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

Department of Machines and Apparatus of Chemical and Oil Refining Production

" Fundamentals of Computer Engineering. Problems of strength "

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	4th year, spring 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, Abstract.
Language of instruction	English
Information about the course leader / teachers	phD., Associate Professor, Seminsky Oleksandr Olehovych, forstd@ukr.net , @mahnv_kpi; Mykyta Byshko, m.byshko@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 "Fundamentals of Computer Engineering. Strength Problems" 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 and 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 the skills of designing 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 components of the program "Engineering and Computer Graphics" and "Fundamentals of Computer Design", complements the educational components of the discipline "Calculations and Design of Equipment" and provides the educational components "Pre-diploma Practice" and "Diploma Design".

3. Content of the discipline

The topics of the training sessions include the study of methods and software for the structural calculation of industrial equipment and its elements.

4. Training materials and resources

Basic literature:

1. Methods of 3D-engineering: a course of lectures [Electronic resource] : a study guide for bachelor's degree students in the educational program "Computer-integrated technologies for designing chemical engineering equipment", specialty 133 "Industrial Engineering" / Igor Sikorsky Kyiv Polytechnic Institute ; compiled by M. A. Byshko, V. V. Kosenko, O. O. Seminsky. - Electronic text data (1 file: 5.24 MB). - Kyiv: Igor Sikorsky Kyiv Polytechnic Institute, 2023. - 169 c. - Title from the screen.
2. Khameel B. Mustapha, Practical Finite Element Simulations with SOLIDWORKS 2022: An illustrated guide to performing static analysis with SOLIDWORKS Simulation, Packt Publishing, 2022.
3. Andreyev, I. Calculation of columns for strength and stability [Electronic resource] : a textbook for students majoring in 133 "Industrial Engineering", educational and professional program "Equipment of chemical, oil refining and pulp and paper industries" / I. Andreyev. Andreyev ; Igor Sikorsky Kyiv Polytechnic Institute [Electronic text data (1 file: 4.51 MB)] - Kyiv : Igor Sikorsky Kyiv Polytechnic Institute, 2021. 112 p. - Title from the screen.
4. Andreyev, I. A. Design and calculation of the main elements of vessels and apparatus [Electronic resource] : textbook for bachelor's degree applicants in specialty 133 Branch engineering / I. A. Andreyev ; Igor Sikorsky Kyiv Polytechnic Institute.
5. Stadnyk, V. A. Machine parts [Electronic resource] : a course of lectures / V. A. Stadnyk ; NTUU "KPI." - Electronic text data (1 file: 24.1 MB) - Kyiv : NTUU "KPI", 2012 - Title from the screen.

Additional reading:

1. Steffen J., Nudehi S. Analysis of Machine Elements Using SOLIDWORKS Simulation 2020. Taylor & Francis Group, 2020. 600 p.

2. Shih R. Introduction to Finite Element Analysis Using SOLIDWORKS Simulation 2022. SDC Publications, 2022.

3. Petrova R. V. Introduction to Static Analysis Using SolidWorks Simulation. Taylor & Francis Group, 2017. 353 p.

4. Steffen J. R., Nudehi S. S. Analysis of Machine Elements Using SOLIDWORKS Simulation 2023. SDC Publications, 2023.

5. Chang K.-H. Motion Simulation and Mechanism Design with SOLIDWORKS Motion 2023. SDC Publications, 2023.

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)*
1, I week	**Lecture 1:** Introduction to the SolidWorks Simulation module.	Install and configure SolidWorks and SolidWorks Simulation.
2, I week	**Computer workshop 1.** Analysis of the stress state and deformations of a beam under simple load.	Practical training on the topic of the class.
3, II week	**Computer workshop 2.** Analysis of the stress state and deformations of a beam under complex load.	Practical training on the topic of the class.
4, I week	**Lecture 2.** Static analysis of structures (methods and approaches).	Study the topic of the class. Work with the recommended literature.
5, I week	**Computer workshop 3.** Analysis of the stress state and deformations of spatial frames.	Practical training on the topic of the class.
6, II week	**Computer workshop 4.** Analysis of stress state and deformations of truss structures.	Practical training on the topic of the class.
7, I week	**Lecture 3:** Static analysis of structures (examples).	Study the topic of the class. Work with the recommended literature.
8, I week	**Computer-based workshop 5.** Final lesson.	Practical training on the topic of the class.
9, II week	**Computer workshop 6.** Calculations of shafts.	Practical training on the topic of the class.
10, I week	**Lecture 4.** Structural stability analysis (examples).	Working out the topic of the lesson. Work with the recommended literature.
11, I week	**Computer workshop 7.** Calculation of cylindrical supports of vertical apparatus.	Practical training on the topic of the class.
12, II week	**Computer workshop 8.** Calculation of skirt supports of vertical apparatus.	Practical training on the topic of the class.
13, I week	**Lecture 5.** Thermal analysis (methods and approaches).	Working out the topic of the lesson. Work with the recommended literature.

Week	*The content of the training work*	*SRS (66 hours according to the curriculum)*
14, I week	**Computer workshop 9.** Calculations of lateral supports of vertical apparatus.	Practical training on the topic of the class.
15, II week	**Computer workshop 10.** Calculations of saddle supports of vertical apparatus.	Practical training on the topic of the class.
16, I week	**Lecture 6:** Thermal analysis (examples).	Working out the topic of the lesson. Work with the recommended literature.
17, I week	**Computer workshop 11.** Final lesson.	Practical training on the topic of the class.
18, II week	**Computer workshop 12.** Analysis of connections.	Practical training on the topic of the class.
19, I week	**Lecture 7.** Analysis of structural elements of "complex" configuration.	Study the topic of the class. Work with the recommended literature.
20, I week	**Computer workshop 13.** Analysis of a vessel under the influence of internal pressure.	Practical work on the topic of the class.
21, II week	**Computer workshop 14.** Analysis of the vessel under the influence of external pressure.	Practical work on the topic of the class.
22, I week	**Lecture 8.** Optimization of conifigurations of structural elements.	Study the topic of the class. Work with the recommended literature.
23, I week	**Computer workshop 15.** Analysis of loads during slinging.	Practical work on the topic of the class.
24, II week	**Computer workshop 16.** Analysis of thermal stresses in equipment elements.	Practical work on the topic of the class.
25, I week	**Lecture 9.** Credit lesson. Master class.	Preparing for a test lesson.
26, I week	**Computer workshop 17.** Modular control work.	Preparing for a module test.
27, II week	**Computer workshop 18.** Defense of abstracts.	Preparing for the defense of abstracts.

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 active work in lecture classes - up to 2 points (maximum 16 points for all lecture classes).
2. For completing computer workshops - up to 4 points for each lesson (maximum 48 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.
3. 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.
4. For completing the essay (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 submission of the essay 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 by the Methodological Commission of the Faculty of Engineering and Chemistry (Protocole No. 11 of June 28, 2024).