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**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

«Interdisciplinary term paper»

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

1. COURSE GOAL(s)

The purpose of mastering the discipline "Interdisciplinary term paper" is to form the student's research skills, increase the level of his professional (theoretical and practical) training, provide a deeper assimilation of the academic discipline, develop interest in independent research work with scientific and reference literature

2. REQUIREMENTS FOR LEARNING OUTCOMES

Mastering the discipline " Interdisciplinary term paper" 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-1	Able to conduct scientific research and obtain new scientific and applied results independently and as part of a scientific team	PC-1.1. Draws up a general research plan and detailed plans for individual stages
		PC-1.2. Selects experimental and computational-theoretical methods for solving the problem based on the available material and time resources
PC-2	Able to develop and analyze conceptual and theoretical models of scientific problems and tasks to be solved	PC-2.1. Searches for specialized information in patent information databases
		PC-2.2. Analyzes and summarizes the results of a patent search on the subject of the project in the selected area of mathematics
PC-3	Able to develop and apply mathematical methods, system and application software for solving problems of scientific and design and technological activities	PC-3.1. Systematizes information obtained in the course of research, analyzes it and compares it with literature data
		PC-3.2. Determines possible directions for the development of work and prospects for the practical application of the results obtained
PC-4	Able to develop and analyze conceptual and theoretical models of the tasks to be solved in the design and production and technological activities	PC-4.1. Capable of compiling mathematical models in solving practical problems
PC-5	Able to manage projects, plan research activities, analyze risks, manage a project team	PC-5.1. Capable of planning when organizing research activities
PC-9	Able to teach mathematical disciplines and informatics in general educational organizations, professional educational organizations and educational institutions of higher education	PC-9.1. Formation of pedagogical skills and abilities
		PC-9.2. Ability to work and interact with a team

3.COURSE IN HIGHER EDUCATION PROGRAMME STRUCTURE

The discipline "Interdisciplinary course work" refers to the mandatory part 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 "Interdisciplinary term paper".

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-1	Able to conduct scientific research and obtain new scientific and applied results independently and as part of a scientific team	-	Research work, Undergraduate practice, State examination
PC-2	Able to develop and analyze conceptual and theoretical models of scientific problems and tasks to be solved	-	Research work, State examination
PC-3	Able to develop and apply mathematical methods, system and application software for solving problems of scientific and design and technological activities	-	State exam
PC-4	Able to develop and analyze conceptual and theoretical models of the tasks to be solved in the design and production and technological activities	-	State exam
PC-5	Able to manage projects, plan research activities, analyze risks, manage a project team	-	Nonlinear Analysis and Optimization, State Exam
PC-9	Able to teach mathematical disciplines and informatics in general educational organizations, professional educational organizations and educational institutions of higher education	-	State exam

4. COURSE WORKLOAD AND ACADEMIC ACTIVITIES

The total labor intensity of the discipline " Interdisciplinary term paper" 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
<i>Contact work, academic hours</i>						
Lectures (LC)						
Lab work (LW)						
Seminars (workshops/tutorials) (S)						
<i>Self-studies</i>						
<i>Evaluation and assessment (exam/passing/failing grade)</i>		72		72		
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. The Cauchy problem and initial-boundary value problems for the equation of string vibrations	Topic 1.1. Construction of solutions to the Cauchy problem and initial-boundary value problems for the equation of string vibrations by the method of propagating waves	-
Section 2. The Cauchy problem for the heat equation	Topic 2.1. Construction of solutions to the Cauchy problem for the heat equation using the Poisson formula	-
Section 3. Variable separation method	Topic 3.1. Construction of solutions to boundary value problems for various classes of partial differential equations by separation of variables	-
Section 4. Quasi-linear equations of the 1st order	Topic 4.1. Construction of classical solutions of the Cauchy problem by the method of characteristics. Construction of solutions to the Riemann problem on discontinuity decay	-

6. CLASSROOM EQUIPMENT AND TECHNOLOGY SUPPORT REQUIREMENTS

Table 6.1. Classroom equipment and technology support requirements

Classroom type	Classroom equipment	Specialized educational/laboratory equipment, software and materials for mastering the discipline
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) Eltsov, A.A. Differential equations: textbook / A.A. Eltsov, T.A. Yeltsov; Ministry of Education and Science of the Russian Federation, Tomsk State University of Control Systems and Radioelectronics (TUSUR). - Tomsk: El Content, 2013. - 197 p.: ill. - Bibliography: pp. 89-90 - ISBN 978-5-4332-0128-6 (<http://biblioclub.ru/index.php?page=book&id=480606>)
- 2) Kovrizhnykh A.Yu. Differential and difference equations / A.Yu. Kovrizhnykh, O.O. Kovrizhnykh; Ministry of Education and Science of the Russian Federation, Ural Federal University. the first President of Russia B. N. Yeltsin. - Yekaterinburg: Ural University Press, 2014. - 150 p. - ISBN 978-5-7996-1341-9 (<http://biblioclub.ru/index.php?page=book&id=275742>)
- 3) Astashova, I.V. Workshop on the course "Differential Equations": textbook / I.V. Astashova, V.A. Nikishkin. - Moscow: Eurasian Open Institute, 2011. - 96 p. - ISBN 978-5-374-00488-5 (<http://biblioclub.ru/index.php?page=book&id=90289>).

Additional literature:

1. Gevorkyan, E.A. Delayed differential equations: educational and methodological complex / E.A. Gevorgyan. - Moscow: Eurasian Open Institute, 2011. - 155 p. - ISBN 978-5-374-00568-4 (http://biblioclub.ru/index.php?page=book_red&id=90344)
2. Rybakov, K.A. Ordinary differential equations: Practical course: textbook / K.A. Rybakov, A.S. Yakimova, A.V. Pantelev. - Moscow: Logos, 2010. - 384 p. - (New University Library). - ISBN 978-5-98704-465-0 (<http://biblioclub.ru/index.php?page=book&id=84753>).
3. Stepanov V.V. Course of differential equations. M., all years of publication
4. Petrovsky I.G. Lectures on the theory of ordinary differential equations. M., all years of publication
5. Pontryagin L.S. Ordinary differential equations. M., all years of publication
6. Arnold V.I. Ordinary differential equations. M., 2010
7. Filippov A.F. Collection of problems on differential equations. M., all years of publication
8. Matveev N.M. Methods for integrating ordinary differential equations. L., all years of publication

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 "Interdisciplinary term paper» are presented in the Appendix to this Work Program of the discipline

Developer:

A.V. Faminskii

signature

name and surname

**HEAD
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V.I. Burenkov

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**HEAD
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