Stochastic Processes 2 - course description

General information

Course name	Stochastic Processes 2
Course ID	11.1-WK-MATD-PS2-Ć-S14_pNadGenUXCK8
Faculty	Faculty of Mathematics, Computer Science and Econometrics
Field of study	Mathematics
Education profile	academic
Level of studies	Second-cycle studies leading to MS degree
Beginning semester	winter term 2020/2021

Course information

Semester	3
ECTS credits to win	7
Course type	optional
Teaching language	polish
Author of syllabus	• prof. dr hab. Jerzy Motyl

Classes forms

The class form	Hours per semester (full-time)	Hours per week (full-time)	Hours per semester (part-time)	Hours per week (part-time)	Form of assignment
Class	30	2	-	-	Credit with grade
Lecture	30	2	-	-	Exam

Aim of the course

After the course of “stochastic processes 2” students should be able to solve themselves practical and theoretical problems on the topic.

Prerequisites

Probability theory, mathematical analysis, functional analysis.

Scope

Lecture:

Introduction (5 h.)

1. Stochastic processes in practical problems
2. Elements of stochastic analysis, stochastic processes, definition and properties, Kołmogorov’s theorem
3. Wiener process: existence and properties

Stochastic square-mean analysis (13 h.):

1. Hilbert process and different types of its convergences
2. Square-mean continuity and differentiability of Hilbert processes
3. Square-mean integrals of Riemann and Lebesgue type
4. Square-mean integrability
5. Variation of stochastic processes, existence of Riemann-Stieltjes and Lebesgue-Stieltjes trajectory integrals

Stochastic Itô integral (7 h.):

1. Wiener filtration and adapted processes
2. Simple processes and their Wiener integrals
3. Convergence of simple processes to process from M[a,b] and convergence of their integrals in L2 (Ω)
4. Stochastic Itô integral and its properties
5. Itô formula and its applications
6. Stochastic Itô differential equations

Class

Properties of random variables

Properties of stochastic processes

Convergence of stochastic processes

continuity and differentiability of Hilbert processes

Stochastic differentials of different processes

Applications of Itô formula

Solving of stochastic Itô differential equations

Teaching methods

Conventional lecture; problem lecture

Auditorium exercises – solving standard problems enlightening the significance of the theory, exercises on applications, solving problems.

Learning outcomes and methods of theirs verification

Outcome description	Outcome symbols	Methods of verification	The class form
Student in the selected field can carry out evidence which, if necessary, also the tools from other departments of mathematics.	• K_U14	• activity during the classes • an exam - oral, descriptive, test and other	• Lecture • Class
Student knows the limitations of his own knowledge and understands the need for further education.	• K_K01	• a discussion • activity during the classes	• Lecture • Class
Student is able to formulate opinions on the basic issues of mathematical proofs.	• K_K04	• a discussion • activity during the classes	• Lecture • Class
Student uses the language and methods of functional analysis in mathematical analysis and its applications, in particular property uses the classic Banach spaces and Hilbert.	• K_U09	• activity during the classes • an exam - oral, descriptive, test and other	• Lecture • Class
Student has in-depth knowledge in the chosen field of theoretical mathematics or applied.	• K_W04	• activity during the classes • an exam - oral, descriptive, test and other	• Lecture • Class
Student has the ability to validate evidence of formal building of proofs.	• K_U03	• activity during the classes • an exam - oral, descriptive, test and other	• Lecture • Class

Assignment conditions

Final exam and grade.

Recommended reading

1. R. Lipcer, A. Sziriajew, Statystyka procesów stochastycznych, PWN 1981.
2. K. Sobczyk, Stochastyczne równania różniczkowe, WNT 1996.
3. M. Fisz, Rachunek prawdopodobieństwa i statystyka matematyczna, PWN 1958.

Further reading

1. E. Parzen, Stochastic processes, Holden-Day Inc. 1962.
2. C.W. Gardiner, Handbook of stochastic methods for Physics, Chemistry and the Natural Sciences, Springer-Verlag 1985.

Notes

Modified by dr Alina Szelecka (last modification: 18-09-2020 13:46)