# COURSE SYLLABUS

| University | **Alexandru Ioan Cuza University of Iaşi** | **Course title** | |
|---|---|---|---|
| Faculty | **Physics** | **FUNDAMENTALS OF MATHEMATICAL PHYSICS** | |
| Department | **Physics** | | |
| Domain | **Physics** | **Course category** (FC/SC/CC[1]): FC | **Term** (1-4): 1 |
| Level | **Postgraduate (MA)** | **Course type** (Co/El/F[2]): Co | |

**I. Course structure**

| Number of hours/week | | | | Credits | Total class hours/ semester | Total hours of individual activity | Examination type (C/Ex/CE[3]) | Teaching language |
|---|---|---|---|---|---|---|---|---|
| Course | Seminar | Lab. | Project | **6** | **56** | **126** | **Ex** | **English** |
| **2** | **2** | | | | | | | |

**II. Instructors**

| | Academic degree[4] | Scientific degree | Name and surname | Faculty position (tenure/ associate - organization) |
|---|---|---|---|---|
| Course | Prof. | Ph.D. | Ciprian Dariescu | Tenure/Al. I. Cuza University |
| Seminar | Prof.<br>Lect. | Ph.D.<br>Ph.D. | Ciprian Dariescu<br>Daniel Radu | Tenure/Al. I. Cuza University<br>Tenure/Al. I. Cuza University |
| Laboratory | | | | |

**III. Prerequisites**

Mathematical Physics Equations, Differential Equations, Functional Analysis, Algebra.

**IV. Course objectives**

It intends to supply good knowledge on basics and main results of mathematical physics.

By its role, this course should prepare the student for a Ph.D. in Physics.

Therefore, the modern views and the checked formalisms are constantly emphasized as far as possible.

**V. Course content**

**Course**

I. Elliptic Equations

Laplace and Poisson Equations, boundary conditions, types of solutions,

Green identity, fundamental solution of Laplace-Beltrami operator,

Green functions and Poisson formula, potentials method,

Laplace –Fourier method of variables separation,

Basic symmetries and special functions: spherical functions, Bessel functions, hypergeometric functions.

II. Parabolic equations:

General physical processes, Heat propagation equation, solutions and Laplace-Fourier method, heat propagation equation in entire space, fundamental solution of heat propagation operator.

III. Hyperbolic equations:

physical general processes, Wave equation and standard conditions,

[1] FC – fundamental course, SC – specialty course, CC – complementary course
[2] Co – compulsory, El – elective, F – facultative
[3] C – colloquium, Ex – exam, CE – colloquium AND exam
[4] Professor / Associate professor / Lecturer / Assistant professor / Teaching assistant

| | |
|---|---|
| | Laplace-Fourier method and types of solutions,<br>IV. Systems of linear and non-linear differential equations.<br>Examples. |
| **Seminar** | Applications to the topics presented at the course;<br>A range of useful mathematical ideas and tools, with direct applications in physics.<br>Mathematical formulation of quantum mechanics and quantum field theory. |
| **Laboratory** | |

**VI. Minimal required references**


V. Barbu. *Procese la limita pentru ecuatii cu derivate partiale*. Ed. Academiei Romane, Bucuresti, 1993.
A.N. Tihonov, A.A. Samarski,*Ecuatiile fizicii matematice*,Ed.Tehnica,Bucuresti 1956
V.S. Vladimirov, *Ecuatiile fizicii matematice*. Ed. St. Si Ped, Bucuresti, 1980.

L. D. Landau, E. M. Lifshitz, *The Classical Theory of Fields*, IV-th Edition, Reed Educational and Professional Publ. 2000.

W. Thirring, *Classical Mathematical Physics. Dynamical systems and tools*, Springer, 2003.


**VII. Didactic methods**

Lectures,
Thematic Debates,
Applications

**VIII. Assessment**

| | | |
|---|---|---|
| **Pre-conditions** | Attendance,<br>Active participation to class activities,<br>Free presentation of a project,<br>Obtaining the minimal grade 5 for each ongoing assessment | |
| **Exam dates** | **1st Assessment** | November |
| | **2nd Assessment** | January |

| | **Assessment means and methods** | **Percentage of the final grade** |
|---|---|---|
| Exam/Colloquium | written | 50% |
| Seminar | oral | 50% |
| Laboratory | | |