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

Department of Machines and Apparatus of Chemical and Oil Refining Production

" Computer modeling and engineering analysis of structures: Inventor "

The syllabus of the discipline

Details of the discipline	
Level of higher education	**First (bachelor's) degree**
Field of expertise	13 - Mechanical engineering
Specialty.	133 – Industrial machinery engineering
Educational program	"Computer-integrated technologies for designing chemical engineering equipment"
Status of the educational component	Normative
Scope of the discipline	120 hours/ 4 ECTS credits
Year of study, semester	3rd year, fall semester
Form of study	Full-time (daytime)
Class schedule	1 lecture every two weeks and 1 computer workshop every week
Semester control / control measures	Credit / ICR, WGR
Language of instruction	English
Information about the course leader / teachers	phD., Associate Professor, Seminsky Oleksandr Olehovych, forstd@ukr.net , @mahnv_kpi; Volodymyr Kosenko, v.v.kosenko@kpi.ua
Placement of the course	http://ci.kpi.ua

Program of the discipline

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

The discipline "Computer modeling and engineering analysis of structures: Inventor" belongs to the elective cycle. It is designed to develop students' competencies in the field of professional application of application software designed for equipment design, which complements the basics of professional training in the program "Computer-integrated technologies for designing chemical engineering equipment".

The aim of the discipline is to improve skills in engineering analysis of structures using computer modeling.

The discipline forms the following ***competencies***:

- Ability to think abstractly.
- Ability to apply knowledge in practical situations.
- Skills in the use of information and communication technologies.
- Ability to learn and master modern knowledge.
- Ability to apply typical analytical methods and computer software tools for solving chemical engineering problems, effective quantitative methods of mathematics, physics, engineering sciences, as well as appropriate software for solving chemical engineering problems.

- Ability to implement engineering developments in industrial engineering, taking into account technical, organizational, legal, economic and environmental aspects throughout the entire life cycle of machines and devices: from design, construction, operation, maintenance, diagnostics and disposal.
- Ability to use computer-aided design systems and specialized application software to solve problems in chemical engineering.
- Ability to make effective decisions on the choice of construction materials, equipment, processes and combine theory and practice to solve engineering problems.

The ***program learning outcomes*** after studying the discipline include:

- To know and understand the principles of technological, fundamental and technical sciences underlying the engineering of equipment for chemical and related technologies.
- Analyze engineering objects, processes, and methods.
- Understand the methods and have the skills to design standard equipment, its components and elements in accordance with the task.
- Develop machine parts and assemblies using computer-aided design systems.

2. Prerequisites and post-requisites of the discipline (place in the structural and logical scheme of study in the relevant educational program)

The discipline is based on the educational component of the program "Engineering and Computer Graphics", complements the educational component "Fundamentals of Computer Design" and provides special courses of professional training, primarily "Calculations and Design of Typical Equipment" and "Processes and Equipment of Chemical Technology", as well as the educational components "Undergraduate Practice" and "Graduate Design".

3. Content of the discipline

Topic 1: Using standard components.

Topic 2. Analysis and simulation using special modules.

Topic 3. Specialized modules and extensions.

4. Training materials and resources

Basic literature:

1. Fundamentals of computer design: lecture notes [Electronic resource] : a study guide for bachelor's degree applicants in the educational program "Computer-integrated technologies for designing chemical engineering equipment", specialty 133 "Industrial Engineering" / Igor Sikorsky Kyiv Polytechnic Institute ; compiled by V. V. Kosenko, M. A. Byshko, O. O. Seminsky. - Electronic text data (1 file: 3.35 MB). - Kyiv : Igor Sikorsky Kyiv Polytechnic Institute, 2023. - 147 c. - Title from the screen.

2. Computer-integrated technologies for the design and manufacture of chemical technology equipment: a course of lectures [Electronic resource] : a textbook for master's degree applicants in the educational program. Program "Engineering and computer-integrated technologies for designing innovative industrial equipment" specialty 133 Industrial Engineering / Igor Sikorsky Kyiv Polytechnic Institute ; compiled by O. V. Husarova - Electronic text data (1 file: 7.91 MB) - Kyiv : Igor Sikorsky Kyiv Polytechnic Institute, 2023. 249 p. - Title from the screen.

3. Connection of machine parts [Electronic resource] : a visual aid for bachelor's degree applicants in the specialties 131 "Applied Mechanics", 133 "Industrial Engineering" / Igor Sikorsky Kyiv Polytechnic Institute ; compiled by A. K. Skuratovskyi, D. A. Lesyk, O. M. Stepura - Electronic text data (1 file: 4.74 MB) - Kyiv : Igor Sikorsky Kyiv Polytechnic Institute, 2021. 80 p. - Title from the screen.

4. Zakhovayko, O. P. Resistance of materials: calculations of rods and rod systems under simple types of loads [Electronic resource] : a textbook / O. P. Zakhovayko ; NTUU "KPI." - Electronic text data (1 file: 5.57 MB) - Kyiv : NTUU "KPI", 2016. 274 p. - Title from the screen.

Additional reading:

1. Banach, D. T., Lockhart, S., & Markazi, S. (2023). Autodesk Inventor 2024 Essentials Plus.
2. Shih, R. (2023). Autodesk Inventor 2024 and Engineering Graphics.
3. Shih, R. (2023). Learning Autodesk Inventor 2024. SDC Publications.
4. Verma, G. (2023). Autodesk Inventor 2024 Black Book. CAD CAM CAE Works.

Educational content

5. Methods of mastering the discipline (educational component)

Calendar and thematic plan

Week	*The content of the training work*	*SRS (66 hours according to the curriculum)*
Topic 1: Using standard components.		
1, I week	**Lecture 1:** Introduction. Approaches and methods of CAD application in engineering analysis of structures. Issuance of individual tasks.	Study the topic of the class. Work with the recommended literature.
2, I week	**Computer workshop 1:** Using standard parts from the Content Center.	Practical training on the topic of the class.
3, II week	**Computer workshop 2.** Setting up the parameters of standard parts for assembly.	Practical training on the topic of the class.
4, I week	**Lecture 2.** Tension and compression in structural elements of equipment.	Study the topic of the class. Work with the recommended literature.
5, I week	**Computer Workshop 3:** Creating an assembly using standard components.	Practical training on the topic of the class.
6, II week	**Computer workshop 4.** Analysis of the assembly for compatibility and correctness.	Practical training on the topic of the class.
7, I week	**Lecture 3.** Shear and stress in structural elements of equipment.	Study the topic of the class. Work with the recommended literature.
8, I week	**Computer workshop 5.** Using the library of standard fasteners.	Practical training on the topic of the class.
9, II week	**Computer workshop 6.** Adjustment of fasteners to meet technological requirements.	Practical training on the topic of the class.
Topic 2. Analysis and simulation using special modules.		
10, I week	**Lecture 4.** Torsion and calculation of springs.	Working out the topic of the lesson. Work with the recommended literature.
11, I week	**Computer workshop 7.** Performing static analysis using standard parts.	Practical training on the topic of the class.
12, II week	**Computer workshop 8.** Interpretation of static analysis results.	Practical training on the topic of the class.
13, I week	**Lecture 5.** Bending. Elastic line of a beam.	Working out the topic of the lesson. Work with the recommended literature.
14, I week	**Computer workshop 9.** Setting up dynamic analysis for the assembly.	Practical training on the topic of the class.

Week	*The content of the training work*	*SRS (66 hours according to the curriculum)*
15, II week	**Computer workshop 10.** Analysis of the kinematic properties of the mechanism.	Practical training on the topic of the class.
16, I week	**Lecture 6.** Calculation of beams on an elastic base.	Working out the topic of the lesson. Work with the recommended literature.
17, I week	**Computer workshop 11.** Thermal analysis.	Practical training on the topic of the class.
18, II week	**Computer workshop 12.** Determination of temperature deformations and stresses.	Practical training on the topic of the class.
Topic 3. Specialized modules and extensions.		
19, I week	**Lecture 7.** Bending of beams whose material does not conform to Hooke's law.	Study the topic of the class. Work with the recommended literature.
20, I week	**Computer workshop 13.** Design of a pipeline system.	Practical training on the topic of the class.
21, II week	**Computer workshop 14.** Hydrostatic analysis of the pipeline system.	Practical training on the topic of the class.
22, I week	**Lecture 8.** Bending with tension and torsion.	Study the topic of the class. Work with the recommended literature.
23, I week	**Computer workshop 15.** Creating and analyzing a frame structure.	Practical training on the topic of the class.
24, II week	**Computer workshop 16.** Optimization of the frame structure for weight reduction.	Practical training on the topic of the class.
25, I week	**Lecture 9.** Discussion of individual assignments.	Performing an individual task.
26, I week	**Computer workshop 17.** Modular control work.	Preparing for a module test.
27, II week	**Computer workshop 18.** Credit lesson	Preparing for a test lesson.

6. Independent work of the student

The types of independent work are listed in the table in paragraph 5, according to the academic weeks and scheduled classes.

Policy and control

7. Policy of the academic discipline (educational component)

A system of requirements for students:

- **rules for attending classes** - attendance at all types of classes (lectures, computer workshops) is mandatory both in classrooms and in distance learning. In the latter case, classes are held in Zoom conferences and students "attend" them by connecting to the links provided by teachers;
- **rules of behavior in the classroom** - not to interfere with other students' listening to lectures or working in practical classes by unnecessary activities or conversations (including by phone). In the classroom and during distance learning at home, follow safety rules;

- **rules for crediting practical classes and awarding points for their completion** - the teacher evaluates the student's work during the class, the quality and timeliness of the presentation of the results of the assignment;
- **rules for awarding reward and penalty points** - no reward and penalty points are provided;
- **policy of deadlines and retakes**:
  1) all assignments are submitted and evaluated exclusively during classroom sessions;
  2) retakes are carried out according to the schedule established at the university level within the timeframe determined by the teacher and communicated to students when the rating scores are announced;
- **Policy on Academic Integrity** - students are required to comply with the provisions of the Honor Code and the requirements of academic integrity during the educational process.

8. Types of control and rating system for assessing learning outcomes (RSO)

Current control. Students receive points:

1. For completing computer workshops - up to 4 points for each lesson (maximum 64 points for all computer workshops):
   4 points are awarded for excellent 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 point is awarded for a sufficient level of task completion.
2. For completing a module test (maximum 16 points):
   14-16 points are awarded for excellent performance of the task;
   11-13 points are awarded for very good performance of the task;
   9-11 points are awarded for a good performance of the task;
   6-8 points are awarded for satisfactory completion of the task;
   1-5 points are awarded for a sufficient level of performance.
3. For completing an individual task in the form of a calculation and graphic work (maximum 20 points):
   20 points are awarded for excellent completion of the task;
   17-19 points are awarded for very good performance of the task;
   14-16 points are awarded for a good performance of the task;
   11-13 points are awarded for satisfactory completion of the task;
   1-10 points are awarded for a sufficient level of performance.

Calendar control: is carried out twice a semester on weeks 7-8 and 14-15 as a monitoring of the current state of fulfillment of SilaBus requirements - a student is "certified" during the first and second calendar controls if his or her current rating is at least 0.5 of the maximum number of points possible at the time of the control.

Semester control is carried out in the form of a test, which is given at the last computer workshop based on the results of work in the semester in accordance with the student's rating in the discipline.

Conditions of admission to semester control:

- admission to the test is possible only in case of successful completion of all tasks of the computer workshop, successful completion of the WGD and writing of the ICR;
- students who received a total rating score of < 25 during the semester are not allowed to take the test.

Table of correspondence between rating points and grades on the university scale:

Number of points	*Assessment.*
100-95	Excellent
94-85	Very good
84-75	Okay.
74-65	Satisfactory
64-60	Enough
Less than 60	Unsatisfactory

The conditions for admission are not met	Not allowed

9. Additional information on the discipline (educational component)

Retakes are conducted according to a "soft" scheme (with the points gained during the semester). In this case, 10 penalty points are removed for each retake.

The silhouette of the discipline:

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Approved at the meeting of the Department of Machines and Apparatus of Chemical and Oil Refining Production (Protocole No. 20 of June 20, 2024).

Approved by the Methodological Commission of the Faculty of Engineering and Chemistry (Protocole No. 11 of June 28, 2024).