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
Study to the program connection	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.
Student assessment	Assessment of student knowledge is based on the mastery of the learning material during the semester and final control (tests, assignments, written and oral work results). During the course of Engineering and computer graphics, students are evaluated on a 100-point system. Of these, 50 points are allocated to the current and intermediate results (60% of 50 points are current control, independent learning and 40% are intermediate control), and 50 points are allocated to the final control results. Students whose total score of current and intermediate points is less than 30 points are not admitted to the final control exam. A student who scores 30 or more points in the final control is considered to have mastered the subject.
Requirements for exams	The student must have fully mastered the theoretical and practical concepts of the subject, be able to correctly reflect the results of the analysis. The student must have completed the tasks given in the current and intermediate forms of independent work, assessment. At the same time, he must have received the necessary points from the current, intermediate, independent education and final tests in the relevant subject within the specified time. A student who has not submitted current control, intermediate control and independent education tasks, as well as who has scored less than 30 points on these tasks and types of control, will not be included in the final type of control. Also, a student who has missed 25 or more percent of the classroom hours allocated to the subject without an excuse will be expelled from this subject, will not be allowed to take the final exam and will be considered as not having mastered the relevant credits in this subject. A student who fails the final exam or scores less than 30 points on this type of exam is considered academically indebted.
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