



Syllabus Course Program

Alternative fuels

Specialty

161 – Chemical technologies and engineering

Institute

SEI chemical technologies and engineering

Educational program

Oil, gas and solid fuel processing technologies

Department

Oil, gas and solid fuel processing technologies

Level of education

Bachelor's level

Course type

Selective

Semester

8

Language of instruction

English

Lecturers and course developers



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Doctor of Philosophy, senior lecturer of the Department of Oil, Gas and Solid Fuel Processing Technology of KhPI National Technical University.

Author of more than 30 scientific and educational and methodological works.
Learn more about the teacher on the department's website

General information

Summary

Acquisition of theoretical knowledge about the basics of production and use of alternative fuels..

Course objectives and goals

formation of students' theoretical knowledge and practical skills on the main issues of using alternative types of fuel, which will ensure the preparation of future bachelors to solve scientific and practical, technical, legal and organizational tasks facing the industry..

Format of classes

Lectures, practical works, consultations. The final control is an exam.

Competencies

The ability to solve complex specialized tasks and practical problems of chemical technologies and engineering, which involves the application of theories and methods of chemical technologies and engineering and is characterized by the complexity and uncertainty of conditions.

The ability to use modern materials, technologies and apparatus designs in chemical engineering.
Ability to choose and use appropriate equipment, tools and methods for control and management of technological processes of chemical production.

The ability to apply general scientific and special knowledge in the analysis of technological processes of production and use of alternative fuels..

Learning outcomes

Choose and design chemical-technological processes for processing alternative energy raw materials to obtain commercial fuel and lubricant materials of appropriate quality.

Understanding the needs of alternative fuels and lubricants and designing the technological processes of their production.

Use the acquired theoretical and practical knowledge to solve tasks related to the organization of tests, quality assurance and rational use of alternative fuels and lubricants..

Student workload

The total volume of the discipline is 120 hours: lectures - 40 hours, practical works - 10 hours, independent work - 70 hours.

Course prerequisites

To successfully complete the course, you must have knowledge and practical skills in the following disciplines: "General and Inorganic Chemistry", "Processes and Apparatus of Chemical Technology", "General Chemical Technology", "Fundamentals of Oil and Gas Processing Technologies", "Fundamentals of Solid Fuel Processing Technologies"

Features of the course, teaching and learning methods, and technologies

The training sessions of the course consist of classroom sessions (lectures, practical sessions, interviews with the teacher during the defense of test papers, consultations, exams) and independent work of students (performance of test papers, calculation tasks, preparation for their defense and exam).

The main type of classroom work is lectures, during which the teacher focuses on studying the properties, ecological characteristics and methods of obtaining alternative types of fuel.

The knowledge gained at the lectures is consolidated by students during other types of training sessions in order to transform them into knowledge and skills necessary for future practical work.

Students' independent work consists of performing control tasks, writing an essay, preparing for their defense and the exam..

Program of the course

Topics of the lectures

Topic 1 Classification of alternative fuels and raw materials for their production

Topic 2 Biomass energy. Solid biofuel

Topic 3 Granulated biofuel

Topic 4 Biogas.

Topic 5 Biohydrogen.

Topic 6 Gasification of biomass

Topic 7 Pyrolysis of biomass

Topic 8 Biofuel for internal combustion engines.

Topics of the workshops

Practical lesson 1 High-viscosity oils (preparation for processing, processing according to the fuel option, final products, their characteristics and applications). Natural oil bitumen and shale

Practical lesson 2 Obtaining hydrocarbons and methanol from synthesis gas. Prospects for gas processing into motor fuel and hydrogen.

Practical lesson 3 Obtaining motor fuels from coal. Types of solid combustible minerals and their physical and chemical characteristics. List, purpose and prospects for the development of coal processing processes.

Practical lesson 4 Obtaining motor fuels from vegetable raw materials, biomass and alcohols.

Topics of the laboratory classes

Laboratory work within the discipline is not provided.

Self-study

1. Classification of sources of raw materials for obtaining motor fuels and their brief characteristics (traditional and unconventional hydrocarbon and alternative non-hydrocarbon raw materials)
2. Prospects for production and processing of shale oil and shale gas
3. Production of hydrocarbons from synthesis gas
4. Hydrocarbon components of motor fuel from bioalcohols
5. Production of hydrogen.



6. Alternative gas fuels
7. Alcohol alternative fuels

Course materials and recommended reading

Basic materials:

- 1 Alternative Fuels The Future of Hydrogen, Third Edition. [Michael Frank Hordeski](#) 2013. 312 p.
2. Alternative Fuels. [Sunggyu Lee](#) 2023. 650 p.
3. Alternative Fuels and Their Application to Combustion Engines. S M Ashrafur Rahman. 2021. 114 p.

Assessment and grading

Criteria for assessment of student performance, and the final score structure

Points are awarded according to the following ratio:

- test papers: 20% of the semester grade;
- individual tasks: 60% of the semester grade;
- credit: 20% of the semester grade

Grading scale

Total points	National	ECTS
90–100	Excellent	A
82–89	Good	B
75–81	Good	C
64–74	Satisfactory	D
60–63	Satisfactory	E
35–59	Unsatisfactory (requires additional learning)	FX
1–34	Unsatisfactory (requires repetition of the course)	F

Norms of academic integrity and course policy

The student must adhere to the Code of Ethics of Academic Relations and Integrity of NTU "KhPI": to demonstrate discipline, good manners, kindness, honesty, and responsibility. Conflict situations should be openly discussed in academic groups with a lecturer, and if it is impossible to resolve the conflict, they should be brought to the attention of the Institute's management.

Regulatory and legal documents related to the implementation of the principles of academic integrity at NTU "KhPI" are available on the website:

<http://blogs.kpi.kharkov.ua/v2/nv/akademichna-dobrochesnist/>

Approval

Approved by

Date, signature

Head of the department

Denys MIROSHNYCHENKO

Date, signature

Guarantor of the educational program

Iryna SINKEVYCH

