STUDY MODULE DESCRIPTION FORM

Name of the module/subject **Difference equations**		Code **1010341741010347258**	
Field of study **Mathematics in Technology**	Profile of study (general academic, practical) **general academic**	Year /Semester **2 / 4**	
Elective path/specialty **-**	Subject offered in: **Polish**	Course (compulsory, elective) **obligatory**	

Cycle of study: **First-cycle** **(Polish Qualifications Framework level six)**	Form of study (full-time,part-time) **full-time**

No. of hours Lecture: **15** Classes: **15** Laboratory: **-** Project/seminars: **-**	No. of credits **2**

Status of the course in the study program (Basic, major, other) **basic**	(university-wide, from another field) **university-wide**

Education areas and fields of science and art **The sciences** **Mathematical sciences**	ECTS distribution (number and %**)** **2 100%** **2 100%**

Responsible for subject / lecturer:

dr hab. Małgorzata Migda
email: malgorzata.migda@put.poznan.pl
tel. +48 61 665 2359
Wydział Elektryczny
ul. Piotrowo 3A 60-965 Poznań

Prerequisites   in terms of knowledge, skills and social competencies:

1	**Knowledge**	Basic knowledge from linear algebra and mathematical analysis. - [K_W01 (P6S_WG)]
2	**Skills**	Ability to solve elementary problems from linear algebra and mathematical analysis by using acquired knowledge, ability to prepare and give presentation. - [K_U01 (P6S_UW)]
3	**Social competencies**	Understanding necessity of broadening ones competences, readiness to working and cooperating in team and taking responsibility for jointly realized task - [K_K01 (P6S_KK), K_K03 (P6S_KO)]

Assumptions and objectives of the course:

To pass on to students knowledge from difference equations and its appliacations in mathematical modeling. To develop students ability of solving   simple difference equations and analyzing phenomena and building theirs mathematical models. To form students ability of team working.

Study outcomes and reference to the educational results for a field of study

Knowledge:

1. One knows most basic definition and theorems and theirs proofs from general linear difference equations theory   - [K_W01 (P6S_WG)]

2. One can explain goal and meaning of simple discrete models - [K_W02 (P6S_WG)]

3. One knows connections   between issues from difference equations theory and other theoretical and applied mathematics sections - [K_W02 (P6S_WG)]

Skills:

1. To solve simple difference equations   - [K_U01 (P6S_UW)]

2. To construct discrete mathematical models, used also in other sections of mathematics -   [K_U02 (P6S_UW)]

3. To carry out proofs, also using, if need it, tools from other sections of mathematics -   [K_U02 (P6S_UW)]

Social competencies:

1. The ability to cooperate in team, to fulfill obligations entrusted by devanning work in team, understanding necessity of systematic work   - [K_K03 (P6S_KO), K_K04 (P6S_KR)]

2. Independency in looking for information in literature, also in different language - [K_K02 (P6S_KK)]

3. Acting in coherence with basic ethical principals - [K_K04 (P6S_KR)]

Assessment   methods of study outcomes

Lecture: evaluation of knowledge and preparation of presentation.

Classes: evaluation of written test and the direct activity during the classes.

Course description

UPDATE: 10.2018

1. Preliminaries. Difference calculus.
2. Linear first order difference equations.
3. Dynamics of first order difference equations. Equlibrium points. Criteria of asymptotic stability of equilibrium points.
4. General theory of linear difference equations.
5. Linear homogeneous equations with constant coefficients.
6. Linear nonhomogeneous equations: method of undermined coefficients.
7. Nonlinear equations transformable to linear equations.
8. Applications of difference equations in   biology, and economics.

Applied methods of education:

- lecture with mulimedia presentation accompanied with examples presented on the blackboard and with questions to the group of students, the students' activity is taken into account during the final evaluation (the students prepare and deliver the presentations in small groups)

- classes: solving problems on the board,   initiating discassion about the solutions.

Basic bibliography:

1. D. Bobrowski, Systemy dynamiczne z czasem dyskretnym, zagadnienia deterministyczne, Wydawnictwo PP, 1994.

2. S. Elaydi, An Introduction to Difference Equations, Undergraduate Texts in Mathematics, Springer, New York, USA,   2005.

Additional bibliography:

1. I. Koźniewska, Równania rekurencyjne, PWN 1972.

2. R. Agarwal,   Discrete oscillation theory, Hindawi Publishing, 2005.

3.   R. Agarwal, D. O'Regan, Infinite interval problems for differential, difference and integral equations, Kluwer Academic Publ., 2001.

Result of average student's workload

Activity	Time (working hours)
1. Active participation in meetings (lectures)	15
2. Active participation in meetings (classes)	15
3. Preaparation of presentation	12
4. Preaparation to classes	12
5. Meetings with the lecturer	6
6. Preaparation to test	10

Student's workload

Source of workload	hours	ECTS
Total workload	60	2
Contact hours	30	1
Practical activities	30	1