



Syllabus of the educational component

Program of educational discipline

Computer-aided design systems

Code and name of specialty

161 – Chemical technologies and engineering

Institute

Educational and scientific institute for Chemical Technology and Engineering

Educational program

Technology of oil, gas and solid fuel refining processes

Department

Technology of oil, gas and solid fuel refining processes

Educational level

Bachelor

Type of discipline

Optional

Semester

7

Language of teaching

Ukrainian, English

Teachers, developers general information



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General information, amount of publications, main courses, etc.

[Learn more about the teacher on the department's website](#)

Abstract

The discipline introduces the modern systems of computer-aided design of various classes, mastering the functional capabilities and methods of its use, mastering the necessary techniques and practical skills for design work using the main systems of automated design (CAD).

Purpose and objectives of the disciplines

Students' acquisition of knowledge in the field of development and design of objects of the oil refining industry. The study of design stages, modern and promising methods of development of project documentation is foreseen.

Format of classes

Lectures, practical work, independent work, consultations. The final control is an exam.

Competences

Ability to demonstrate knowledge, understanding and skills in working with modern CAD

Learning outcomes

Be able to use modern software complexes for design and operational calculations of technological process parameters of primary and secondary oil processing, transportation and storage of oil and gas

Scope of the discipline

The total volume of the discipline is 120 hours. (4 ECTS credits): lectures - 20 hours, laboratory work - no hours, practical classes - 30 hours, independent work - 70 hours.

Prerequisites for studying the discipline (prerequisites)

Previous disciplines necessary for successful completion of the course:

Processes and devices of chemical technologies

Basics of oil and gas processing technology

Basics of technology of processing of solid combustible fossils

Basics of designing productions for the processing of combustible fossils

Features of the discipline, methods and technologies of education

The discipline is taught using the following traditional types of educational technologies and forms of organization of the educational process:

lecture;

practical training;

independent work;

individual calculation task;

consultations.

Conducting lectures is based on an active learning method, in which students take an active part, not only listening to the teacher, but also answering his questions. The teacher prepares in advance a list of questions that stimulate associative thinking and the formation of logical connections with the previously taught material.

Practical work is carried out using the AutoCAD software package. They are based on the study of the basic functionality of the software and the formation of the skills to independently solve typical engineering and design problems in accordance with the general task of a specific job. At the same time, students learn to apply a number of acquired knowledge and skills in practical activities, acquire elements of critical and analytical thinking.

The task for performing calculation and graphic work is determined by the teacher individually for each student. When processing it, it is necessary to use the AutoCAD computer program and reference literature. The finished work is checked in the form of a student survey with a demonstration of electronic results using the three-dimensional modeling program AutoCAD.

The study of materials for independent processing is carried out by students individually according to the general plan. At the same time, reference, methodical and educational literature that corresponds to a certain topic is used. Questions included in the list of control and examination tasks in the discipline must also be worked out.

Program of educational discipline

Topics of lectures

Topic 1. Introduction to automated design systems. Appointment of CAD. Stages of computer-integrated production. Types of engineering tasks. Modeling as a CAD tool. Signs of a system object. Means of providing CAD.

Topic 2. CAD of an oil refinery as a complex system. Methodical approaches to the development of CAD for the oil refining industry. Management of territorial assets of production. Energy consumption and energy efficiency. Means of ACS TP. Modeling and information systems. Measures of automated minimization of operating costs. CAD management: balancing production, time and labor.



Topic 3. Systematicity and data structures. The concept of engineering design. Principles of the system approach. Fundamentals of system engineering. Hierarchical structure of design specifications and hierarchical levels of design. Stages of design, content of technical design tasks. Classification of models and parameters used during automated design of fossil fuel processing enterprises.

Topic 4. CALS technologies. Stages of the product life cycle and their implementation activities. Prerequisites and reasons for the emergence of CALS technologies. Purpose and areas of application of CALS technologies. CAD system environments. Modern directions of CALS development. CALS standards. Industrial product quality management standards. STEP standard for describing product data. Basic components of STEP. Methods of description. Implementation methods. Application protocols. Typical fragments of information models.

Topic 5. CALS technologies. Stages of the product life cycle and their implementation activities. Prerequisites and reasons for the emergence of CALS technologies. Purpose and areas of application of CALS technologies. CAD system environments. Modern directions of CALS development. CALS standards. Industrial product quality management standards. STEP standard for describing product data. Basic components of STEP. Methods of description. Implementation methods. Application protocols. Typical fragments of information models.

Topic 6. Automated technological process management systems (ASUTP). Characteristics of the automatic control system. Implementation of ACSTP. SCAJA-systems. Appointment of ASOU. Comparison of ACS and MES-systems. Characteristics of ASUK. ASUK models. Tasks of ASUK.

Topic 7. CAD subsystems of the oil and gas and petrochemical industries. Designing the arrangement of the deposit. Formation, coordination and development of the technical task. Creation of a master plan of an industrial site. Enterprise infrastructure. Protection of subsoil and environment. CAD of architectural and construction solutions. CAD of industrial enterprise management.

Topic 8. Training of specialists. Automated systems of scientific research (ASND). Structure of ASND. Value of ASND components. Interaction with ASND. Automated learning systems (ANS). Training complexes. Interaction with ANS. Operator training options.

Topics of practical classes

Topic 1. Getting to know the interface of the AutoCAD software package. Learning the program menu. Workspace tools. Basic methods of creating and editing objects in the software environment.

Topic 2. Basics of drawing in 2D. Polyline, ellipses, points, hatching, gradient, creating blocks.

Topic 3. Modes and bindings in the AutoCAD environment. Step, grid, ortho mode, tracking, tracking objects.

Topic 4. Three-dimensional modeling in the AutoCAD environment. Basic operations. Creation of template objects. Setting dimensions, adding marks. Working with combined two-dimensional bindings.

Topic 5. Layers and properties. Actions with objects. Arrays, trimming, elongation, chamfers, connections, tolerances, roughness.

Topic 6. Three-dimensional modeling in the AutoCAD environment. Simple models. Drawing sketches on selected planes. Creation of objects with the correct geometry.

Topic 7. Three-dimensional modeling in the AutoCAD environment. Medium and complex models. Creation of complex objects and bodies of rotation. Adding holes.

Topic 8. Creation of prefabricated models. Orientation of finished elements in space. Creation of prefabricated models.



Topic 9. Creation of two-dimensional models based on three-dimensional models in the AutoCAD environment. Projection of three-dimensional elements and models on drawings. Creating sections on the drawing.

Topic 10. Formation of design reports by full-time CAD resources. Preparation of specifications in manual and automatic mode. Preparation for printing of individual fragments of design documentation.

Topics of laboratory works

Independent work

Making an individual calculation task with a graphic component.

Literature and educational materials

Basic literature

1. A.G. Tulska Synopsis of lectures on the course "Automated design systems"
2. John Bacus Digital sketching Computer-aided conceptual design. Wiley, 2021. — 259 p. — (Practical Revolutions: Disruptive Technologies and Their Applications to Building Design and Construction). — ISBN 9781119640806.
3. Nyemba WR Computer Aided Design: Engineering Design and Modeling using AutoCAD. CRC Press, 2023. — 315 p. — ISBN 978-1-032-26514-8.

Assessment system

Criteria for evaluating student performance and distribution of points

Distribution of points for evaluating student performance:

Completion of the calculation task - 60
Attending practical classes - 40

Rating scale

Total points	National assessment	ECT S
90–100	Perfectly	A
82–89	Fine	B
75–81	Fine	C
64–74	Satisfactorily	D
60–63	Satisfactorily	E
35–59	Unsatisfactory (requires further study)	FX
1–34	Unsatisfactorily (re-study required)	F

Norms of academic ethics and policy of the course

The student must adhere to the Code of Ethics of Academic Relations and Integrity of NTU "KhPI": show discipline, education, benevolence, honesty, responsibility. Conflict situations should be openly discussed in study groups with the teacher, and if it is impossible to resolve the conflict, it should be brought to the attention of the employees of the institute's directorate.

Regulatory and legal support for the implementation of the principles of academic integrity of NTU "KhPI" is posted on the website: <http://blogs.kpi.kharkov.ua/v2/nv/akademichna-dobrochesnist/>

Coordination

Syllabus agreed

Date of approval, signature

Head of Department
Denys MIROSHNYCHENKO



Національний технічний університет
«Харківський політехнічний інститут»

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Guarantor OP
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