THE DOCTORAL SCHOOL OF IPPT PAN

COURSE OFFERED IN THE DOCTORAL SCHOOL OF IPPT PAN

Name of the course	Polish	**Równania różniczkowe w naukach przyrodniczych**				
	English	**Differential equations in natural sciences**				
Type of the course	**Specialized course**					
Course coordinator	**Bogdan Kaźmierczak, Ph.D., D.Sc.**		Course teacher	**Bogdan Kaźmierczak, Ph.D., D.Sc.**		
Implementing unit	**ZBiMM**	Scientific discipline / disciplines	**Mechanical/biomedical engineering**			
Level of education	**Doctoral studies**	Semester	**Summer or winter**			
Language of the course	**English**					
Type of assessment	**Examination**	Number of hours in a semester	**30**	ECTS credits	**4**	

Type of classes		Lecture	Auditory classes	Project classes	Laboratory	Seminar
Number of hours	in a week	**2**	**0**	**0**	**0**	**0**
	in a semester	**30**	**0**	**0**	**0**	**0**

1. Prerequisites

Knowledge of mathematics at the level of master studies: basic techniques of solving simple ordinary differential and selected partial differentia equations.

2. Course objectives

The aim of the course: more advanced study of odes and pdes. Introduction to functional analysis, qualitative properties of solutions to different types of equations. Application in analysis of chosen standard processes in biology, medicine and physics.

3. Course content (separate for each type of classes)

Lecture

Main topics:

1. Classification of ordinary differential equations
2. Classification of partial differential equations
3. Introduction to functional analysis
4. Basic methods of functional analytic approach to partial differential equations
5. Applications of the implicit function theorem
6. Hopf bifurcation and Turing instability
7. Description of various phenomena in natural sciences.

Laboratory

Does not apply

4. Learning outcomes			
Number of the learning outcome	Learning outcomes description	Reference to the learning outcomes according to the 8th level of PRK	Learning outcomes verification methods*
Knowledge			
1	The graduate acquires basic knowledge about classification and properties of ordinary and partial differential equations	P8S_WG	examination
2	The graduate acquires knowledge about basic methods of analysis of ordinary and partial differential equations	P8S_WG	examination
3	The graduate knows how validate the results of his research	P8S_WK	assesment of acitivity during the classes
Skills			
1	The graduate knows how to apply the knowledge to properly describe various phenomena in the area of the interest	P8S_UW	examination
2	The graduate knows how to analyse the properties of a given differential equation and characterise the properties of its solution	P8S_UW	assessment of activity during classes and examination
3	The graduate knows how to use the results of the mathematical analysis and formulate conclusions about the examined phenomenon	P8S_UW	assessment of activity during classes and examination
Communication			
1	The graduate knows how to transfer the acquired knowledge to the scientific community	P8S_UK	assessment of activity during classes
Social competences			
1	The graduate is ready to critically evaluate the achievements of other researchers and confront them with their own results	P8S_KO	assessment of activity during classes
2	The graduate understands the necessity of collaboration between scientists	P8S_KK	assessment of activity during classes

*Allowed learning outcomes verification methods: exam; oral exam; written test; oral test; project evaluation; report evaluation; presentation evaluation; active participation during classes; homework; tests

5. Assessment criteria
assessment of activity during classes, results of the examination

6. Literature
References:
[1] J.D. Murray, Mathematical Biology, Vol. I and II, Springer 2002
[2] Keener J, Sneyd J (1998) Mathematical physiology. Springer-Verlag, New York
[3] P. Hartman, ODES, Wiley & Sons, 1964
[4] L.C. Evans, Partial differential equations, AMS, 1998

7. PhD student's workload necessary to achieve the learning outcomes**		
No.	Description	Number of hours
1	Hours of scheduled instruction given by the lecturer in the classroom	**30**
2	Hours of consultations with the lecturer, exams, tests, etc.	**15**
3	Amount of time devoted to the preparation for classes, preparation of presentations, reports, projects, homework	**25**
4	Amount of time devoted to the preparation for exams, test, assessments	**35**
	Total number of hours	**105**
	ECTS credits	**4**

** 1 ECTS = 25–30 hours of the PhD students work (2 ECTS ≈ 60 hours; 4 ECTS ≈ 110 hours, etc.)