Federal State Autonomous Educational Institution of Higher Education
PEOPLES' FRIENDSHIP UNIVERSITY OF RUSSIA NAMED AFTER PATRICE LUMUMBA
RUDN University

Academy of Engineering

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

COURSE SYLLABUS

Geoinformation Systems and Applications

(name of the discipline/module)

Recommended by the Didactic Council for the Education Field of:

13.04.03 POWER ENGINEERING

(field of studies / speciality code and title)

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

MECHANICAL ENGINEERING

(higher education programme profile/specialisation title)

2024 г.

1. COURSE GOAL(s)

The discipline "Geoinformation Systems and Applications" is included in the master's degree program "Mechanical Engineering" in the direction of 13.04.03 " Power Engineering" and is studied in the 2nd semester of the 1st year. The discipline is implemented by the Department of Mechanics and Control Processes. The discipline consists of 5 sections and 11 topics and is aimed at studying the fundamental foundations of remote sensing of the Earth, the theoretical principles of the organization of geoinformation systems, computer geoinformation technologies for processing spatial and temporal data; analysis of the main methods for solving typical problems and familiarization with the field of their application in professional activities.

The purpose of mastering the discipline is to form the fundamental knowledge necessary for making informed decisions at all stages of using geoinformation systems focused on the analysis of spatial (geographical) data, increasing the overall level of digital literacy of students.

2. REQUIREMENTS FOR LEARNING OUTCOMES

The development of the discipline "Geoinformation systems and their application" is aimed at the formation of the following competencies (parts of competencies) among students:

Table 2.1. List of competencies formed by students during the development of the discipline (results of the development of the discipline)

Code	Competence descriptor	Indicators of competence achievement (within the framework of this discipline)
UC-7	Able to search for the necessary sources of information and data, perceive, analyze, memorize and transmit information using digital means, as well as using algorithms when working with data obtained from various sources in order to effectively use the information received to solve problems; evaluate information, its reliability, build logical conclusions based on incoming information and data	UC-7.1 To know the methods of collecting and processing information using digital means, as well as current Russian and foreign sources of information in the field of professional activity, principles, methods and means of solving standard tasks of professional activity using digital means and taking into account the basic requirements of information security; UC-7.2 Be able to apply methods of searching, collecting and processing information; using digital means, carry out critical analysis and synthesis of information obtained from various sources, and solve standard tasks of professional activity using digital means and taking into account the basic requirements of information security; UC-7.3 B possess methods of searching, collecting and processing, critical analysis and synthesis of information using digital tools to solve tasks, skills in preparing reviews, annotations, abstracts, scientific reports, publications and bibliographies on research work using digital tools and taking into account information security requirements;

3. COURSE IN HIGHER EDUCATION PROGRAM STRUCTURE

The discipline "Geoinformation systems and application" belongs to the mandatory part of block 1 "Disciplines (modules)" of the educational program of higher education.

Within the framework of the educational program of higher education, students also master other disciplines and/or practices that contribute to achieving the planned results of mastering the discipline "Geoinformation systems and application".

Table 3.1. The list of the higher education program components that contribute to the achievement of the expected learning outcomes as the internship results

Code	Competence descriptor	Previous courses/modules, internships	Subsequent courses/modules, internships
UC-7	Able to search for the necessary sources of information and data, perceive, analyze, memorize and transmit information using digital means, as well as using algorithms when working with data obtained from various sources in order to effectively use the information received to solve problems; evaluate information, its reliability, build logical conclusions based on incoming information and data	Modern computer communication services; Digital technologies in energy engineering.	Reduction of internal combustion engine pollution issues; Digital technologies in energy engineering.

* - it is filled in according to the competence matrix

** - elective disciplines /practices

4. COURSE WORKLOAD

The total workload of the course «Geoinformation Systems and Applications» is «3» credits.

Table 4.1. Academic activities types by periods of the higher education program

Type of academic activities	Total, academic hours		Semester(s) 2
Contact work, academic hours	*51*		*51*
Lectures (**LC**)	17		17
Lab works (**LW**)	34		34
Seminars (workshops / tutorials) (**S**)	0		0
Self-studies, academic hours	*57*		*57*
Evaluation and assessment, academic hours	*0*		*0*
Course workload	**academic hours**	*108*	*108*
	credits	*3*	*3*

5. COURSE CONTENTS

Table 5.1. The content of the discipline (module) by type of academic work

№	Modules		Contents (topics)	Academic activities types
Section 1	Fundamental concepts of geoinformatics	1.1	Geographic information system: overview, software and data, spatial and attribute data, vector and raster data, layers, networks and web clients.	LC, LW, S
		1.2	Open and Commercial GIS.	LC, LW, S
		1.3	Thematic GIS applications.	LC, LW, S
Section 2	Geoinformation systems and spatial data	2.1	Data sources for GIS. Data entry problems.	LC, LW, S
		2.2	Remote sensing as a data source.	LC, LW, S
		2.3	Geographic reference and cartographic projections in GIS.	LC, LW, S
Section 3	Thematic mapping, surfaces and digital terrain model (DEM)	3.1	Compilation of thematic maps, types of digital terrain models, algorithms for working with DEM, creation of 3D terrain models.	LC, LW, S
		3.2	Integrated use of remote sensing data and geoinformation technologies in industry management	LC, LW, S
Section 4	Analytical functions of GIS	4.1	Typical requests. Overlay.	LC, LW, S
		4.2	Spatial queries in GIS	LC, LW, S
Section 5	Design of the project style	5.1	Creating a map layout	LC, LW, S

6. CLASSROOM EQUIPMENT AND TECHNOLOGY SUPPORT REQUIREMENTS

Table 6.1. Classroom equipment and technology support requirements

Type of academic activities	Classroom equipment	Specialized educational / laboratory equipment, software and materials for course study (if necessary)
Lectures	An auditorium for conducting lectures, equipped with a set of specialized furniture; a blackboard (screen) and technical means for multi-media presentations.	
Computer class	A classroom for conducting classes, group and individual consultations, current and mid-term assessment, equipped with personal computers (in the amount of 15 pcs), a board (screen) and technical means of multimedia presentations.	
Seminar room	An auditorium for conducting seminar-type classes, group and individual consultations, ongoing monitoring and intermediate certification, equipped with a set of specialized furniture and multimedia presentation equipment.	
Self-studies	A classroom for independent work of students (can be used for seminars and consultations), equipped with a set of specialized furniture and computers with access to the electronic information and educational environment.	

7. RESOURCES RECOMMENDED FOR INTERNSHIP

Main readings:
1. E. Baldina. A. Labutina.And decryption of aerospace images: textbook, [electronic edition of network distribution] / E.A. Baldina, I.A. Labutina. – 2nd ed., revised and supplemented. – M.: "KSU", "Dobrosvet", 2021. - 269 p.

2. Robert A. Shovengert, Remote sensing. Models and methods of image processing / shovengerdt R.A.; Kiryushin A.V., Demyanikov A.I. (in trans. see). — 3rd ed. - M.: Technosphere, 2013. - 589 p.

3. Monograph "The state and prospects of using the results of space activities in the interests of modernizing the economy of the Russian Federation and the development of its regions" / Makarov Yu.N., Bezborodov V.G., Zhiganov A.N., etc.; edited by V.G. Bezborodov. - Moscow: CJSC "Research Institute "ENZITECH", 2014. - 318 p.

4. Geoinformatics. // Kapralov E.G., Koshkarev A.V., Tikunov V.S., Lurie I.K., Serapinas B.B., Rylsky I. N.A.; edited by N. Tikunov V.S. – 3rd ed., reprint. and additional – M. Academy, 2010. ISBN: 5-7695-6468-7 ISBN 978-5-7695-6468-0, 400 pages.

5. Fig. U. G. Fundamentals of remote sensing/U. Fig.- Moscow: Technosphere,2006, ISBN 5-94836-094-6.-336.

6. O. Tokareva.S. Processing and interpretation of Earth remote sensing data. A study guide. Publishing house of Tomsk Polytechnic University. Tomsk, 2010 -148 P.

7. A. Malinovsky.C. Regional management. The teaching manual of the state. University of the Higher School of Economics, Moscow:ed. House of GOUVE, 2006.

8. Shikhov A.N., Cherepanova E.S., Pyankov S.V. Geoinformation systems: methods of spatial analysis: textbook. handbook /A.N. Shikhov, E.S. Cherepanova, S.V. Pyankova. Perm. state National issl.un-ta. – Perm, 2017-88 P.: ill.

Additional readings:
1. Geoinformatics: in 2 books: textbook for students of higher educational institutions / Kapralov E.G., Koshkarev A.V., Tikunov V.S., etc.; ed. Tikunova V.S. – 2nd ed., reprint. and additional – M. Academy, 2008, 384 p.

2. Tikunov V.S., Kapralov E.G. Koshkarev A.V. and others. Fundamentals of geoinformatics. Textbook for universities. M. Academy. 2004, 2006

3. Geoinformation mapping. Methods of geoinformatics and digital processing of satellite images: textbook. // Lurie I.K. - 2nd edition, revised – Moscow: KDU, 2010.

4. Mirtova I.A., Topographic decryption of Land and urban cadastre objects. Textbook - M.:–Publishing house of MIIGAiK, 2007 -120 p.

5. Handbook of standard and used (common) terms) on geodesy and cartography, topography, geoinformation systems, spatial data// Alexandrov V.N., Bazina M.A., Zhurkin I.G., Kornilova L.V., Pleshkov V.G., Pobedinsky G.G., Rebriy A.V., Timkina O.V. - M. Bratishka, 2007-736 p

. 6. Zhurkin I.G., Shaitura S.V. Geoinformation systems. Kudits Press, 2009– 272 p.

7. Gruzinov V.S. System foundations of geoinformation modeling of territories // Geodesy and cartography. - 2009. - No. 1 - pp. 51-54

8. Gruzinov V.S. Knowledge system as an element of GIS information support // Izvestiya vuzov. Geodesy and aerial photography. - 2009. - No. 3 - pp. 72-75

9. Gruzinov V.S. Prospects for the development of GIS software functionality // Izvestiya vuzov. Geodesy and aerial photography. - 2009. No. 6 - pp.89-91

10. Gruzinov V.S. Geoportals and geosets as elements of the geospatial data exchange infrastructure // Izvestia of Higher educational institutions. Geodesy and Aerial Photography, No. 1, 2014 pp. 95-100

11. Zhurkin I.G., Chaban L.N., Gruzinov V.S. Geoinformation modeling and mapping of natural resource potential. Geodesy and Cartography, No. 7, 2009, pp. 34-39

Internet sources

Electronic libraries (EL) of RUDN University and other institutions, to which university students have access on the basis of concluded agreements:

- RUDN Electronic Library System (RUDN ELS) http://lib.rudn.ru/MegaPro/Web
- EL "University Library Online" http://www.biblioclub.ru
- EL "Yurayt" http://www.biblio-online.ru
- EL "Student Consultant" www.studentlibrary.ru
- EL "Lan" http://e.lanbook.com/
- EL "Trinity Bridge"
2. Databases and search engines:
- electronic foundation of legal and normative-technical documentation http://docs.cntd.ru/
- Yandex search engine https:// www .yandex.ru/
- Google search engine https://www.google.ru/
- Scopus abstract database http://www.elsevierscience.ru/products/scopus/
      1. *The training toolkit and guidelines for a student* «Geoinformation System and Application».

8. ASSESSMENT TOOLKIT AND GRADING SYSTEM* FOR EVALUATION OF STUDENTS' COMPETENCES LEVEL AS INTERNSHIP RESULTS

The assessment toolkit and the grading system* to evaluate the level of competences (competences in part) formation as the course Geoinformation System and Application results are specified in the Appendix to the internship syllabus.

      * The assessment toolkit and the grading system are formed on the basis of the requirements of the relevant local normative act of RUDN University (regulations / order).

DEVELOPERS:

Associate Professor		D.O. Dryga
Position	*Signature*	

HEAD OF EDUCATIONAL DEPARTMENT:

Head of Department		Yu.N. Razoumny
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