NATIONAL TECHNICAL UNIVERSITY OF UKRAINE "IGOR SIKORSKY KYIV POLYTECHNIC INSTITUTE"

PHYSICO-MATHEMATICAL FACULTY

APPROVED
Academic Council
Physics and Mathematics Faculty
Record No. 1 of February 23, 2017
Chairman of the Academic Council _____.V. Vanin

PROGRAM

Basic entrance exam
On the educational-professional program of postgraduate training

Specialty 111 Mathematics

The program is recommended by the department
Mathematical analysis and theory

Probabilities

Record No. 6 dated February 22, 2017

Head of the Department _____ O.I. Klesov

Kyiv – 2017

1. INTRODUCTION

In modern science and technology, mathematical methods of research, modeling and
Designing play an important role. An important task of the higher course
Mathematics is the development of logical and algorithmic thinking students, skills
To conduct mathematical analysis of applied tasks. This program is from the highest
Mathematics reflects the new demands placed on mathematical education of the XXI century
century. It is characterized by applied orientation and orientation towards use
Mathematical methods, special attention to probabilistic-statistical methods in
Connection with its practical significance. The general course of mathematics is
The foundation of mathematical training.
Disciplines, the content of which is included in the program, belong to the cycle of
mathematical
Disciplines The purpose of this test is to test basic skills and
Incoming skills in solving mathematical problems, which are the basis for
The study of the characteristics of processes, knowledge of the basic principles and laws
Mathematical disciplines; The ability to reproduce mathematical models, quantitatively
To formulate and solve mathematical problems, the presence of boundaries
Application of mathematical models and theories.
Applicants must fully understand the fundamental laws
Mathematics, as well as methods of their research, be able to apply this knowledge at
Considering individual phenomena, combining their essence with analytical relations,
To be able to use knowledge of the courses of basic mathematical disciplines, with
Studying other disciplines, both general engineering and specialty. Introductory
The test takes place in the form of a written exam.
Each entrant receives a ticket, which contains three theoretical
Question on math. Preparation of the response is given 90 minutes. Time

II. KEYWORD

The entrance examination program is based on such programs
Disciplines: "Functional analysis", "Theory of probabilities", "Integrated
Analysis "," Random Processes "," Mathematical Statistics "," Analysis of Time
Rows "- and contains the following sections:

1. Functional analysis

1. Principle of compressed mappings in metric spaces.
2. Lebesgue measure in
3. Compactness and fullness. Hausdorff theorem.
4. Lebesgue integral.
5. The criterion of compactness in the space of continuous functions (Arzel's theorem).
6. Theorem on continuation of measure on algebra on
Σ -algebra.
7. Full metric spaces. The principle of nested balls.
8. The Lebesgue-Stilltiess integral.
9. Theorems of Yegorov and Luzin.
10. Gilbert-Schmidt operators and integral operators.
11. Lebesgue theorem on the boundary transition under the integral sign.
12. The Cantor theorem on the infinite number of real numbers.

13. Theorem of F. Riesz on the general form of linear continuous functionals on Space of continuous functions.
14. A Cauchy formula theorem.
15. The product of measure and Fubini's theorem.
16. Criterion of compactness in
17. Cauchy's integral formula.
18. Types of convergence of dimensional functions.
19. Linear continuous functionals. Khan-Banakh theorem.
20. Formula Green.
21. Inverted operator. Banach's theorem on an inverse operator.
22. Replacing variables and calculating multiple integrals.
23. Investigation of the extremum of several variables. Necessary and sufficient Extreme conditions.
24. The Lebesgue theorem on the boundary transition under the integral sign.
25. The Taylor formula for functions of several variables.
26. Fourier series and their relation with the decomposition of a vector by an orthonormal basis.
27. Cauchy integral theorem.
28. Measuring functions and their properties.
29. Bessel's inequality and Parseval's equality.
30. Properties of continuous functions on a compact.

2. The probability theory

1. Discrete distributions: Bernoulli, binomial, Poisson
2. Continuous distributions: uniform, normal
3. Probabilistic space: the axioms of probability theory; Continuity of probability
4. Condition probability, formula of complete probability
5. Random variables, distribution function
6. Moments of random size; Mathematical expectation, variance
7. Chebyshev's inequality; Law of large numbers
8. Random vectors, common distribution function
9. Correlation, covariance; Inequality of Bunyakovsky-Koshi
11. Multidimensional normal distribution
11. Characteristic functions, properties
12. Weak convergence of distributions
13. The law of large numbers of Hinchin
14. Central limit theorem

3. Random processes

1. The Poisson process
2. Wiener process
3. Markov chains; Clustering of states
4. Markov chains; Agility
5. Markov chains: stationary distribution
6. Stochastic differential equations; Definitions, examples
7. Stochastic differential equations; Ito formula

4 Mathematical statistics

1. Selective estimation of distribution parameters
2. Maximum Likelihood Method
3. The task of regression; Estimation of parameters by the method of least squares

5.Analiz time series

1. Stationary sequences; Properties, examples
2. Processes of ARMA (p, q)
3. The task of forecasting stationary sequences
4. Stationary processes; Examples
5. The elasticity of stationary processes
6. Spectral function, spectral density of stationary processes
7. The problem of filtration for stationary processes
8. Cross-characteristics of filters for stationary processes

6. Comprehensive analysis

1. Analytical functions.
2. Conditions of the analytic function of a complex variable.
3. Integral of a complex variable function
4. Integral theorem, the Cauchy formula.
5. The Cauchy integral theorem
6. The Cauchy integral formula.
7. Laurent's line, special points.
8. Schedule in the Laurent series.
9. Theory of scum.
10. Calculation of integral with residuals.

III FINAL PROVISIONS

1. Support materials.
The exams do not allow the use of additional literature.

2. Evaluation criteria.
The examination ticket consists of three theoretical questions in mathematics.
The assessment system evaluates the ability of the entrant:
- - generalize the knowledge acquired to solve specific problems, problems;
- apply rules, methods, principles, laws in specific situations;
- analyze and evaluate the facts, events and make substantiated conclusions;
- interpret circuits, graphs, diagrams;
- to present the material logically, consistently, in accordance with the requirements of the standards.
The answer for an entrant is estimated on a 100-point scale (33-34
Points for each question). The correct answer is considered complete and
Adequate coverage of the issue in accordance with the program of the main professional trial.

After that, the transfer of these marks into ECTS assessment according to the table is carried out:

Amount of points scored	Score
95...100	A
85...94	B
75...84	C
65...74	D
60...64	E
Less 60	F