National Technical University of Ukraine
"Igor Sikorsky Kyiv Polytechnic Institute"

Department
of Manufacturing Engineering

SYSTEM ANALYSIS

Working program of educational discipline (Syllabus)

Details of educational discipline	
Level of higher education	***First (bachelor's)***
Branch of knowledge	*13 Mechanical Engineering*
Specialty	*131 Applied mechanics*
Educational program	*Manufacturing Engineering*
Discipline status	*Normative / Selective*
Form of study	*full-time (day)/full-time (evening)/part-time/remote/mixed*
Year of preparation, semester	*4th year, autumn semester*
The scope of discipline	*120 hours*
Semester monitoring/ control measures	*Offset*
Class schedule	*Lectures - 1 time a week, practical - 1 time in 2 weeks*
Language of instruction	*English*
Information about the course leader / teachers	Lecturer: *Candidate Degree in Technical Sciences, Docent, Lapkovsky S., phone: 0677851784* Practical / Seminar: *Candidate Degree in Technical Sciences, Docent, Lapkovsky S., phone: 0677851784* Laboratory:
Course placement	*https://classroom.google.com/u/0/c/NTg2NjA5Mzk2ODI0*

Curriculum

1. Description of the discipline, its purpose, subject of study and learning outcomes

At present, to get an idea of such a complex system as the technological system, of the interaction of subsystems and tasks in it, of the influence of this system on the organizational structure of the enterprise, of the role of the system in the preparation and adoption of management decisions, of the place and role of a specific shop, division , an individual specialist in the production process is practically impossible without knowledge of the basic patterns of functioning and development of complex systems, without the use of methods and models of system analysis. One of the directions for improving the development of higher education is overcoming the shortcomings of narrow specialization, strengthening interdisciplinary ties, and developing systemic thinking. A modern mechanical engineer must be able to use modern methodological bases of analysis and synthesis of technological systems and objects of mechanical engineering. System analysis and system research is the most effective and the only scientific method for solving theoretical and practical problems. The discipline "System analysis" is of great importance for the training of specialists in mechanical engineering technology, because its study allows to improve the technological process of manufacturing products, that is, to reduce the labor intensity and cost of manufacturing both parts and machines as a whole. This discipline provides an opportunity for specialists to apply new methods of research of mechanical engineering objects, forms the ability to solve various complex problems in the field of mechanical engineering with a high degree of reasonableness when making a decision. This discipline ensures the acquisition of methodological skills necessary for the analysis and synthesis of any complex technological systems and engineering objects.

The discipline is taught in such a way that it fully adapts to the future specialty of the student in the field of engineering specialty, namely, mechanical engineering technology. Based on this concept, not only the specifics of existing technical systems, but also the methodology of creating new ones are considered.

The discipline refers to the cycle of professional and practical training.

2. Prerequisites and postrequisites of the discipline (place in the structural and logical scheme of education according to the relevant educational program)

The course consists of lectures, practical classes and a test. The discipline is based on the courses "Mathematics", "Physics", "Computer Science", "Theoretical Mechanics", "Machine Details and Fundamentals of Design", "Theory of Mechanisms and Machines" and prepares students for better assimilation of the materials of the courses "Fundamentals of Mechanical Engineering Automation", " Automated systems of technological preparation of production and flexible automated production", "Equipment of machining shops", "Designing of equipment of machining shops".

3. The content of the discipline

Topic 1 *History of the development of system analysis.*

Topic 2 *Scientific areas of systems research. System analysis.*

Topic 3 *Qualitative methods of system analysis.*

Topic 4 *Concept of system.*

Topic 5 *Methods of presentation of systems.*

Topic 6 *Concepts characterizing the structure and functioning of systems.*

Topic 7 *Regularities of systems.*

Topic 8 *Classification of systems.*

Topic 9 *Structures of systems.*

Topic 10 *Presentation of system structures using graphs.*

Topic 11 *Topological analysis of system structures.*

Topic 12 *Informational-epistemological approach to system analysis.*

4. Educational materials and resources

Main:

1. Bentley, Lonnie D., and Jeffrey L. Whitten. Systems analysis and design for the global enterprise. McGraw-Hill Irwin.
2. Bentley, Lonnie D., and Jeffrey L. Whitten. Systems analysis and design for the global enterprise. McGraw-Hill Irwin.
3. Bentley, Lonnie D., Kevin C. Dittman, and Jeffrey L. Whitten. Systems analysis and design methods.
4. Hawryszkiewycz, Igor T. Introduction to systems analysis and design. Prentice Hall PTR.
5. Hawryszkiewycz, Igor Titus, and I.T. Hawryszkiewycz. Database analysis and design. Chicago, IL: Science Research Associates.
6. Hawryszkiewycz, Igor. A metamodel for modeling collaborative systems.
7. Hawryszkiewycz, Igor. Knowledge Management: Organizing Knowledge Based Enterprises. Palgrave Macmillan P. Articles, a selection.
8. I.T. Hawryszkiewycz. Semantics of data base systems. PhD thesis, Massachusetts Institute of Technology, Cambridge.
9. Whitten, Jeffrey L., and Lonnie D. Bentley. Introduction to systems analysis and design. McGraw Hill Irwin.
10. Whitten, Jeffrey L., and Lonnie D. Bentley. Using Excelerator for systems analysis and design.
11. Whitten, Jeffrey L., and Lonnie D. Bentley. Introduction to systems analysis and design. McGraw Hill Irwin.
12. Whitten, Jeffrey L., and Lonnie D. Bentley. Using Excelerator for systems analysis and design.
13. Whitten, Jeffrey L., Lonnie Bentley, Victor M. Barlow. Projects and cases for use with Systems analysis and design methods. Irwin.

Educational content

5. Methods of mastering the discipline (educational component)

Topic	Content	Lectures	Practical / Seminars
Topic 1 *History of the development of system analysis.*	*Introduction. Historical background on the development of system analysis. Chronology of the development of system analysis in the USA, European countries and the USSR. Activities of the RAND Corporation.*	2	
Topic 2 *Scientific areas of systems research. System analysis.*	*Characteristics of systems research areas. A systematic approach. Systemology. System engineering. System analysis. Purpose and tasks of system analysis. The subject of system analysis. Connection of system analysis with other disciplines.*	2	2
Topic 3 *Qualitative methods of system analysis.*	*The concept of methods aimed at intensifying the use of intuition and surveying specialists. Brainstorming (method of collective generation of ideas). Method of scenarios. Methods of expert evaluations. The goal tree method. The sequence of stages of the method of collective generation of ideas. Concept of morphological approach. Zwicky's methods. Zwicky's box.*	6	6
Topic 4 *Concept of system.*	*Concept of system. The properties that an object needs to be considered a system. Definition of the system. Black box model. Different levels of "black box" detailing.*	4	2
Topic 5 *Methods of presentation of systems.*	*The first topological representations of systems. Operating rings of Neumann dependencies. Structural diagrams and transfer functions. Methods of presenting systems using graphs, specific images and structural matrices.*	4	2
Topic 6 *Concepts characterizing the structure and functioning of systems.*	*Concepts characterizing the structure and functioning of systems. Element. Subsystem. Structure. Communication. State. Behavior. Balance. Constancy Development.*	2	
Topic 7 *Regularities of systems.*	*The regularity of integrity. Regularity of integrability. Regularity of communicativeness. Regularity of hierarchy. The regularity of historicity. Regularity of equifinality. The law of necessary diversity. Regularity of feasibility and potential effectiveness of systems. Patterns of goal formation. Patterns of goal emergence.*	2	
Topic 8 *Classification of systems.*	*Classification of systems by substantial feature. Classification of systems according to their origin. Open and closed systems. Targeted systems. Classification of systems by means of control. Classification of systems according to the description of variables. Classification of systems by degree of organization. Presentation of the object in the form of a well-organized system.*	2	

	Presentation of the object in the form of a poorly organized system. Presentation of the object in the form of a self-organizing system. Classification of systems by degree of complexity.		
Topic 9 *Structures of systems.*	*Concept of structure. Classification of structures. Classification of structures by time. Extensive and intensive structures. Reducing, degrading and stable structures. Classification of structures depending on spatial organization. Flat and three-dimensional structures. Dispersed, locally concentrated and concentrated structures. Classification of structures depending on the nature of the organization in the system of elements and their connections. Hierarchical, non-hierarchical and mixed structures. Linear, centralist, tree-like, matrix, skeletal, dense, network structures.*	2	
Topic 10 *Presentation of system structures using graphs.*	*An undirected graph. Oriented graph. Earl's rib. Count's arc. Isolated peak. Hanging peak. A dead-end peak. Adjacent vertices of the graph. Adjacent edges (arcs) of the graph. Edges (arcs) incident to the vertex. Parallel arcs. The degree of the top. Way. Elementary path. Contour (cycle). Elementary outline. The length of the path (circuit). Loop. A simple node (vertex). Connected graph. An unrelated graph. Complete graph. Null graph. Unigraph. Multigraph. A symmetric graph. Asymmetric graph. Isomorphic graphs. Subgraph Appendix subgraph. Tree. Lagrangian tree. Branches Chords Forest. Hypergraph. A bipartite graph. Rules for transforming graphs. Incidence matrix. Adjacency matrix. List of edges. Incident list.*	4	4
Topic 11 *Topological analysis of system structures.*	*Analysis of elements. Analysis of connections. Connectivity. Structure diameter. Degree of centralization. Complexity.*	4	2
Topic 12 *Informational and epistemological approach to system analysis.*	*Matter. Information. Essence.*	2	
Offset			

6. Independent work of a student/graduate student

Independent work is provided by topics:

Topic 2 *Scientific areas of systems research. System analysis.*

Topic 4 *Concept of system.*

Topic 5 *Methods of presentation of systems.*

Topic 6 *Concepts characterizing the structure and functioning of systems.*

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Policy and control

7. Course policy (educational component)

Deadline and recompilation policy. *Works that are submitted in violation of deadlines without good reason are evaluated at a lower score (-10 points). Re-examination takes place with the permission of the dean's office if there are good reasons (for example, hospital).*
Academic Integrity Policy. *All written works are checked for plagiarism and are allowed to be defended with correct text borrowings not more than 20%.*
Attendance policy. *Attendance is a mandatory component of the assessment, for which points are accrued. For objective reasons (eg illness, international internship) training can take place on-line in agreement with the course leader.*

8. Types of control and rating system of assessing learning outcomes (RSA)

Current monitoring: express survey, survey on the topic of the lesson, test, etc.
Semester monitoring: offset.
Conditions of admission to semester control: semester rating is more than 63 points.

Table of correspondence of rating points to grades on a university scale:

The number of points	Rating
100-95	*Perfectly*
94-85	*Very good*
84-75	*Good*
74-65	*Satisfactorily*
64-60	*Enough*
Less than 60	*Unsatisfactorily*
Admission conditions are not met	*Not allowed*

9. Additional information on the discipline (educational component)

- the possibility of enrollment in certificates of distance or online courses on relevant topics;
- the possibility of crediting articles published abroad.

Curriculum (Syllabus):

Folded: Candidate Degree in Technical Sciences, Docent Lapkovsky S.

Approved: Department of Manufacturing Engineering (minutes № 1 of 31 august 2023)

Agreed Methodical commission of the faculty [1] (minutes № 1 of 31 august 2023)

[1] Methodical council of the University - for general university disciplines