

SYLLABUS

1. Information regarding the programme

1.1 Higher education institution	Babeş-Bolyai University
1.2 Faculty	Mathematics and Computer Science
1.3 Department	Mathematics
1.4 Field of study	Mathematics
1.5 Study cycle	Bachelor
1.6 Study programme / Qualification	Mathematics - Computer Science

2. Information regarding the discipline

2.1 Name of the discipline	Partial Differential Equations						
2.2 Course coordinator	Prof. Dr. Radu Precup						
2.3 Seminar coordinator	Prof. Dr. Radu Precup						
2.4. Year of study	3	2.5 Semester	5	2.6. Type of evaluation	Exam	2.7 Type of discipline	Compulsory

3. Total estimated time (hours/semester of didactic activities)

3.1 Hours per week	4	Of which: 3.2 course	2	3.3 seminar/laboratory	2	
3.4 Total hours in the curriculum	56	Of which: 3.5 course	28	3.6 seminar/laboratory	28	
Time allotment:						hours
Learning using manual, course support, bibliography, course notes						24
Additional documentation (in libraries, on electronic platforms, field documentation)						20
Preparation for seminars/labs, homework, papers, portfolios and essays						20
Tutorship						10
Evaluations						16
Other activities:						
3.7 Total individual study hours			90			
3.8 Total hours per semester			146			
3.9 Number of ECTS credits			4			

4. Prerequisites (if necessary)

4.1. curriculum	<ul style="list-style-type: none"> • Ordinary differential equations; Measure theory
4.2. competencies	<ul style="list-style-type: none"> •

5. Conditions (if necessary)

5.1. for the course	<ul style="list-style-type: none"> •
5.2. for the seminar /lab activities	<ul style="list-style-type: none"> •

6. Specific competencies acquired

Professional competencies	<ul style="list-style-type: none"> • Basic theory of linear second-order partial differential equations • Capacity to frame physical models in one of the following classes of PDEs: elliptic, parabolic, and hyperbolic.
Transversal competencies	<p>CT3 Utilizarea unor metode și tehnici eficiente de învățare, informare, cercetare și dezvoltare a capacităților de valorificare a cunoștințelor, de adaptare la cerințele unei societăți dinamice și de comunicare în limba română și într-o limbă de circulație internațională</p>

7. Objectives of the discipline (outcome of the acquired competencies)

7.1 General objective of the discipline	<ul style="list-style-type: none"> • Basic theory of linear second-order partial differential equations
7.2 Specific objective of the discipline	<ul style="list-style-type: none"> • Properties of harmonic functions. • The notion of weak solution. • Fourier series method for solving boundary value problems. • Fourier transform method.

8. Content

8.1 Course	Teaching methods	Remarks
1. Preliminaries. Classifications. Particular equations.	<ul style="list-style-type: none"> • Interactive exposure • Explanation • Conversation • Didactical demonstration 	
2. Mathematical models expressed by partial differential equations	<ul style="list-style-type: none"> • Interactive exposure • Explanation • Conversation • Didactical demonstration 	
3. Green's formula. The fundamental solution of the Laplace equation.	<ul style="list-style-type: none"> • Interactive exposure • Explanation • Conversation • Didactical demonstration 	
4. Mean value theorems for harmonic functions	<ul style="list-style-type: none"> • Interactive exposure • Explanation • Conversation • Didactical demonstration 	
5. The maximum principle. Uniqueness and continuous dependence on data for the Dirichlet problem.	<ul style="list-style-type: none"> • Interactive exposure • Explanation • Conversation • Didactical demonstration 	

6. Green's functions of the Dirichlet problem. Poisson's formula.	<ul style="list-style-type: none"> • Interactive exposure • Explanation • Conversation • Didactical demonstration 	
7. Dirichlet's principle. The generalized solution of the Dirichlet problem.	<ul style="list-style-type: none"> • Interactive exposure • Explanation • Conversation • Didactical demonstration 	
8. Fourier Series. The eigenvalues and eigenfunctions of the Dirichlet problem.	<ul style="list-style-type: none"> • Interactive exposure • Explanation • Conversation • Didactical demonstration 	
9. The maximum principle for the heat equation.	<ul style="list-style-type: none"> • Interactive exposure • Explanation • Conversation • Didactical demonstration 	
10. The Cauchy-Dirichlet problem for the heat equation.	<ul style="list-style-type: none"> • Interactive exposure • Explanation • Conversation • Didactical demonstration 	
11. The Cauchy-Dirichlet problem for the wave equation.	<ul style="list-style-type: none"> • Interactive exposure • Explanation • Conversation • Didactical demonstration 	
12. The Cauchy problem for evolution equations. The Fourier transform.	<ul style="list-style-type: none"> • Interactive exposure • Explanation • Conversation • Didactical demonstration 	
13. The Cauchy problem for the heat equation.	<ul style="list-style-type: none"> • Interactive exposure • Explanation • Conversation • Didactical demonstration 	
14. Nonhomogeneous equations: Duhamel's principle	<ul style="list-style-type: none"> • Interactive exposure • Explanation • Conversation • Didactical demonstration 	
Bibliography		
<ol style="list-style-type: none"> 1. R. Precup, Lectii de ecuatii cu derivate partiale, Presa Universitara Clujeana, 2004. 2. R. Precup, Linear and Semilinear Partial Differential Equations, De Gruyter, Berlin, 2012. 3. L.C. Evans, Partial Differential Equations, Amer. Math. Soc., Providence, 1998. 		
8.2 Seminar / laboratory	Teaching methods	Remarks
1. The canonical form of linear second-order PDEs.	Exercise, explanation, dialogue, team work	

2. The method of separation of variables: cases of rectangular and circular domains.	Exercise, explanation, dialogue, team work	
3. Properties of the harmonic functions. Exercises.	Exercise, explanation, dialogue, team work	
4. Mean value theorems. Exercises.	Exercise, explanation, dialogue, team work	
5. The maximum principle. Applications.	Exercise, explanation, dialogue, team work	
6. Green's function for particular domains.	Exercise, explanation, dialogue, team work	
7. Dirichlet's principle. Generalized solutions. Examples.	Exercise, explanation, dialogue, team work	
8. Elliptic equations in the divergence form.	Exercise, explanation, dialogue, team work	
9. The generalized solution of Neumann's problem.	Exercise, explanation, dialogue, team work	
10. The eigenvalues and eigenfunctions for particular domains.	Exercise, explanation, dialogue, team work	
11. Mixed problems for the heat equation.	Exercise, explanation, dialogue, team work	
12. Mixed problems for the wave equation.	Exercise, explanation, dialogue, team work	
13. The Fourier transform. Examples.	Exercise, explanation, dialogue, team work	
14. The Cauchy problem for the heat equation. Particular cases.	Exercise, explanation, dialogue, team work	
Bibliography <ol style="list-style-type: none"> 1. R. Precup, Lectii de ecuatii cu derivate partiale, Presa Universitara Clujeana, 2004. 2. R. Precup, Linear and Semilinear Partial Differential Equations, De Gruyter, Berlin, 2012. 3. L.C. Evans, Partial Differential Equations, Amer. Math. Soc., Providence, 1998. 4. V.S. Vladimirov s.a., Culegere de probleme de ecuatiile fizicii matematice, Ed. St. Encicl., Bucuresti, 1981. 		

9. Corroborating the content of the discipline with the expectations of the epistemic community, professional associations and representative employers within the field of the program

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10. Evaluation

Type of activity	10.1 Evaluation criteria	10.2 Evaluation methods	10.3 Share in the grade (%)
10.4 Course		Continuous observations	10%
		Written exam	50%
10.5 Seminar/lab activities		Continuous observations	10%
		Practical examination	30%
10.6 Minimum performance standards			
<ul style="list-style-type: none"> • Method of separation of variables. • Properties of the harmonic functions (mean value theorem; maximum principle). • Solving of mixed problems for evolution equations. • Fourier transform. 			

Date

20 September 2019

Signature of course coordinator

..Radu Precup

Signature of seminar coordinator

Radu Precup.....

Date of approval

21 September 2019.....

Signature of the head of department

Octavian Agratini.....