STUDY MODULE DESCRIPTION FORM

Name of the module/subject **Special functions**		Code **1010321351010324373**
Field of study **Mathematics in Technology**	Profile of study (general academic, practical) **general academic**	Year /Semester **4 / 7**
Elective path/specialty **-**	Subject offered in: **Polish**	Course (compulsory, elective) **elective**
Cycle of study: **First-cycle studies** **(Polish Qualifications Framework level six)**	Form of study (full-time,part-time) **full-time**	
No. of hours Lecture: **30** Classes: **15** Laboratory: **-** Project/seminars: **-**		No. of credits **4**
Status of the course in the study program (Basic, major, other) **major**	(university-wide, from another field) **university-wide**	
Education areas and fields of science and art **The sciences** **Mathematical sciences**		ECTS distribution (number and %) **4 100%** **4 100%**

Responsible for subject / lecturer:

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Prerequisites in terms of knowledge, skills and social competencies:

1	**Knowledge**	The knowledge required from the area of linear algebra and calculus (integral transform, Laplace transform and Fourier transform) and partial differential equations. [K_W01 (P6S_WG)]
2	**Skills**	Uses mathematical techniques to analize simple mathematical models, makes calculations with application of calculus. Has the abilities of effective self-education in the area of selected major. [K_U01 (P6S_UW)]
3	**Social competencies**	Has the awareness to extend the knowledge in the area of the special function. Is able to make the effort to apply the obtained knowledge to solve a new discovered problem in technical sciences. [K_K01 (P6S_KK), K_K02 (P6S_KK)]

Assumptions and objectives of the course:

The goal of the subject is to attain the knowledge from the area of the special function and to get the skills that allow to apply the obtained knowledge to analize the problems in mathematics and physics.

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

Knowledge:

Knows and understands the role and meaning of the proof in the mathematics, in particular the meaning of the assumptions. Is able to recall the basic theorems concerning the special functions and their proofs. Has the knowledge of the basic results involving the special functions [K_W01 (P6S_WG)].

Skills:

Is able to describe clearly the mathematical knowedge related with the special functions. Is able to prove the fundamental correspondence in the theory of the special functions. Is able to study individually and use the foreign language literature [K_U01 (P6S_UW)].

Social competencies:

The graduate is ready to critically evaluate his/her knowledge in the context of the actual scientific research. The graduate understands the need of extend its scientific horizon and knows the possibilities of continuous learning. The graduate is able to formulate the questions to improve his/her knowledge or discover the missing part of the problem [K_K01 (P6S_KK), K_K02 (P6S_KK)].

Assessment methods of study outcomes

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Lecture:
- evaluation of the knowledge and abilities showed in a written exam

Exercises:
- testing the knowledge and preparation for exercises,
- awarding the practical knowledge obtained during the previous exercises and lectures,
- evaluation of the knowledge and abilities related with calculations and proofs
- testing for exercises and/or written elaboration (that can be made partially outside of exercises)

Additional points for individual work during the exercises:
- abilities to solve the problems individually related with the special functions theory,
- using the knowledge from the additional literature (not discussed in lectures)

Course description

1. Gamma function i beta function.
2. Pochhammer symbol and hipergeometric Gauss series.
3. Chebyshev polynomial.
4. Legendre polynomial, Adjoint Legendre polynomial I.
5. Jacobi polynomial and Gegenbauer polynomial.
6. Laguerre polynomial.
7. Hermite polynomial.
8. Airy function and Bessel function.
9. Mathieu equation.
10. Hipergeometric function (Kummer, Tricomi, Whittaker, Coulomb).
11. Elliptic function.

Teaching methods:

Lectures – the lecture is organized with the multimedia presentations and complemented with many examples, showing some applications of the presented issues in mathematics and physics

Exercises – discussing open problems, comprehensive analysis for selected problems in mathematics, initiating open discussions devoted to methods which may be able to solve some problems related to selected topis in mathematics, grading homeworks.

Update: 10.2018

Basic bibliography:

1. E. Korpal, Funkcje specjalne, Kraków : AGH Uczelniane Wydawnictwa Naukowo-Dydaktyczne, 2001
2. W. Hudyka, Funkcje specjalne, Warszawa : Wojskowa Akademia Techniczna, 1979.
3. N. N. Lebedev, Funkcje specjalne i ich zastosowania [z jęz. ros. tł. Michał Hornowski], Warszawa : Państwowe Wydaw. Naukowe, 1957.

Additional bibliography:

1. Beals, Richard; Wong, Roderick Special functions. A graduate text. Cambridge Studies in Advanced Mathematics, 126. Cambridge University Press, Cambridge, 2010.
2. Viola, Carlo An introduction to special functions. Unitext, 102. La Matematica per il 3+2. Springer, [Cham], 2016.
3. Korenev, B. G. Bessel functions and their applications. Translated from the Russian by E. V. Pankratiev. Analytical Methods and Special Functions, 8. Taylor & Francis, Ltd., London, 2002.

Result of average student's workload

Activity	Time (working hours)
1. attendance at lectures	30
2. attendance at exercises	15
3. attendance at consultation devoted to lectures	5
4. attendance at consultation devoted to exercises	8
5. studying exercises	12
6. studying the additional litarature and doing the additional homework assignment	2
7. studying for tests	16
8. studying for exam	30
9. exam	2

Student’s workload

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Source of workload	hours	ECTS
Total workload	120	4
Contact hours	60	2
Practical activities	25	1

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