Name of subject	**Engineering and computer graphics (ECTS 4)**
Subject/module code	MKG1204
Science taught semester (s).	2nd semester
Responsible teacher	Gapparov Bekhzod Nematillaevich, senior teacher.
Education language	Uzbek
Connection to the curriculum	Compulsory
Training hours (this including independent education)	**Total hours - 120 .** **Audience Training hours - 48.** Lecture hours - 12 Practical hours - 36 **Independent education - 72 hours**
ECTS	4
The purpose and tasks of subject / learning outcomes	The purpose of teaching the subject “Engineering and Computer Graphics” is to provide students with the knowledge required by the educational standards in accordance with the profile of the direction, to improve and develop thinking skills related to the logical analysis and generalization of spatial constructive-geometric structures, to visualize various three-dimensional objects in space and their relationships, to logically analyze and generalize spatial structures based on graphic models of space in the form of two-dimensional drawings on a plane. It is to acquaint students with modern graphic software tools, to train them to master the knowledge and skills of performing graphic primitives corresponding to the direction of the specialist, to edit them and create acceptable variants, to store the performed graphic information in memory and print it on paper, to the level required by the educational standards. The task of the subject is to master the methods of creating specific graphic models based on the central and orthogonal projection of space in "Engineering and Computer Graphics" and to acquire sufficient knowledge, skills and qualifications to independently solve positional and metric problems related to spatial objects and their relationships using these graphic models. It is to provide students with sufficient knowledge, skills and qualifications necessary for the automation of work such as designing two- and three-dimensional images of geometric objects in engineering and specialized disciplines, as well as creating models of technological processes. **Learning outcomes:** 1. To develop knowledge, skills and competencies in students to graphically represent complex details leading to a green economy. 2. To be able to analyze theoretical models and understand the main mechanisms. 3. To collect data relevant to graphically representing complex details leading to a green economy. 4. To be able to apply their empirical knowledge in the analyses being conducted. 5. To be able to express and defend their opinions justifying the use of graphic images for a green economy. 6. To be able to analyze production-related data on the use of graphic images for a green economy.

Course content (topics)	**I. Main theoretical part (Lecture)** **Topic 1: Introduction. Basic information about drawing. Drawing materials, tools and devices. Standards, drawing formats, basic notation, scales.** Drawing tools and their use. Types of pencils and their preparation for work. Ruler. Triangles. Gotovalnya (set of drawing tools). Drawing circle. Drawing standards. Formats. Drawing format frame and main inscription. Line types. Scales. G. Monge method. Central projection method. Parallel projection method. Point coordinates. Symmetry of points and shapes. Basic properties of projection. Straight line. Position of a straight line in space. **Topic 2: Straight lines in special situations. Traces of a straight line. Intersections of two straight lines.** Constructing the actual length of a section in a general situation. Special cases of a straight line with respect to the planes of projections. Traces of a straight line. Mutual cases of two straight lines. Projections of the angle between intersecting straight lines. Methods of representing a plane in a diagram. Traces of a plane. Planes in a special situation. Properties of projecting planes. Perpendicularity of a straight line and a plane and mutual perpendicularity of two planes. Constructing traces of a plane given by a point or straight lines. Points lying on a plane. Parallelism of a straight line and a plane. Intersection of two planes. **Topic 3: Geometric constructions in drawings. Drawing parallel straight lines. Drawing perpendicular straight lines. Dividing a straight line segment into equal parts. Dividing an angle into equal parts.** Drawing a straight line. Selecting a point on a straight line. Determining the actual length of a straight line segment in an arbitrary position and the angles formed by its projection planes. The mutual location of two straight lines. Projecting an object onto projection planes. The concept of central and parallel projection. The plane of vertical projections (V) and its position in space. The plane of horizontal projections (H) and its position in space. Basic concepts of views and their mutual correspondence with the image of the object on the projection plane. The concepts of section and cut. Their different aspects. Requirements for the location of images in drawings. **Topic 4: Views. Sections and cuts. Graphical designations of materials in sections and cuts.** View. Local view. Main view. Additional view. Image positioning system. Section. Shear. Simple shearing of details. Local shear. Complex shear. Simple shears. Graphical designation of materials in drawings. Elements of extraction. Axonometric projections. Right-angle axonometric projections. Oblique axonometric projection. Creating axonometric projections. Axonometric projection of flat shapes. Axonometric projection of flat-sided objects. Axonometric projection of geometric shapes with rounded surfaces. **Topic 5: Polygons. Representation of polygons on a plane. Intersection of polygons with a plane. Intersection of a polygon with a straight line. Construction of regular polygons.** Polygons. Areas of application of polygons and a group of arising problems. Describing polygons using the method of G. Monge. Methods for constructing projections of polygons. Intersection of polygons with a plane. Intersection of a polygon with a straight line. Construction of regular polygons. Intersection of surfaces with projective planes. Drawing a tangent plane through an arbitrary point of a surface. Drawing a tangent plane through a given straight line. Constructing a projection of cylindrical surfaces. Constructing a projection of conical surfaces. Constructing a line of intersection of surfaces. The theorem on the

	intersection of second-order surfaces. Surface of a polygon. Intersection of a polygon with a straight line. **Topic 6: Curves. Curves drawn using a circle. Ovals. Curves drawn using a ruler. Ellipse. Drawing technical drawings. Drawing flat shapes. Drawing geometric objects. Hatching light and shade.** Curves. Lekalo curves. Circular curves. Ellipse. Parabola. Hyperbola. Cyclic curves. Cycloid. Epicycloid. Hypocycloid. Classification of points on a plane curve. Second-order curves. Spatial curves and their changes in slope and norm. Drawing of plane shapes. Hatching of light and shade and shadows. Drawing of geometric bodies. Bolted connection. Stud connection. Screw and screw connections. Threaded connections with pipes. Pin and pin connections. Inch threads. Depiction and designation of threads in drawings. Thread termination, protrusion, chamfer. Details of threaded connections. Rules for drawing and reading assembly drawings of any complexity. Conventions and simplifications in assembly unit drawings. Simple structure of the scheme. Conventions and simplifications in assembly drawings. **II. Instructions and recommendations for practical training** The teacher's preparation for a practical training session begins with the study of preliminary documents (curriculum, thematic plan, etc.) and ends with the development of a lesson plan. The teacher should have an idea of the goals and objectives of the practical training session, the amount of work that each student must perform. Methodological guidelines are the main methodological document of the teacher in preparing and conducting practical training sessions. The purpose of the practical training session is to understand the theory, acquire skills. It consists in developing the ability to consciously apply it in educational and professional activities, and confidently form one's own point of view. **Recommended practice topics**: The following topics are recommended for practical training: **Topic 1:** Introduction. Basic information about drawing. Drawing materials, tools and devices. Standards, drawing formats, basic notation, scales. **Topic 2:** Engineering and computer graphics science and theoretical foundations of drawing. G. Monge method. Graph by point coordinates. **Topic 3:** Straight line. Position of a straight line in space. Straight lines in a special situation. Traces of a straight line. Mutual positions of two straight lines. **Topic 4:** Plane. Point and straight line on a plane. Main lines of a plane. Planes in a special situation. Intersection of a straight line and a plane. Perpendicularity of a straight line and a plane and mutual perpendicularity of two planes. Parallelism of a straight line and a plane. Mutual parallelism of two planes. Intersection of two planes. **Topic 5:** Geometric constructions in drawings. Drawing parallel straight lines. Drawing perpendicular straight lines. Dividing a straight line section into equal parts. Dividing an angle into equal parts. **Topic 6:** Projection drawing. Central and parallel projection. Projecting an object onto two mutually perpendicular planes. **Topic 7:** Views, sections and cuts in drawings. Arrangement of images in drawings. Views. Sections and cuts. Graphical designations of materials in sections and cuts. **Topic 8:** Axonometric projections. Rectangular axonometric projections. Rectangular isometric projection. Rectangular dimetric projection. **Topic 9:** Polygons. Representation of polygons on a plane drawing. Intersection of polygons with a plane. Topic 10: Intersection of a polygon with a straight line. Construction

	of regular polygons. **Topic 11:** Intersection of surfaces with a plane and a straight line. Intersection of surfaces with projecting planes. **Topic 12:** Construction of surface projections. General information. Propagations of polygons. Construction of projections of cylindrical surfaces. **Topic 13:** Connections used in solar panels. **Topic 14:** Curves. Curves drawn using a circle. Ovals. Curves drawn using a template. Ellipse. **Topic 15:** Drawing technical drawings. Drawing flat shapes. Drawing geometric bodies. Hatching light and shade. **Topic 16:** Separable and non-separable joints. General information. Threads, their types and designation. Depiction and designation of threads in a drawing. **Topic 17:** Fasteners, screws, studs, stud sockets, nuts, washers. Drawing threads. Drawing stud joints. Non-separable joints. **Topic 18:** Creating and reading assembly drawings. Reading assembly drawings. Drawing assembly drawings into details. **III. Independent learning and independent work.** **Recommended topics for independent learning:** 1. Making traces of a plane in an arbitrary situation. 2. Determining the actual size of the distance from a point to a plane. 3. Drawing a plane perpendicular to a straight line from a point. 4. Drawing traces of a plane parallel to a given plane with a length of 20 mm. 5. Drawing projections of the intersection line of two given planes with a triangular plane and determining the “visible and invisible” parts. 6. Determining the actual size of the angle between two intersecting planes by the substitution method. 7. Determining the actual appearance of a plane by the rotation method. 8. Determining the intersection line of two polyhedral surfaces. 9. Determining the projections of the intersection line of surfaces with a plane in a general situation and its actual appearance. Performing the intersection line of surfaces by the method of auxiliary intersecting planes. 10. Constructing the intersection line of surfaces of revolution using the method of auxiliary cutting spheres. The following independent works are performed in AutoCAD, KOMPAS or Corel Draw programs: 1. Constructing three images of the part based on a clear image of the part in engineering graphics. 2. Drawing a third view based on two views of the part in “projection drawing”, performing a section and an axonometric projection. 3. Drawing a third view based on two views of a complex part, performing a section and an oblique section. 4. Drawing drawings of bolted and studded joints. 5. Drawing a sketch drawing of mechanical engineering parts and performing a working drawing of the part based on it. 6. Drawing a working drawing of 3-4 parts in an assembly unit according to the direction, dividing them into details and performing an axonometric projection of one of them. Note: Students are recommended to complete their homework assignments on a computer using AutoCAD, KOMPAS or Corel Draw programs, based on the instructions of the professor-teacher. In addition, when organizing independent learning, it is recommended to use the following forms, taking into account the characteristics of a particular subject, and they are considered current control:

	1) preparing a synopsis (abstract, presentation) on topics. This method, which helps to thoroughly master the theoretical material, helps to attract more attention to the educational material. The student's synopsis simplifies the preparation for various control works and saves time. 2) working with automated systems of teaching and control. Recommended electronic resources, innovative lesson project samples, test tasks for self-control, etc. are used to prepare for various control works. 3) working with additional literature on the subject. For independent study, students use additional educational and scientific literature in addition to the recommended main literature on the topics given. In this case, the use of literature in Russian and foreign languages is encouraged. 4) Use of the INTERNET. The development of subject topics, finding INTERNET resources on the topic, working with them is encouraged with additional rating points in all types of control. • Studying subject chapters and topics in textbooks and manuals; • Mastering the lecture part on handouts; • Working on subject sections or topics in special literature; • Studying new techniques, processes and technologies that lead to a green economy; • Training sessions using active and problem-based learning methods; • Distance learning; To place practical training work, complete A4 or A3 formats with basic notes.
Exam form	Written
Teaching/learning and examination requirements	Complete mastery of theoretical and methodological concepts and practical knowledge of the discipline, the ability to correctly reflect the results of analysis, independently reason about the processes being studied and carry out tasks in the current, intermediate forms of control and independent work, pass written work on the final control. When drawing up final exam questions, deviations from the content of the discipline program are not allowed. The bank of final exam questions for each discipline is discussed at the meeting and approved by the head of the department. No later than 1 week before the start of the final control, tickets signed by the head of the department, enclosed in an envelope, are sealed by the Dean’s office and opened 5 minutes before the start of the exam in the presence of students. Final exam duration is 80 minutes. Answers to final exam questions are recorded in copybooks with the seal of the Dean’s office. After completion of the final work, the work is immediately encrypted by a representative of the Dean’s office, and the copybooks are handed over to the commission for verification. From the moment of completion of the final exam, a period of 72 hours is allotted for checking and posting the results on the electronic platform. The teacher who taught the students in this discipline is not involved in the process of conducting the exam and checking the students' answers. Student(s) who are dissatisfied with the final exam results may submit a written or oral appeal within 24 hours of the publication of the final exam results. Complaints submitted after 24 hours from the publication of the final exam results will not be accepted.
Scope of assessment criteria and procedure	CURRENT CONTROL Purpose: Determining and assessing the student's level of knowledge, practical skills, and competencies on course topics. Instructions: The student's activity in daily classes is assessed through the student's mastery of course topics, as well as constructively

	interpreting and analyzing the educational material, developing module-specific skills, acquiring practical skills (in terms of quality and the specified number) and competencies, solving problem situations aimed at applying professional practical skills, working in a team, preparing presentations, etc. Current control form: Activity in lessons Preparing educational materials Working with sources within the subject Using educational technologies Working in a team Preparing presentations Working with projects. MIDTERM CONTROL Purpose: Assessing the student's knowledge and practical skills and level of mastery of lecture material after completing the relevant section of the course. Form and procedure of intermediate control: Midterm examination is held during the semester during the training sessions after the completion of the relevant module of the curriculum of the subject. Midterm examination is held once in written form within the framework of this subject. Midterm examination questions cover all topics of the subject. INDEPENDENT LEARNING Purpose: Independent learning is aimed at fully covering the content of this course, expanding the theoretical knowledge acquired, and establishing independent learning activities for students. Form and procedure of independent education: independent work assignments are completed in the form of an educational project, presentation, case study, problem solving, information search, digest, colloquium, essay, article, abstract, etc. Completed assignments for independent study are placed in the electronic system and checked based on the anti-plagiarism program and evaluated by the subject teacher. In this case, the uniqueness of the completed assignment should not be less than 60%, otherwise the assignment will not be accepted for assessment. The number of independent work assignments, depending on the nature of the subject, should not be less than 3 for one subject (module). Independent work assignments account for 60% of the points allocated for current and intermediate control. FINAL CONTROL Purpose: The final examination is held at the end of the semester to determine the level of mastery of the student's theoretical knowledge and practical skills in the relevant subject. The final examination is held at a specified time according to the examination schedule created by the Registrar's Office on the electronic platform. Requirements: The student must have passed the current control, intermediate control and independent learning assignments by the deadline for the final control type in the relevant subject. A student who has not passed the current control, intermediate control and independent learning assignments, as well as who has received a score in the range of "0-29.9" for these assignments and control types, is not included in the final control type. Also, a student who has missed 25 percent or more of the classroom hours allocated to a subject without a reason is excluded from this subject and is not included in the final control type and is considered not to have mastered the relevant credits in this subject. A student who has not passed or was not included in the final control type and has received a score in the range of "0-29.9" for this type of control is considered to be an academic debtor. Final control form: The final examination in this subject will be conducted in written form. If the final examination is conducted in written form, the requirements for assessment must also be reflected.
Criteria for assessing	5 | 100 | | Assessment criteria

student knowledge

grade	points		
5	90-100	Excellent	When a student is considered to be able to make independent conclusions and decisions, think creatively, observe independently, apply the knowledge he has gained in practice, understand, know, express, and narrate the essence of the subject, and have an idea about the subject.
4	70-89,9	Good	When the student is considered to be able to observe independently, apply the knowledge he has gained in practice, understand, know, express, and narrate the essence of the subject, and has an idea about the subject.
3	60-69,9	Satisfactory	When the student is found to be able to apply the knowledge he has gained in practice, understands, knows, can express, and narrate the essence of the subject, and has an idea about the subject.
2	0-59,9	Unsatisfactory	When it is determined that the student has not mastered the science program, does not understand the essence of the subject, and does not have an idea about the science.

Course assessment criteria and procedure

Assessment type	Total points allocated	Control (task) form	Distribution of points	Qualifying score
Current assessment	30 points	System tasks	20 points (divided by the number of tasks)	18 points
		Student activity (in seminars, practical, laboratory classes)	10 points	
Midterm assessment	20 points	Supervision: Written work	10 points	12 points
		System tasks	10 points (divided by the number of tasks)	
Final assessment	50 points	Written assignment (5 questions)	50 points (10 points per question)	30 points
* Note: 60% of the points allocated for current and intermediate control are allocated to independent work assignments. Independent work assignments are evaluated as system assignments through the electronic platform.				

Recommended Literature

Main literature:

1. A.B.Mukhitdinov. “Drawing geometry and engineering graphics”. Textbook.–Jizzakh: JizPI, 2021, 145 p.

2. X.A.Aynakulov. “Engineering and computer graphics”. Textbook.–Jizzakh; JizPI 2021, 267 p.

3. F.B.Urazaliyev. “Engineering and computer graphics”. Textbook.–Jizzakh; JizPI, 2022, 188 p.

4. A.Y.Khatamov. “Engineering and computer graphics”. Textbook.–Jizzakh; JizPI, 2022, 209 p.

5. A.Y.Khatamov. “Engineering and Computer Graphics” textbook.–

Jizzakh JizPI, 2022, 320 p.
6. R. Khorunov. Course in Drawing Geometry. Textbook for Technical Universities.–T.: Teacher, 1997.
7. A.N. Valiyev. N.Kh. Gulomova. “Drawing” (mechanical engineering). Textbook.–T.:, People's Islamic Academy of Uzbekistan 2020, 228 p.
8. A.N. Valiyev. Textbook “Perspective”.–T.: Voris, 2012, 325 p.
9. A.A. Karimov. “Drawing Geometry”. Textbook.–T.: Science and Technology. 2017, 208 p.
10. M.B.Shah, B.C.Rana. «Engineering Drawing», 2009. 568 pages
11. Elliot Gindis «Up and Running with AutoCAD® 2011 2D Drawing and Modeling», 2011. 511 pages.
12. U.T.Rikhsiboyev, D.F.Kuchkarova, Ch.T.Shokirova, X.M.Rikhsiboyeva. “Engineering and computer graphics” textbook. –T.: Tafakkur kinagi. 2019 383 p.
13. Sh.Murodov, L.Khakimov, A.Kholmurzayev, M.Jumayev, A.Tukhtayev. “Drawing geometry”. Textbook, Economics–finance, 2006, 241 p.
14. B.B. Kulnazarov. Fundamentals of drawing and computer graphics. Textbook. Samarkand, 2004.
15. J. Yodgorov. “Drawing geometry”. Textbook.–T.: TURON–IQBOL, 2007, 232 p.
16. A.A. Karimov. “Drawing geometry”. Textbook, T.: Science and technologies. 2017, 208 p.
17. Sh.K. Murodov. “Engineering graphics”. Textbook–T.: Sano–standart 2013, 176 p.
18. J.Y. Yodgorov. “Geometric and projection drawing”. Textbook –T.: Yangi asr avlod. 2008, 150 p.
19. M.I. Hurboyev. “Machine engineering drawing”. Textbook T.: –Taffakur Avlody, 2020, 170 p.
20. A. Abdurakhmonov. “The system of graphic works in drawing”. Textbook. T.: Cholpon, 2005, 180 p.
21. A. Tokhtayev. “Machine engineering drawing” textbook. Textbook. T.: Ilm–ziyo, 2010, 182 p.
22. Saydaliyev S.S., Khamrakulova M.M. “Construction drawing”. Textbook. Publishing house of the State Pedagogical University of Technology. 2017.

Additional literature:

23. Mirziyoyev Sh.M. We will build our great future together with our brave and noble people. Tashkent, “U‘zbekiston”, 2017, 488 pages.
24. Mirziyoyev Sh.M. The rule of law and ensuring human interests are the guarantee of the country’s development and the well-being of the people. Tashkent, “U‘zbekiston”, 2017, 48 pages.
25. Mirziyoyev Sh.M. “We will build a free and prosperous, democratic state of Uzbekistan together”. Speech at a joint session of the chambers of the Oliy Majlis dedicated to the solemn ceremony of taking office as the President of the Republic of Uzbekistan.–T.: “U‘zbekiston”, 2016. 56 pages.
26. Mirziyoyev Sh.M. “Critical analysis, strict order–discipline and personal responsibility–must be the daily rule of every leader’s activities.” Speech of the President of the Republic of Uzbekistan at the meeting of the Cabinet of Ministers of the Republic of Uzbekistan dedicated to the results of 2016 and prospects for 2017.–Tashkent.: 2017. 104 p.
27. Strategy of actions on five priority areas of development of the Republic of Uzbekistan in 2017–2021.–Tashkent.: 2017.
28. Rahmonov I, Abdurahmonov A. Chizmachilirdan reference book. Publishing house of the National Library of Uzbekistan. Tashkent, 2005.

	29. L.O‘.Rasul–Zade, Dj.Kh.Mirhamidov. Drawing geometry (Perspective and shadows). Tashkent. TAQI, 2015. **Internet resources:** 30. www.gov.uz–Government Portal of the Republic of Uzbekistan. 31. www.lex.uz–National Database of Legislative Documents of the Republic of Uzbekistan. 32. www.edu.uz–Official website of the Ministry of Higher and Secondary Specialized Education of the Republic of Uzbekistan 33. http://ziyonet.uz 34. https://stat.uz 35. www.Autodeks.com 36. www.AutoCAD.ru