Syllabus
selective component of VC

Technologies of computer design in mechanical engineering

Subjects:	**Technologies of computer design in mechanical engineering**
Level of higher education:	**first (undergraduate)**
Course page in Moodle:	*https://dl2022.khadi-kh.com/course/view.php?id=2971*
The scope of the educational component	**4 credits (120 hours)**
Final control form	**Test**
Consultations:	**on schedule**
Name of the department:	**department of engineering and computer graphics**
Teaching language:	**English**
Course leader:	**Ragulin Vitaliy Mykolayovych, Ph.D., associate professor**
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Brief content of the educational component:
The purpose of studying the academic discipline there is training of specialists in the field of application of modern design tools and geometric computer modeling of machine-building objects and processes corresponding to them. One of the constituent parts of the process of design and construction of parts and assemblies of products is the development of design documentation, including drawings. It is especially valuable to acquire the skills of applying geometric modeling when solving spatial problems, as well as spatial representation as a special quality.
Subject: the study of the educational discipline is a pedagogically adapted system of concepts about the principles of modeling three-dimensional objects using two-dimensional projection images of draftsmen.
The main tasks of studying an academic discipline are:

- formation of knowledge, abilities and skills in the execution of blueprints for various purposes;
- development of spatial perception, necessary for the creation of new structures;
- mastering the methods of reflection on the plane of spatial objects;
- ability to create drawings using computer technologies.

Prerequisites for studying the educational component: the discipline is studied after the disciplines of sketch geometry, engineering and computer graphics

Competencies acquired by the acquirer:
***General competences*:**
The ability to think abstractly.
The ability to critically understand the theories and principles underlying the design of lifting and transport, construction, road and reclamation machines.
Ability to work in a team.

Special (professional) competences:
Ability to apply typical analytical methods and computer software for solving engineering tasks in the field of lifting and transport, construction, road and reclamation engineering.

Ability to use computerized design systems and specialized application software to solve engineering tasks in the field of mechanical engineering

Learning outcomes:

Knowledge and understanding of mechanics and lifting and transport, construction, road and reclamation engineering and the prospects for their development.

Understand the relevant methods and have the skills to design typical assemblies and mechanisms in accordance with the task.

Thematic plan

No topics	Name of topics (LK, LR, PZ, SZ, SR)	Number of hours	
		ocular	extramural
1	**LR.** Basics of work in the package: features of the interface and debugging of the program, modeling environment, sketches, assembly and drafters. Using the shaft design wizard, the principles of using dialog boxes when creating a 3D model of the "Shaft" type. Work in the "Kreslenik" environment, a "Shaft" type part draftsman, design documentation techniques.	16	2
	SR. On the topic	12	25
2	**LR.** Using the shaft design wizard, the principles of using dialog boxes when creating 3D models of the "Shaft" type by option. Work in the "Draft" environment, drafter of parts of the "Shaft" type according to the option, methods of drawing up design documentation.	10	2
	SR. On the topic	10	25
3	**LR.** Using the gear/slot wizard, principles of using dialog boxes when creating 3D models. Work in the "Kreslenik" environment, a gear wheel draftsman, design documentation techniques.	12	2
	SR. On the topic	10	30
4	**LR.** Creation of a parametric model of a compression spring and design of its drawing.	8	1
	SR. On the topic	8	
5	**LR.** Development of a complete package of design documentation (modeling of the assembly unit and design of the assembly drawing and specification).	18	1
	SR. On the topic	16	32
Together	LR	64	8
	SR	56	112

Individual educational and research task (in the presence):

Teaching methods:

TM2 – practical method (laboratory classes, performing exercises);

TM3 – visual method (illustration method, demonstration method, drawing);

TM4 – work with literature (educational and methodical; normative literature; information search by task);

TM5 – video method in combination with the latest information technologies and computer learning tools (distance learning);

TM6 – independent work.

Forms and methods of evaluation
FME2 - final control (semester assessment, graphic)
FME4 – written control (individual tasks)
FME5 – test control (standardized tests, final complex tests)
FME6 – graphic control (graphical)

Evaluation system and requirements:

Current performance
1 The current success of applicants for the performance of educational types of work in training sessions and for the performance of independent work tasks is evaluated using a four-point rating scale with subsequent transfer to a 100-point scale. During the evaluation of the current performance in are counted all types of work provided by the curriculum program
1.1 Lecture classes are evaluated by determining the quality of performance of specified tasks.
1.2 Practical classes are evaluated by the quality of performance of a control or individual task, performance and design of practical work.
2 Evaluation of the current success rate of higher education applicants is carried out at each practical session (laboratory or seminary) on a four-point scale ("5", "4", "Z", "2") and are entered in accounting journal academic success

– “excellent”: the winner mastered the theoretical material flawlessly, demonstrates deep knowledge of the relevant topic or academic discipline, the main provisions;

- "good": the applicant has mastered the theoretical material well, has the main aspects from primary sources and recommended literature, presents it in a reasoned manner; has practical skills, expresses his thoughts on certain problems, but certain inaccuracies and errors are assumed in the logic of the presentation of theoretical content or in the analysis of practical ones;

- "satisfactory": the applicant has basically mastered the theoretical knowledge of the educational topic or discipline, orients himself in primary sources and recommended literature, but answers unconvincingly, confuses concepts, answers additional questions uncertainly, does not have stable knowledge; when answering questions of a practical nature, reveals inaccuracy in knowledge, does not know how to evaluate facts and phenomena, connect them with the future profession;

- "unsatisfactory": the applicant has not mastered the educational material of the topic (discipline), does not know scientific facts, definitions, hardly orients himself in primary sources and recommended literature, lacks scientific thinking, practical skills are not formed.
3Final score by current activity is recognized as an arithmetic average sum points for each lesson, for individual work, current control works according to the formula:

$$K^{current} = \frac{K1 + K2 + ... + Kn}{n},$$

where $K^{current}$ – final assessment of success based on the results of current control;
$K1, K2, ..., Kn$ – performance evaluation n -th measure of current control;
n – number of ongoing control measures.

Grades are converted in points according to the calculation scale (table 1).

Table 1 – Recalculation of the average grade for the current activity into a multi-point scale

4-point scale	100 points scale	4-ball scale	100 points scale	4-ball scale	100 points scale	4-ball scale	100 points scale
5	100	4.45	89	3.90	78	3.35	67
4.95	99	4.4	88	3.85	77	3.3	66
4.9	98	4.35	87	3.80	76	3.25	65
4.85	97	4.3	86	3.75	75	3.2	64
4.8	96	4.25	85	3.7	74	3.15	63
4.75	95	4.20	84	3.65	73	3.1	62
4.7	94	4.15	83	3.60	72	3.05	61
4.65	93	4.10	82	3.55	71	3	60
4.6	92	4.05	81	3.5	70	from 1.78 to 2.99	from 35 to 59
						reassembly	
4.55	91	4.00	80	3.45	69	from 0 to 1.77	from 0 to 34
4.5	90	3.95	79	3,4	68	repeated study	

Final assessment:

1 A student of higher education receives a credit in the last lesson in the discipline based on the results of the current assessment. The average score for the current activity is converted into points on a 100-point scale, according to the conversion table (table 1).

Graduates of higher education, who have an average current grade in the discipline lower than "3" (60 points), in the last session can increase their current grade by taking tests in the discipline.

Assessment of the knowledge of applicants through testing is carried out according to the following scale:

– "Excellent": at least 90% of correct answers;

– "Very good": 82% to 89% correct answers;

– "Good": from 74% to 81% of correct answers;

– "Satisfactory": from 67% to 73% of correct answers;

– "Fair enough": 60% to 66% correct answers;

–"Unsatisfactory": less than 60% of correct answers.

2 The condition for obtaining credit is:

–making up for all missed classes;

–the average current grade in the discipline is not lower than "3" (60 points).

3 For performing individual independent work and participating in scientific events, winners are awarded additional points.

3.1 Additional points are added to the sum of points scored by the student of higher education for the current educational activity (for disciplines, for which the final form of control is a test), or to the final grade in the discipline, for which the final form of control is an exam.

3.2 The number of additional points awarded for different types of individual tasks depends on their volume and importance:

–prizes in the discipline at the international / all-Ukrainian competition of scientific student works - 20 points;

–prize places in the discipline at the All-Ukrainian Olympiads - 20 points;

–participation in the international / all-Ukrainian competition of scientific student works - 15 points

–participation in international / all-Ukrainian scientific conferences of students and young scientists - 12 points;

–participation in all-Ukrainian Olympiads in the discipline - 10 points

–participation in olympiads and scientific conferences of the Khnadu in the discipline - 5 points;

– performance of individual scientific and research (educational and research) tasks of increased complexity - 5 points.

3.3 The number of additional points cannot exceed 20 points.

4 The result of the study is evaluated (select is required):

–on a two-point scale (passed/failed) according to table 2;

–on a 100-point scale (for differentiated assessment) according to table 3.

The final grade together with additional points cannot exceed 100 points.

Table 2 -The scale for transferring points to the national evaluation system

On a 100-point scale	**On a national scale**
from 60 points to 100 points	counted
less than 60 points	not counted

The overall final grade for the study of the academic discipline is determined according to the scale given in Table 3.

Table 3 – The scale for evaluating the knowledge of students based on the results of the final control of the academic discipline

Score in points	Evaluation on a national scale		Evaluation according to the ECTS scale	
	examination	test	Rating	Criteria
90-100	**Perfectly**	**Enrolled**	**A**	The theoretical content of the course has been mastered in its entirety, without gaps, the necessary practical skills for working with the mastered material have been formed, all educational tasks provided for in the training program have been completed, the quality of their performance has been assessed with a number of points close to the maximum
80–89	**Okay**	**Enrolled**	**B**	The theoretical content of the course has been mastered in its entirety, without gaps, the necessary practical skills for working with the mastered material have mainly been formed, all educational tasks provided for by the training program have been completed, the quality of most of them has been assessed with a number of points close to the maximum
75-79			**C**	The theoretical content of the course has been mastered in its entirety, without gaps, some practical skills of working with the mastered material have not been formed enough, all educational tasks provided for by the training program have been completed, the quality of none of them has been assessed with a minimum number of points, some types of tasks have been completed with errors

Score in points	Evaluation on a national scale		Evaluation according to the ECTS scale	
	examination	test	Rating	Criteria
67-74	**Satisfactorily**		**D**	The theoretical content of the course is partially mastered, but the gaps are not of a significant nature, the necessary practical skills for working with the mastered material are basically formed, most of the educational tasks provided by the training program have been completed, some of the completed tasks may contain errors
60–66			**E**	The theoretical content of the course has been partially mastered, some practical work skills have not been formed, many educational tasks provided by the training program have not been completed, or the quality of some of them has been assessed with a number of points close to the minimum.
35–59	**Unsatisfactorily**	**Not counted**	**FX**	The theoretical content of the course has been partially mastered, the necessary practical work skills have not been formed, most of the prescribed training programs of educational tasks have not been completed, or the quality of their implementation has been assessed with a number of points close to the minimum; with additional independent work on the course material, it is possible to improve the quality of the performance of educational tasks (with the possibility of retaking)
0–34	**Unacceptable**		**F**	The theoretical content of the course has not been mastered, the necessary practical work skills have not been formed, all completed educational tasks contain gross errors, additional independent work on the course material will not lead to any significant improvement in the quality of the performance of educational tasks (with a mandatory repeat course)

Course policy:

– the course involves working in a team, the environment in the classroom is friendly, creative, open to constructive criticism;

- mastering the discipline involves mandatory attendance of lectures and practical classes, as well as independent work;

- independent work involves the study of individual topics of the academic discipline, which are presented in accordance with the program for independent study, or were considered briefly;

– all tasks provided by the program must be completed within the set time;

- if the student of higher education is absent from classes for a good reason, he presents the completed tasks during independent preparation and consultation of the teacher;

– the coursework must be protected no later than a week before the beginning of the examination session (indicated if available);

- while studying the course, students of higher education must adhere to the rules of academic integrity set forth in the following documents: "Rules of academic integrity of participants in the educational process of the Khnadu" (https://www.khadi.kharkov.ua/fileadmin/P_Standart/pologeniya/stvnz_67_01_dobroch_1.pdf), "Academic Integrity. Checking the text of academic, scientific and qualification papers

for plagiarism" (https://www.khadi.kharkov.ua/fileadmin/P_Standart/pologeniya/stvnz_85_1_01.pdf), "Moral and ethical code of participants in the educational process of the National Academy of Sciences (https://www.khadi.kharkov.ua/fileadmin/P_Standart/pologeniya/stvnz_67_01_MEK_1.pdf).
- in case of detection of plagiarism, the applicant receives 0 points for the task and must repeat the tasks provided for in the syllabus;
- writing off during tests and exams is prohibited (including using mobile devices). Mobile devices are allowed to be used only during online testing.

Recommended literature: *(literature no later than 10 years old, except for 1 fundamental classical textbook or monograph)*

1. Shevchenko V. A., Ragulin V. N. Analysis of the suspension of the working equipment of a motor grader by the method of computer modeling // Vestnik of the Kharkiv National Automobile and Road University. 2016. Issue 73. P. 234–238.
2. Ragulin V.M., Meshalkina T.S., Palii M.R. Analysis of the modernized suspension of the working equipment of the motor grader using computer modeling// Interdepartmental scientific and technical collection "Applied geometry and engineering graphics". Issue 94. Kyiv, 2018. P. 95–99.
3. Ragulin V.M. Computer modeling in the analysis of the suspension mechanism of the traction frame of motor graders // Modern modeling problems: Collection of scientific papers. Issue 13. Melitopol: MDPU named after B. Khmelnytskyi, 2018. P. 154–161.
4. Nazarko O.O., Ragulin V.M., Zaitsev I.S. The use of the computer modeling method in the study of the aerodynamic efficiency of a passenger car equipped with aerodynamic elements // Modern problems of modeling: Collection of scientific papers. Issue 22. Melitopol: MDPU named after B. Khmelnytskyi, 2021. P. 104-110.
5. Kyrychenko I.G., Chernikov O.V., Rogovii A.S., Ragulin V.M., Reznikov O.O., Taburov O.S. Peculiarities of computer modeling and study of operating modes of lifting platform elements // Bulletin of the Kharkiv National Automobile and Road University. 2021. Issue 95. P. 143–148.
6. Ragulin V.M., Yarizhko O.V., Nazarko O.O. Computer modeling as a method and means of improving construction machines // Interdepartmental scientific and technical collection "Applied geometry and engineering graphics". Issue 102. Kyiv, 2022. P. 181–187.
7. Mykhaylenko V.E. Engineering and computer graphics / V.E. Mykhaylenko, V.M. Naidysh - Kyiv. High school. 2011 – 342 p.
8. Vanin V.V., Perevertun V.V., Nadkernychna T.M., Vlasyuk H.G. Engineering graphics. - K.: BHV Publishing Group, 2018. - 400 p.
9. Basics of computer modeling in engineering: a study guide / V. D. Borysenko, S. A. Ustenko, I. V. Ustenko. Mykolaiv: MNU, 2016. 276 p.
10. Chernikov O.V. Video course on creating models of parts, assemblies and drawings in the environment of the Autodesk Inventor program. URL:https://forums.autodesk.com/t5/product-design-manufacturing/videouroki-z-autodesk-inventor-vid-autodesk-expert-elite/mp/11443156#M234
11. Help system: Autodesk Inventor Help. URL:https://help.autodesk.com/view/INVNTOR/2021/ENU/
12. Methodical instructions for independent work on engineering graphics on the topics "folding drawing", "detailing" for students of technical specialties / O.V. Arkhipov, Ya.A. Kovaleva, V.I. Hopper. - Kh.: Khnadu, 2014. - 64 p.

Additional sources:

1. Peter RN Childs Mechanical Design: Engineering Handbook (Second edition). Elsevier: 2019. 982p.

2. Yu. M. Kovalev, V. M. Vereshchaga. Applied geometry: textbook. K.:, 2012. 472 p.
3. Distance course:https://dl.khadi.kharkov.ua/course/view.php?id=3678
4. Inventor for Mechanical Design Learning Pathway: Explore courses and skills that help you become an Autodesk Certified Professional in Inventor for Mechanical Design. Learn at your own pace, track your progress, and determine your path forward (Mechanical Design Inventor Learning Path: Learn the courses and skills that will help you become an Autodesk Certified Mechanical Design Inventor Professional. Learn at your own pace pace, track your progress and determine your path forward). URL:https://www.autodesk.com/certification/learning-pathways/inventor-mechanical-design
5. Inventor. Support and learning (learning resources). URL:https://knowledge.autodesk.com/support/inventor

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