Национальный исследовательский университет «Высшая школа экономики» Программа дисциплины «Математика» для магистерской программы "Политика. Экономика. Философия" направления 41.04.04 "Политология" подготовки магистра.

Федеральное государственное автономное образовательное учреждение высшего образования "Национальный исследовательский университет "Высшая школа экономики"

Факультет социальных наук

Программа дисциплины «Математика» (Mathematics)

для магистерской программы
"Политика. Экономика. Философия"
направления 41.04.04 "Политология" подготовки магистра

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Одобрена на заседании кафедры высшей математики «___»_____ 20 г
Зав. кафедрой Макаров А.А.

Рекомендована секцией УМС [Введите название секции УМС] «___»_____ 20 г
Председатель [Введите И.О. Фамилия]

Утверждена УС факультета [Введите название факультета] «___»_____20 г.
Ученый секретарь [Введите И.О. Фамилия] _____ [подпись]

Москва, 2016

1. Course Description

The program of the course describes the basic requirements for the knowledge and skills of students and determines the content and types of classes and assessment.

The program is designed for lectures of this discipline, learning assistants and students enrolled in the master's program.

The program is developed according to:

- Educational Program of NRU HSE.
- University Academic Plan of NRU HSE for Master level education, confirmed in 2016.

The course aims to provide students with understanding of key concepts and methods of probability theory required for understanding the other practical courses, related to data analysis and programming, particularly, “Data analysis in social sciences”.

2. Learning Objectives

In the process of studying the discipline, students will become familiar with theoretical foundations and basic methods of solving tasks on the following topics

- combinatorial analysis, definition of probability, random events;
- independent events, expected value and variance of random variable;
- main discrete distributions of random variables;
- Normal distribution. Limit theorems;
- Sample. Descriptive statistics: sample mean, median, sample variance, quintiles, quartiles.

3. Learning Outcomes

As a result of this course a student will:

- know main definitions and results of probability theory and statistics

to be essential for understanding further practical courses;

- be able to formalize the problem from subject area, choose the adequate methods of solutions, perform calculations and to interpret the results;
- have skills of solving problems to be important in professional activity.

4. Course Plan

№	Theme	Total Hours			Student Work
			Lecture hours	Workshop hours	
1.	Combinatorial analysis. Axioms of probability.	11	2	2	7
2.	Conditional probability and independence	11	4	4	7
3.	Random variables. Main characteristics. Main types of discrete random variables	22	4	4	14
4.	Continuous random variables. Normal distribution. Limits theorem	22	4	4	14
5.	Basic definitions of statistics.	10	2	2	6
	In total	76	14	14	48

5. Reading list

a) Required

1. S. Ross. A first course in probability (1997), Prentice hall, Upper saddle river, New Jersey.

2. F.M. Dekking, C. Kraaikamp, H.P. Lopuhaa, L.E. Meester. A Modern Introduction to Probability and Statistics. Understanding Why and How. London: Springer-Verlag, 2005

3. Ю.Н. Тюрин, А.А. Макаров, Г.А. Симонова. Теория вероятностей. Учебник для экономических и гуманитарных специальностей. М.: МЦНМО, 2009.

4. Тюрин Ю.Н., Макаров А.А. Анализ данных на компьютере: учебное пособие. – М.: ИД «ФОРУМ», 2008.

b) Optional

1. Кремер. Н. Ш. Теория вероятностей и математическая статистика. М.: Юнити-Дана, 2010.

2. S. Ross. Introduction to probability models (1997), Academic press.

6. **Grading System**

The final grade is formatted form

- Written final exam (50%).
- Accumulated grade (50%).

The accumulated grade (AG) consists of the grade for active participating in classes hours including

- Active participating in classes hours including small control works at seminars (40% of AG);
- Final written control work at the last seminar (60% of AG)

7. **Guidelines for Knowledge Assessment**

Part 1. Combinatorial analysis. Combinations. Permutations. Axioms of probability. Sample space. Event. Main properties of probability ([1], Ch 1, 1.2-1.4, Ch 2, 2.2 – 2.4).

Part 2. Classical definition of probability. Conditional probabilities. Bayes' formula. Independent Events ([1], Ch 2, 2.5, Ch 3, 3.2 – 3.4).

Part 3. Random variables. Distribution function. Discrete random variables ([1], Ch 4, 4.1 – 4.3).

Part 4. Expected value of discrete random variable. Expectation of a Function of a Random. Variance ([1], Ch 4, 4.4 – 4.6).

Part 5. Continuous random variables. Normal distribution. Limits theorem ([1], Ch 5, 5.2 – 5.5, Ch 8, 8.2 - 8.3).

Part 6. Basic definitions of statistics. Exploratory data analysis: graphical summaries. Histograms. Kernel density estimates. The empirical distribution function. Scatter plot. The center of a dataset. Empirical quintiles, quartiles, and the IQR. ([2], Ch 15, 16).

8. **Methods of Instruction**

Delivery of seminar homework can be done remotely by e-mails. The result of essential homework and final control work are sent by e-mail. Every week students get brief summary of the lectures to help them to do homework and literature study.