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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**

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

## **COURSE SYLLABUS**

### **Fueled heat engine co-generation plant**

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course title

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

### **13.04.03. POWER ENGINEERING**

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field of studies / speciality code and title

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

### **Mechanical Engineering**

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higher education programme profile/specialisation title

## 1. The COURSE GOAL

The discipline "Fuel heat engine co-generation plant" is included in the master's degree program "Mechanical Engineering" in the direction of 13.04.03 "Energy Engineering" and is studied in the 1st semester of the 1st year. The discipline is implemented by the Basic Department of Energy Engineering. The discipline consists of 2 sections and 7 topics and is aimed at studying ways to use cogeneration in the energy sector.

The purpose of mastering the discipline is to gain knowledge, skills and experience in the field of energy engineering, characterizing the stages of competence formation and ensuring the achievement of the planned results of mastering the educational program. The main objectives of the discipline are: To familiarize students with the basic schemes of cogeneration plants with heat engines as ways to solve problems in the field of energy-saving technologies in the energy sector. Modern methods of using secondary energy resources of heat engines are considered.

## 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-2	Ability to manage a project at all stages of its life cycle.	GC-2.1. Formulates a project task based on the problem posed and a way to solve it through the implementation of project management; GC-2.2. Develops the concept of the project within the framework of the designated problem: formulates the purpose, objectives, justifies the relevance, significance, expected results and possible areas of their application; GC-2.3. Plans the necessary resources, including taking into account the possibility of their replacement.
GPC-2	Ability to apply modern research methods, evaluate and present the results of the work performed.	GPC-2.1. Selects the necessary research method to solve the task; GPC-2.2. Analyzes the results obtained; GPC-2.3. Represents the results of the work performed.

## 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-2	Ability to manage a project at all stages of its life cycle.		Special chapters of the theory of heat engines. Improving of economical and ecological ICE characteristics. Undergraduate Training

GPC-2	Ability determine and implement the priorities of his own activities and ways to improve them based on self-assessment	-	Modern issues of power engineering science and manufacture.
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\* - 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)			
		1			
<i>Contact academic hours</i>	36	36			
including:					
Lectures (LC)	18	18			
Lab works (LW)	0	0			
Seminars (workshops / tutorials) (S)	18	18			
<i>Self-studies academic hours</i>	81	81			
<i>Evaluation and assessment academic hours</i>	27	27			
<i>Course work / project, credits</i>	0	0			
<b>Course workload</b>	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 Cogeneration.	Basic concepts and definitions. Ensuring energy security.	LC, SM, AW
	An overview of the types of cogeneration plants with heat engines, their main characteristics.	LC, SM, AW
	Cogeneration plants based on steam turbines.	LC, SM, AW
	Cogeneration plants based on gas turbines. Combined cycle gas installations.	LC, SM, AW
Section 2 Secondary energy resources of heat engines.	Cogeneration plants based on internal combustion engines.	LC, SM, AW
	Classification of heat pump installations (TNIs).	LC, SM, AW

	Characteristics of the secondary resources of the heat engine. The use of TNCs to increase the efficiency of the use of SER heat engines.	LC, SM, AW
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\* - 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 multimedia 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:

1. Трухний А.Д., Ломакин Б.В. Теплофикационные паровые турбины и турбо-установки. Учебное пособие. [Электронный ресурс] [https://www.studmed.ru/truhniy-ad-lomakin-bv-teplofikacionnye-parovye-turbiny-i-turboustanovki\\_8478e54a640.html](https://www.studmed.ru/truhniy-ad-lomakin-bv-teplofikacionnye-parovye-turbiny-i-turboustanovki_8478e54a640.html)
2. Трубаев П. А. Тепловые насосы: учеб. Пособие / П. А. Трубаев, Б. М. Гришко. – Белгород: Изд-во БГТУ, 2010. [Электронный ресурс] <http://eitas.bstu.ru/shared/attachments/125019>

### Additional readings:

1. Комбинированные двигатели внутреннего сгорания: Учебник для студентов вузов./ Н. Д. Чайнов, Н. А. Иващенко, А. Н. Краснокутский, Л. Л. Мягков; Под ред. Н. Д. Чайнова. - М.: Машиностроение, 2008. – 496 с. <https://www.twirpx.com/file/346021/>
2. Патрахальцев Н. Н. Повышение экономических и экологических качеств двигателей внутреннего сгорания на основе применения альтернативных топлив [Текст/электронный ресурс] : Учебное пособие / - М. : Изд-во РУДН, 2008. - 267 с. : ил. - (Приоритетный национальный проект "Образование": Комплекс экспортоориентированных инновационных образовательных программ по приоритетным направлениям науки и технологий). - Приложение: CD ROM (Электр.ресурс). - 94.64. <http://lib.rudn.ru/MegaPro2/Web/SearchResult/ToPage/1>
3. Патрахальцев Н. Н. Наддув двигателей внутреннего сгорания [Текст] : Учебное пособие / - М. : Изд-во РУДН, 2003, 2006. - 319 с. - ISBN 5-209-01501-7 : 125.00. <http://lib.rudn.ru/MegaPro2/Web/SearchResult/ToPage/1>
4. Рудаченко А. В. Газотурбинные установки для транспорта природного газа: учебное пособие. [Электронный ресурс] [http://portal.tpu.ru/files/departments/publish/IPR\\_Rudachenko.pdf](http://portal.tpu.ru/files/departments/publish/IPR_Rudachenko.pdf) ¶5

5. С.В. Цанев, В.Д. Бузов, А.Н. Ремезов. Газотурбинные и парогазовые установки тепловых электростанций. [Электронный ресурс] [https://www.studmed.ru/canev-sv-i-dr-gazoturbinnye-i-parogazovye-ustanovki-teplovyh-elektrostanciy\\_22c135f50bf.htm](https://www.studmed.ru/canev-sv-i-dr-gazoturbinnye-i-parogazovye-ustanovki-teplovyh-elektrostanciy_22c135f50bf.htm)

*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](http://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 Fueled heat engine co-generation plant.

\* 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 Fueled heat engine co-generation plant 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 in the Department  
of Energy Engineering

position, educational department

signature

Oshchepkov P.P.

name and surname

### **HEAD OF EDUCATIONAL DEPARTMENT:**

Head of the Department of  
Energy Engineering

position, educational department

signature

Yu.A. Radin

name and surname

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

Head of the Department of  
Energy Engineering

position, educational department

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Yu.A. Radin

name and surname