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| **Course code** | CC3 |
| **Type and description** |  |
| **ECTS credit** | 1 |
| **Course name** | **Stochastic processes I** |
| **Course name in Polish** | **Procesy stochastyczne I** |
| **Language of instruction** | English |
| **Course level** | 8 PRK |
| **Course coordinator**  | **Lesław Gajek** |
| **Course instructors** |  |
| **Delivery methods and course duration** |

|  | **Lecture** | **Tutorials** | **Laboratory** | **Project** | **Seminar** | **Other** | **Total of teaching hours during semester** |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Contact hours | 15 | 0 | 0 | 0 | 0 | 0 | 15 |
| E-learning | No | No | No | No | No | No |  |
| Assessment criteria (weightage) | 1,00 |  |  |  |  | 0,00 |  |

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| **Course objective** | The aim of the course is:1. to enable the acquisition of knowledge and skills in stochastic processes and time series
2. to enable the acquisition of knowledge of elementary properties/theorems concerning stochastic processes
3. to enable the acquisition of elementary knowledge of applications of stochastic processes in other sciences
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| **Learning outcomes** |  After completing the course students can:1. formulate the definition/properties of the conditional expectation with respect to a sigma-field – effects W1, U1, U2
2. give definitions/properties of basic stochastic processes/time series, describe their types and give their probabilistic properties – effects W1, U2, K3
3. apply the above knowledge to analyse mathematical models – effects U1, K1-K3
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| **Assessment methods** | Learning outcomes 1—3 (effects W1, U1, U2, K1 – K3): oral exam |
| **Prerequisites** | The student has the knowledge and skills in the basics of probability, measure and integral theory. |
| **Course content with delivery methods** | LECTURE 1. Definition and properties of the conditional expectation with respect to a sigma-field.
2. Definition of a stochastic process. The Kolmogorov Existence Theorem. Time series.
3. Basic characteristics of stochastic processes. Stationary processes. The Poisson process. The Wiener process.
4. Stopping times. Martingales, submartingales, supermartingales. Doob's optional stopping theorem. Wald's identities. Doob's decomposition theorem.
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| **Basic reference materials** | 1. Kallenberg, O. (2002) Foundations of Modern Probability, 2nd ed. Springer. 2. Resnick S.I. (2013). Adventures in Stochastic Processes. Springer 3. Williams D. (2019) Probability with Martingales. 2nd ed. Cambridge University Press |
| **Other reference materials** | 4. Rolski T., Schmidli H., Schmidt V., Jozef L. Teugels J.L. (1999) Stochastic Processes for Insurance and Finance John Wiley and Sons |
| **Average student workload outside classroom** | 10h |
| **Comments** |  |
| **Last update** |  |