Національний технічний університет України
«КИЇВСЬКИЙ ПОЛІТЕХНІЧНИЙ ІНСТИТУТ
імені ІГОРЯ СІКОРСЬКОГО»

Machines and devices
chemical and oil refining
productions

Computer design of hydromechanical equipment

Working program of the academic discipline (Syllabus)

Details of the academic discipline

Level of higher education	*First (undergraduate)*
Branch of knowledge	*13 mechanical engineering*
Specialty	*133 industrial engineering*
Educational program	*Computer-integrated technologies of chemical engineering equipment design*
Discipline status	*Selective*
Form of education	*full-time (face-to-face/distance)*
Year of training, semester	*4th year, autumn semester*
Scope of the discipline	*120 hours (18 hours of lectures; 36 hours – computer workshop; 66 hours – SRS)*
Terminal control/ controls activities	*Test*
Lessons schedule	*https://rozklad.kpi.ua/* *https://ecampus.kpi.ua/*
Language of teaching	*Ukrainian*
Information about course leader / teachers	*Lecturer: Ph.D., Associate Professor Gaidai Serhiy Serhiyovych* *ssgaidai@gmail.com* *Practical: Ph.D., associate professor Gaidai Serhiy Serhiyovych* *ssgaidai@gmail.com*
Placement of the course	*https://ecampus.kpi.ua/*

Program of educational discipline

*1.*Description of the educational discipline, its purpose, subject of study and learning outcomes

This discipline is a component of professional training for practical activities of a bachelor in industrial mechanical engineering, it belongs to the cycle of professional and practical training. It is a practical basis for the design and construction of typical hydromechanical equipment of chemical technology. The study of this discipline will allow students to learn the fundamental concepts of hydromechanical processes, as well as their practical application when performing computer design of hydromechanical equipment and its individual elements. It will allow you to create a professional basic foundation for the successful development of energy-efficient equipment, as well as the preparation of design documentation.

The discipline contributes to the development of professional self-awareness, communication culture, formation of theoretical, practical and personal motivational components of professional competence.

The subject of the academic discipline

Mastering the methods of computer design of hydromechanical equipment, taking into account the need to ensure the efficiency of hydromechanical processes.

Interdisciplinary connections

The discipline "Computer design of hydromechanical equipment" is based on the following disciplines: engineering and computer graphics, processes and equipment of chemical technology - hydromechanical processes, calculations and design of typical equipment. In addition, interrelationships with the educational components "Pre-Diploma Practice" and "Diploma Design" are taken into account, which create a context for students to acquire competencies in computer modeling and engineering analysis of structures using CAD systems.

The purpose of this educational discipline*consists in mastering the means and equipment for computer design of hydromechanical equipment.*

The main tasks of the academic discipline

After mastering the discipline, students should acquire the following knowledge:

- knowledge and understanding of the basics of technological, fundamental and technical sciences the context of chemical engineering equipment engineering;

- analysis of engineering objects and the ability to apply computer methods modeling and design of equipment for their study;

- understanding the methods and acquiring the skills of construction and design of equipment for using CAD systems;

- development of skills in the development of machine parts and assemblies using systems automated design.

According to the goal, the training of bachelors requires deepening of the competences formed by students:

- usingscientific and technical information, regulatory documents, using professional knowledge to solve problems in the design, maintenance, modernization and disposal of equipment of chemical and oil refining industries, taking into account the basic principles of the theory of hydromechanics;

- usingscientific and technical information, regulatory documents, using professional knowledge to independently solve problems in the design and modernization of chemical and oil refining equipment, taking into account the basic principles of the theory of hydromechanics;

- usingscientific and technical information, regulatory documents, using professional knowledge to solve problems in the selection and preparation of raw materials, obtaining products and waste disposal of chemical and oil refining industries, taking into account the basic principles of the theory of hydromechanics;

- apply methods of computer engineering using special software, perform computer design of equipment of chemical and oil refining industries taking into account the basic principles of the theory of hydromechanics.

***2.*Pre-requisites and post-requisites of the discipline (place in the structural and logical scheme of training according to corresponding educational program)**

Prerequisites:*the ability to apply knowledge in practice when evaluating methods design of hydromechanical processes and equipment, skills in using information*

and computer technologies, the ability to search, process and analyze from various sources, the ability to apply knowledge of the basic physico-chemical principles of technological processes of chemical engineering.

Post-requisites:*the ability to apply knowledge for practical problem solving, related to the provision of innovative technical solutions for conducting hydromechanical processes and choosing an algorithm for its implementation, the ability to use computerized systems of modeling and design of industrial equipment to justify technical decisions regarding the improvement of existing equipment in order to increase its energy efficiency, the ability to evaluate the technical and economic efficiency of systems and their components based on the application of analytical methods and analysis of analogs, the ability to make decisions regarding the selection of structural materials for the creation of innovative equipment.*

After mastering the academic discipline, students will be able to use knowledge of fundamental disciplines, mathematical apparatus, and computer modeling to implement professionally-profiled knowledge and practical skills to solve system engineering tasks to create effective processes and innovative equipment for their implementation.

*3.*Content of the academic discipline

Topic 1. Interface and basic settings of the CAD system Topic 2. Sketches
Topic 3. Solid geometry Topic 4. Components. Topic 5. Creating drawings.

*4.*Educational materials and resources ***Basic literature***

1. Kornienko Y. M. Processes and equipment of chemical technology 1: textbook / Ya. M. Kornienko, Yu. Yu. Lukach, I. O. Mikulonok, V. L, Rakytskyi, G.L. Ryabtsev // K.: NTUU "KPI". – 2011. – Part 1. - 300 C.

2. L. L. Tovazhnysky Processes and devices of chemical technology / L. L. Tovazhnyanskyi, A. L. Gotlinska, V. O. Nechiporenko. I. S. Chernyshov // Kharkiv, NTU. – 2006. – Part 1. - 540 S.

3. Basics of computer design: a summary of lectures [Electronic resource]: education. manual for bachelor's degree holders in the educational program "Computer-integrated technologies of chemical engineering equipment design" specialty 133 "Industrial mechanical engineering" / KPI named after Igor Sikorskyi; edited by: V. V. Kosenko, M. A. Byshko, O. O. Seminskyi. - Electronic text data (1 file: 3.35 MB). - Kyiv: KPI named after Igor Sikorskyi, 2023. – 147 p.

4. Technical draftsmen. General design principles: DSTU ISO 128-34:2005 (ISO 128-34:2001, IDT) : national standard of Ukraine : introduced for the first time : valid from 2004-07-01 : translation from English = Technical drawings. General design principles = Technical Drawings. General Principles of Presentation. Ch. 34. Views on mechanical engineering drawings = Views on mechanical engineering drawings. Kyiv: State Consumer Standard of Ukraine, 2007.

5. Young Engineer YouTube channel [Electronic resource]. – Mode of access to resource:https://www.youtube.com/@junior_enginee

6. Autodesk Inventor YouTube channel [Electronic resource]. – Mode of access to resource:https://www.youtube.com/@AutodeskMFG.

7. Autodesk. Autodesk Inventor 2023 Help [Electronic resource]. – Mode of access to resource:https://help.autodesk.com/view/INVNTOR/2024/ENU/

Additional literature

8. Dogra S. Autodesk Inventor 2022: A Power Guide for Beginners and Intermediate / Dogra., 2021. - 790 p.

9. Kishore T. Learn Autodesk Inventor 2018 Basics: 3D Modeling, 2D Graphics, and Assembly Design (1st ed. 2017.) / Kishore., 2017. – (Berkeley, CA: Apress)

10. Autodesk Inventor on the forum [Electronic resource]. – Resource access mode: https://forums.autodesk.com/t5/inventor/ct–p/70

Educational content

5. Methods of mastering an educational discipline (educational component)

Lecture classes

No s/p	***The name of the topic of the lecture and a list of main questions (a list of didactic tools, references to literature and tasks on SRS)***	***Number hours***
1	***Topic 1. Interface and basic settings of the CAD system*** *Installation and configuration of the CAD system.*	***2***
2	***Topic 2. Creating sketches*** *Creating sketches, working with dimensions and bindings. Elaboration of the subject of the lesson. Work with recommended literature.*	***4***
3	***Topic 3. Solid geometry*** *Basic and auxiliary operations of solid modeling. Examples of application in the design of parts of hydromechanical equipment.* *Elaboration of the subject of the lesson. Work with recommended literature.*	***6***
4	***Topic 4. Components*** *Basic and auxiliary operations when assembling structural elements of hydromechanical equipment. Examples of application in the design of hydromechanical equipment.* *Elaboration of the subject of the lesson. Work with recommended literature.*	***3***
5	***Topic 5. Creating drawings*** *Creation of standardized drawings hydromechanical equipment: details, assembly units and specifications.* *Elaboration of the subject of the lesson. Work with recommended literature.*	***3***
	In total	***18***

Computer workshop

No s/p	The name of the topic of the practical session and the list of main questions (list of didactic support, references to the literature and tasks on the SRS)	Number hours
1	**Computer workshop No. 1.** Setting up the workspace in the CAD system. Working with the interface.	2
2	**Computer workshop No. 2.** Acquaintance with the features of work in the CAD system.	2
3	**Computer workshop No. 3.** Geometric elements for creating sketches.	2
4	**Computer workshop No. 4.** Tools for working on design in modeling.	2
5	**Computer workshop No. 5.** Work with dimensions and text.	2
6	**Computer workshop No. 6.** Working with bindings.	2
7	**Computer workshop No. 7.** Basic operations for creating 3D sketches and displaying the construction.	2
8	**Computer workshop No. 8** Basic operations for the implementation of complex geometry models.	2
9	**Computer workshop No. 9** Additional solid modeling operations. Examples of application in modeling hydromechanical equipment.	2
10	**Computer workshop No. 10** Using auxiliary geometry. Examples of application in modeling hydromechanical equipment.	2
11	**Computer workshop No. 11** Additional operations. Examples of application in modeling hydromechanical equipment.	2
12	**Computer workshop No. 12** Techniques of modeling and design of details.	2
13	**Computer workshop No. 13** Modeling of connecting elements.	2
14	**Computer workshop No. 14** Modeling of body elements.	2
15	**Computer workshop No. 15** Creating and working with species. Insertion of dimensions and markings.	2
16	**Computer workshop No. 16** Drafting of drawings and specifications.	2
17	**Computer workshop No. 17** Modular control work.	2
18	**Computer workshop No. 18** Credit class.	2
	Together	36

6. Independent work of the student

No s/p	The name of the topic submitted for independent processing	Number hours
	Chapter 1. Fundamentals of mass transfer theory	
1	***Topic 1. Interface and basic settings of the CAD system.*** *Installation and configuration of the CAD system. Working out the topics of lecture session No. 1 and computer workshops No. 1-2.*	5
2	***Topic 2. Creating sketches.*** *Elaboration of the topics of lecture classes, work with recommended literature.* *Practical implementation of the topics of computer workshops #3-6*	10
3	***Topic 3. Solid geometry.*** *Elaboration of the topics of lecture classes, work with recommended literature.* *Practical implementation of the topics of computer workshops #7-12*	16
4	***Topic 4. Components.*** *Elaboration of the subject lecture occupation, work with recommended literature.* *Practical implementation of the subjects of computer workshops No. 13-14*	5
5	***Topic 5. Creating drawings.*** *Elaboration of the subject lecture occupation, work with recommended literature.* *Practical implementation of the subjects of computer workshops No. 15-16*	5
6	***Preparation for modular control work***	10
7	***Preparation for the test***	15
	Together	66

Policy and control

Policy of academic discipline (educational component)

The system of requirements for the student:

– attending lectures and computer workshops is a mandatory component study of the discipline;

– at the lecture, the teacher uses his own presentation material, uses Google drive or other generally available tools for teaching the materials of the current lecture, additional resources, practical works, etc., the teacher opens access to a certain directory for downloading methodical materials in electronic form;

– it is not advisable to distract the teacher from teaching the material during lectures, all questions, clarifications and other questions are asked by students at the end of the lecture in the time allotted for this purpose;

– incentive points are awarded for active participation in lectures, participation in faculty and university olympiads in academic disciplines, in work competitions, preparation of reviews of scientific works; presentations on one of the topics of the SRS discipline, etc. The number of incentive points is no more than 10.

– *submission of the results of the students' performance of all tasks and their assessment is taking place exclusively during classes and consultations.*

Teaching methods

When teaching an educational discipline, the use of such educational technologies as problem-based lectures, work in small groups, etc. is provided for the activation of the educational process.

Problem lectures*aimed at the development of students' logical thinking and are characterized by the fact that the range of issues of the topic is limited to two or three key points, the students' attention is concentrated on the material that was not reflected in the textbooks, the experience of foreign educational institutions is used with the distribution of printed material to students during the lecture and the selection of the main conclusions on the issues under consideration. During lectures, students are given questions for independent reflection, but the lecturer answers them himself, without waiting for the students' answers. The system of questions during the lecture plays an activating role, forces students to concentrate and start actively thinking in search of the right answer.*

Mini-lectures*provide for the presentation of educational material in a short period of time and are characterized by a significant capacity, complexity of logical constructions, images, proofs and generalizations. Mini-lectures are held, as a rule, as part of a research class.*

Case method*(method of analysis of specific situations) makes it possible to bring the learning process closer to real practical activity of specialists and involves consideration of production, management and other situations, complex conflict cases, problem situations, incidents in the process of learning educational material.*

Tools and software*, the use of which is provided by the educational discipline "Computer design of hydromechanical equipment".*

*6.*Types of control and rating system for evaluating learning outcomes (RSO)

Distribution of study time by types of classes and tasks in the discipline according to the working study plan:

Semester	Training time		Distribution of study hours			Control measures	
	Credits	Acad. hours	Lectures	Practical	SRS	MKR	Terminal CONTROL
7	4	120	18	36	66	2	test

The student's rating in the discipline consists of the points he receives for:

– *performance of computer workshops (36 hours)*

– *execution of a modular test (2 hours)*

System of rating (weighted) points and evaluation criteria

Current control*. Students receive points:*

1. For performing computer workshops - up to 5 points for each task (maximum 80 points for all computer practicals):

5 points are awarded for excellent performance of the task; 4 points are awarded for a very good performance of the task; 3 points are awarded for good performance of the task; 2 points are awarded for satisfactory completion of the task; 1 points are awarded for a sufficient level of task performance.

2. For the performance of a modular control work (maximum 20 points): 20 points are awarded for excellent performance of the task; 17-19 points are awarded for very good performance of the task; 13-16 points are awarded for a good performance of the task; 6-12 points are awarded for satisfactory completion of the task; 1-5 points are awarded for a sufficient level of task performance.

Calendar control*: conducted twice per semester in weeks 7-8 and 14-15 as a monitoring of the current state of meeting the Syllabus requirements - the student receives a "certified" during the first and second calendar inspections, if his current rating is at least 0.5 of the maximum number of points , possible at the time of control.*

Semester control*is carried out in the form of a credit, which is presented at the last one computer workshop according to the results of work in the semester according to the student's rating in the discipline.*

Terms of admission to semester control*:*

- admission to credit is possible only in case of successful completion of all tasks computer workshop and writing ICR;

- students who received a total rating score of less than during the semester25 to calculation is not allowed.

Table of correspondence of rating points to grades on the university scale*:*

Scores	*Rating*
100-95	Perfectly
94-85	Very good
84-75	Fine
74-65	Satisfactorily
64-60	Enough
Less than 60	Unsatisfactorily
Admission conditions not met	Not allowed

***7.*Additional information on the discipline (educational component)**

The resit is carried out according to the "soft" scheme (with preservation of the points gained during the semester). At the same time, 10 penalty points are deducted for each rearrangement.

Working program of the academic discipline (syllabi):

Compiled*Assoc., Ph.D., Gaidaim S.S.*

Approved*by the department of MAHNV (protocolNo. 20 dated June 20, 2024)*

Agreed*Methodical council of the IHF faculty[1](protocol No. 11 dated June 28, 2024)*