Name of		STUDY MODULE D				
Name of the module/subject Dynamical systems			Code 1010342611010349073			
Field of	study		Profile of study (general academic, practical)	Year /Semester		
Flective			(DI dK) Subject offered in:			
Elective path/specialty Modelling in applied sciences			Polish	obligatory		
Cycle of	f study:	•	Form of study (full-time,part-time)			
Second-cycle studies			full-time			
No. of hours			No. of credits			
Lectur	e: 30 Classe	s: 30 Laboratory: -	Project/seminars:	. 4		
Status c	of the course in the study	program (Basic, major, other)	(university-wide, from another fie	ld)		
		(brak)	()	orak)		
Educatio	on areas and fields of sc	ience and art		ECTS distribution (number and %)		
dr Ja ema tel. (Wyc ul. F	arosław Mikołajski ail: jaroslaw.mikolajsk 61 665 2712 dział Elektryczny Piotrowo 3A, 60-965 F	@put.poznan.pl Poznań				
Prere	quisites in term	ns of knowledge, skills an	d social competencies:			
4	Knowledge	Knowledge of theory of ordinary differential and recurrence equations, as well as fied theory				
1	KIIOwiedge	from first degree studies.				
2	Skills	Solving differential and recurren field theory.	ce equations, drawing function graphs, using of elements of			
3	Social competencies	Awareness of limitations of acqueducation.	ired knowledge and understandi	ng the need for further		
Assu	mptions and ob	jectives of the course:				
Assu Getting knowle	to know theory and b dge to theory and pra	jectives of the course: uses of continuous and discrete dy actice in other fields of mathematic	namical systems. Gaining the sk s and physics.	ills to apply the acquired		
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Lecture

Assessment of knowledge and practical skills demonstrated in the written and oral exam.

Classes

Up-to-date: systematic control of theoretical knowledge in the form of oral and written responses, assessment of the ability to apply knowledge to solve tasks and assessment of activity in the classroom.

In the 7th and 14th week activities: tests acquired on the classes skills.

Course description

Actualization 2017/2018

1. Dynamical systems and their representation by differential or recurrence equations.

2. First order autonomous differential equations and their singularities.

3. Classification of critical points for stability.

4. Autonomous differential equations of higher order.

5. Solving the linear autonomous equations of higher order using Cardano formulas.

6. Autonomous homogeneous linear systems of two differential equations - form of solutions and trajectories.

7. Classification of singular points: stable or unstable regular node, saddle, stable or unstable focus, center, stable or unstable degenerate node, stable or unstable singular node.

8. Autonomous nonhomogeneous linear and nonlinear systems of two differential equations - singular points of a new type and separatrysas.

9. Analysis of exemplary physical dynamical systems.

10. Phase field and its use for testing types of singular points.

11. Outline of the rotation theory of vector flat field - relationship between index of singular point and trajectories.

12. Generalization of the presented theory into autonomous nonlinear systems of any number of differential equations.

13. Transition of the theory of continuous autonomous systems to discrete systems (recurrence equations).

14. Similarities and differences between continuous and discrete autonomous systems.

The applied methods of education:

- lecture led in interactive way implemented by examples on board,

- theory presented in close connection with practical tasks,

- in track of lecture formulating questions to students and initiating the discussion,

- recomendation materials for self-completion of the message,

- during classes solving on board example tasks,

- discussions on various methods of solution,

- the students activity is taken into account during the final evaluation.

Basic bibliography:

1. R. H. Martin, Elementary Differential Equations with Boundary Value Problems, McGraw-Hill Book Company, New York ? 1983.

2. R. Gutowski, Równania różniczkowe zwyczajne, WNT, Warszawa 1971.

3. J. Muszyński, A. D. Myszkis, Równania różniczkowe zwyczajne, PWN, Warszawa 1984.

4. D. Bobrowski, Systemy dynamiczne z czasem dyskretnym, Wyd. PP, Poznań 1994.

Additional bibliography:

1. W. J. Cunningham, Analiza układów nieliniowych, WNT, Warszawa 1962.

2. M. Medved?, Fundamentals of Dynamical Systems and Bifurcation Theory, Adam Hilger, Bristol ? 1991.

Result of average student's workload

Activity	Time (working hours)				
1. Active participation in meetings (lectures and classes).		60			
2. Active participation in consultations with posing questions.	5				
3. Solving exercises designed for individual work.	20				
4. Individual studying theoretical questions.	10				
5. Preparing to get credits.		30			
Student's workload					
Source of workload	hours	ECTS			
Total workload	125	4			
Contact hours	65	2			

Practical activities	60	2