie**				
2.4. Year of study	3	2.5. Semester	6	2.6. Type of evaluation	E	2.7. Type of course unit	Content[1)]	**DF**
							Type[2)]	**DO**

[1)] fundamental (DF), speciality (DS), complementary (DC); [2)] compulsory (DI), elective (DO), optional (DFac)

3. Total estimated time (hours/semester)

3.1. Hours per week in curriculum	**4**	distribution: Lecture	**2**	Tutorials/ Practicals	**1/1**
3.2. Total hours per semester	**40**	distribution: lecture	**20**	Tutorials/ Practicals	**10/10**

Distribution of estimated time for study	**hours**
3.2.1. Learning by using one's own course notes, manuals, lecture notes, bibliography	**20**
3.2.2. Research in library, study of electronic resources, field research	**18**
3.2.3. Preparation for practicals/tutorials/projects/reports/homeworks	**18**
3.2.4. Examination	**4**
3.2.5. Other activities	**0**

3.3. Total hours of individual study	**56**
3.4. Total hours per semester	**100**
3.5. ECTS	**4**

4. Prerequisites (if necessary)

4.1. curriculum	Lectures: Electricity and magnetism, Optics, Equations of mathematical physics, Solid state physics
4.2. competences	• Use of software packages for data analysis

5. Conditions/Infrastructure (if necessary)

5.1. for lecture	Multimedia infrastructure (videoprojector, PC)
5.2. for practicals/tutorials	Equipments for electrical and optical characterizations of materials

6. Specific competences acquired

Professional competences	• C1 – Identification and correct use of physical laws and principles in given contexts • C3 – Solving of physics problems in imposed conditions • C4 – Performing of physics experiments by using standard laboratory equipments • C5 – Analysis and communication/presentation of scientific data

Transversal competences	• CT3 – Efficient use of the sources of scientific information and communication of scientific data in English

7. Course objectives

7.1. General objective	Study of the physical properties of semiconductors (introductory level)
7.2. Specific objectives	- knowledge of specific physical models used in semiconductor physics - developing the ability to creatively use specific physical models to solve problems and analyze experimental data - knowledge and use of specific experimental characterization methods

8. Contents

8.1. Lecture [chapters]	Teaching techniques	Observations
Physical and chemical characteristics of semiconductor compounds	Systematic exposition - lecture. Examples	2 hours
Electronic structure of semiconductors. Controlled doping. Electronic properties of defects.	Systematic exposition - lecture. Examples	4 hours
Statistics of equilibrium charge carriers in doped semiconductors. Electrons and holes. Shockley-Read statistics. Recombination rate.	Systematic exposition - lecture. Heuristic conversation. Critical analysis. Examples	4 hours
Organic semiconductors. Specific physical properties	Systematic exposition - lecture. Examples	2 hours
Fundamental transport equations in semiconductor physics. Free carriers injection. Space-charge limited currents.	Systematic exposition - lecture.	4 hours
Optical properties of semiconductors. Fundamental optical absorption.	Systematic exposition - lecture. Critical analysis. Examples	4 hours
Bibliography: 1. P.Y. Yu, M. Cardona, Fundamentals of Semiconductors, 3-rd edition (Springer Verlag, Berlin, 2005).		
8.2. Tutorials [main themes]	Teaching and learning techniques	Observations
Temperature dependence of equilibrium charge carriers in doped and compensated semiconductors	Guided work	4 hours
Thermoelectric effects in semiconductors	Guided work	2 hours
Surface states. Contact phenomena.	Guided work	2 hours
Fundamental optical absorption. Joint density of states.	Guided work	2 hours
Bibliography: 1. P.Y. Yu, M. Cardona, Fundamentals of Semiconductors, 3-rd edition (Springer Verlag, Berlin, 2005).		
8.3. Practicals [practical activities, projects, etc.]	Teaching and learning techniques	Observations
Measurements of the temperature dependences of electrical resistivity and charge carriers density in semiconductors	Guided practical activity	4 hours
Optical characterization of thin semiconductor films	Guided practical activity	4 hours
Parameters characterizing the p-n junction	Guided practical activity	2 hours
Bibliography: 1. L. Ion, Solid state physics – Laboratory manual		
8.4. Project [only if included in syllabus]	Teaching and learning techniques	Observations
Bibliography:		

9. Compatibility of the course unit contents with the expectations of the representatives of epistemic communities, professional associations and employers (in the field of the study program)

This course unit aims at developing specific theoretical and practical competences and abilities in the field of semiconductor physics, corresponding to national and european/international standards. The contents and teaching methods were selected after a thorough analysis of the contents of similar course units in the syllabus of other universities from Romania or the European Union. The contents are in line with the requirements/expectations of the main employers of the graduates (industry, research – e.g. the National R&D Institute for Materials Physics, secondary school teaching).

10. Assessment

Activity type	10.1. Assessment criteria	10.2. Assessment methods	10.3. Weight in final mark
10.4. Lecture	- coherence and clarity of exposition - correct use of equations/mathematical methods/physical models and theories - ability to indicate/analyse specific examples	Written exam	50%
10.5.1. Tutorials	- ability to use specific problem solving methods - ability to analyse the results	Homeworks	25%
10.5.2. Practicals	- ability to perform specific experiments - ability to present and discuss the results	Lab reports	25%
10.5.3. Project [only if included in syllabus]			
10.6. Minimal requirements for passing the exam			
Requirements for mark 5 (10 points scale) - Performing all experiments and presentation of Lab reports - Correct solution for indicated subjects in homeworks and the final exam			

Date
03/24/2016

Teacher's name and signature

Prof. Ștefan Antohe

Prof. Lucian Ion,

Practicals/Tutorials instructor(s) name(s) and signature(s)

Lect. Sorina Iftimie

Date of approval

Head of Department,
Assoc. Prof. Petrică Cristea

DO 311 F.2.EN Special topics in solid state physics

1. Study program

1.1. University	University of Bucharest
1.2. Faculty	Faculty of Physics
1.3. Department	Department of Electricity, Solid State Physics and Biophysics
1.4. Field of study	Exact and natural sciences / Physics
1.5. Course of study	Undergraduate/Bachelor of Science
1.6. Study program	Physics (in English)
1.7. Study mode	Full-time study

2. Course unit

2.1. Course unit title	**Special topics in solid state physics**							
2.2. Teacher				**Prof. Daniela Dragoman**				
2.3. Practicals instructor(s)				**Assoc. Prof. George Alexandru Nemneş**				
2.4. Year of study	3	2.5. Semester	6	2.6. Type of evaluation	E	2.7. Type of course unit	Content[1)]	**DF**
							Type[2)]	**DO**

[1)] fundamental (DF), speciality (DS), complementary (DC); [2)] compulsory (DI), elective (DO), optional (DFac)

3. Total estimated time (hours/semester)

3.1. Hours per week in curriculum	**4**	distribution: Lecture	**2**	Practicals	**2**
3.2. Total hours per semester	**40**	distribution: lecture	**20**	Tutorials/ Practicals	**20**

Distribution of estimated time for study	**hours**
3.2.1. Learning by using one's own course notes, manuals, lecture notes, bibliography	**21**
3.2.2. Research in library, study of electronic resources, field research	**20**
3.2.3. Preparation for practicals/tutorials/projects/reports/homeworks	**15**
3.2.4. Examination	**4**
3.2.5. Other activities	**0**

3.3. Total hours of individual study	**56**
3.4. Total hours per semester	**100**
3.5. ECTS	**4**

4. Prerequisites (if necessary)

4.1. curriculum	Lectures: Solid state physics, Quantum mechanics, Electricity and magnetism, Optics
4.2. competences	- Use of software packages for data analysis

5. Conditions/Infrastructure (if necessary)

5.1. for lecture	Multimedia infrastructure (videoprojector, PC)
5.2. for practicals	Equipments for electrical, optical and magnetic characterizations

6. Specific competences acquired

Professional competences	- C1 – Identification and correct use of physical laws and principles in given contexts - C3 – Solving of physics problems in imposed conditions - C4 – Performing of physics experiments by using standard laboratory equipments - C5 – Analysis and communication/presentation of scientific data
Transversal competences	- CT3 – Efficient use of the sources of scientific information and communication of scientific data in English

7. Course objectives

7.1. General objective	Study of advanced topics in the physics of crystalline solids
7.2. Specific objectives	- knowledge of specific physical theories and models used in advanced solid state physics - developing the ability to creatively use specific physical models to solve problems and analyze experimental data - knowledge and use of specific experimental characterization methods

8. Contents

8.1. Lecture [chapters]	Teaching techniques	Observations
Optical properties of bulk crystalline solids. Optical constants. Main absorption mechanisms.	Systematic exposition - lecture. Examples	4 hours
Physics of nanostructures. Introduction. Specific electrical and optical properties	Systematic exposition - lecture. Examples	4 hours
Magnetic properties of solids. Applications. Spintronics. Giant magnetoresistive effect. Magnetic tunnel junctions.	Systematic exposition - lecture. Examples	4 hours
Superconductivity. Introduction. London equations. Cooper pairing.	Systematic exposition - lecture. Examples	4 hours
Graphene and topological insulators. Introduction. Topological invariants. Quantum Hall and spin Hall effects	Systematic exposition - lecture. Examples	4 hours
Bibliography: • D. Dragoman, Course notes on Complements to solid state physics • Y.M. Galperin, Introduction to Modern Solid State Physics (CreateSpace Publishing Platform, 2014) • D.K. Ferry, S.M. Goodnick, Transport in Nanostructures (Cambridge Univ. Press, 2009, 2nd ed) • B.A. Bernevig, Topological Insulators and Topological Superconductors (Princeton Univ. Press, 2013)		
8.2. Tutorials [main themes]	Teaching and learning techniques	Observations
N.A.	N.A.	
8.3. Practicals [practical activities, projects, etc.]	Teaching and learning techniques	Observations
Determination of material parameters from absorption spectra	Guided practical activity	4 hours
Determination of electron transmission coefficiens	Guided practical	4 hours

through low-dimensional structures	activity	
Rashba effect. Spin injection efficiency	Guided practical activity	4 hours
Josephson tunnel junctions. Applications	Guided practical activity	4 hours
Model of a Chern insulator on a square lattice	Guided practical activity	4 hours

Bibliography:

- Y.M. Galperin, Introduction to Modern Solid State Physics (CreateSpace Publishing Platform, 2014)
- D.K. Ferry, S.M. Goodnick, Transport in Nanostructures (Cambridge Univ. Press, 2009, 2nd ed)
- B.A. Bernevig, Topological Insulators and Topological Superconductors (Princeton Univ. Press, 2013)

8.4. Project [only if included in syllabus]	Teaching and learning techniques	Observations
Bibliography:		

9. Compatibility of the course unit contents with the expectations of the representatives of epistemic communities, professional associations and employers (in the field of the study program)

This course unit aims at developing specific theoretical and practical competences and abilities in the field of advanced solid state physics, corresponding to national and european/international standards. The contents and teaching methods were selected after a thorough analysis of the contents of similar course units in the syllabus of other universities from Romania or the European Union. The contents are in line with the requirements/expectations of the main employers of the graduates (industry, research – e.g. the National R&D Institute for Materials Physics, secondary school teaching).

10. Assessment

Activity type	10.1. Assessment criteria	10.2. Assessment methods	10.3. Weight in final mark
10.4. Lecture	- coherence and clarity of exposition - correct use of equations/mathematical methods/physical models and theories - ability to indicate/analyse specific examples	Written exam	50%
10.5.1. Tutorials			
10.5.2. Practicals	- ability to design and perform specific experiments - ability to present and discuss the results	Lab reports	50%
10.5.3. Project [only if included in syllabus]			

10.6. Minimal requirements for passing the exam
All practical activities must be finalized.

Requirements for mark 5 (10 points scale)
- Performing all experiments and presentation of Lab reports
- Correct solution for indicated subjects in homeworks and the final exam

Date	Teacher’s name and signature	Practicals instructor
03/24/2016	Prof. Daniela Dragoman	Assoc. Prof. George Alexandru Nemneș

Date of approval

Head of Department,
Assoc. Prof. Petrică Cristea

DO 312 F.1.EN Electronic Devices and Electronic Circuits

1. Study program

1.1. University	University of Bucharest
1.2. Faculty	Faculty of Physics
1.3. Department	Department of Electricity, Solid State Physics and Biophysics
1.4. Field of study	Physics
1.5. Course of study	Undergraduate/Bachelor of Science
1.6. Study program	Physics (in English)
1.7. Study mode	Full-time study

2. Course unit

2.1. Course unit title	**Electronic Devices and Electronic Circuits**							
2.2. Teacher				**Conf. Dr. Andrei BARBORICA**				
2.3. Tutorials/Practicals instructor(s)				**Conf. Dr. Andrei BARBORICA**				
2.4. Year of study	3	2.5. Semester	II	2.6. Type of evaluation	E	2.7. Type of course unit	Content[1)]	**DS**
							Type[2)]	**DO**

[1)] fundamental (DF), speciality (DS), complementary (DC); [2)] compulsory (DI), elective (DO), optional (DFac)

3. Total estimated time (hours/semester)

3.1. Hours per week in curriculum	**4**	distribution: Lecture	**2**	Practicals/Tutorials	**2**
3.2. Total hours per semester	**40**	distribution: 1-st semester	**0**	2-nd semester	**40**

Distribution of estimated time for study	**hours**
3.2.1. Learning by using one's own course notes, manuals, lecture notes, bibliography	**15**
3.2.2. Research in library, study of electronic resources, field research	**15**
3.2.3. Preparation for practicals/tutorials/projects/reports/homeworks	**26**
3.2.4. Examination	**4**
3.2.5. Other activities	**0**

3.3. Total hours of individual study	**56**
3.4. Total hours per semester	**100**
3.5. ECTS	**4**

4. Prerequisites (if necessary)

4.1. curriculum	Real and Complex Mathematical Analysis, Electricity and Magnetism
4.2. competencies	C2 Use of software packages for data analysis and visualization

5. Conditions/Infrastructure (if necessary)

5.1. for lecture	Course room, projector, screen
5.2. for practicals/tutorials	Lab room, experimental setups, power supplies, measurement instruments, oscilloscopes

6. Specific competences acquired

Professional competences	C1.2 Ability to describe physical systems, using theoretical approaches and appropriate instruments C2.4 Ability to compare the results of numerical models and simulations with literature data or experimental measurements. C4.4 Critical evaluation of the results of the implementation of physical models, including the uncertainity in experimental data. C4.5 Ability to implement, improve and extend the use of a physical model. Ability to design and implement experimental setups and devices capable of validating a physical model.
Transversal competences	CT1 Efficient and responsible fulfillment of the professional duties, while respecting the deontological laws of the domain, under qualified supervision. CT3 Efficient use of informational, communication and guided professional development resources in Romanian and another widespread foreign language.

7. Course objectives

7.1. General objective	An introduction to electronics: description of the main circuits and devices used in lab room; highlighting of dynamic and static characteristics; highlighting of design and construction parameters; highlighting of circuit components; exposition of dedicated measurement techniques; exhibition of suitable means of calculating various physical parameters
7.2. Specific objectives	Study of the most frequently used semiconductor devices and study of the related physical processes involved. Applications. Study of various electronic circuits and study of the related physical processes involved. Applications. Systematic and logic way exposition of the physical phenomena and processes involved so that to allow to student to solve future difficulties in this field.

8. Contents

8.1. Lecture [chapters]	Teaching techniques	Observations
Common collector amplifier. Input voltage amplifier. Input impedance. Output impedance. Boot-strap method to increase the value of input impedance. Applications.	Systematic exposition - lecture. Heuristic conversation. Critical analysis. Examples	2 hours
Common emitter amplifier. Common emitter amplifier in alternative current. Common emitter-resistance amplifier. Study of various methods to improve the linearity by decreasing the amplification value. Input impedance and output impedance. Applications.	Systematic exposition - lecture. Heuristic conversation. Critical analysis. Examples	2 hours
Common base amplifier. Input voltage amplifier. Input impedance and output impedance. Applications.	Systematic exposition - lecture. Heuristic conversation. Critical analysis. Examples	2 hours
Differential level of bipolar junction transistors. Differential mode and common	Systematic exposition - lecture. Heuristic	2 hours

mode. Rejection ratio of common mode. Applications.	conversation. Critical analysis. Examples	
Power level of bipolar junction transistors. Working levels. Opposite working level. Distortions.	Systematic exposition - lecture. Heuristic conversation. Critical analysis. Examples	2 hours
Field effect transistor. Classification, working principle. Static characteristics. Relative studies to bipolar junction transistor. Applications.	Systematic exposition - lecture. Heuristic conversation. Critical analysis. Examples	2 hours
Electronic circuits feedback: introduction. Electronic circuits feedback in DC. Comparative studies to hysteresis loop. Delay time oscillators.	Systematic exposition - lecture. Heuristic conversation. Critical analysis. Examples	2 hours
Positive selective feedback of electronic circuits. Sinusoidal oscillators. Studies of how to stabilize the oscillation amplitude. Applications.	Systematic exposition - lecture. Heuristic conversation. Critical analysis. Examples	2 hours
Negative selective feedback of electronic circuits. Negative selective feedback of various electronic devices. Study of performances of amplifiers.	Systematic exposition - lecture. Heuristic conversation. Critical analysis. Examples	2 hours
Operational amplifiers. Electronic circuits based on operational amplifiers. Instrumentation amplifiers.	Systematic exposition - lecture. Heuristic conversation. Critical analysis. Examples	2 hours
Bibliography: - Razvan BOBULESCU, Andrei BARBORICA Introduction to Electronics, Editura Universitatii din Bucuresti, 2002. - P. Horowitz and W. Hill, "The art of electronics", 2nd edition, Cambridge Unversity Press,1994 - Mihai P Dinca, "Electronica - Manualul studentului", vol1, Editura Universitatii din Bucuresti, 2003. - J. COX, Fundamentals of Linear Electronics, Ed. Delmar, 2001		
8.2. Tutorials [main themes]	Teaching and learning techniques	Observations
Some specific theme	Guided work	2-4-6 hours
Bibliography: ...whatever you decide to indicate...		
8.3. Practicals [practical activities, projects, etc.]	Teaching and learning techniques	Observations
Common emitter amplifier	Guided practical activity	2 hours
Common base amplifier	Guided practical activity	2 hours
Common collector amplifier	Guided practical activity	2 hours
Differential amplifier	Guided practical activity	2 hours

Power amplifier	Guided practical activity	2 hours
Feedback of the amplifier	Guided practical activity	2 hours
Wien network integrated oscillator	Guided practical activity	2 hours
Inverted circuit based on the operational amplifier; non-inverted circuit based on the operational amplifier; differential circuit based on the operational amplifier.	Guided practical activity	4 hours
Differentiator circuit based on the operational amplifier and integrator circuit based on the operational amplifier.	Guided practical activity	2 hours
Bibliography: - Razvan BOBULESCU, Andrei BARBORICA Introduction to Electronics, Editura Universitatii din Bucuresti, 2002. - P. Horowitz and W. Hill, "The art of electronics", 2nd edition, Cambridge Unversity Press,1994 - Mihai P Dinca, "Electronica - Manualul studentului", vol1, Editura Universitatii din Bucuresti, 2003.		
8.4. Project N/A	Teaching and learning techniques	Observations
Bibliography: N/A		

9. Compatibility of the course unit contents with the expectations of the representatives of epistemic communities, professional associations and employers (in the field of the study program)

This course unit forms/develops basic theoretical and practical competencies and abilities in the field of electronics, which are fundamental for an undergraduate student in the field of modern Physics, corresponding to national and european/international standards. The contents and teaching methods were selected after a thorough analysis of the contents of similar course units in the syllabus of other universities from Romania or from the European Union. The contents are in line with the requirements/expectations of the main employers of the graduates (industry, research, secondary school teaching, etc)

10. Assessment

Activity type	10.1. Assessment criteria	10.2. Assessment methods	10.3. Weight in final mark
10.4. Lecture	- coherence and clarity of exposition - correct use of equations/mathematical methods/physical models and theories - ability to indicate/analyze specific examples	Written test/oral examination	
10.5.1. Tutorials	N/A	N/A	

10.5.2. Practicals	- ability to use specific experimental methods/apparatus - ability to perform/design specific experiments - ability to present and discuss the results	Lab reports	
10.5.3. Project [only if included in syllabus]	N/A	N/A	
10.6. Minimal requirements for passing the exam 80% of the practical activities must be finalized, mark 5 for the lab examination			
Requirements for mark 5 (10 points scale) A mimimum grade of 5 for the lab examination Answering the theoretical exam questions and solving the exercises with grade 5			

	Teacher's name and signature	Practicals/Tutorials instructor(s) name(s) and signature(s)
Date 01.05.2016	Conf. univ. dr. Andrei BARBORICA	Conf. univ. dr. Andrei BARBORICA

Date of approval

Head of Department
Conf. univ. dr. Petrica Cristea

DO 312 F.2.EN INTRODUCTION IN NANOTECHNOLOGY

1. Study program

1.1. University	University of Bucharest
1.2. Faculty	Faculty of Physics
1.3. Department	Department of Electricity, Solid State Physics and Biophysics
1.4. Field of study	Physics
1.5. Course of study	Undergraduate/Bachelor of Science
1.6. Study program	Physics (in English)
1.7. Study mode	Full-time study

2. Course unit

2.1. Course unit title	**INTRODUCTION IN NANOTECHNOLOGY**							
2.2. Teacher				**Prof. Dr. Daniela Dragoman**				
2.3. Tutorials/Practicals instructor(s)				**Asist. Dr. Vlad ANTOHE**				
2.4. Year of study	3	2.5. Semester	2	2.6. Type of evaluation	E	2.7. Type of course unit	Content[1)]	**DS**
							Type[2)]	**DO**

[1)] fundamental (DF), speciality (DS), complementary (DC); [2)] compulsory (DI), elective (DO), optional (DFac)

3. Total estimated time (hours/semester)

3.1. Hours per week in curriculum	**4**	distribution: Lecture	**2**	Practicals/Tutorials	**2**
3.2. Total hours per semester	**56**	distribution: Lecture	**28**	Practicals/Tutorials	**28**

Distribution of estimated time for study	**hours**
3.2.1. Learning by using one's own course notes, manuals, lecture notes, bibliography	**15**
3.2.2. Research in library, study of electronic resources, field research	**10**
3.2.3. Preparation for practicals/tutorials/projects/reports/homeworks	**15**
3.2.4. Preparation for exam	**4**
3.2.5. Other activities	

3.3. Total hours of individual study	**40**
3.4. Total hours per semester	**100**
3.5. ECTS	**4**

4. Prerequisites (if necessary)

4.1. curriculum	Electricity and Magnetism, Solid State Physics, Electronics, Thermodynamics and Statistics
4.2. competences	• Skills in handling industry-scale equipment or standard laboratory research tools, in order to perform complex scientific experiments • Adequate knowledge of the Physics theoretical concepts, as well as of the Applied Engineering Sciences

5. Conditions/Infrastructure (if necessary)

5.1. for lecture	Multimedia-equipped room (audio/video projector) Lecture notes Recommended bibliography

5.2. for practicals/tutorials	Multimedia-equipped room (audio/video projector) Different instruments for preparing nanostructures, quality control equipment, various characterization tools, as well as experimental layouts

6. Specific competences acquired

Professional competences	Fundamental knowledge of the theoretical concepts of nanometer-scale structures Basic skills in preparing and handling nanostructures, as well as in characterization of various nanostructure-based electronic and optoelectronic devices
Transversal competences	• To demonstrate interest in the development of the professional competence through analytical thinking • To demonstrate implication in scientific activities, such as reports writing or communications of specific research studies.

7. Course objectives

7.1. General objective	To present the fundamental principles of the nanometer-scale physics, as well as to provide information about various techniques employed in the preparation of nanostructures
7.2. Specific objectives	- Analysis of the fundamental principles and physical processes involved in the preparation and characterization of various nanostructures - Studying about applications of nanostructures in electronics and optoelectronics

8. Contents

8.1. Lecture [chapters]	Teaching techniques	Observations
Introduction in nanotechnology. Types of nanostructures. Effects of the nanometer length scale. Nanostructures characterization methods. From nanostructures to nanostructured devices.	Systematic exposition - lecture. Heuristic conversation. Critical analysis. Examples	4 hours
Morphological characterization tools for nanostructures. Optic and electronic microscopy – physical principles, description of the construction elements	Systematic exposition - lecture. Heuristic conversation. Critical analysis. Examples	2 hours
Advanced nanostructuring methods. Template-assisted preparation of nanostructures. Description of the physico-chemical processes. Study of the employed materials. Description of the equipment	Systematic exposition - lecture. Heuristic conversation. Critical analysis. Examples	4 hours
Advanced nanostructuring methods. Physical vapor deposition methods. Vacuum thermal evaporation, electron-beam deposition, magnetron sputtering. Laser ablation. Description of the physical principles and of the equipment.	Systematic exposition - lecture. Heuristic conversation. Critical analysis. Examples	4 hours
Advanced nanostructuring methods.	Systematic exposition -	4 hours

Anodization. Electrochemical deposition. Description of the physical principles and of the equipment.	lecture. Heuristic conversation. Critical analysis. Examples	
Advanced nanostructuring methods. Chemical vapor deposition methods. Thermal oxidation. Molecular beam epitaxy. Description of the physical principles and of the equipment.	Systematic exposition - lecture. Heuristic conversation. Critical analysis. Examples	4 hours
Etching techniques. Classification. Description of the physical principles and of the equipment.	Systematic exposition - lecture. Heuristic conversation. Critical analysis. Examples	2 hours
Bibliography: 1. M. Di Ventra, S. Evoy, J.R. Heflin Jr., Introduction to nanoscale science and technology (Kluwer, Boston, 2004). 2. V.A. Antohe, Capacitive sensors based on localized nanowire arrays (Lambert Academic Publishers, Saarbrucken, Germany, 2012)		
8.2. Tutorials [main themes]	Teaching and learning techniques	Observations
8.3. Practicals [practical activities, projects, etc.]	Teaching and learning techniques	Observations
Advanced nanostructuring methods. Magnetron sputtering	Guided practical activity	8 hours
Advanced nanostructuring methods. Vacuum thermal evaporation	Guided practical activity	4 hours
Advanced nanostructuring methods. Template-assisted electrodeposition	Guided practical activity	8 hours
Morphological and structural characterization. X-ray diffraction, scanning electron microscopy, atomic force microscopy	Guided practical activity	4 hours
8.4. Project [only if included in syllabus]	Teaching and learning techniques	Observations
Bibliography:		

9. Compatibility of the course unit contents with the expectations of the representatives of epistemic communities, professional associations and employers (in the field of the study program)

This course unit develops some theoretical and/or practical competences and abilities which are fundamental for an undergraduate student in the field of modern Physics, corresponding to national and international standards. The contents and teaching methods were selected after a thorough analysis of the contents of similar course units in the syllabus of other universities from Romania or European Union (Université Catholique de Louvain, University of Groningen, Technische Universitat Munchen). The contents are in line with the requirements/expectations of the main employers of the graduates (industry, research, secondary school teaching).

10. Assessment

Activity type	10.1. Assessment criteria	10.2. Assessment methods	10.3.

			Weight in final mark
10.4. Lecture	- coherence and clarity of exposition - correct use of equations/mathematical methods/physical models and theories - ability to indicate/analyse specific examples	Written test/oral examination	60%
10.5.1. Tutorials			
10.5.2. Practicals	- ability to use specific experimental methods/apparatus - ability to perform/design specific experiments - ability to present and discuss the results	Lab reports	40%
10.5.3. Project [only if included in syllabus]			
10.6. Minimal requirements for passing the exam			
Requirements for mark 5 (10 points scale) Correct assessment of a theoretical subject within final exam Correct assessment of a problem within final exam			

Date	Teacher's name and signature Prof. Dr. Daniela Dragoman	Practicals/Tutorials instructor(s) name(s) and signature(s) Asist. Dr. Vlad Andrei Antohe

Date of approval

Head of Department
Prof. dr. Petrica Cristea

DFC 314 F.EN Physics of deformable bodies

1. Study program

1.1. University	University of Bucharest
1.2. Faculty	Faculty of Physics
1.3. Department	Department of Electricity, Solid State Physics and Biophysics
1.4. Field of study	Physics
1.5. Course of study	Undergraduate/Bachelor of Science
1.6. Study program	Physics (in English)
1.7. Study mode	Full-time study

2. Course unit

2.1. Course unit title	**Physics of deformable bodies**							
2.2. Teacher				**Lect. univ. dr. Tiberius Cheche**				
2.3. Tutorials/Practicals instructor(s)				**Lect. univ. dr. Tiberius Cheche**				
2.4. Year of study	4	2.5. Semester	VII	2.6. Type of evaluation	E	2.7. Type of course unit	Content[1)]	**DS**
							Type[2)]	**DFac**

[1)] fundamental (DF), speciality (DS), complementary (DC); [2)] compulsory (DI), elective (DO), optional (DFac)

3. Total estimated time (hours/semester)

3.1. Hours per week in curriculum	**4**	distribution: Lecture	**2**	Practicals/Tutorials	**2**
3.2. Total hours per semester	**56**	distribution: 1-st semester	**56**	2-nd semester	**0**

Distribution of estimated time for study	**hours**
3.2.1. Learning by using one's own course notes, manuals, lecture notes, bibliography	**5**
3.2.2. Research in library, study of electronic resources, field research	**5**
3.2.3. Preparation for practicals/tutorials/projects/reports/homeworks	**5**
3.2.4. Examination	**4**
3.2.5. Other activities	**0**

3.3. Total hours of individual study	**15**
3.4. Total hours per semester	**75**
3.5. ECTS	**3**

4. Prerequisites (if necessary)

4.1. curriculum	Mechanics, Analytical Mechanics, Equations of Mathematical Physics
4.2. competences	Mathematics knowledge, Solid State Physics, Prpgramming Languages and Numerical Methods

5. Conditions/Infrastructure (if necessary)

5.1. for lecture	Multimedia room
5.2. for practicals/tutorials	Laboratory, PC network

6. Specific competences acquired

Professional competences	C1: Identification and adequate use of main laws and physics principles in specific problems C1.1: Proof of physical expressions for calculus of physical quantities by adequate use of principles and physics law. C1.2: Physics systems description by use of theories and specific tools (experimental and theoretical methods, algorithms, schemes, etc.) C1.3: Application of laws and physics principles in solving theoretical or practical problems, under qualified assistance. C2: Solving physical problems by use of analytical and numerical methods C3: Application of physics knowledge in related research activities and experimental projects, by use of the lab instruments. C4: Inter-curricular approach of some specific themes of physics.
Transversal competences	CT1: Application of efficient techniques of in multidisciplinary team. CT3: Efficient use of information and communication resources, in Romanian and English.

7. Course objectives

7.1. General objective	Something here
7.2. Specific objectives	- knowledge of specific physical theories/models - developing the ability to work in a team - knowledge and use of specific experimental methods - something else...

8. Contents

8.1. Lecture [chapters]	Teaching techniques	Observations
Introductory mathematics: Cartesian and curvilinear orthogonal coordinates. Tensor of second order, change of basis. Vector differential operators. Integrals of vector fields.	Systematic exposition - lecture. Examples	2 hours
Basics of elasticity theory: Stress tensor. Strain tensor. Termodynamics of deformations. Generalized Hook law.	Systematic exposition - lecture. Examples	2 hours
Equilibrium equations for homogenous bodies. Equilibrium equations for bodies in contact.	Systematic exposition - lecture. Examples	2 hours
Equations of motion. Constitutive equations. Compatibility equations (Saint Venant conditions).	Systematic exposition - lecture. Examples	2 hours
Theorems of work and energy in elasticity theory. Virtual work principle. Minimum energy principle.	Systematic exposition - lecture. Examples	2 hours
Boundary conditions in elasto-statics. Fundamental problems in elasto-dynamics.	Systematic exposition - lecture. Examples	2 hours
Elastic waves in isotropic systems. Elastic waves in crystals. Rayleigh surface waves.	Systematic exposition - lecture. Examples	2 hours
Elastic properties of crystals. Continuum dislocation theory. Dislocations in thin epitaxial films.	Systematic exposition - lecture. Examples	2 hours
Bibliography:		
8.2. Tutorials [main themes]	Teaching and learning techniques	Observations
Some specific theme	Guided work	2-4-6 hours
Bibliography: 1. Y.A. Amenzade, Theory of elasticity, Mir, 1979. 2. L.D. Landau, E.M. Lifshitz-Theory of Elasticity, Pergamon Press, 1970.		

3. **A.S. Saada, Elasticity: Theory and Applications,** 2nd edition**,** J. Ross Publishing, 2009.
4. Barber J., Elasticity, 2nd edition, Springer, 2002.
5. M.H. Sadd, Elasticity.Theory, applications, and numerics, 3rd edition, Elsevier, 2014.
6. D. Royer, E. Dieulesaint, Elastic waves in solids, Springer, 2000.
7. W.M. Lai, D. Rubin, E. Krempl, Introduction to continuum mechanics, 3rd edition, Butterworth-Heinemann, 1999.

8.3. Practicals [practical activities, projects, etc.]	Teaching and learning techniques	Observations
Elastic flexure of beam - laboratory	Guided practical activity	2 hours
Torsion of bar with prismatic and cylindrical crossection - laboratory	Guided practical activity	2 hours
Simulation of strain in mesoscopic heterostructure: - spherical core/shell heterostructure - cylindrical core/shell heterostructure	Guided practical activity	2 hours
Meshing of two dimensional shape by finite element method.	Guided practical activity	2 hours
Newton-Raphson method for equilibrium equation solving.	Guided practical activity	2 hours
Matrices encoding for stiffness calculus.	Guided practical activity	2 hours
Boundary conditions encoding	Guided practical activity	2 hours
Simulation of strain in a strip with a hole.	Guided practical activity	2 hours
Bibliography: ...whatever you decide to indicate...		
8.4. Project [only if included in syllabus]	Teaching and learning techniques	Observations

Bibliografie:
1. Y.A. Amenzade, Theory of elasticity, Mir, 1979.
2. L.D. Landau, E.M. Lifshitz-Theory of Elasticity, Pergamon Press, 1970.
3. J. Bonet, R.D. Wood, Nonlinear Continuum Mechanics For Finite Element Analysis, Cambridge University Press, 1997.
4. M.H. Sadd, Elasticity.Theory, applications, and numerics, 3rd edition, Elsevier, 2014.
5. I.M. Smith, D. V. Griffiths, L. Margetts, Programming the Finite Element Method, 4th edition,Wiley, 2005.
6. T.O. Cheche, Y.C. Chang, Analytical approach for strain and piezoelectric potential in conical self-assembled quantum dots, *Journal of Applied Physics* 104, 083524(1-11) (2008).
7. T.E. Pahomi, T.O. Cheche, Strain influence on optical absorption of giant semiconductor colloidal quantum dots, *Chemical Physics Letters* 612, 33-38 (2014).

9. Compatibility of the course unit contents with the expectations of the representatives of epistemic communities, professional associations and employers (in the field of the study program)

This course unit develops some theoretical competences and abilities which are fundamental for an undergraduate student in the field of Condesed Matter Physics, corresponding to national and european/international standards. The contents and teaching methods were selected after a thorough analysis of the contents of similar course units in the syllabus of other universities from Romania or the European Union as for example:
University of Oxford https://www.ox.ac.uk/admissions/undergraduate/courses-listing?wssl=1,
University of Parma http://www.difest.unipr.it/it/didattica/laurea-triennale-fisica/calendario-didattico,
Universitatea Padova http://en.didattica.unipd.it/didattica/2015/SC1158/2014.
The contents are in line with the requirements/expectations of the main employers of the graduate studeents.

10. Assessment

Activity type	10.1. Assessment criteria	10.2. Assessment methods	10.3. Weight in final mark
10.4. Lecture	- coherence and clarity of exposition - correct use of equations/mathematical methods/physical models and theories - ability to indicate/analyse specific examples	Written test/oral examination	60%
10.5.1. Tutorials	- ability to use specific problem solving methods - ability to analyse the results	Homeworks/written tests	10%
10.5.2. Practicals	- ability to use specific experimental methods/apparatus - ability to perform/design specific experiments - ability to present and discuss the results	Lab reports	30%
10.5.3. Project [only if included in syllabus]	- coherence and clarity of exposition - correct use of mathematical and physical methods/models - ability to use specific experimental methods/apparatus - ability to present and discuss the results	Report	
10.6. Minimal requirements for passing the exam Correct understanding of notions and phenomena, ability of using them, obtaining correct numerical results on some concrete problems.			
Requirements for mark 5 (10 points scale) All laboratory activites should be finalized. Correct exposure of the exam tests for obtaining mark 5 (10 points scale).			

	Teacher's name and signature	Practicals/Tutorials instructor(s) name(s) and signature(s)
Date 5.05.2016	Tiberius O. Cheche	Tiberius O. Cheche

Date of approval

Head of Department
Prof. dr. Alexandru Jipa

DFC 315 F.EN Time series analysis

1. Study program

1.1. University	University of Bucharest
1.2. Faculty	Faculty of Physics
1.3. Department	Department of Electricity, Solid State Physics and Biophysics
1.4. Field of study	Physics
1.5. Course of study	Undergraduate/Bachelor of Science
1.6. Study program	Physics (in English)
1.7. Study mode	Full-time study

2. Course unit

2.1. Course unit title	**Time series analysis**							
2.2. Teacher				**Lect. Dr. Cristian Necula**				
2.3. Tutorials/Practicals instructor(s)				**Lect. Dr. Cristian Necula**				
2.4. Year of study	3	2.5. Semester	V	2.6. Type of evaluation	C	2.7. Type of course unit	Content[1)]	**DS**
							Type[2)]	**DFac**

[1)] fundamental (DF), speciality (DS), complementary (DC); [2)] compulsory (DI), elective (DO), optional (DFac)

3. Total estimated time (hours/semester)

3.1. Hours per week in curriculum	**4**	distribution: Lecture	**2**	Practicals/Tutorials	**2**
3.2. Total hours per semester	**56**	distribution: 1-st semester	**28**	1-st semester	**28**

Distribution of estimated time for study	**hours**
3.2.1. Learning by using one's own course notes, manuals, lecture notes, bibliography	5
3.2.2. Research in library, study of electronic resources, field research	5
3.2.3. Preparation for practicals/tutorials/projects/reports/homeworks	5
3.2.4. Examination	**4**
3.2.5. Other activities	**0**

3.3. Total hours of individual study	**15**
3.4. Total hours per semester	**75**
3.5. ECTS	**3**

4. Prerequisites (if necessary)

4.1. curriculum	Mathematical analysis, Mathematical Phyics equations
4.2. competences	Mathematics, work under various programming platforms

5. Conditions/Infrastructure (if necessary)

5.1. for lecture	Classroom having a projector
5.2. for practicals/tutorials	Computers with specific softwares (Matlab, R, Origin, Excel, etc).

6. Specific competences acquired

Professional competences	C1: Properly identification and application of the main problems and spectral analysis methods in a given context C1.1: Description and recognition of the physical signals (periodic, non periodic, stationay and nonstationary signals) using specific theories and methods (theoretical and experimental models, algorithms etc.) C1.2: Correct application of the time series analysis methods and of the adequate solutions selection criteria in order to fulfill the specified performances C3: Solving spectral analysis problems in given conditions using specific methods and algorithms C3.1 Properly application of the time series analysis methods for analysis and processing of specific time series C3.3 Correlation between time series analysis methods and the specified particular problems (calculus, signal processing, results interpretation) C3.4 Evaluation of the results confidence and comparison to theoretical calculus, literature data, using statistical methods) C4: Application of the knowledge acquired from times series analysis in concrete situations from various Physics domains. C6: Interdisciplinary approach of several Physics subjects C6.1: Making connections necessary to application of time series analysis using basic knowledge from other domains (Climatology, Meteorology, Geology, Biology, Oceanography, Paleontology, Environmental pollution, Paleomagnetism etc.) C6.4: Making connections between Physics and other domains (Climatology, Meteorology, Biologie, Geology, Oceanography, Paleontology, Environmental pollution, Computer programming, etc.).
Transversal competences	CT2: Efficient work techniques application in multidisciplinary team on various hierarchical levels CT3: Efficient usage of information, communication resources and assisted training both in Romanian and international languages.

7. Course objectives

7.1. General objective	Fundamental concepts presentation regarding time series analysis , types of time series (stationaty, nonstationary, etc) their frequency and time-frequency domain representation, specific calculus.
7.2. Specific objectives	Understanding of the specific aspects of the time series analysis methods and ability to use them. Developing of experimental specific abilities (ability to work with various programming languages and various specific sofwares). Understanding of the main application classes in time series analysis of the natural signals.

8. Contents

8.1. Lecture [chapters]	Teaching techniques	Observations
Representation of a signal in frequency domain. Continuous Fourier transform. Discrete Fourier transform. Amplitude, frequency (period), phase of a signal. Trend and noise definition. White noise and red noise.	Systematic exposition - lecture. Heuristic conversation. Critical analysis. Examples	5 hours
Effects of the trend and red noise in the frequency domain. Methods for removing trends and noise. Filtering in frequency domain. Analysis of unevenly spaced time series: Lomb-Scargle periodogram, CLEAN algorithm.	Systematic exposition - lecture. Heuristic conversation. Critical analysis. Examples	5 hours
Bivariate analisys of time series. Frequency leakage, spectral windowing. Cross-spectrum,	Systematic exposition - lecture. Heuristic	5 hours

coherency and phase shift between two signals.	conversation. Critical analysis. Examples	
Analysis of the nonstationary time series. Windowed Fourier transform. Continuous wavelet transform. Discrete wavelet transform. Cross-spectrum, coherency and phase shift using continuous wavelet trasnform. Wavelet transform application on unevenly spaced time series.	Systematic exposition - lecture. Heuristic conversation. Critical analysis. Examples	5 hours
Maximal Overlap Discrete Wavelet Transform. Multiresolution ananlysis. Cross-spectrum, coherency and phase shift based on multiresolution analysis.	Systematic exposition - lecture. Heuristic conversation. Critical analysis. Examples	3 hours
Maximal Overlap Discrete Wavelet Packet Transform. Hilbert spectrum. Filtering using wavelet functions. Coherency and phase shift based on MODWPT.	Systematic exposition - lecture. Heuristic conversation. Critical analysis. Examples	5 hours

Bibliography:

1. Robert H. Shumway, David S. Stoffer, 2011, Time Series Analysis and Its Applications, With R Examples, Third edition, Springer.
2. Olafsdottir, K. B., Schulz, M. and Mudelsee, M. (2016): REDFIT-X: Cross-spectral analysis of unevenly spaced paleoclimate time series. Computers and Geosciences, 91, 11-18
3. Donald Percival, Andrew Walden, 2000, Wavelet Methods for Time Series Analysis, Cambridge University Press.
4. Stephane Malat, 2005, A wavelet tour of signal processing, Academic Press.
5. D. Heslop, M.J. Dekkers, 2002, Spectral analysis of unevenly spaced climatic time series using CLEAN: signal recovery and derivation of significance levels using a Monte Carlo simulation, Physics of the Earth and Planetary Interiors 130 (2002) 103–116
6. Foster Grant, 1996, Wavelets for period analysis of unevenly sampled time series, The astronomical journal, vol 112, no, 4.
7. BRANDON WHITCHER and PETER F. CRAIGMILE, MULTIVARIATE SPECTRAL ANALYSIS USING HILBERT WAVELET PAIRS, Int. J. Wavelets Multiresolut Inf. Process. 02, 567 (2004)
8. Brandon Whitcher, Peter F. Craigmile, Peter Brown, 2005, Time-varying spectral analysis in neurophysiological time series using Hilbert wavelet pairs, Signal Processing, Volume 85, Issue 11, November 2005, Pages 2065–2081
9. S. OLHEDE AND A. T. WALDEN, 2005, A generalized demodulation approach to time-frequency projections for multicomponent signals, Proc. R. Soc. A (2005) 461, 2159–2179.

8.3. Practicals [practical activities, projects, etc.]	Teaching and learning techniques	Observations
Generating periodic signals with various amplitudes, phases and frequencies using Matlab and/or R. Representation of these signals in frequency domain using Fourier transform. Periodogram calculus. Preocessing of uevenly spaced using REDFIT-X sofware	Guided work	2 hours
Removing the trend. Methods for removing the trend. Red and white noise simulatons. The Welch method. Filtering in the frequency domain. Applications on sinthetic and natural signals.	Guided work	4 hours
Bivariate analysis. Cross-spectrum, coherency and phase calculus using sinthetic signals. Processing of unevenly spaced natural signals. Results interpretation. Confidence levels.	Guided work	4 hours
Stationary and nonstationary signals simulations.	Guided work	4 hours

The spectrum of the windowed Fourier transform. Applications on synthetic and natural signals.		
Continuous wavelet spectrum. Cross-spectrum, coherency and phase using continous wavelet trasnform. Applications on synthetic and natural signals. Continuous wavelet spectrum for unevenly spaced time series: weighted z-wavelet transform.	Guided work	4 hours
Multiresolution analysis using Maximal Overlap Discrete Wavelet Transform. Spectrum interpretation. Cross-spectrum, coherency and phase using multiresolution ananlysis. Applications on natural signals. Results interpretation.	Guided work	4 hours
Hilbert spectrum using Maximal Overlap Discrete Wavelet Packet Transform (MODWPT). Cross-spectrum, coherency and phase using MODWPT. Filtering through MODWPT. Applications on natural signals.	Guided work	4 hours
Examination		2 hours

Bibliography

1. Robert H. Shumway, David S. Stoffer, 2011, Time Series Analysis and Its Applications, With R Examples, Third edition, Springer.
2. Olafsdottir, K. B., Schulz, M. and Mudelsee, M. (2016): REDFIT-X: Cross-spectral analysis of unevenly spaced paleoclimate time series. Computers and Geosciences, 91, 11-18
3. Donald Percival, Andrew Walden, 2000, Wavelet Methods for Time Series Analysis, Cambridge University Press.
4. Stephane Malat, 2005, A wavelet tour of signal processing, Academic Press.
5. D. Heslop, M.J. Dekkers, 2002, Spectral analysis of unevenly spaced climatic time series using CLEAN: signal recovery and derivation of significance levels using a Monte Carlo simulation, Physics of the Earth and Planetary Interiors 130 (2002) 103–116
6. Foster Grant, 1996, Wavelets for period analysis of unevenly sampled time series, The astronomical journal, vol 112, no, 4.
7. BRANDON WHITCHER and PETER F. CRAIGMILE, MULTIVARIATE SPECTRAL ANALYSIS USING HILBERT WAVELET PAIRS, Int. J. Wavelets Multiresolut Inf. Process. 02, 567 (2004)
8. Brandon Whitcher, Peter F. Craigmile, Peter Brown, 2005, Time-varying spectral analysis in neurophysiological time series using Hilbert wavelet pairs, Signal Processing, Volume 85, Issue 11, November 2005, Pages 2065–2081
9. S. OLHEDE AND A. T. WALDEN, 2005, A generalized demodulation approach to time-frequency projections for multicomponent signals, Proc. R. Soc. A (2005) 461, 2159–2179.
10. Grinsted, A., Moore, J.C., Jevrejeva, S. (2004) Application of the cross wavelet transform and wavelet coherence to geophysical time series, Nonlin. Processes Geophys., 11, 561–566, doi:10.5194/npg-11-561-2004

8.4. Project [only if included in syllabus]	Guided practical activity	2-4 hours

9. Compatibility of the course unit contents with the expectations of the representatives of epistemic communities, professional associations and employers (in the field of the study program)

This course unit forms/develops theoretical and practical competences and abilities which are important for an undergraduate student in the field of modern Physics, corresponding to national and european/international standards. The contents and teaching methods were selected after a thorough analysis of the contents of similar

course units in the syllabus of other universities from Romania or the European Union. http://www.geo.uni-bremen.de/geomod/staff/mschulz/#research , University of Bremen https://www.ucl.ac.uk/statistics/people/sofiaolhede, University of London. The contents are in line with the requirements/expectations of the main employers of the graduates (Research Institutes of Earth Physics, Environmetal monitoring and meteorology national administrations, industry (mobile networks), education, etc).

10. Assessment

Activity type	10.1. Assessment criteria	10.2. Assessment methods	10.3. Weight in final mark
10.4. Lecture	- coherence and clarity of exposition - correct use of analysis methods and theories - ability to /analyse specific examples	oral examination	50%
10.5.2. Practicals	- ability to use specific methods of time series analysis on given examples - ability to present and discuss the results	Lab reports	50%
10.5.3. Project [only if included in syllabus]			
10.6. Minimal requirements for passing the exam Correct understanding of the main concepts and time series analysis methods, ability to use them and ability to obtain correct results on given particular examples			
Requirements for mark 5 (10 points scale) All practical activities must be finalized and mark 5 at lab reports Correct exposition of subjects for mark 5 at lecture oral examination			

Date
06.05.2016

Teacher's name and signature
Lect. Dr. Cristian Necula

Practicals instructor name and signature
Lect. Dr. Cristian Necula

Date of approval

Head of Department
Prof. univ. dr Alexandru JIPA

DFC 316 F.EN INSTRUIRE ASISTATĂ DE CALCULATOR

1. Date despre program

1.1 Instituţia de învăţământ superior	UNIVERSITATEA DIN BUCUREŞTI
1.2 Facultatea	PSIHOLOGIE ŞI ŞTIINȚELE EDUCAȚIEI
1.3 Departamentul	FORMARE A PROFESORILOR
1.4 Domeniul de studii	Formarea profesorilor
1.5 Ciclul de studii	Licenţă - Nivelul I (iniţial) de certificare pentru profesia didactică
1.6 Programul de studii/Calificarea	Profesor pentru învăţământul obligatoriu

2. Date despre disciplină

2.1 Denumirea disciplinei				**INSTRUIRE ASISTATĂ DE CALCULATOR**			
2.2 Titularul activităţilor de curs				Lect. univ. dr. Nicoleta DUȚĂ			
2.3 Titularul activităţilor de seminar				Lect. univ. dr. Nicoleta DUȚĂ			
2.4 Anul de studiu	III	2.5 Semestrul	I/II	2.6 Tipul de evaluare	Sumativă	2.7 Regimul disciplinei	Opțională

3. Timpul total estimat (ore pe semestru al activităţilor didactice)

3.1 Număr de ore pe săptămână	2	din care 3.2 curs	1	3.3 seminar/laborator	1
3.4 Total ore din planul de învăţământ din care	28	3.5 curs	14	3.6 seminar/laborator	14

Distribuţia fondului de timp	ore
Studiul după manual, suport de curs, bibliografie și notițe	15
Documentare suplimentară în bibliotecă, pe platformele electronice de specialitate si pe teren	24
Pregătire seminarii/laboratoare, teme, referate, portofolii și eseuri	15
Tutoriat	10
Examinări	8
Alte activităţi	

3.7 Total ore studiu individual	**72**
3.9 Total ore pe semestru	**100**
3. 10 Numărul de credite	**4**

4. Precondiţii (acolo unde este cazul)

4.1 de curriculum	Cunoștințe minimale din domeniile: Psihologia educaţiei Pedagogie I (Fundamentele pedagogiei; Teoria şi metodologia curriculum-ului) Pedagogie II (Teoria şi metodologia instruirii; Teoria şi metodologia evaluării) Didactica specialităţii
4.2 de competenţe	Cursanții vor deține abilități specifice alfabetizării digitale. Competența de utilizare a computerului este o precondiție a derulării eficiente a activității în sistem blended learning.

5. Condiţii (acolo unde este cazul)

5.1 de desfăşurare a cursului	Cursul se desfășoară în locații ale Facultăților din Universitatea din București care dispun de condiții materiale funcționale: sală de curs,

	dotată cu videoproiector şi software adecvat, conexiune Internet.
5.2 de desfăşurare a seminarului/laboratorului	Seminarul se desfășoară în locații ale Facultăților din Universitatea din București care dispun de condiții materiale eficiente: sală de seminar/laborator, dotată corespunzător: calculatoare, rețea, conectare la Internet.

6. Competenţe specifice acumulate

Competenţe profesionale	Formarea unei concepţii sistemice asupra instruirii asistate de calculator, a rolului instruirii asistate de calculator şi posibilităţile oferite pentru predarea disciplinei de specializare. Analiza modalităţilor specifice prin care instruirea asistată de calculator poate fi utilizată în diferite contexte educaţionale. Proiectarea activităţii didactice, utilizând ca mijloc de învăţământ tehnologia multimedia; utilizarea legităţilor procesului de învăţământ, ale didacticii generale la specificul instruirii asistate de calculator, în contextul disciplinei.
Competenţe transversale	Formarea şi dezvoltarea competenţelor de organizare a activităţilor de lucru individual şi în echipă; Dezvoltarea abilităţilor sociale şi de comunicare.

7. Obiectivele disciplinei (reieşind din grila de competenţe specifice acumulate)

7.1 Obiectivul general al disciplinei	Asimilarea noţiunilor fundamentale privind instruirea asistată de calculator, utilizând limbajul de specialitate..
7.2 Obiective specifice	- Formarea unui stil didactic creativ, interactiv, democratic, centrat pe educabil, utilizând posibilităţile oferite de instruirea asistată de calculator; - Utilizarea instruirii asistate de calculator în procesul educaţional, pentru realizarea obiectivelor şi conţinuturilor curriculare; - Asigurarea elevilor formării competenţelor prevăzute de programele curriculare ale disciplinei, utilizând instruirea asistată de calculator, în cadrul strategiei de formare; - Utilizarea mediilor virtuale de instruire pentru optimizarea unor activităţi didactice; - Proiectarea pedagogică a mediilor virtuale de instruire şi a softului educaţional; - Alegerea celor mai adecvate soluţii şi instrumente TIC pentru diverse tipuri de situaţii de învăţare; - Elaborarea unui proiect de unitate de învăţare în care să integreze elemente de TIC; - Utilizarea comunităţilor online de practică pentru activităţi colaborative; - Realizarea conexiunilor interdisciplinare necesare formării unei concepţii unitare în domeniul acţiunii pedagogice eficiente şi de calitate, în cadrul căreia se utilizează instruirea asistată de calculator.

8. Conţinuturi

8.1 Curs	Metode de predare	Observaţii
1. Introducere în Instruirea Asistată de Calculator- IAC (I) 1.1. Noțiuni, concepte utilizate în IAC 1.2. Conceptul de asistare a procesului de învățământ 1.3. Tehnologia în procesul de învățământ 1.4. Tehnologii informaționale și de comunicare	Prelegere, dezbatere, problematizare, conversația euristică, exemplificare	Prelegerile sunt axate pe utilizarea de suport power-point şi prezi dar și pe acces la resurse multimedia/ aplicații online.

2. Introducere în Instruirea Asistată de Calculator (II) 2.1. Utilizarea calculatorului în procesul de învățământ 2.2. Elevii în centrul propriei lor învățări şi tehnologii 2.3. Consecinţe pedagogice ale IAC	Prelegere, dezbatere, problematizare, conversația euristică, exemplificare	
3. Societatea bazată pe cunoaştere.	Prelegere, dezbatere, problematizare, conversația euristică, exemplificare	
4. Rolul *IAC* în dobândirea noilor competenţe cheie 4.1. Competenţe digitale. 4.2. Competenţele profesorilor în medii virtuale de instruire	Prelegere, dezbatere, problematizare, conversația euristică, exemplificare	
5. Programe de elearning. Medii virtuale de instruire în învăţământul superior şi pentru formare continuă	Prelegere, dezbatere, problematizare, conversația euristică, exemplificare	
6. Medii virtuale de instruire în învăţământul preuniversitar. Software educațional	Prelegere, dezbatere, problematizare, conversația euristică, exemplificare	
7. Folosirea TIC în procesul de predare-învăţare (I) 7.1. Proiectarea activităţii de predare cu ajutorul tehnologiei informatice şi comunicaţionale 7.2. Produse multimedia ale învăţării elevilor: afişe, prezentări, publicaţii, bloguri, wikis 7.3. Instrumente de comunicare prin Internet: e-mail, chat, mesaje instant (IM)	Prelegere, dezbatere, problematizare, conversația euristică, exemplificare	
8. Folosirea TIC în procesul de predare-învăţare (II) 8.1. Planificarea evaluării 8.2. Cum evaluăm produsele multimedia? 8.3. Cum evaluăm procesele? 8.4. Cum evaluăm performanţele practice?	Prelegere, dezbatere, problematizare, conversația euristică, exemplificare	
9. Utilizarea noilor tehnologii în procesul didactic. 9.1. Perspectiva constructivistă. 9.2. Integrarea în curriculum a componentei de IAC. 9.3. Învăţarea bazată pe proiect. 9.4. Învățarea în situații nonformale.	Prelegere, dezbatere, problematizare, conversația euristică, exemplificare	
10. Proiectarea softului educaţional 10.1. Analizarea unui soft educațional 10.2. Aprecierea şi folosirea unui soft educaţional	Prelegere, dezbatere, problematizare, conversația euristică, exemplificare	
11. Resurse și aplicații online (I)	Prelegere, dezbatere,	

11.1. Instrumente pentru cooperare şi proiecte educaţionale collaborative 11.2. Instrumente de comunicare şi colaborare 11.3. Instrumente pentru imagini	problematizare, conversaţia euristică, exemplificare	
12. Resurse şi aplicaţii online (II) 12.1. Teste, chestionare şi instrumente ludice 12.2. Instrumente pentru creare de pagini web şi publicare online 12.3. Instrumente pentru planificare, brainstorming	Prelegere, dezbatere, problematizare, conversaţia euristică, exemplificare	
13. Resurse şi aplicaţii online (III) 13.1. Instrumente pentru editare video şi animaţie 13.2. Platforme educaţionale colaborative	Prelegere, dezbatere, problematizare, conversaţia euristică, exemplificare	
14. Evaluarea cu ajutorul TIC. 14.1. Evaluarea produselor multimedia 14.2. Evaluarea cunoştinţelor şi competenţelor, utilizând noile tehnologii	Prelegere, dezbatere, problematizare, conversaţia euristică, exemplificare	

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evaluare 2004. Disponibil online: http://www.tehne.ro/resurse/TEHNE_Impact_formativ_AEL_2005.pdf		
8.2 Seminar	Metode de predare	Observaţii
1. Aplicaţii IAC. Softul educaţional	Aplicație, exemplificare, dezbatere, problematizare, conversația euristică, Lucrul în echipă, metoda mozaicului, instrumente şi medii colaborative online	
2. Programe specifice Instruirii Asistate de Calculator (I) 2.1. Tutorialele 2.2. Exerciţiile Practice	Aplicație, brainstorming, metoda pălăriilor gânditoare, cercetare, Internet	
3. Programe specifice Instruirii Asistate de Calculator (I) 3.1. Simulările 3.2. Jocurile Educative 3.3. Testele	Aplicație: Analiză de site, studiu de caz, dezbatere, problematizare, conversația euristică	
4. Proiectarea situaţiilor educative cu utilizare TIC (I) 4.1. Aplicații practice 1 – integrarea unui soft educațional în lecție 4.2. Aplicații practice 2 – prezentările PREZI, Power Point şi Slideshare; Cum realizam o prezentare prezi ?	Aplicații, dezbatere, brainstorming, problematizare, conversația euristică	
5. Proiectarea situaţiilor educative cu utilizare TIC (II) 5.1. Aplicații practice 3 – Prezi Pas cu Pas 5.2. Prezi în sala de clasă: Elevi/studentii lucrând cu Prezi. Aplicații	Aplicație: Analiză de site, analiză de conținut, studiu de caz, dezbatere, problematizare, conversația euristică	
6. Proiectarea situaţiilor educative cu utilizare TIC (III) 6.1. Aplicații practice 4 – utilizarea unei aplicații online la alegere 6.2. Aplicații practice 5– evaluare intermediară/ interevaluare	Aplicații, dezbatere, brainstorming, problematizare, conversația euristică	
7. Instrumente de colaborare prin Internet: blog, wiki, google docs	Aplicație: Analiză de site, analiză de conținut, studiu de caz, dezbatere, problematizare, conversația euristică	
8. Platforme educationale colaborative: 8.1. eTwinning 8.2. iTeach	Aplicație: Analiză de site, analiză de conținut, studiu de caz, dezbatere, problematizare, conversația euristică	
9. Platforme educaţionale 9.1. PLONE şi 9.2. MOODLE	Aplicație: Analiză de site, analiză de conținut, studiu de caz, dezbatere, problematizare, conversația euristică	

10. Instrumente pentru cooperare şi proiecte educaţionale colaborative - Google Docs - Wikispaces - Wallwisher/ Padlet - Glogster, Wordle si Voki	Aplicație: Analiză de site, analiză de conținut, studiu de caz, dezbatere, problematizare, conversația euristică	
11. Instrumente pentru comunicare (Skype, Google Groups)	Aplicație: Analiză de site, analiză de conținut, studiu de caz, dezbatere, problematizare, conversația euristică	
12. Instrumente pentru imagini (Slide Picnik, Picasa, Fotobabble)	Aplicații: Analiză de site, analiză de conținut, studiu de caz, dezbatere, problematizare, conversația euristică	
13. Instrumente pentru planificare, brainstorming (Bubble.us, Slideshare, Prezi)	Aplicații Lucrul în echipă dezbatere, problematizare, conversația euristică	
14. Instrumente pentru editare video şi animaţie (Teachertube, Windows Moviemaker, Xtranormal)	Aplicații, lucrul în echipă, dezbatere, problematizare, conversația euristică, brainstorming	

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***** Digital Game Based Learning Types ~ Educational Technology and Mobile Learning**

http://www.powtoon.com/, www.elearning.ro

https://www.youtube.com/watch?v=vjDLVQKNw1g

https://www.youtube.com/watch?v=D8Ho-NV2V9A

***A Good Chart on Traditional Classroom Game Play Vs Game-based Learning ~ Educational Technology and Mobile Learning

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Prezi Pas cu Pas: http://www.youtube.com/watch?v=MAloWJiCQ-o

Tutorial Prezi http://www.youtube.com/watch?v=bMHBNa5KGJ0

Intro Oficial Prezi- motive pentru care Prezi este un instrument mai bun decat PowerPoint http://www.youtube.com/watch?v=pxhqD0hNx4Q&feature=related

Prezi în sala de clasă: Elevi lucrând cu Prezi http://www.youtube.com/watch?v=TK6gbn9Bx80&feature=player_embedded

9. Coroborarea conţinuturilor disciplinei cu asteptările reprezentanţilor comunităţii epistemice, asociaţiilor profesionale si angajatori reprezentativi din domeniul aferent programului

Prin intermediul conținuturilor abordate la cursuri și seminarii, disciplina răspunde nevoii de profesionalizare a profesorilor în unul dintre cele mai recente și de interes domenii de competență în societatea cunoașterii – IAC, tehnologii informaționale și de comunicare; asimilarea conținuturilor constituie o condiție necesară pentru formarea, în etapele următoare, a competenței digitale a viitoarelor cadre didactice.

10. Evaluare

Tip activitate	10.1 Criterii de evaluare	10.2 Metode de evaluare	10.3 Pondere în nota finală
10.4 Curs	- demonstrarea cunoașterii conceptelor şi teoriilor cu care operează disciplina; - capacitatea de motivare argumentată a alegerii unor soluţii şi instrumente TIC adecvate pentru o situaţie educativă dată; - capacitatea de analiză critică a iniţiativelor, proiectelor şi programelor de elearning/; - utilizarea mediilor colaborative online pentru dezvoltare profesională continuă; - promovarea aspectelor privind mediile virtuale cu valoare adăugată pentru teoria şi practica instruirii.	Evaluarea sumativă de progres pe bază de elaborare a unei sarcini de învățare în curriculumul disciplinei de specializare, în rezolvarea căreia elevii utilizează noile tehnologii (resurse și aplicații online învățate) – descrierea manierei posibile de lucru și (2) elaborarea unui suport vizual pe o temă din domeniul de specialitate în Prezi sau Power Point	70%
10.5 Seminar	- participarea activă la aplicații, dezbateri și exerciții; - feedback şi discuţii pe marginea proiectului elaborat.	Evaluare formativă de progres	30%
10.6 Standard minim de performanţă			
Elaborarea unei sarcini de învățare în curriculumul disciplinei de specializare, în rezolvarea căreia elevii utilizează noile tehnologii – descrierea manierei posibile de lucru sau elaborarea unui suport vizual pe o temă din domeniul de specialitate în Prezi sau Power Point, respectând exigențele impuse de domeniu. Standardul va fi considerat atins dacă va fi determinată eficacitatea generală a instruirii (toți cursanții vor realiza în proporție de 70% cerințele formulate).			

Data completării aplicaţii — Semnătura titularului de curs — Semnătura titularului de

Lect. univ. dr. Nicoleta DUȚĂ — Lect. univ. dr. Nicoleta DUȚĂ

Data avizării în catedră

.....

Semnătura șefului de departament,

Prof. univ. dr. Ion-Ovidiu PÂNIȘOARĂ

DFC 317 F.EN PRACTICĂ PEDAGOGICĂ I

1. Date despre program

1.1 Instituţia de învăţământ superior	UNIVERSITATEA DIN BUCUREŞTI
1.2 Facultatea	Facultatea de Fizică
1.3 Departamentul	Structura materiei, Fizica atmosferei şi a pământului, Astrofizică
1.4 Domeniul de studii	Formarea profesorilor
1.5 Ciclul de studii	Nivelul I (Licenţă)
1.6 Programul de studii/Calificarea	Profesor de cultură civică pentru ciclul gimnazial

2. Date despre disciplină

2.1 Denumirea disciplinei				**Practică Pedagogică I** *(obligatoriu*)			
2.2 Titularul activităţilor de curs				Lect. univ. dr. Cristina MIRON			
2.3 Titularul activităţilor de seminar				Lect. univ. dr. Cristina MIRON			
2.4 Anul de studiu	III	2.5 Semestrul	I	2.6 Tipul de evaluare	Colocviul	2.7 Regimul disciplinei	Opțional

3. Timpul total estimat (ore pe semestru al activităţilor didactice)

3.1 Număr de ore pe săptămână din care	3	3.2 curs	-	3.3 seminar/laborator	3
3.4 Total ore din planul de învăţământ din care	42	3.5 curs	-	3.6 seminar/laborator	42
Distribuţia fondului de timp					ore
Studiul după manual, suport de curs, bibliografie și notițe					5
Documentare suplimentară în bibliotecă, pe platformele electronice de specialitate si pe teren					5
Pregătire seminarii/laboratoare, teme, referate, portofolii și eseuri					16
Tutoriat					5
Examinări					5
Alte activităţi					5

3.7 Total ore studiu individual	41
3.9 Total ore pe semestru	125
3. 10 Numărul de credite	5

4. Precondiţii (acolo unde este cazul)

4.1 de curriculum	- Nu există
4.2 de competenţe	- Nu există

5. Condiţii (acolo unde este cazul)

5.1 de desfăşurare a cursului	Activităţile seminariale se desfășoară la școlile pilot arondate ISMB care asigură toate condițiile materiale (spațiu și utilități).
5.2 de desfăşurare a seminarului/laborato	Activităţile de mentorat, lecțiile model, simulările și celelalte activități practice se desfășoară la sediul școlilor cu care Facultatea de Fizică prin

rului	Universitatea din București a încheiat contracte de colaborare pe durată determinată cu ISMB. Laboratoarele de specialitate și sălile de clase satisfac condiţiile desfășurării activităţilor practice.

6. Competenţe specifice acumulate

Competenţe profesionale	**1. Cunoaştere şi înţelegere** *(cunoaşterea şi utilizarea adecvata a noţiunilor specifice disciplinei)* ▪ Cunoașterea și utilizarea adecvată a noțiunilor însușite anterior ▪ Cunoașterea unor metode de instruire activ – participative și de intercomunicare, precum și a formelor și metodelor de evaluare ▪ Cunoasterea și utilizarea adecvată a metodelor de cunoaștere a elevului ▪ Cunoasterea structurii fișei de caracterizare psihopedagogică Cunoașterea curriculumului învățământului gimnazial **2. Explicare şi interpretare** *(explicarea si interpretarea unor idei, proiecte, procese, precum şi a conţinuturilor teoretice si practice ale disciplinei)* ▪ Explicarea și interpretarea procesualității formării noțiunilor operațiilor psihice, atitudinilor și sentimentelor la elevii de vârstă gimnazială ▪ Explicarea si interpretarea demersurilor didactice intreprinse de cadrele didacticein cadrul scenariilor teoretice Explicarea și interpretarea demersurilor didactice întreprinse de profesorul mentor în cadrul lecțiilor asistate **3. Instrumental – aplicative** *(proiectarea, conducerea si evaluarea activităţilor practice specifice; utilizarea unor metode, tehnici si instrumente de investigare si de aplicare)* ▪ Utilizarea metodelor de cunoaștere a elevului ▪ Elaborarea fișei de caracterizare psihopedagogică a elevilor Aplicarea cunoștințelor teoretice în elaborarea unor variante de strategii didactice în predarea unei activități didactice la Fizică **4. Atitudinale** *(manifestarea unei atitudini pozitive si responsabile fata de domeniul ştiinţific / cultivarea unui mediu ştiinţific centrat pe valori si relaţii democratice / promovarea unui sistem de valori culturale, morale şi civice / valorificarea optima si creativa a propriului potenţial în activităţile ştiinţifice / implicarea în dezvoltarea instituţională şi în promovarea inovaţiilor ştiinţifice / angajarea in relaţii de parteneriat cu alte persoane - instituţii cu responsabilităţi similare / participarea la propria dezvoltare profesionala)* ▪ Formarea unei atitudini pozitive față de cariera didactică și față de elevi ▪ Participarea activa la propria dezvoltare profesională
Competenţe transversale	Absolvenții vor fi capabili: - să rezolve probleme practice aplicând (în activitățile didactice) transdisciplinar-achizițiile anterioare; - să evalueze portretul psihopedagogic al subiecților observați; - să aplice personalizat principiile generale necesare soluționării diverselor situații de învățare.

7. Obiectivele disciplinei (reieşind din grila de competenţe specifice acumulate)

7.1 Obiectivul general al disciplinei	Inițierea studenților în problememele practice ale predării potrivit curriculumului educațional înțeles în calitatea sa de ”high culture”.
4.2 Obiective specifice	Aplicarea practică a conceptelor, principiilor, teoriilor și modelelor de bază ale disciplinelor parcurse anterior în cadrul modului psiho-pedagogic .

8. Conţinuturi

8.1 Seminar	Metode de predare	Observaţii
1. Statutul și competențele cadrului didactic	Dezbaterea + jocul de rol	
2. Observația ca metoda de cunoaștere a personalității și a realității sociale: Obiectul observarii. Tipuri si forme de observatie. Cerinte ale observatiei.Elaborarea si utilizarea protocolului de observatie.	Observarea + protocolul de observație + grile de observare	
3. Analiza produselor școlare (plan de învățământ, programă școlară, planificarea calendaristică a obiectului de studiu, manual școlar, orarul școlar, etc.)	Dezbaterea + problematizarea + demonstrația	
4.Structura fișei de caracterizare psihopedagogică	Rezolvarea de probleme	
5. Curriculumul învățământului gimnazial	Exegeză critică + tehncici de gîndire critică	
6. Lecția. Tipologie, condiții, analiza sarcinilor de învățare	Exercițiul + Demonstrația	
7. Formate standardizate ale lecției	Exercițiul + studiul de caz	
8. Analiza critică a proiectului de lecție	Studiul de caz + proiectul de grup	
9. Alternative la lecția tradițională	Proiectul	
10. Structura și dinamica unei clase de elevi	Proiectul individual și de grup	
11. Mijloace și materiale didactice	Studiul de caz + Demonstrația	
12. Simulări ale lecției	Proiectul	
13. Activități practice: predarea lecțiilor, realizarea unor activități de consiliere a elevilor, participarea la întrunirile cu părinții elevilor etc.	Proiectul + team teaching + studiul de caz	
14. Analiza finală a demersurilor de observare și predare. Întocmirea ”Raportului de Practică Pedagogică” și definitivarea portofoliului necesar evaluării	Portofoliul + simulare didactică	
Curs		
-	-	

9. Coroborarea conţinuturilor disciplinei cu aşteptările reprezentanţilor comunităţii epistemice, asociaţiilor profesionale si angajatori reprezentativi din domeniul aferent programului

Conținuturile abordate la seminarii vizează formarea abilităților practice ale studenților de a concepe și soluționa diverse situații de instruire, esențiale pentru abordarea practică a problematicii științelor educației. De asemenea, prioritatea o constituie exersarea la viitorii profesori a capacității

de rezolvare de probleme, în convergență cu piața muncii.

10. Evaluare

Tip activitate	10.1 Criterii de evaluare	10.2 Metode de evaluare	10.3 Pondere în nota finală
10.4 Curs	-		
	-		
	-		
10.5 Seminar	- activități de observare potrivit temelor prevăzute în planificare,	Evaluare formativă	30%
	-simularea unor activități didactice, -întocmirea ”Fișei de caracterizare psiho-pedagogică” a elevului, -activități de predare (lecții de probă + lecția finală)		70%
10.6 Standard minim de performanţă			
Efectuarea completă a stagiului de ”Practică Pedagogică” și acumularea a cel puțin 60% din punctajul obținut prin cele două tipuri de evaluare practicat la seminarii.			

Data completării Semnătura titularului de curs Semnătura titularului de aplicaţii
Lect. univ. dr. Cristina MIRON Lect. univ. dr. Cristina MIRON

Data avizării în catedră Semnătura sefului de departament
Prof. univ. dr. Alexandru JIPA

.....

DFC 318 F.EN PRACTICĂ PEDAGOGICĂ

1. Date despre program

1.1 Instituţia de învăţământ superior	UNIVERSITATEA DIN BUCUREȘTI
1.2 Facultatea	Facultatea de Fizică
1.3 Departamentul	Structura materiei, Fizica atmosferei şi a pământului, Astrofizică
1.4 Domeniul de studii	Formarea profesorilor
1.5 Ciclul de studii	Nivelul I (Licenţă)
1.6 Programul de studii/Calificarea	Profesor de cultură civică pentru ciclul gimnazial

2. Date despre disciplină

2.1 Denumirea disciplinei				**Practică Pedagogică** *(obligatoriu*)			
2.2 Titularul activităţilor de curs				Lect. univ. dr. Cristina MIRON			
2.3 Titularul activităţilor de seminar				Lect. univ. dr. Cristina MIRON			
2.4 Anul de studiu	III	2.5 Semestrul	II	2.6 Tipul de evaluare	Colocviul	2.7 Regimul disciplinei	Opțional

3. Timpul total estimat (ore pe semestru al activităţilor didactice)

3.1 Număr de ore pe săptămână din care	3	3.2 curs	-	3.3 seminar/laborator	3
3.4 Total ore din planul de învăţământ din care	42	3.5 curs	-	3.6 seminar/laborator	42

Distribuţia fondului de timp	ore
Studiul după manual, suport de curs, bibliografie și notițe	5
Documentare suplimentară în bibliotecă, pe platformele electronice de specialitate si pe teren	5
Pregătire seminarii/laboratoare, teme, referate, portofolii și eseuri	16
Tutoriat	5
Examinări	5
Alte activităţi	5

3.7 Total ore studiu individual	41
3.9 Total ore pe semestru	125
3. 10 Numărul de credite	5

4. Precondiţii (acolo unde este cazul)

4.1 de curriculum	- Nu există
4.2 de competenţe	- Nu există

5. Condiţii (acolo unde este cazul)

5.1 de desfăşurare a cursului	Activitățile seminariale se desfășoară la școlile pilot arondate ISMB care asigură toate condițiile materiale (spațiu și utilități).

5.2 de desfăşurare a seminarului/laboratorului	Activitățile de mentorat, lecțiile model, simulările și celelalte activități practice se desfășoară la sediul școlilor cu care Facultatea de Fizică prin Universitatea din Bucureşti a încheiat contracte de colaborare pe durată determinată cu ISMB. Laboratoarele de specialitate și sălile de clase satisfac condiţiile desfăşurării activităţilor practice.

6. Competenţe specifice acumulate

Competenţe profesionale	**1. Cunoaştere şi înţelegere** *(cunoaşterea şi utilizarea adecvata a noţiunilor specifice disciplinei)* ▪ Cunoașterea și utilizarea adecvată a noțiunilor însușite anterior ▪ Cunoașterea unor metode de instruire activ – participative și de intercomunicare, precum și a formelor și metodelor de evaluare ▪ Cunoasterea și utilizarea adecvată a metodelor de cunoaștere a elevului ▪ Cunoasterea structurii fișei de caracterizare psihopedagogică Cunoașterea curriculumului învățământului gimnazial **2. Explicare şi interpretare** *(explicarea si interpretarea unor idei, proiecte, procese, precum şi a conţinuturilor teoretice si practice ale disciplinei)* ▪ Explicarea și interpretarea procesualității formării noțiunilor operațiilor psihice, atitudinilor și sentimentelor la elevii de vârstă gimnazială ▪ Explicarea si interpretarea demersurilor didactice intreprinse de cadrele didacticein cadrul scenariilor teoretice Explicarea și interpretarea demersurilor didactice întreprinse de profesorul mentor în cadrul lecțiilor asistate **3. Instrumental – aplicative** *(proiectarea, conducerea si evaluarea activităţilor practice specifice; utilizarea unor metode, tehnici si instrumente de investigare si de aplicare)* ▪ Utilizarea metodelor de cunoaștere a elevului ▪ Elaborarea fișei de caracterizare psihopedagogică a elevilor Aplicarea cunoștințelor teoretice în elaborarea unor variante de strategii didactice în predarea unei activități didactice la Fizică **4. Atitudinale** *(manifestarea unei atitudini pozitive si responsabile fata de domeniul ştiinţific / cultivarea unui mediu ştiinţific centrat pe valori si relaţii democratice / promovarea unui sistem de valori culturale, morale şi civice / valorificarea optima si creativa a propriului potenţial în activităţile ştiinţifice / implicarea în dezvoltarea instituţională şi în promovarea inovaţiilor ştiinţifice / angajarea in relaţii de parteneriat cu alte persoane - instituţii cu responsabilităţi similare / participarea la propria dezvoltare profesionala)* ▪ Formarea unei atitudini pozitive față de cariera didactică și față de elevi ▪ Participarea activa la propria dezvoltare profesională
Competenţe transversale	Absolvenții vor fi capabili: - să rezolve probleme practice aplicând (în activitățile didactice) transdisciplinar-achizițiile anterioare; - să evalueze portretul psihopedagogic al subiecților observați; - să aplice personalizat principiile generale necesare soluționării diverselor situații de învățare.

7. Obiectivele disciplinei (reieşind din grila de competenţe specifice acumulate)

7.1 Obiectivul general al disciplinei	Inițierea studenților în problememele practice ale predării potrivit curriculumului educațional înțeles în calitatea sa de ”high culture”.
4.2 Obiective specifice	Aplicarea practică a conceptelor, principiilor, teoriilor și modelelor de bază ale disciplinelor parcurse anterior în cadrul modulului psiho-pedagogic .

8. Conţinuturi

8.1 Seminar	Metode de predare	Observaţii
3. Statutul și competențele cadrului didactic	Dezbaterea + jocul de rol	
4. Observația ca metoda de cunoaștere a personalității și a realității sociale: Obiectul observarii. Tipuri si forme de observatie. Cerinte ale observatiei.Elaborarea si utilizarea protocolului de observatie.	Observarea + protocolul de observație + grile de observare	
4. Analiza produselor școlare (plan de învățământ, programă școlară, planificarea calendaristică a obiectului de studiu, manual școlar, orarul școlar, etc.)	Dezbaterea + problematizarea + demonstrația	
4.Structura fișei de caracterizare psihopedagogică	Rezolvarea de probleme	
5. Curriculumul învățământului gimnazial	Exegeză critică + tehncici de gîndire critică	
6. Lecția. Tipologie, condiții, analiza sarcinilor de învățare	Exercițiul + Demonstrația	
7. Formate standardizate ale lecției	Exercițiul + studiul de caz	
8. Analiza critică a proiectului de lecție	Studiul de caz + proiectul de grup	
9. Alternative la lecția tradițională	Proiectul	
10. Structura și dinamica unei clase de elevi	Proiectul individual și de grup	
11. Mijloace și materiale didactice	Studiul de caz + Demonstrația	
12. Simulări ale lecției	Proiectul	
13. Activităţi practice: predarea lecţiilor, realizarea unor activităţi de consiliere a elevilor, participarea la întrunirile cu părinţii elevilor etc.	Proiectul + team teaching + studiul de caz	
14. Analiza finală a demersurilor de observare și predare. Întocmirea ”Raportului de Practică Pedagogică” și definitivarea portofoliului necesar evaluării	Portofoliul + simulare didactică	
Curs		

9. Coroborarea conţinuturilor disciplinei cu aşteptările reprezentanţilor comunităţii epistemice, asociaţiilor profesionale si angajatori reprezentativi din domeniul aferent

programului

Conținuturile abordate la seminarii vizează formarea abilităților practice ale studenților de a concepe și soluționa diverse situații de instruire, esențiale pentru abordarea practică a problematicii științelor educației. De asemenea, prioritatea o constituie exersarea la viitorii profesori a capacității de rezolvare de probleme, în convergență cu piața muncii.

10. Evaluare

Tip activitate	10.1 Criterii de evaluare	10.2 Metode de evaluare	10.3 Pondere în nota finală
10.4 Curs	-		
	-		
	-		
10.5 Seminar	- activități de observare potrivit temelor prevăzute în planificare,	Evaluare formativă	30%
	-simularea unor activități didactice, -întocmirea ”Fișei de caracterizare psiho-pedagogică” a elevului, -activităţi de predare (lecţii de probă + lecţia finală)		70%
10.6 Standard minim de performanţă			
Efectuarea completă a stagiului de ”Practică Pedagogică” și acumularea a cel puțin 60% din punctajul obținut prin cele două tipuri de evaluare practicat la seminarii.			

Data completării Semnătura titularului de curs Semnătura titularului de aplicaţii
Lect. univ. dr. Cristina MIRON Lect. univ. dr. Cristina MIRON

Data avizării în catedră Semnătura sefului de departament
Prof. univ. dr. Alexandru JIPA

.....

DFC 319 F.EN MANAGEMENTUL CLASEI DE ELEVI

1. Date despre program

1.1 Instituţia de învăţământ superior	UNIVERSITATEA din Bucureşti
1.2 Facultatea/Departamentul	Psihologie şi Ştiinţe ale Educaţiei
1.3 Departamentul	D.F.P.
1.4 Domeniul de studii	ŞTIINŢE ALE EDUCAŢIEI
1.5 Ciclul de studii	LICENŢĂ / POSTUNIVERSITAR
1.6 Programul de studii/Calificarea	PROGRAMUL DE FORMARE PSIHOPEDAGOGICĂ/Profesor pentru învăţământ /gimnazial

2.Date despre disciplină

2.1 Denumirea disciplinei				MANAGEMENTUL CLASEI DE ELEVI			
2.2 Titularul activităţilor de curs				Lector Diana MELNIC			
2.3 Titularul activităţilor de seminar				Lector Diana MELNIC			
2.4 Anul de studiu	III	2.5 Semestrul	VI	2.6 Tipul de evaluare	E	2.7 Regimul disciplinei	Ob.

3.Timpul total estimat (ore pe semestru al activităţilor didactice)

3.1 Număr de ore pe săptămână	2	din care: 3.2 curs	1	3.3 seminar/laborator	1
3.4 Total ore din planul de învăţământ	28	din care: 3.5 curs	14	3.6 seminar/laborator	14
Distribuţia fondului de timp					ore
Studiul după manual, suport de curs, bibliografie şi notiţe					15
Documentare suplimentară în bibliotecă, pe platformele electronice de specialitate şi pe teren					18
Pregătire seminarii/laboratoare, teme, referate, portofolii şi eseuri					10
Tutoriat					2
Examinări					2
Alte activităţi					0
3.7 Total ore studiu individual					47
3.9 Total ore pe semestru					75
3.10 Numărul de credite					3

4.Precondiţii (acolo unde este cazul)

4.1 de curriculum	Psihologia educaţiei, Fundamentele pedagogiei, Teoria şi metodologia curriculumului, Teoria şi metodologia instruirii, Teoria şi metodologia evaluării, Didactica specialităţii, Practica pedagogică (1)

4.2 de competenţe	Competenţe specifice disciplinelor menţionate

5.Condiţii (acolo unde este cazul)

5.1 de desfăşurare a cursului	Sală de curs dotată cu: ✓ Videoproiector ✓ Tablă/flipchart ✓ Materiale pe suport CD/DVD sau fotocopiate
5.2 de desfăşurare a seminarului/laboratorului	Sală de seminar dotată cu: ✓ Videoproiector ✓ Tablă/flip-chart ✓ Fişe de lucru ✓ Materiale pe suport CD/DVD sau fotocopiate

6.Competenţe specifice acumulate

Competenţe profesionale	C 5. Cunoaşterea, consilierea şi tratarea diferenţiată a elevilor C 6. Managementul grupului educațional ca model de abordare globală, strategică, invatoare, la nivel contextual şi în cadrul activităților specifice (didactice, educative)
Competenţe transversale	CT2. Cooperarea eficientă în echipe profesionale, interdisciplinare, specifice derulării proiectelor şi programelor din domeniul educaţiei

7.Obiectivele disciplinei (reieşind din grila competenţelor specifice acumulate)

7.1 Obiectivul general al disciplinei	➢ Formarea-dezvoltarea unor competenţe cognitive, funcţionale în contextul specific profesiei didactice în perspectiva valorificării resurselor clasei de elevi la nivel contextual şi în cadrul activităților specifice (instruire, educație, orientare, consiliere etc.)
7.2 Obiectivele specifice	➢ formarea-dezvoltarea capacităților de cunoaştere, înţelegere şi utilizare corectă a terminologiei specifice managementului clasei de elevi; ➢ înţelegerea şi interpretarea rolului cadrului didactic ca manager al, clasei ca grup social special şi al procesului de educație / instruire realizat prin activităţi specifice; ➢ formarea-dezvoltarea capacității de identificare şi interpretare a unor soluţii care vizează eficientizarea conducerii clasei de elevi, asigurarea condiţiilor de activizare şi autoconducere a elevilor; ➢ formarea-dezvoltarea capacității de explicare şi interpretare a unor teorii, principii, procese manageriale, precum şi a conţinuturilor teoretice şi practice specifice managementului clasei de elevi; ➢ analiza şi aplicarea teoriei managementului în rezolvarea situaţiilor de criză educațională şi a problemelor de organizare a resurselor planificare și coordonare a activităților specifice, evaluare, decizie, decizie, cu scop de reglare-autoreglare la nivelul clasei de elevi; ➢ identificarea și analiza conduitelor/stilurilor manageriale eficiente; ➢ valorificarea capacităţilor cognitive, empatice, decizionale şi de comunicare implicate în actul managerial, la nivelul clasei;

	➢ formarea-dezvoltarea atitudinii pozitive faţă de profesia didactică eficientă în context managerial; ➢ formarea-dezvotlarea unei conduite didactice eficiente în contextul activităților și situațiilor specifice clasei de elevi.

8.Conţinuturi

8.1 Curs	**Metode de predare**	**Observaţii**
1. *Statutul epistemologic al disciplinei Managementul clasei de elevi* 1.1. Managmenetul clasei în sistemul științelor educației. Știință a educației cu caracter aplicatiiv, construită metodologic interdisciplinar 1.2. Obiect de cercetare specific: clasa de elevi ca grup social, context educațional, cadru de realizare a unor activități specifice 1.3. Metodologie de cercetare, de tip interdisciplinar și intradisciplinar 1.3. Normativitate specifică în calitate de model de conducere eficientă. Principii d eproeictare / de realizare	Prelegerea-dezbatere, reflecţia personală	
2. Managmentul clasei de elevi ca model de conducere 2.1.Sfera de referință, perspective de abordare (context, tip de grup social, activități proeictate și realizate) 2.2. Conducerea managerială a clasei de elevi: eficientă, globală, optimă, strategică, inovatoare 2.3. Analliza comparativă conducerea managerială – conducerea biorcatică 2.4. Motivația naturală a învățării și tehnicile artificiale de motivare a învățării școlare	prelegerea-dezbatere, brainstorming-ul metode şi tehnici de învăţare prin cooperare, reflecţia personală şi de grup	
3. *Managementul clasei de elevi ca grup social* 3.1.Tipuri de relații interpersonale în clasa de elevi 3.2. Parteneriatul educațional 3.3. Sintalitatea ccolecivului. Fișa de caracterizare a clasei	prelegerea-dezbatere, brainstorming-ul metode şi tehnici de învăţare prin cooperare, reflecţia personală şi de grup	
4. *Dimensiunile structurale ale clasei elevi la nivel contextual* 4.1. Dimensiunea ergonomică 4.2 Dimensiunea psihologica 4.3. Dimensiunea socială 4.4 Dimensiunea pedagogică 4.5 Variabile contextula cu caracter obiectiv (spațiul și timpul pedagogic, anumite forme de organizzare) subiectiv (formele de organizare inițiate de rofesor, stilurile manageriale)	prelegerea-dezbatere, brainstorming-ul, exerciţiul, reflecţia personală şi de grup, metode şi tehnici de învăţare prin cooperare, jocul de rol	
5. *Managementul activităților didactice în contextul clasei de elevi* 5.1 Organizarea resurselor pedagogice	prelegerea-dezbatere, studiul de caz, brainstorming-ul, exerciţiul,	

5.2 Planificarea activităţii de referinţă 5.2 Implementarea planificării în context deschis	metode şi tehnici de învăţare prin cooperare, reflecţia personală şi de grup	
6. *Un model managerial de conducere a activităţii idactice în cadrul clasei de elevi* 6.1. Organizarea adminsitrativă – organizarea pedagogică (forme tip, variante) 6.2. Planificarea (scop general, operaţionalizabil, conţinuturi de bază, metode, evaluare 6.3. Implementarea planificării în context deschis. Optimzarea raporturilor dintre acţiunile necesare (evaluare iniţială – predare-învăţare-evaluare continuă – evaluare finală) şi resursele existente (informaţionale, umane, spaţiotemporale, didactico-materiale	prelegerea-dezbatere, problematizarea, studiul de caz, brainstorming-ul, reflecţia personală şi de grup	
7. Conducerea managerială a clasei de elevi realizată de profesorul-diriginte 7.1. Specificul activităţilor educative organizate la nivelul clasei de elevi, formal (ora de dirigenţie), nonformal (activităţi în afara programelor şcoalre, în clasă şi în afara clasei, în şcoală şi în afara şcolii 7.2. Modele de proiectare a activităşilor educative de tip formal şi nonformal	prelegerea-dezbatere, studiul de caz, brainstorming-ul, exerciţiul, metode şi tehnici de învăţare prin cooperare, jocul de rol, reflecţia personală şi de grup	
7.3 Prevenirea şi r*ezolvarea situaţiile de criză educaţională în contextul clasei de elevi* 7.3.1. Caracterizarea situaţiilor de criză educaţională 7.3. 2. Gestionarea situaţiilor de criză educaţională 7.3.3. Strategii de intervenţie în în situaţiile de criză educaţională:	prelegerea-dezbatere, studiul de caz, brainstorming-ul, metode şi tehnici de învăţare prin cooperare, reflecţia personală şi de grup	

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33. Vlasceanu, Mihaela, *Psihosociologia educatiei si invatamantului*, Ed. Paideia, Bucuresti, 1993.

8.2 Seminar/laborator	**Metode de predare**	**Observaţii**
1.Problematica mangementului clasei de elevi	discuţie colectivă, problematizare, lucrul pe grupe	
2.Perspective de abordare a clasei de elevi: didactica si psihosociala; Clasa ca micro-grup psihosocial Condiţii de asigurare a disciplinei la nivelul colectivului de elevi	brainstorming, discuţie colectivă, problematizare, lucrul pe grupe	Prezentare şi analiză proiecte tematice,postere
3.Tipuri de relaţii interpersonale în clasa de elevi Parteneriatul educațional. Roluri ale partenerilor	discuţie colectivă, problematizare, lucrul pe grupe, studiul de caz	Prezentare şi analiză proiecte tematice, postere
4.Educatorul manager – promotor al schimbării în şcoala românească. Rolurile manageriale ale cadrului didactic Activitatile manageriale ale cadrului didactic: planificarea, organizarea,controlul si indrumarea,evaluarea si reglarea,decizia, consilierea	brainstorming-ul, discuţie colectivă, problematizare, lucrul pe grupe, studiul de caz	Prezentare şi analiză proiecte tematice, postere
5.Comunicarea interpersonala:verbala, nonverbala si paraverbala in clasa de elevi. Comunicarea eficientă in contextul clasei de elevi. Bariere/blocaje in comunicare. Modalităţi de prevenire şi combatere	discuţie colectivă, problematizare, lucrul pe grupe, studiul de caz	Prezentare şi analiză proiecte tematice, postere

6.Exemple de bune practici în managementul clasei de elevi vs. consecinţe ale unui management defectuos.	Brainstorming-ul, discuţie colectivă, problematizare, lucrul pe grupe, studiul de caz	Prezentare și analiză proiecte tematice, postere
7.Comportamentul perturbator al elevului. Cauze si posibilitati de combatere sau prevenire;	discuţie colectivă, problematizare, lucrul pe grupe,	Prezentare și analiză proiecte tematice, postere
8.Gestionarea situaţiilor de criză educaţională Strategii si tehnici de rezolvare a conflictelor ce apar in clasa	discuţie colectivă, lucrul pe grupe, studiul de caz, jocul de rol	Prezentare și analiză proiecte tematice, postere
9.Personalitatea cadrului didactic. Stiluri manageriale ale profesorului	discuţie colectivă, problematizare, lucrul pe grupe, jocul de rol	Prezentare și analiză proiecte tematice, postere. Depunere portofolii.

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9.Coroborarea conţinuturilor disciplinei cu aşteptările reprezentanţilor comunităţii epistemice, asociaţiilor profesionale şi angajatori reprezentativi din domeniul aferent programului

Disciplina asigură formarea/dezvoltarea competenţelor cognitive şi funcţionale ale viitoarelor cadre didactice, în perspectiva adaptării acestora la solicitările specifice profesiei didactice şi la schimbările şi dinamica educaţiei în societatea postmodernă, informaţională, bazată pe cunoaştere

10.Evaluare

Tip activitate	10.1 Criterii de evaluare	10.2 Metode de evaluare	10.3 Pondere din nota finală
10.4 Curs	Referinţe din suportul de curs şi din recomandările bibliografice	Examen scris	50%
	Participare constantă la activitatea didactică		10%
10.5 Seminar/laborator	Aplicarea cunoştinţelor, a deprinderilor/abilităţilor în elaborarea și prezentarea pieselor de portofoliu	Portofoliu	30%
	Participare constantă la activitatea didactică. Intervenții pertinente. Valorificarea experieţei personale.	Evaluare orală	10%
10.6 Standard minim de performanţă			
• Operaţionalizarea conceptelor-cheie • Valorificarea cunoştinţelor teoretice şi metodologice asimilate, în rezolvarea unor situaţii fictive de criză educaţională. • Prezentarea a cel puţin unei piese din portofoliu în cadrul activităţii de seminar			

Data completării	Semnătura titularului de curs Lector Diana MELNIC	Semnătura titularului de seminar Lector Diana MELNIC
Data avizării în departament	Semnătura directorului de departament	

Decan,
Prof. dr. Stefan ANTOHE