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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 programme developer

COURSE SYLLABUS

Alternative Energy Sources

course title

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 programme of higher education:

Mechanical Engineering

higher education programme profile/specialisation title

1. The COURSE GOAL

The discipline "Alternative Energy Sources" is included in the master's degree program "Mechanical Engineering" in the direction of 13.04.03 "Energy Engineering" and is studied in the 3rd semester of the 2nd year. The discipline is implemented by the Basic Department of Energy Engineering. The discipline consists of 3 sections and 9 topics and is aimed at exploring 13 possibilities of using alternative energy sources.

The purpose of mastering the discipline is to familiarize students with the current state of energy, prospects and ways of its development. The environmental problems associated with the development of energy, ways to reduce the harmful effects on the environment are considered. Possible energy sources and reasons limiting their use. Energy conversion, its necessity, possibilities and ways. The focus on saving energy consumption and the reasons for focusing on it. The development of creative thinking in terms of the issues under consideration.

2. REQUIREMENTS FOR LEARNING OUTCOMES:

The following competences are formed in the study process.

Table 2.1. List of competences that students acquire during the course

Competence code	Competence descriptor	Competence formation indicators
GC-1	Ability to carry out a critical analysis of problematic situations based on a systematic approach, develop a strategy for action.	GC-1.1. Analyzes the problematic situation and decomposes it into separate tasks; GC-1.2. Develops a strategy for solving the task; GC-1.3. Forms possible solutions to problems.
GPC-1	Ability to formulate research goals and objectives, identify priorities for solving problems, and select evaluation criteria.	GPC-1.1. Formulates the goals and objectives of the study; GPC-1.2. Defines the sequence of problem solving GPC-1.3. Formulates the criteria for making a decision.
PC-1	Ability to analyze, make scientific generalizations and conclusions, put forward new ideas, interpret and present the results of scientific research.	PC-1.1. Knowledge of modern methods of scientific research in the subject area; PC-1.2. The ability to conduct scientific research, analysis and put forward new ideas; PC-1.3. Have the skills to interpret and present the results of scientific research.

3. COURSE IN HIGHER EDUCATION PROGRAMME STRUCTURE

The subject refers to the variable component of (B1) block of the higher educational programme curriculum.

Within the higher education programme students also master other disciplines and internships that contribute to the achievement of the expected learning outcomes as results of the subject mastery

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

Competence code	Competence descriptor	Previous courses/modules, internships*	Subsequent courses/modules, internships*
GC-1	Ability to carry out a critical analysis of problematic situations based on a systematic approach, develop a strategy for action.	Philosophical issues of technical knowledge; Mathematical modeling of thermal processes; Special chapters of the theory of heat engines; Automatic heat engine control; Systems of fuel supply for ICE**; Prospects for the use of alternative	

		fuels in diesel engines**; Patenting; Independent Research Work (Practice in Obtaining Primary Skills in Research Work)	
GPC-1	Ability to formulate research goals and objectives, identify priorities for solving problems, and select evaluation criteria.	Internal Combustion Engine test methods; Special chapters of the theory of heat engines; Automatic heat engine control;	
PC-1	Ability to analyze, make scientific generalizations and conclusions, put forward new ideas, interpret and present the results of scientific research.	Systems of fuel supply for ICE**; Prospects for the use of alternative fuels in diesel engines**; Patenting; Independent Research Work (Practice in Obtaining Primary Skills in Research Work) Research Work	Undergraduate practice; Research Practice;

* - in accordance with the matrix of competencies and the SUP EP VO

4. WORKLOAD OF THE COURSE AND FORMS OF STUDY WORK

General workload of the course *4 credits, 144 hours. Table 4.1. Form of study work of EP HE*

Type of academic activities		Total academic hours	Semester(s)			
			3			
<i>Contact academic hours</i>		72	72			
including:						
Lectures (LC)		36	36			
Lab works (LW)		0	0			
Seminars (workshops / tutorials) (S)		36	36			
<i>Self-studies academic hours</i>		72	72			
<i>Evaluation and assessment academic hours</i>		0	0			
<i>Course work / project, credits</i>		0	0			
Course workload	academic hours	144	144			
	credits	4	4			

5. CONTENT OF THE COURSE

Table 5.1. Content of the course

The title of the section of the discipline	Content of the section (topic)	Types of educational work*
Section 1 Traditional and alternative energy sources.	The state strategy in the field of energy conservation.	LC, AW
	Secondary energy resources and energy conservation.	LC, SM, AW

Section 2 Renewable energy sources.	Solar energy.	LC, SM, AW
	Wind energy.	LC, SM, AW
	The energy of water flows.	LC, SM, AW
	Biofuels.	LC, SM, AW
	Geothermal energy	SM, AW
Section 3 Energy storage and conservation.	Energy storage devices.	LC, SM, AW
	Transmission and conservation of energy.	LC, SM, AW

* - LC – lecture, LR – laboratory work, SM – seminars; AW – Autonomous work

6. INTERNSHIP EQUIPMENT AND TECHNOLOGY SUPPORT REQUIREMENTS

Table 6.1. Technical Support Requirements

A type of aclassroom	Technical Support Requirements	Special equipment, software
For lectures	An auditorium for lecture-type classes, equipped with a set of specialized furniture; board (screen) and technical means of multi-media presentations	Technical means: projector Epson EH- TW5300 (LCD, 1080p 1920 x 1080, 2200Lm, 35000:1, 2 x HDMI, MHL, экран Draper Bar-onet NTSC (3:4) 244/96(8) 152*203 MW
For seminars	Auditorium for seminar-type classes, group and individual consultations, current control and intermediate certification, equipped with a set of specialized furniture and technical means of multimedia presentations	Computer class; technical equipment: personal computers, projection screen, multimedia projector, NEC NP-V302XG, Internet access. Software: Microsoft products (OS, office suite, incl. MS Office/Office 365, Teams, Skype),
For autonomous work	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	Computer class; technical equipment: personal computers, projection screen, multimedia projector, NEC NP-V302XG, Internet access. Software: Microsoft products (OS, office suite, including. MS Office/Office 365, Teams, Skype)

7. RESOURCES RECOMMENDED FOR THE COURSE:

Main literature:

- Кузьмин С. Н. Нетрадиционные источники энергии: биоэнергетика : учебное пособие / С.Н. Кузьмин, В.И. Ляшков, Ю.С. Кузьмина. - Москва : ИНФРА-М, 2018. - 128 с. - (Высшее образование: Бакалавриат). - ISBN 978-5-16-011314-2. - URL: <https://znanium.com/catalog/product/924946>. - Текст : электронный.
- Тетельмин В. В. Физические основы традиционной и альтернативной энергетики: учебное пособие / Тетельмин В.В., Язев В.А. - Долгопрудный: Интеллект, 2016. - 176 с. ISBN 978-5-91559-211-6. - URL: <https://znanium.com/catalog/product/552448>. - Текст : электронный.

3. Экологическая оценка возобновляемых источников энергии : учебное пособие / Г. В. Пачурин, Е. Н. Соснина, О. В. Маслеева, Е. В. Крюков. - 2-е изд., стер. - Санкт-Петербург : Лань, 2017. - 236 с. - ISBN 978-5-8114-2218-0. - URL : <https://e.lanbook.com/book/93003>. - Текст : электронный.

Additional readings:

1. Фортов В.Е. Энергетика в современном мире : учебное пособие / В.Е. Фортов, О.С. Попель. - Долгопрудный: Интеллект, 2011. - 168 с. - ISBN 978-5-91559-095-2. - URL : <https://znanium.com/catalog/product/255890>. - Текст : электронный.
2. Ергин Д. В поисках энергии: Ресурсные войны, новые технологии и будущее энергетики / Д. Ергин. - Москва : Альпина Пабли., 2016. - 712 с. - ISBN 978-5-9614-4379-0. - URL : <http://znanium.com/catalog/product/912389>. - Текст : электронный.
3. Гидроэнергетика : учебное пособие / Т.А. Филиппова, М.Ш. Мисриханов, Ю.М. Сидоркин, А.Г. Русина. - Новосибирск : НГТУ, 2013. - 620 с. - ISBN 978-5-7782-2209-0. - URL : <http://znanium.com/catalog/product/557101>. - Текст : электронный.

Electronic library systems:

1. 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/](https://www.yandex.ru/)
 - Google search engine <https://www.google.ru/>
 - Scopus abstract database <http://www.elsevierscience.ru/products/scopus/>

The training toolkit and guidelines for a student:

1. Collection of lectures on the course Alternative Energy Sources.

* The training toolkit and guidelines for the course are placed on the internship page in the university telecommunication training and information system under the set procedure.

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 Alternative Energy Sources 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:

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position, educational department

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