COURSE DESCRIPTION CARD - SYLLABUS

Course name
Special functions [S1MwT1>E-FS]

Course

Field of study
Mathematics in Technology

Year/Semester
3/5

Area of study (specialization)
–

Profile of study
general academic

Level of study
first-cycle

Course offered in
polish

Form of study
full-time

Requirements
elective

Number of hours

Lecture
30

Laboratory classes
0

Other (e.g. online)
0

Tutorials
15

Projects/seminars
0

Number of credit points

4,00

Coordinators

dr hab. Maciej Ciesielski
maciej.ciesielski@put.poznan.pl

Lecturers

Prerequisites

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)]. 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)]. 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)].

Course objective

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.

Course-related learning outcomes

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 competences:
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)].

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

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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).

Programme content

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, solving problems given by the instructor, grading homeworks.

Bibliography

Basic
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
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.

Breakdown of average student's workload

	Hours	ECTS
Total workload	100	4,00
Classes requiring direct contact with the teacher	45	2,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	55	2,00