COURSE PROGRAMME

1. Information about the programme

1.1 University	**University "Alexandru Ioan Cuza" of Iasi**
1.2 Faculty	**Faculty of Mathematics**
1.3 Department	**Department of Mathematics**
1.4 Domain	**Mathematics**
1.5 Cycle	**Masters**
1.6 Programme / Qualification	**Applied Mathematics**

2. Information about the course

2.1 Course Name			Partial differential equations				
2.2 Course taught by			Prof. PhD. SEBASTIAN ANITA				
2.3 Seminary / laboratory taught by			Prof. PhD. SEBASTIAN ANITA				
2.4 Year	I	**2.5** Semester	II	**2.6** Type of evaluation*	E	**2.7** Course type**	Op

E – Exam / C – Colloquium / V – Verification
OB – Obligatory / OP – Optionally / F – Facultative

3. Total hours (estimated per semester and activities)

3.1 Number of hours per week	4	**3.2** course	2	**3.3** seminary/ laboratory	2
3.4 Total number of hours	56	**3.5** course	28	**3.6** seminary/ laboratory	28

Distribution	hours
Individual study using textbooks, course notes, bibliography items, etc.	56
Supplimentary study (library, on-line platforms, etc.)	0
Individual study for seminary/laboratory, homeworks, projects, etc.	59
Tutoring	0
Examination	4
Other activities	0
3.7 Total hours of individual activity*	119
3.8 Total hours per semester	175
3.9 Credit points	7

4. Pre-requisites - Curriculum (if necessary)

Mathematical Analysis, Differential Equations

5. Conditions (if necessary)

5.1 Course	Classes will be held in the amphitheater
5.2 Seminary / Laboratory	Classes will be held in the seminary room

6. Objectives

• Model a variety of real-world phenomena using partial differential equations
• Use the theoretical results to establish the existence and uniqueness of the solutions to some partial differential equations
• To use the theoretical results to establish comparison results for elliptic or for parabolic semilinear equations
• Compute the solutions to certain partial differential equations using the method of separation of variables

7. Specific competencies/Learning outcomes

• applies scientific methods
• thinks abstractly
• performs analytical mathematical calculations

8. Contents

8.1 Course	**Teaching methods**	**Remarks** (number oh hours, references)
Introduction. The Lebesgue integral	Exposition, mathematical proof	2 hours, [1]
Elliptic equations. Phenomena, boundary conditions. The fundamental solution of the Laplace operator	Exposition, mathematical proof	3 hours, [1]
Distributions	Exposition, mathematical proof	3 hours, [1]
Sobolev spaces	Exposition, mathematical proof	4 hours, [1], [2]
Embedding theorems for Sobolev spaces	Exposition, mathematical proof	4 hours, [1], [2]
Variational theory of elliptic equations with boundary conditions	Exposition, mathematical proof	4 hours, [1], [2]
Eigenfunctions and eigenvalues for the Laplace operator	Exposition, mathematical proof	2 hours, [1]
Parabolic equations. Existence and uniqueness of a weak solution for the mixed problem	Exposition, mathematical proof	4 hours, [1], [2], [3]
Hyperbolic equations. Existence and uniqueness of a weak solution for the mixed problem	Exposition, mathematical proof	4 hours, [1]

Bibliography

[1] V. Barbu, Probleme la limită pentru ecuaţii cu derivate parţiale, Editura Academiei Române, Bucureşti, 1993.
[2] H. Brezis, Functional Analysis, Sobolev Spaces and Partial Differential Equations, Springer, New York, 2011.
[3] M. H. Protter, H.F. Weinberger, Maximum Principles in Differential Equations, Springer-Verlag, New York, 1984.

8.2 Seminary / Laboratory	**Teaching methods**	**Remarks** (number oh hours, references)
Polar, spherical, cylindrical coordinates	Exercise and conversation	2 hours
Special equations and functions	Exercise and conversation	4 hours
Distributional solutions	Exercise and conversation	2 hours
Variable separation method for elliptic equations for rectangular and parallelipipedic domains	Exercise and conversation	3 hours
Variable separation method for elliptic equations for disk and annulus	Exercise and conversation	3 hours
Applications of Lax-Milgram’s lemma	Exercise and conversation	4 hours
Eigenvalues and eigenfunctions for the elliptic operators	Exercise and conversation	2 hours
Separation of variables for parabolic equations	Exercise and conversationl	4 hours
Separation of variables for hyperbolic equations	Exercise and conversation	4 hours

Bibliography

1. G. Aniculăesei, S. Aniţa, Ecuaţii cu derivate parţiale. Aplicaţii, Editura Universităţii ``Al.I. Cuza'' Iaşi, 2001.

9. Coordination of the contents with the expectations of the community representatives, professional associations and relevant employers in the corresponding domain

The course and seminary aim to provide the basic notions and results of PDEs theory. A special attention will be paid to the modelling of various phenomena via PDEs and to deriving the basic properties of the solutions.
The results and methods have several applications in Physics, Chemistry, Economics, Biology, Engineering and provide a strong background for those interested in mathematical research.

10. Assessment and examination

10.1 Continuous assessment				
		Percentage (min. 30%)		50
Course	Assessment type			
	Percentage			0
	Failure to pass the continuous assessment results in failure to pass the final assessment			
	Assessment methods	Details	Percentage	with reexamination
Seminary / Laboratory	Assessment type			Mixed assessment
	Percentage			100
	Failure to pass the continuous assessment results in failure to pass the final assessment			No
	Assessment methods	Details	Percentage	with reexamination
		Test	50	No
		Continuous oral assessment	50	No

10.2 Final assessment	Percentage (max. 70%)	50
	Assessment type	Final mixed assessment

10.3 Special notes (special situations is assessment)	
LA EVALUAREA FINALA: Din ponderea de 50%: 40% - examenul scris si 10% - examinarea orala	

10.4 Minimum performance standard

1. Finding solutions using the method of separation of variables, Fourier series
2. Establishing existence and uniqueness results for the weak solutions of certain PDEs
3. Mastering the basic results: Lax-Milgram’s lemma, The embedding theorems, the existence and uniqueness of the weak solutions, etc.
4. Ability of using the theoretical results in different situations

Date,

Course coordinator,
Prof. PhD. SEBASTIAN ANITA

Seminary coordinator,
Prof. PhD. SEBASTIAN ANITA

Aproval date in the department,

Head of the departament,
Prof. PhD. IONEL DUMITREL GHIBA