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THE ROLE OF ENGINEERING GRAPHICS IN THE TRAINING OF MECHANICAL STUDENTS

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Abstract. *Engineering graphics is a fundamental discipline in the system of technical education. It plays a key role in the formation of professional competence of students of mechanical specialties, as it provides basic skills of spatial representation, technical drawing, reading and creation of design documentation. In the modern engineering environment, where there is constant digitalization of processes, graphic training acquires new forms and tools, but does not lose its relevance.*

Key words: *Engineering graphics, Spatial thinking, Analytical thinking, Attention and accuracy, Graphic literacy*

Introduction

Engineering graphics is a fundamental discipline in the system of technical education. It plays a key role in the formation of professional competence of students of mechanical specialties, as it provides basic skills of spatial representation, technical drawing, reading and creation of design documentation. In the modern engineering environment, where there is constant digitalization of processes, graphic training acquires new forms and tools, but does not lose its relevance.

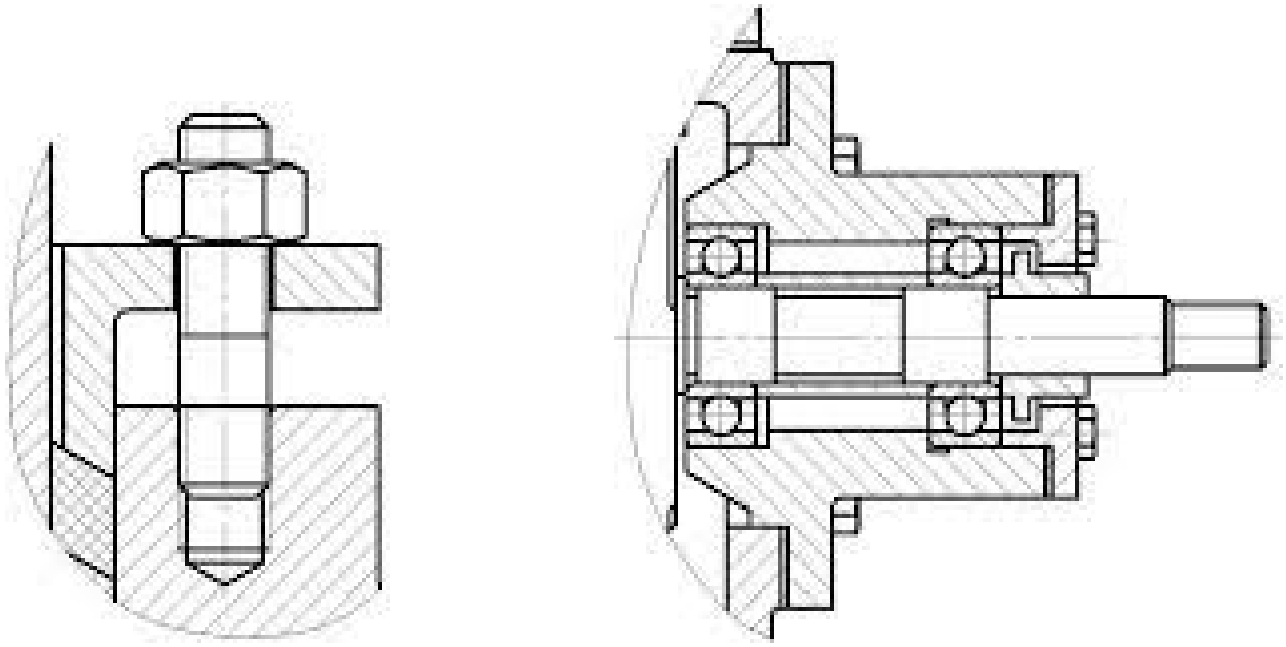

Fig. 1. Example of a technical drawing

1. Theoretical basis of the discipline

Engineering graphics combines the principles of descriptive geometry, geometric modeling and drawing. Knowledge of these basics allows students to:

- build projections of complex spatial objects;
- determine geometric relationships between structural elements;
- create correct graphic documentation in accordance with state and international standards (DSTU, ISO).

2. Formation of professional competencies

- Mastering engineering graphics contributes to the development of a number of important skills:
- Spatial thinking - the ability to imagine a three-dimensional object from a two-dimensional image and vice versa;
- Analytical thinking - the ability to logically justify the sequence of constructing projections;
- Attention and accuracy - necessary for reading and creating drawings with a high degree of detail;
- Graphic literacy - the ability to design technical drawings in accordance with standards.

Competence	Role in engineering training
Spatial Thinking	Ability to visualize complex shapes
Technical Literacy	Creating documentation according to standards
Logical Thinking	Analysis of complex geometric constructions
Visualization	Transition from 2D to 3D representations

3. Practical significance for mechanical specialties

- Future specialists in mechanical specialties constantly work with technical documentation. Engineering graphics provides:
- the ability to read drawings of machine parts and assemblies;

- execution of sketches, technical drawings and working drawings;
- participation in the design and modernization of mechanical systems.

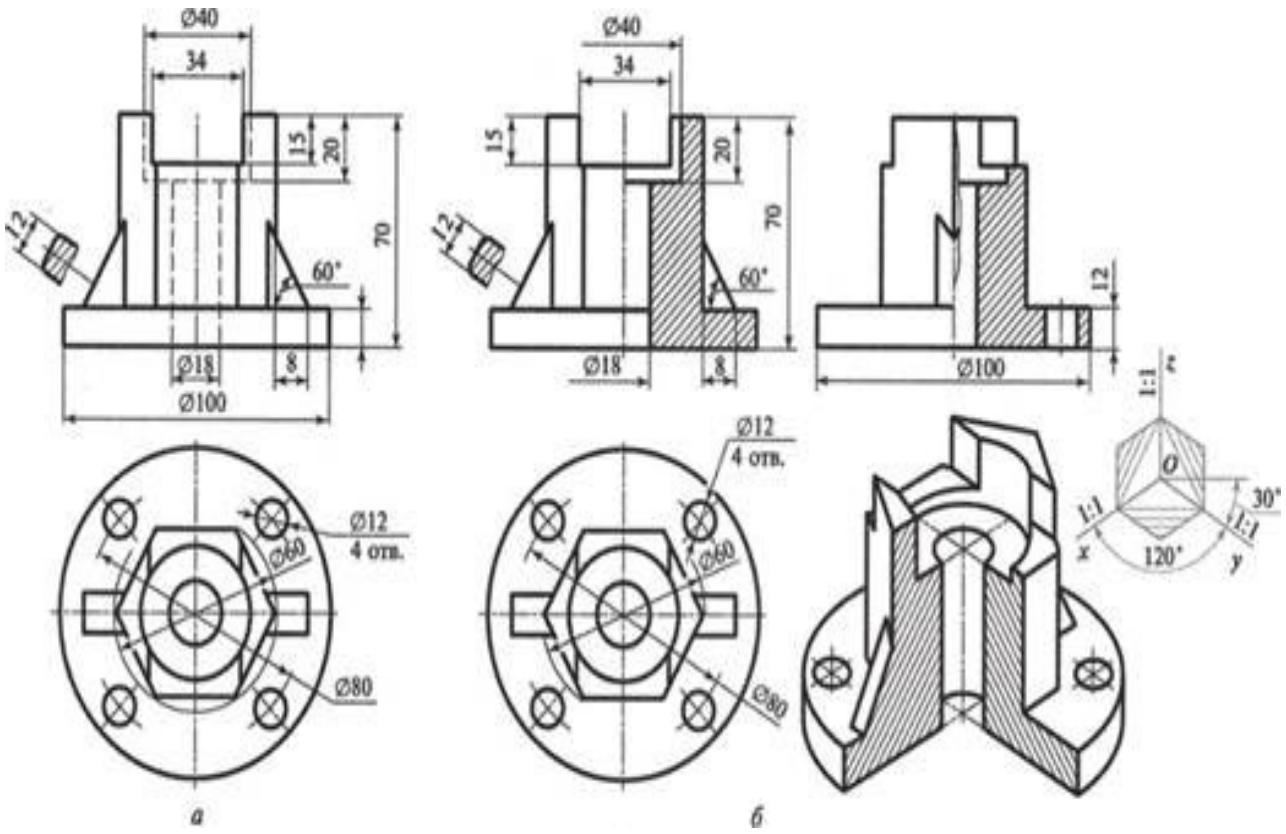

Fig. 2. Isometric view of the part

4. Engineering Graphics in the Digital Age

- Modern educational programs include computer graphics - working with CAD systems:
- AutoCAD - creating 2D and 3D drawings;
- SolidWorks, Compass-3D - parametric modeling of objects; Fusion 360 - cloud platform for design and simulations.

Program	Purpose	Level of development
AutoCAD	2D drawing and basic 3D	Beginner
SolidWorks	Parametric 3D modeling	Intermediate
Fusion 360	Cloud CAD/CAE platform	High

5. Using engineering graphics in design activities

In course and diploma design courses, students:

- develop drawings of parts, assemblies and assemblies;
- create specifications, schematic and kinematic plans;
- draw up explanatory notes with graphic applications.

6. Pedagogical aspects of teaching engineering graphics

- Gradual complication of tasks - from simple projections to complex scans and axonometric images;
- Use of visualization and models - application of physical models, 3D visualizations, VR technologies;
- Gamification and interactive learning - graphic simulators, digital platforms, tests, online drawings;
- Differentiated approach - taking into account the individual level of training of students and their ability to spatial representation.

7. Problems and ways to improve

- Reducing the number of hours in the curriculum - requires the integration of graphics into other disciplines;
- Low level of basic knowledge among first-year students - it is advisable to introduce preparatory graphics courses;
- Insufficient technical support - it is important to update computer classes, CAD program licenses;
- The need to improve the qualifications of teachers - constant participation in training and certification programs.

8. Development prospects

- Integration with the latest technologies: 3D printing, augmented reality (AR), digital twins;
- International standards: harmonization with ISO to train competitive specialists;
- Project-oriented learning: more real engineering tasks and production cases;
- Integration with STEM: combining engineering graphics with programming, physics, mathematics.

Conclusions

Engineering graphics are not only a base for technical education, but also a powerful tool for training qualified specialists in the field of mechanics. Its role in the formation of engineering thinking, the ability to technical analysis, creativity and adaptation to modern challenges is crucial. The development of the discipline should be focused on the integration of digital technologies, interdiscipline and project activity.

List of recommended literature

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