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

Department of machines and devices of chemical and oil refining industries

3D-engineering: Solidworks

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	*daytime*
Year of training, semester	*3rd year, autumn semester*
Scope of the discipline	*4 ECTS credits / 120 hours*
Semester control/ control measures	*assessment, modular control work, graphic work*
Lessons schedule	*3 hours per week (1 hour of lectures and 2 hours of computer workshop)*
Language of teaching	*Ukrainian*

Information about the head of the course / teachers	**Lecturer:** *associate professor, candidate of technical sciences Novokhat Oleg Anatoliyovych,*
	        e-mail : novokhatoleh@gmail.com , telegram: @Novokhat_Oleh
	 Practical: *associate professor, candidate of technical sciences , Novokhat Oleg Anatoliyovych,*
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Placement of the course	*https :// ci . kpi _ ua / uk / syllabus -2023-2024 /*

Program of educational discipline

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

The goal of the educational discipline is the formation of students' competencies .

ABILITY:

–   apply professional knowledge to create conceptual engineering projects; solve engineering problems of conceptualization using innovative methods;

- apply engineering knowledge to make previously unknown project decisions, including in related fields, in difficult conditions of technical uncertainty and lack of information.

The main tasks of the academic discipline.

After mastering the academic discipline, students must demonstrate the following learning outcomes:

KNOWLEDGE:

–   general principles of modeling and design, development of technical characteristics and layouts of hydromechanical and heat -mass exchange equipment of chemical, oil refining, biotechnological and refrigeration industries;

–   modern information technologies and modern application software packages;

SKILLS:

– to   model and carry out the selection of rational technological equipment for the installation of equipment of chemical, oil refining, biotechnological and refrigeration industries;

- choose ways of modeling and designing equipment of chemical, oil refining, biotechnological and refrigeration industries, perform calculation and its analysis.

The knowledge, skills and experience gained while studying this discipline will be useful for further professional activities.

requisites and post- requisites of the discipline (place in the structural and logical scheme of training according to the relevant educational program)

This academic discipline is optional. To successfully master this discipline, a student must meet all of the following criteria:

- have the skills and abilities to work with a personal computer at the level of a confident user;
- know and understand the basic principles of information organization in computer systems;
- learn the "Informatics" course.

2. Content of the academic discipline

Educational discipline " Computer systems three-dimensional design " consists of the following topics:
1. The interface of the KOMPAS-3D automated design system.
2. Designing details.
3. Creation of blueprints using 3D models.
4. Design of assembly units.

3. Educational materials and resources

Basic literature

1. Kozyar M.M., Feshchuk Yu.V., Parfenyuk O.V. Computer graphics: SolidWorks. Helvetyka Publishing House, 2020. – 252 p.

2. Pustylga S., Samostyan V., Klak V. Engineering graphics in SolidWorks. LNTU, Lutsk 2018.– 174 p.

Additional literature

1. Gaurav Verma, Matt Weber. SolidWorks Simulation 2017 Black Book (Colored). CADCAMCAE Works; 4th edition (December 14, 2016). - 362 p.

2. Yu. V. Kholodnyak. Computer design of industrial products: educational and methodological manual for practical work / Yu. V. Kholodnyak; TDATU. – Melitopol: TDATU, 2020. – 152 p.

3. Biletsky V.S. Modeling in oil and gas engineering: a tutorial. / V.S. Biletsky - Lviv: Publishing House "Novy Svit - 2000", - Kharkiv: NTU "KhPI", 2021. - 306 p. ISBN 978-617-7519-90-3

Educational content

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

The structure of the credit module

Names of sections, topics	Number of hours				
	In total	including			
		Lectures	Practical training	Laboratory	SRS
Chapter 1. Interface of the automated design system KOMPAS- 3 D.					
Topic 1.1 Concept of automated design system, KOMPAS environment, interface, settings and capabilities. Menu, header, toolbars, compact panel, properties panel, message bar.	8	2	2		4
Chapter 2. Design of details.					

Topic 2.1 Creation of parts by the method of extrusion and rotation. Creation of detail elements: holes, chamfers, roundings , stiffeners .	12	2	4		6
Topic 2.2 Kinematic operation and sketches. Basics of parametric drawing. Basics of sheet body design.	12	2	4		6
Topic 2.3 Saving a file as a picture. Printing.	8	2	2		4
Chapter 3. Creating drawings using 3 D models					
Topic 3.1 Creating drawings based on 3D sketches models Adding axonometric projections, sections, views. Dimensioning and automatic stamp filling.	12	2	4		6
Chapter 4. Design of assembly units.					
Topic 4.1 Adding details. Imposition of restrictions (conjunctions). Separation of the assembly unit. Save the file as a picture. Printing.	12	4	2		6
Topic 4.2 Design of various types of devices.	32	4	16		12
Graphic work	14				14
MKR	2				2
Test	6				6
Hours in general	**120**	**18**	**36**		**66**

Lecture classes

No. z/p	The name of the topic of the lecture and a list of the main questions (a list of didactic tools, references to the literature and tasks on the SRS)
Section 1	
1,2	The concept of an automated design system in the Kompas-3 D environment Design possibilities in the Kompas- 3D system . Interface, settings and features. Menu, header, toolbars, compact panel, properties panel, message bar. *Literature 1, 2, 3, 4* Tasks on the SRS: Setting up the Kompas-3D program (placing panels, choosing the theme of the program, choosing the accuracy of drawing , etc.)
Section 2	
3, 4, 5	Designing details in the Kompas- 3D environment Creation of parts by the method of extrusion and rotation. Creation of detail elements: holes, chamfers, roundings , stiffeners . Kinematic operation and sketches. Basics of parametric drawing. Basics of sheet body design. Save the file as a picture. Printing. *Literature 1, 2, 3, 4* Tasks at SRS: Creation of parts of the type "pipe grate ", cast fitting and one-piece support for cylindrical vertical devices.
Section 3	
6	Automated creation of detail drawings. Creation of drawings based on sketches of 3D models. Adding axonometric projections, sections, views. Dimensioning and automatic stamp filling. *Literature 1, 2* Task on SRS: Creating drawings from 3 D parts of the type "pipe grate ", cast fitting and one-piece support for cylindrical vertical devices built earlier according to SRS.
Chapter 4	

7-8	Design of assembly units.
	Adding details. Imposition of restrictions (conjunctions). Separation of the assembly unit. Save the file as a picture. Printing.
	Literature: 6,7
	Task on SRS: Establishing the minimum number of necessary conjugations.
9	Designing of apparatus for chemical production.
	Design of vertical cylindrical devices. Design of horizontal body apparatuses.
	Literature: 7
	Tasks on the SRS: Disassemble the devices into parts, setting the informative display of the disassembly.

Practical training

No. z/p	Name of the subject of the lesson and list of main questions (list of didactic support, references to the literature and tasks on the SRS)
Section 1	
1	Optimum setting of the Kompas- 3D working window .
	Literature 1, 2, 4
	Tasks on SRS. Explore the features of working in the Kompas- 3D environment using the touchpad .
Section 2	
2, 3	Creation of parts by the method of extrusion and rotation. Creation of detail elements: holes, chamfers, roundings , stiffeners .
	Literature 1, 2, 3, 4
	Tasks on SRS. Construction of gears and gears.
4, 5	Kinematic operation and sketches. Basics of parametric drawing.
	Literature 1, 2, 3, 4
	Tasks on SRS. Construction of spirals of different types.
6	Basics of sheet body design. Save the file as a picture. Printing.
	Literature 1, 2, 3, 4
	Tasks on SRS. Designing a pattern of a box made of polymer material.
Section 3	
7, 8	Creation of drawings based on sketches of 3D models. Adding axonometric projections, sections, views. Dimensioning and automatic stamp filling.
	Literature 1, 2
	Tasks on SRS. Adding a stamp fill template to the library.
Chapter 4	
9	Adding details. Imposition of restrictions (conjunctions). Separation of the assembly unit. Save the file as a picture. Printing.
	Literature: 6,7
	Task on SRS: Identify the differences in graphic images of different formats.
10-12	Design of vertical cylindrical devices.
	Literature: 7
	Task on SRS: Proposition of parametric dimensions.
13-15	Design of horizontal cylindrical devices.
	Literature: 7
	Task on SRS: Proposition of parametric dimensions.
16-17	Design of housing devices.
	Literature: 7
	Task on SRS: Proposition of parametric dimensions.
18	MKR: preparation

Laboratory classes

According to the curriculum, laboratory classes are not provided.

Graphic work

It involves designing a 3D model of the device according to the task.

Approximate types of devices: heat exchanger, cyclone, absorber, rectification column.

5. Independent work of student

Independent work of students within this course involves:

- preparation for the lecture, which includes familiarization with the provided text of the lecture, identification of poorly understood fragments and theses, identification of issues that, in the student's opinion, require more extensive coverage, preparation of questions to the teacher that are planned to be asked during the lecture (up to 1-2 hours for each lecture) ;
- preparation for practical classes, which includes familiarization with the topic and purpose of the class, task, familiarization with control questions and formation of answers to them (up to 30-60 minutes for each practical work);
- preparation of reports based on the results of work carried out in practical classes (up to 30-60 minutes for each practical class);
- development of the device according to the task of performing graphic work (14 hours).
- preparation for the modular control work (2 hours);
- preparation for the test (6 hours).

Policy and control

6. Policy of educational discipline

The system of requirements that the teacher sets before the student:

6.1. Attendance and behavior in classes.

- the student must come to class prepared;
- turning off mobile phones or switching them to silent mode in all classes and during consultations is mandatory;
- attendance at lectures on the discipline is welcome and will contribute to better learning of the discipline;
- the student's activity in lectures and the ability to ask questions about the topic of the lecture to the teacher are welcome;
- attending laboratory classes and completing tasks during practical classes is mandatory;
- the use of information search tools is allowed (except for control classes);
- free movement of the audience is allowed during practical (but not lecture) classes.

6.2. Issuance of penalty and incentive points.

- incentive points are awarded to students who completed additional work tasks or tasks of increased complexity during the class;
- incentive points are awarded to students who proposed a different way of completing the task, not provided for in the work plan;
- skipping practical classes without a good reason leads to the issuance of zero points according to its results, but it is absolutely necessary to complete the work tasks;
- skipping the modular test without a good reason leads to the issuance of zero points based on its results.

6.3. Policy of deadlines and rescheduling.

- at the beginning of the next practical session, the student must submit a completed report based on the results of the previous session;
- repeated execution of modular control work is not allowed;
- writing a modular test by students who did not write it on time without a good reason is not allowed;

— retaking the test is allowed only in the manner prescribed by the normative documents on the organization of the educational process of KPI named after Igor Sikorsky.

6.4. Academic Integrity Policy.

— students studying the discipline must adhere to the rules and norms of academic integrity when performing all types of work;
— calculation and graphic work performed in gross violation of the rules and norms of academic integrity is evaluated with a score of 0 points, in addition, the student is awarded 4 penalty points when issuing a repeated assignment.

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

The student's credit module rating consists of points obtained for:
1) performance of 18 practical works in classroom classes;
2) execution of modular control work;
3) execution of graphic work.

8.1. Performance of practical works.

A total of 18 practical works are provided during the semester. The weighted point is 3. The maximum number of points for all works is equal to 3 ×18 = 54 points. Points are awarded as follows:
— work tasks were completed correctly and on time, within the set time of the lesson, correct answers were received - 3 points;
— the work task was completed partially correctly during the set time of the lesson, and it was not completed completely, in a time exceeding the time of the practical lesson, a part of the correct answers was obtained - 1-2 points;
— the work task was not completed or was completed completely incorrectly - 0 points.

Note: if the student was absent from the class for a valid reason, which is documented and presented at the next class the completed task of the missed work, the work is considered completed on time.

8.2. Modular control work.

The weighted score is 6. The evaluation of the work task is carried out according to the following scale:
— data analysis is correct, the answer is correct - 6 points;
— the data analysis is correct, the answer is correct, there are minor inaccuracies - 4-5 points;
— the course of data analysis is generally correct, but there are errors that do not make it possible to get a correct answer, only the analysis algorithm is given, but the analysis itself is missing or completely incorrect - 2-3 points;
— incorrectly selected data analysis method, incorrectly selected analysis algorithm or missing task - 0 points.

8.3. Graphic work

The weighted score is 40. The calculation work consists of a complex task.
Evaluation of the work task is carried out according to the following scale:
— performing the task correctly and without errors - 40 points;
— the execution of the task is correct and without errors, there are minor inaccuracies or irrationally chosen solutions for the execution of the task, but which allowed to obtain the correct result - 35-39;
— the progress of the task is generally correct, but there are non-critical errors, the prompt correction of which will allow you to get a correct answer - from 20 to 29 points;
— the progress of the task is generally correct, but there are sufficiently gross errors that prevent a correct answer - from 10 to 19 points;
— only certain fragments are given correctly, but the task itself is not performed, or performed completely incorrectly - from 1 to 9 points;

— the method of performing the task is incorrectly chosen, the calculation formulas are incorrectly specified or the task is missing, work performed in gross violation of the rules and norms of academic integrity is evaluated with a score of 0 points.

The maximum number of points during the semester is: **R = 54 + 6 + 40 = 100 points.**

Calendar control *: is carried out **twice a semester** as a monitoring of the current state of meeting the requirements of the syllabus .*

According to the results of the educational work in the first 7 weeks, the "ideal achiever" should score 21 points. At the first attestation (8th week), the applicant receives "credited" if his current rating is at least 10 points.

According to the results of the educational work in 13 weeks of training, the "ideal achiever" should score 45 points. At the second attestation (14th week), the applicant receives "credited" if his current rating is at least 22 points.

The maximum number of points is 100. To receive credit from the credit module "automatically" you need to have a rating of at least 60 points.

Semester control *: **credit.***

If the student receives less than 60 points or if he wishes to increase the total score, all points received for practical tasks and modular control work are canceled (with no possibility of cancellation if the student receives a lower score for the credit work). Points for graphic work are saved. The student is given a credit assignment for 60 points.

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*
0 ... 60	*unsatisfactorily*
0 ... 22	*not allowed*

8. Additional information on the discipline (educational component)

9.1. Completion of credit work.

Students who scored a rating of less than 60 points during the semester or decided to increase their score perform credit work.

The weighted score of the exam is 60 points. The work consists of three practical tasks. The weighted score of the tasks is 20 points. The practical task involves the student solving typical problems from the credit module. The assessment of the practical task is carried out according to the following scale:

— the approach to the solution is correct, the answer is correct - from 19 to 20 points;
— the approach to the solution is correct, but the answer is incorrect due to the presence of minor errors - from 15 to 18 points depending on the number of indicated errors;
— the approach to the solution is generally correct, but there are sufficiently gross errors that prevent a correct answer - from 10 to 14 points depending on the number and severity of errors;
— only fragments of the task are correct, but the task itself is missing or completely incorrect - from 1 to 9 points depending on the number and correctness of the available elements;
— the calculation method is incorrectly chosen, the solution strategy is incorrectly chosen or the task is missing - 0 points.

9.2. Enrollment of distance or online course certificates.

For students who have completed distance learning or online courses on the relevant subject, this training can be counted as studying this academic discipline if all the following conditions are met:

— the student provided a certificate or other document that confirms his completion of a distance or online course and provided an opportunity to verify its authenticity;
— a distance or online course posted on the platform or conducted by an organization that is recommended or recognized by KPI named after Igor Sikorskyi;
— the volume of a distance or online course is at least 108 study hours;
— the list of topics studied in the distance or online course contains at least four topics specified in the content of the academic discipline (item 3 of the syllabus); in the case of a difference in titles, the correspondence of the content of the topics is established on the basis of a comparative analysis with the distance or online course program;
— the student's success rate based on the results of studying a distance or online course is at least 75% of the maximum.

The working program of the academic discipline (syllabus):

— **was compiled by** *an associate professor of the MAHNV department, candidate of technical sciences* **Oleg NOVOKHAT**
— **adopted by the** *department of machines and devices of chemical and oil refining industries*
                                        (protocol No. 19 dated 17.05.2023)
— **approved by** *the Methodical Commission of the Faculty of Engineering and Chemistry*
                                        (protocol No. 10 dated 26.05.2023)