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Federal State Autonomous Educational Institution of Higher Education
PEOPLES' FRIENDSHIP UNIVERSITY OF RUSSIA
RUDN University
Academy of Engineering

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

COURSE SYLLABUS OF THE DISCIPLINE

**Applications of Geoinformation Systems / Практикум применения
геоинформационных систем**

(name of discipline/module)

Recommended by the Didactic Council for the Education Field:

21.04.01 Oil and gas engineering

(code and name of the Higher Education Field)

The development of the discipline is carried out within the framework of the implementation of the higher education program of higher education (Higher Education Program):

Oil and gas engineering / Технологии добычи и транспортировки нефти и газа

(name (profile/specialization) of the Higher Education Program)

1. COURSE GOALS

The purpose of mastering the discipline "Applications of Geoinformation Systems / Практикум применения геоинформационных систем" is to form a new quality of education using the latest software that allows you to use the results of space activities (RSA), the formation of special professional competencies associated with the possibility of using innovative management methods in solving applied problems.

The aims of the course are:

- formation and development of professional, methodological, information and communication competence in accordance with the requirements of the State educational standards of the new generation;
- formation of special professional competencies related to the possibility of using innovative methods of information support for management processes in solving applied problems;
- maximum approximation of the latest achievements of Russian science to the needs of the educational process;
- mastering the methodology of project activities, taking into account the use of digital educational resources;
- providing a new quality of education using the latest software that allows you to use the achievements of the RSA.

2. LEARNING OUTCOMES

Mastering the discipline "Applications of Geoinformation Systems / Практикум применения геоинформационных систем" is aimed at developing the following competencies (parts of competencies) among students:

Table 2.1. The list of competencies formed by students in the course of mastering the discipline (the results of mastering the discipline)

| Competence code | Competence | Competence indicators (within this discipline) |
|-----------------|--|--|
| GPC-4 | Able to find and process the information required for decision-making in scientific research and in practical technical activities | <p>GPC-4.1. Knows the technology of conducting standard experiments on standard equipment in the laboratory and in production; a complex of modern methods for processing the results of research, practical technical activities using existing equipment, instruments and materials.</p> <p>GPC-4.2. Can independently search, analyze and select the necessary information, organize, transform, store and transmit it; analyze the internal logic of scientific knowledge; justify their worldview and social position and apply the acquired knowledge in areas not related to professional activities; assess innovation risks; compare and process the results of research activities using standard equipment, instruments and materials.</p> <p>GPC-4.3. Has the technique of experimentation using software packages; the main directions of development of innovative technologies in the oil and gas industry; the skills in developing innovative approaches in specific technologies with the help of AWS.</p> |

| Competence code | Competence | Competence indicators (within this discipline) |
|-----------------|--|--|
| GPC-5 | Able to evaluate the results of scientific and technical developments, scientific research and justify their own choice, systematizing and summarizing achievements in the oil and gas industry and related fields | <p>GPC-5.1. Knows the complex of modern technological processes and productions in the field of oil and gas engineering; the modern innovative achievements and scientific research carried out at the present stage; methods and principles of systematization and generalization of the results of achievements in the oil and gas industry and related fields; main technologies for search, exploration and organization of oil and gas production in Russia and abroad, standards and specifications, sources of information, mass media and multimedia technologies.</p> <p>GPC-5.2. Can consciously perceive information, independently search, extract, systematize, analyze and select information necessary for solving problems, organize, transform, store and transmit it; interpret the results of laboratory and technological studies in relation to specific conditions.</p> <p>GPC-5.3. Has the methods of collecting, processing and interpreting the information received, using modern information technologies and applied hardware and software, methods of protecting, storing and presenting information.</p> |
| SPC-1 | Able to use theoretical knowledge when performing technological scientific research in the field of development, transportation and processing of oil and gas | <p>SPC-1.1 Knows fundamental concepts in the field of geology of oil and gas fields, methods of forecasting, prospecting and exploration of mineral deposits; regulatory and methodological documents in the field of hydrocarbon production and development of oil and gas fields</p> <p>SPC-1.2 Can use theoretical knowledge and mining and geological information to carry out technological scientific research, as well as apply knowledge of regulatory and methodological documents to assess oil and gas fields</p> <p>SPC-1.3 Has the theoretical knowledge, methods of subsurface research in the field of oil and gas field development; skills to perform production, technological and engineering research in the field of hydrocarbon production, development of oil and gas fields</p> |

3. ACADEMIC PROGRAM STRUCTURE

The discipline "Workshop on the application of geographic information systems" refers to refers to the base part of block B1 of the Higher Education Program.

As part of the Higher Education Program, students also master other disciplines and / or practices that contribute to the achievement of the planned results of mastering the discipline "Practical work on the use of geographic information systems".

Table 3.1. List of Higher Education Program components / disciplines that contribute to expected learning/training outcomes

| Competence code | Name of competence | Previous disciplines/modules, practices* | Subsequent disciplines/modules, practices* |
|-----------------|--|---|--|
| GPC-4 | Able to find and process the information required for decision-making in scientific research and in practical technical activities | - | Information technologies in the oil and gas industry / Информационные технологии в нефтегазовом комплексе Current development of the production of unconventional hydrocarbon resources in the world / Современное развитие добычи нетрадиционных ресурсов углеводородов в мире SFC |
| GPC-5 | Able to evaluate the results of scientific and technical developments, scientific research and justify their own choice, systematizing and summarizing achievements in the oil and gas industry and related fields | History and methodology of subsoil use / История и методология недропользования | Research work (obtaining primary skills in research work) / Научно-исследовательская работа (получение первичных навыков научно-исследовательской работы) SFC |
| SPC-1 | Able to use theoretical knowledge when performing technological scientific research in the field of development, transportation and processing of oil and gas | - | Current development of the production of unconventional hydrocarbon resources in the world / Современное развитие добычи нетрадиционных ресурсов углеводородов в мире Advanced oil and gas processing equipment and product quality management / Современное оборудование для переработки нефти и газа и управление качеством производимой продукции Innovative technologies for the development of hydrocarbon deposits / Инновационные технологии разработки месторождений углеводородов Innovative technologies for the transportation and storage of hydrocarbons / Инновационные технологии транспортировки и хранения углеводородов Comprehensive analysis of processing, storage and marketing of hydrocarbons / Комплексный анализ переработки, хранения и сбыта углеводородов Research work (obtaining primary skills in research work) / Научно-исследовательская работа (получение первичных навыков научно-исследовательской работы) Research work / Научно- |

| Competence code | Name of competence | Previous disciplines/modules, practices* | Subsequent disciplines/modules, practices* |
|-----------------|--------------------|--|--|
| | | | исследовательская работа Pre-graduate practice / Преддипломная практика SFC |

* - filled in in accordance with the matrix of competencies and the Higher Education Program.

4. COURSE WORKLOAD and ACADEMIC/TRAINING/LEARNING ACTIVITIES

The course total workload for the discipline "Applications of Geoinformation Systems / Практикум применения геоинформационных систем" is equal to 3 credits.

Table 4.1 Types of academic activities during the period of the HE program mastering

| Type of study work | TOTAL, acc. | Semester(s) | | | |
|--|----------------|-------------|------------|---|---|
| | | 2 | - | - | - |
| <i>Contact work, acc.</i> | 48 | 48 | | | |
| including: | | | | | |
| Lectures | 16 | 16 | | | |
| Laboratory work | 32 | 32 | | | |
| Seminars (workshops/tutorials) | | | | | |
| <i>Self-study (ies), academic hours</i> | 60 | 60 | | | |
| <i>Evaluation and assessment (exam or pass/fail grading)</i> | | | | | |
| The course total workload | acc. hrs. | 108 | 108 | | |
| | credits | 3 | 3 | | |

5. COURSE MODULE and CONTENTS

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

| Name of the discipline section | Contents of the section (topic) | Type of study* |
|--|---|-------------------|
| Geoinformation analysis | Digital elevation model; air pollution. | Lecture, Lab work |
| Methodology of geoinformation approach in solving applied problems | Methods of complex analysis of spatial data and their features in solving specific industry problems: Geoportal solutions based on the use of RKD in sectoral management. Capabilities of technological platforms selected for deploying geoportal data | Lecture, Lab work |

6. CLASSROOM EQUIPMENT and TECHNOLOGY SUPPORT REQUIREMENTS

- Table 6.1. Classroom Equipment and Technology Support Requirements

| Classroom for Academic Activity Type | Classroom equipment | Specialized educational / laboratory equipment, software and materials for mastering the discipline (if necessary) |
|--------------------------------------|---|--|
| computer class | System unit assembly for working with engineering software and 3D modeling programs Country of origin Russia/Processor CPU Intel Core i7-7700, Pre-installed operating system | Auditorium 207, 1. PC "Quantum GIS (QGIS)"; 2. PC "MapInfo"; 3. PC "AutoCAD Map3D"; 4. S.A.S. Planet; |

| Classroom for Academic Activity Type | Classroom equipment | Specialized educational / laboratory equipment, software and materials for mastering the discipline (if necessary) |
|--------------------------------------|---|---|
| | Windows 10 Pro 64Bit Russian, Monitor Philips 243V7QDAB 23.8" Scope of delivery: system units-25 pcs. Qty - monitors - 50 pcs (000000000147015) VERNER CF/LB chrome PU18 25 pcs BenQ MX507 projector for classroom with screen and bracket included 1 pc Motorized screen Viewscreen Breston (4:3) 203*153 (195*145) MW(EBR-4303) EBR-4303 1 pc Mitsubishi Electric Inverter Air Conditioner PLA-RP125EA/PUHZ-P125YKA 1 pc. work tables 25 pcs | 5. PC "ScanEx Image Processor"; JOSM ; |
| For self-study | An auditorium 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 EIOS. | Classroom No. 5 for independent work. st. Miklukho-Maclay, house 8, building 3. A set of specialized furniture; technical means: projection screen; mobile whiteboard, Epson multimedia projector EMP S -42 - 1 pc. Samsung laptop RC 730 - 1 pc. |

7. EDUCATIONAL-METHODOLOGICAL AND INFORMATION SUPPORT OF THE DISCIPLINE

Main reading(sources):

1. Shovengerdt Robert A. Remote sensing. Models and methods of image processing / Shovengerdt R.A.; Kiryushin A.V., Demyannikov A.I. (translated from English). - 3rd ed. — M.: Technosfera, 2013. — 589 p.
2. Monograph "The state and prospects of using the results of space activities in the interests of modernizing the economy of the Russian Federation and developing its regions" / Makarov Yu.N., Bezborodov V.G., Zhiganov A.N. and etc.; under the general editorship of V.G. Bezborodov. - Moscow: CJSC "NII "ENZITEKH", 2014. - 318 p.
3. Geoinformatics. // Kapralov E.G., Koshkarev A.V., Tikunov V.S., Lurie I.K., Serapinas B.B., Rylsky I.A.; ed. Tikunova V.S. - 3rd ed., revised. and additional - M. Academy, 2010. ISBN: 5-7695-6468-7 ISBN 978-5-7695-6468-0, 400 pages.
4. Rice U.G. Fundamentals of remote sensing/U. Fig.-Moscow: Technosphere, 2006, ISBN 5-94836-094-6.-336.
5. Tokareva O.S. Processing and interpretation of Earth remote sensing data. Tutorial. Publishing House of the Tomsk Polytechnic Institute. Tomsk, 2010 -148 p.
6. Malin A.S. Regional management. Uch. allowance State. Univ. Higher School of Economics M.: ed. house GUVSE, 2006.
7. Shikhov A.N., Cherepanova E.S., Pyankov S.V. Geoinformation systems: methods of spatial analysis: textbook. allowance / A.N. Shikhov, E.S. Cherepanova, S.V. Pyankov. Perm. state nat. research university - Perm, 2017 - 88 p.: ill.

Additional(optional) reading (sources):

1. Geoinformatics: in 2 books: a textbook for students of higher educational institutions / Kapralov E.G., Koshkarev A.V., Tikunov V.S. and etc.; ed. Tikunova V.S. - 2nd ed., revised. and additional - M. Academy, 2008, 384 p.
2. Tikunov V.S., Kapralov E.G. Koshkarev A.V. etc. Fundamentals of geoinformatics. Textbook for high schools. M. Academy. 2004, 2006
3. Geoinformation mapping. Methods of geoinformatics and digital processing of space images: textbook. // Lurie I.K. - 2nd edition, revised - M.: KDU, 2010.
4. Mirtova IA, Topographic interpretation of objects of the Land and city cadastre. Textbook - M.: - Publishing House MIIGAiK, 2007 -120 p.
5. Reference book 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. Brother, 2007 -736 p.
6. Zhurkin I.G., Shaitura S.V. Geoinformation systems. Kudits-Press, 2009– 272 p.
7. [Gruzinov V.S. System bases of geoinformation modeling of territories // Geodesy and cartography. - 2009. - No. 1 - p. 51-54](#)
8. Gruzinov V.S. Knowledge system as an element of GIS information support. Izvestiya vuzov. Geodesy and aerial photography. - 2009. - No. 3 - p. 72-75
9. Gruzinov V.S. Prospects for the development of functional capabilities of GIS software. Izvestiya vuzov. Geodesy and aerial photography. - 2009. No. 6 - p.89-91
10. Gruzinov V.S. [Geoportals and Geonetworks as Elements of the Geospatial Data Exchange Infrastructure // Izvestia of Higher Educational Institutions. Geodesy and aerial photography, No. 1, 2014 p. 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 p. 34-39
12. Kravchenko Yu.A. Fundamentals of designing geomodeling systems. Book 2 Information geomodelling. Models and methods. SSGA, Novosibirsk, 2008

Internet-(based) sources:

1. Interregional public organization for promoting the development of the market for geoinformation technologies and services Web-site of the GIS - Association: <http://www.gisa.ru>
2. Association of developers, manufacturers and consumers of equipment and applications based on global navigation satellite systems "GLONASS / GNSS-Forum": <http://aggf.ru/>
3. Intersectoral journal of navigation technologies Vestnik GLONASS: <http://vestnik-olonass.ru/>
4. State and prospects of the Russian satellite navigation market in 2010: an analytical review. – M: 2011 http://aggf.ru/analitika/AGGF_2011.pdf
5. Introduction to Geoinformation Systems / GIS-Lab and Authors Web site (<http://gis-lab.info/docs/giscourse>), Aug. 2007
6. [Basic GIS - platform REKOD . http://ssc.rekod.ru/content/services/3](#)

Resources of the information and telecommunications network "Internet":

1. Electronic libraries with access for RUDN students:

- 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.entd.ru/>
 - Yandex search engine [https:// www .yandex.ru/](https://www.yandex.ru/)
 - Google search engine <https://www.google.ru/>
 - abstract database **SCOPUS** <http://www.elsevierscience.ru/products/scopus/>

Learning toolkits for self- studies in the RUDN LMS TUIS:

1. A course of lectures on the discipline "Practical work on the use of geographic information systems."
2. Guidelines for independent work of students in the discipline "Practical work on the use of geographic information systems."



* - all educational and methodological materials for independent work of students are placed in accordance with the current procedure on the page of the discipline **in TUIS!**

8. ASSESSMENT AND EVALUATION TOOLKIT

Marking criteria (MC) and a 100-point (score) scale for evaluating the level of competencies (parts of competencies) based on the results of mastering the discipline "Practical work on the use of geographic information systems" are presented in the Appendix to this Work Program of the discipline.

* - MC and the 100-point (score) are formed on the basis of the requirements of the relevant local normative act of the Peoples' Friendship University of Russia.

DEVELOPERS:

| | | |
|--|--|-----------------|
| Associate Professor of the Department of Mechanics and Control Processes | | Kravtsov V.V. |
| Position, Department | Signature | Full name |
| Head of Department: | | |
| Director of the Department of Mineral Developing and Oil&Gas Engineering |  | Kotelnikov A.E. |
| Name of Department | Signature | Full name |
| Head of Educational Programme: | | |
| Professor of the Department of Mineral Developing and Oil&Gas Engineering |  | Kapustin V.M. |
| Position, Department | Signature | Full name |