BACHELOR 'S PROGRAMME
1st YEAR OF STUDY, 1st SEMESTER

COURSE TITLE	DIFFERENTIAL EQUATIONS AND MATHEMATICAL PHYSICS EQUATIONS
COURSE CODE	
COURSE TYPE	full attendance
COURSE LEVEL	1st cycle (bachelor's degree)
YEAR OF STUDY, SEMESTER	1st year of study, 1st semester
NUMBER OF ECTS CREDITS	5
NUMBER OF HOURS PER WEEK	4 (2 lecture hours + 2 seminar hours)
NAME OF LECTURE HOLDER	Prof.Ph. Catalin POPA
NAME OF SEMINAR HOLDER	Conf. dr. Ionuţ MUNTEANU
PREREQUISITES	Advanced level of English

A	GENERAL AND COURSE-SPECIFIC COMPETENCES

General competences:

- → Achievement of professional tasks efficiently and responsibly, in compliance with the field-specific deontology legislation, with qualified assistance.
- → Elaboration of a specialty or license work, respecting the objectives, proposed deadlines and norms of professional ethics.
- → The achievement and presentation of a project on a specialized theme in a rigorous and comprehensible way.

Course-specific competences:

- → C.1 Identification and proper use of the main laws and physical principles in a given context. (2 credits)
- → C 1.1 Derivation of working formulas for calculations with physical quantities using appropriate principles and laws of Physics.
- → C 1.2 Description of physical systems, using specific theories and tools (experimental and theoretical models, algorithms, schemes, etc.)
- → C 1.3 Application of the principles and laws of Physics in solving theoretical or practical problems, under qualified assistance conditions.
- → C 1.4 Correct application of methods of analysis and of criteria for choosing the appropriate solutions to achieve the specified performances.
- → C 1.5 Comparative assessment of the theoretical results offered by literature and of an experiment conducted in the framework of a professional project.
- → Minimal standard
- → Elaboration of a specialty report/project by identifying and using the main Physics laws and principles from a real (problem) context.
- → C4. Application of Physics knowledge in given situations in related fields, as well as in experiments, using standard laboratory equipment. (1 credit)
- → C 4.1 Application of Physics knowledge both in given situations in related fields and in experiments, using standard laboratory equipment.
- → C 4.2 Explanation and interpretation of physical phenomena by formulating assumptions and operationalizing key concepts and proper use of laboratory equipment.
- → C 4.3 Identification of Physics and Informatics methods, techniques and tools; Design of Physics experiments using specific laboratory methods and equipment.
- → C 4.4 Critical assessment of the results obtained by employing a physical model, including the degree of uncertainty of the obtained experimental results.
- → C 4.5 Implementation, improvement and extension of a physical model utilization. Making experimental devices capable of validating a physical model.
- → Minimal standard
- → Making an experimental device for the application of an appropriate model to a given situation/ problem.
- → C5. Communication and analysis of didactic, scientific and popularization of Physics-related information. (1 credit)
- → C 5.1 Proper use in professional communication of the terminology specific to Physics but also to related domains (especially Mathematics)
- → C 5.2 Presentation of scientific and popularization seminars on topics such as Atomic Physics, Nuclear and Elementary Particles Physics, Quantum Mechanics, Material Physics, Optics.
- → C 5.3 Elaboration of reports and presentations, the construction of logical and coherent arguments, the support of these arguments in front of an informed audience, on subjects of General Physics.

	→ C 5.4 Critical assessment of a scientific communication, a paper/specialty report with a reduced degree of difficulty. → C 5.5 Drafting and presenting scientific reports in the field of Physics by using of new media technologies for communication. → Minimal standard → Convey and interpretation of information in the field of Physics, with an average degree of difficulty.
B	LEARNING OUTCOMES
	At the end of the course of lectures, the students should be able to explain the taught notions and results and use the learned methods.
C	LECTURE CONTENT
	Ordinary differential equations Mathematical modelling of physical processes. Differential equations. Systems of differential equations. The notion of solution. Differential equations which are solvable by quadratures (integrations). Initial conditions. Cauchy problems. Existence and uniqueness of solution to Cauchy problem. Picard's method. Euler method. Finite-difference methods. Homogeneous second-order linear differential equations. Fundamental system of solutions. Wronskian test. Characteristic equation. Non-homogeneous second-order linear differential equations. General solution formula. The variation of constants method. Higher-order linear differential equations. Systems of first-order differential equations. Partial differential equations Poisson (Laplace) equation. Dirichlet and Neumann boundary value problems. Fundamental solution for the Laplace operator. Green's identities. Method of Green's function. Method of potentials. Eigenvalues and eigenfunction for the Laplace operator. Heat equation. Associated boundary and initial value problem. Fourier method. Wave equation. Associated boundary and initial value problem. Fourier method.
D	RECOMMENDED READING FOR LECTURES
	1. Viorel Barbu, Differential Equations, Springer, Berlin, Heidelberg, New York, 2016. 2. Viorel Barbu, Partial Differential Equations and Boundary Value Problems, Kluwer Academic Publishers, Dordrecht, Boston, London, 1998.
E	SEMINAR CONTENT
	The contents is the same to that of the course, illustrated by examples, applications and problems
F	RECOMMENDED READING FOR SEMINARS
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G	EDUCATION STYLE
LEARNING AND TEACHING METHODS	Examples, exposition, proof, applications
ASSESSMENT METHODS	• Midterm examination (in the form of a written paper) and final exam (written paper)
LANGUAGE OF INSTRUCTION	English