**Federal State Autonomous Educational Institution of Higher Education**

**PEOPLES' FRIENDSHIP UNIVERSITY OF RUSSIA**
**RUDN University**

*Faculty of Physics, Mathematics and Natural Sciences*

educational division (faculty/institute/academy) as higher education programme developer

# COURSE SYLLABUS

Numerical analysis

course title

**Recommended by the Didactic Council for the Education Field of:**

01.04.01 Mathematics

field of studies / speciality code and title

**The course instruction is implemented within the professional education programme of higher education:**

«Functional methods in differential equations and interdisciplinary research»

higher education programme profile/specialisation title

**2026**

## 1. COURSE GOAL(s)

The purpose of mastering the discipline "Numerical analysis" is to form an idea of numerical methods for studying mathematical models and the areas of application of these methods, to improve the mathematical culture of the student. The implementation of this goal includes a consistent presentation of theoretical material in lectures, in which all the main results are provided with rigorous proofs; development of methods for solving problems in practical classes; intermediate and final control reveal the degree of assimilation of the acquired skills

## 2. REQUIREMENTS FOR LEARNING OUTCOMES

Mastering the discipline " Numerical analysis " is aimed at developing the following competencies (parts of competencies):

*Table 2.1. List of competences that students acquire through the course study*

| Code | Competence | Competence achievement indicators (within this discipline) |
|---|---|---|
| PC-5 | Able to manage projects, plan research activities, analyze risks, manage the project team | **PC-5.1.** Capable of planning when organizing research activities<br>**PC-5.2.** Selects experimental and computational-theoretical methods for solving the given problem based on the available material and time resources |
| PC-11 | Carrying out work on the processing and analysis of scientific and technical information and research results | **PC-11.1** Ability to process scientific and technical information;<br>**PC-11.2** Ability to analyze the results of scientific research |

## 3.COURSE IN HIGHER EDUCATION PROGRAMME STRUCTURE

The discipline " Numerical analysis " refers to the part formed by the participants in the educational relations of block B1 of the EP HE.

As part of the EP HE, students also master other disciplines and / or practices that contribute to the achievement of the planned results of mastering the discipline " Numerical analysis ".

*Table 3.1. The list of the higher education programme components/disciplines that contribute to the achievement of the expected learning outcomes as the course study results*

| Code | Competence | Previous disciplines/modules, practices | Subsequent disciplines/modules, practices* |
|---|---|---|---|
| PC-5 | Able to manage projects, plan research activities, analyze | - | State exam |

| Code | Competence | Previous disciplines/modules, practices | Subsequent disciplines/modules, practices* |
|---|---|---|---|
| | risks, manage the project team | | |
| PC-11 | Carrying out work on the processing and analysis of scientific and technical information and research results | Function spaces | State exam |

## 4. COURSE WORKLOAD AND ACADEMIC ACTIVITIES

The total labor intensity of the discipline " Numerical analysis " is 2 credits.

*Table 4.1. Types of academic activities during the periods of higher education programme mastering (**full-time training**)**

| Type of study work | | TOTAL, **a**.h. | Semester | | | |
|---|---|---|---|---|---|---|
| | | | **1** | **2** | **3** | **4** |
| *Contact work, academic hours* | | *36* | | *36* | | |
| | | | | | | |
| Lectures (LC) | | 36 | | 36 | | |
| Lab work (LW) | | | | | | |
| Seminars (workshops/tutorials) (S) | | | | | | |
| *Self-studies* | | *36* | | *36* | | |
| *Evaluation and assessment (exam/passing/failing grade)* | | | | | | |
| **Course workload** | a.h. | **72** | | **72** | | |
| | credits | **2** | | **2** | | |

## 5. COURSE CONTENTS

*Table 5.1. Course contents and academic activities types*

| Course Module Title | Brief Description of the Module Content | Type of study work |
|---|---|---|
| Section 1. Introduction | Topic 1.1. Practical relevance of finding numerical solutions. Problems of computational mathematics, convergence, accuracy. | Lecture |
| Section 2. Solution of nonlinear equations | Topic 2.1. Half division method. Simple iteration method. Newton's method. The secant method. Parabola method.<br><br>Topic 2.2. Methods for finding the roots of systems of nonlinear equations. Seidel iteration method. | Lecture |

| | | |
|---|---|---|
| | Newton's method. Aitken convergence acceleration | |

## 6. LOGISTICS AND TECHNICAL SUPPORT OF THE DISCIPLINE

*Table 6.1. Logistics of discipline*

| Classroom type | Classroom equipment | Specialized educational/laboratory equipment, software and materials for mastering the discipline |
|---|---|---|
| Lecture | An auditorium for lecture-type classes, equipped with a set of specialized furniture; board (screen) and technical means of multimedia presentations. | - |
| Seminar | An auditorium for conducting seminar-type classes, group and individual consultations, current control and intermediate certification, equipped with a set of specialized furniture and technical means for multimedia presentations. | Windows, Microsoft Office, Maple, TeX, WinEdt. |
| For independent work of students | An auditorium for conducting seminar-type classes, group and individual consultations, current control and intermediate certification, equipped with a set of specialized furniture and technical means for multimedia presentations. | - |

## 7. RESOURCES RECOMMENDED FOR COURSE STUDY

**Main literature:**

1. Kalitkin, N.N. Numerical methods / N.N. Kalitkin. - St. Petersburg: BHV, 2014. - 592 p.
2. Samarsky, A.A. Numerical methods of mathematical physics / A.A. Samarsky, A.V. Gulin. - M.: Alliance, 2016. - 432 p.
3. Bakhvalov, N.S. Numerical Methods in Problems and Exercises: Textbook / N.S. Bakhvalov, A.V. Lapin, E.V. Chizhonkov. - M.: Binom, 2015. - 240 p.

**Additional literature:**

1. Bakhvalov, N.S. Numerical methods./ Bakhvalov N.S., Zhidkov N.P., Kobelkov G.M. M.: BINOM. Knowledge Lab. 2004, 636 p.

**Resources of the information and telecommunications network "Internet":**

1. RUDN ELS and third-party ELS, to which university students have access on the basis of concluded agreements:

- RUDN Electronic Library System - RUDN EBS http://lib.rudn.ru/MegaPro/Web
- ELS "University Library Online" http://www.biblioclub.ru
- EBS Yurayt http://www.biblio-online.ru
- ELS "Student Consultant" www.studentlibrary.ru
- EBS "Lan" http://e.lanbook.com/
- EBS "Trinity Bridge"

**2. Databases and search engines:**
- electronic fund of legal and normative-technical documentation http://docs.cntd.ru/
- Yandex search engine https://www.yandex.ru/
- Google search engine https://www.google.ru/
- abstract database SCOPUS http://www.elsevierscience.ru/products/scopus/

## 8. ASSESSMENT TOOLKIT AND GRADING SYSTEM* FOR EVALUATION OF STUDENTS' COMPETENCES LEVEL UPON COURSE COMPLETION

Evaluation materials and a point-rating system* for evaluating the level of formation of competencies (parts of competencies) based on the results of mastering the discipline "Numerical analysis» are presented in the Appendix to this Work Program of the discipline

**Developer:**

| | **E.B. Laneev** |
|---|---|
| signature | name and surname |

**HEAD**
**OF HIGHER EDUCATION PROGRAMME:**

| | **V.I. Burenkov** |
|---|---|
| signature | name and surname |

HEAD
OF EDUCATIONAL DEPARTMENT

| | **A.B. Muravnik** |
|---|---|
| signature | name and surname |