**Syllabus**

**THE RANDOM PROCESSES THEORY**

**Department responsible for the course or equivalent:** Institute of Advanced Technologies and Piezotechnics.

**Lecturer:**

Olga D. Glod, associate professor, PhD (candidate of technical sciences)

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**Semester when the course unit is delivered:**

4th.

**ECTS credits:** 5, 180 academic hours

**Level of the course unit:**

Bachelor.

**Course description**

The following issues are studied:

Basic concepts and definitions of the theory of random processes. Lectures topics: basic concepts of probability theory. Probabilistic space, Axiomatic definition of probability. Random variables, Random functions and random processes. The definition of a random process. Methods of setting and description of random processes. Stochastically equivalent random processes. Elementary random processes, Numerical characteristics of a random process. Expectation and variance of a random process. Correlation function of a random process, the main classes of random processes. Stationary random processes, Gaussian random processes. Processes with independent increments, Markov random processes.

Elements of stochastic analysis. Lectures topics: Convergence of random processes. Convergence of random variables. Types of convergence, Mean square convergence from group A, Stochastic continuity of random processes. Differentiability of a random process, Integrability of a random process, Ergodicity of random processes, Stochastic measure, Stochastic Ito’s integral and stochastic differential, Spectral representation of stationary random processes, Stochastic differential equations and Kolmogorov equations for Markov processes with continuous state space.

**Planned lecturing activities and teaching method**

When applying the lecture, following materials are used:

* Problem lecture, lecture-discussion, lecture with analysis of a specific problem.
* Electronic means of presenting information on the course (electronic version of lecture notes, presentations for lectures and material for individual works).
* Multimedia facilities when presenting lecture material.

Laboratory classes of students are held in the form of programmed instruction.

Independent work of students is organized:

* Using Internet resources
* Using materials obtained in lectures
* Using the materials of the scientific and technical library.

Forms of control-the current is carried out on the results of lectures, laboratory work, boundary control – control work, credit.

**Learning outcomes:**

After completing the course student must be able to:

\* apply in research and applied activities mathematical apparatus for description, modeling and analysis of random processes;

\* solve the problems of scientific production and technological activities;

\* develop algorithms for statistical processing of random processes using modern information and computer technologies;

\* process data from statistical studies.

**Course literature**

1. [Electronic resource biblioclub: http://biblioclub.ru/index.php?page=book&id=442107] Katsman U. Theory of chances, mathematical statistics and casual processes /by Katsman U., Tomsk: publishing House of the Tomsk Polytechnic university, 2013. - 131 p.

 2. [Electronic resource http://e.lanbook.com/books/element.php?pl1\_cid=25&pl1\_id=426] Khrushcheva Irene Victorovna. Bases of mathematical statistics and theory of casual processes /by I.V. Khrushcheva, V.I. Sherbakov, D.S.Levanov, Moscow: Lan’, 2009. - 331 p.

 3. [Electronic resource: <http://e.lanbook.com/books/element>.php?pl1\_cid=25&pl1\_id=656] Sveshnikov Aram Aratynovich. Applied methods of casual functions theory / by А. А. Sveshnikov Moscow: Lan’, 2011. - 463 p.

4. Ventcel, Elena Sergeevna. Casual processes theory and her engineering applications: Studies. a manual for HEIs is a 2th publ., wiped. - М.: Higher school, 2000. - 383 p. quantity: 5 (2000)

5. Ventcel, Elena Sergeevna. Casual processes theory and her engineering applications: train aid for the students of HEIs / by Е. S. Ventcel, L. А. Shepherds is a 3th publ., Moscow: Academy, 2003. - 432 p. quantity: 9 (2003)

 6. Kuleshov, Evgeny Lvovich. Applied analysis of casual processes in the conditions of a priori vagueness: Studies. Manual, Vladivostok: DVU, 1993. - 188 p. quantity: 1 (1993)

7. Khrushcheva, Irene Victorovna. Bases of mathematical statistics and casual processes theory : train / aid by I.V. Khrushchev, V.I. Sherbakov, D.S.Levanova, Saint Petersburg [and other]: Lan’, 2009. - 336 p. quantity: 3 (2009)

8. Gromkovich, Uray. Theoretical informatics: introduction to the theory of automata, theory of computability, theory of complication, theory of algorithms, randomization, communication theory and cryptography. A textbook for the students of higher educational establishments for studying preparations of VPO 010501 (010500.62) "Applied mathematics and informatics" (ENF 0.2 Informatics), direction 010400 "Information technologies" (ENF.02 Informatics) / Uray Gromkovich ; [trudged. with him. Boris Melnikov, Elena Melnikova] - a 3th publ. is Saint Petersburg: BHV-St.Petersburg, 2010. - 336 p. quantity: 55 (2010).