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

Department
of Manufacturing Engineering

MEANS OF ORGANIZING OBJECTS OF PRODUCTION

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/NTg2NjEwNDg1MjEw*

Curriculum

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

Means of organizing production facilities is a discipline that studies the methodological foundations of creating and ensuring the further effective functioning of automated production facilities in various branches of mechanical engineering. In the process of studying this discipline, the student masters a universal mathematical apparatus and a systematic approach to the specifics of automation of technological processes in machine-building production, existing typical solutions in the field of automation of technological processes in machine-building; structures and technical characteristics of auxiliary technological equipment of automated production. This allows you to determine the possibilities of automating the manufacturing process of the product, make a reasonable choice of the design and technical characteristics of the auxiliary technological equipment to ensure the production of the product in the conditions of automated production, and determine and choose the layout of the equipment. Such important concepts as transportation, orientation, feeding, stacking of products, manufacturability of the product design are considered, methods of increasing the efficiency of the use of auxiliary technological equipment of automated production in mechanical engineering are studied.

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 automated productions, but also the methodology of creating new automated productions 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 tests. The discipline is based on the courses "Mathematics", "Physics", "Computer Science", "Theoretical Mechanics", "Machine Parts and Fundamentals of Design", "Theory of Mechanisms and Machines" and prepares students for better mastering materials of courses "Fundamentals of automation of mechanical engineering", "Automated systems of technological preparation of production and flexible automated productions", "Equipment of machining shops", "Design of equipment of machining shops".

3. The content of the discipline

Topic 1 *Technical and economic aspect of automation of machine-building production.*

Topic 2 *Classification of additional technological equipment.*

Topic 3 *Transport technological equipment.*

Topic 4 *Orientation technological equipment.*

Topic 5 *Feed technological equipment.*

Topic 6 *Accumulate technological equipment.*

Topic 7 *Industrial robots.*

4. Educational materials and resources

Main:

1. M.P. Groover: Automation, Production Systems, and Computer-Integrated Manufacturing, 2nd edn. (Prentice Hall, Upper Saddle River, 2000).
2. S.Y. Nof: Handbook of Industrial Robotics (Wiley, New York, 1985).
3. L. Westerlund: The Extended Arm of Man. A History of the Industrial Robot (Informations Förlaget, Stockholm, 2000).
4. Y.R. Siegwart, I.R. Nourbakhsh: Introduction to Autonomous Mobile Robots (MIT Press, Cambridge, 2004).
5. K. Ikeuchi, B.K.P. Horn, S. Nagata: Picking up an object from a pile of objects, A.I. Memo 726, Artificial Intelligence Laboratory, Massachusetts Institute of Technology (1983).
6. K. Modrich: 3D machine vision solution for bin picking applications, Proc. Int. Robot. Vision Show (Rosemont, 2007).
7. B. Siciliano, L. Villani: Robot Force Control, Ser. Eng. Comput. Sci. (Springer, Berlin, Heidelberg, 2000).
8. J.J. Craig: Introduction to Robotics: Mechanics and Control (Prentice Hall, Upper Saddle River, 2003).
9. Wolf, R. Steinmann, H. Schunk: Grippers in Motion (Springer, New York, 2005).
10. J.N. Pires: Industrial Robot Programming, Building Applications for the Factories of the Future (Springer, New York 2007).
11. R. Zurawski: Integration Technologies for Industrial Automated Systems (CRC, Boca Raton, 2006).
12. Wesley L. Stone: Robotics and Automation Handbook (Western Carolina University, 2005).

Additional:

13. http://maytec.com.de/.
14. http://tc.kpi.ua/content/book2005/book1/.
15. https://adeptconveyor.com.au/.
16. https://www.bastiansolutions.com/.
17. https://www.bofabconveyor.se/.

Educational content

5. Methods of mastering the discipline (educational component)

Topic	Content	Lectures	Practical / Seminars
Topic 1 *Technical and economic aspect of automation of machine-building production.*	*Introduction. The main directions of the scientific foundations of complex automation. The theory of controlled technological processes, including issues of differentiation and concentration of operations, adaptive management of modes, etc. Theory of functional and structural analysis of technological operations and automated equipment. Theory of designing systems of automatic regulation and control of automatic machines and their systems. Scientific bases of calculation and design of target mechanisms and devices, technological equipment and devices. The theory of optimal design of automatic machines and their systems, first of all, multi-parameter synthesis of structural and component options at the early stages of design. Scientific foundations of highly productive and highly efficient operation of automated equipment, etc. The main tasks of complex automation of production. Modern problems of automation of machine-building production.*	2	
Topic 2 *Classification of additional technological equipment.*	*Transport devices. Orientation devices. Feed devices. Storage devices. Control devices. Industrial robots.*	2	
Topic 3 *Transport technological equipment.*	*Classification characteristics of transport technological equipment. The field of application of transport technological equipment. Purpose of transport technological equipment. The driving force of transport technological equipment. The nature of the movement of objects on transport technological equipment. Type of movement of objects on transport technological equipment. The position of the carrier body of the transport technological equipment. The connection of the object with the supporting body of the transport technological equipment. Circulation of the material flow of transport technological equipment. Requirements for the construction of parts that are transported automatically.*	6	2
Topic 4 *Orientation technological equipment.*	*Type of control of orienting devices. Uncontrolled, cyclic and adaptive orienting devices. Stages of orientation. Orientation devices of primary and secondary orientation.*	8	2

	Orientation methods. Passive, active, control and coercive and logical orienting devices. The principle of operation of orienting devices. The type of receiving capacity of the orienting device. Bunker, cassette and conveyor orienting devices. Types of orienting elements of orienting devices. Calculation of elements of orienting devices.		
Topic 5 *Feed technological equipment.*	*Feeder capacity. Bunker, shop and stack feeders. Tape, plate and scraper feeders with traction elements. Rotating and rocking feeders without traction elements. Gear, vane, ring, screw (screw) and piston volumetric dispensers.*	4	2
Topic 6 *Accumulate technological equipment.*	*Store storage devices. Bunker storage devices. Conveyor stacking devices. Cassettes. Gravity trays. Drive trays. Gravitational bunker storage devices. Driven bunker stacking devices. Rotary conveyor stacking devices. Linear conveyor stacking devices.*	6	2
Topic 7 *Industrial robots.*	*The main classification features of industrial robots. Classification of industrial robots by the nature of operations performed. Classification of industrial robots by degree of specialization. Classification of industrial robots by field of use. Classification of industrial robots by type of manipulator coordinate system. Classification of industrial robots by the number of degrees of mobility. Classification of industrial robots by load capacity. Classification of industrial robots according to the method of installation at the workplace. Classification of industrial robots by mobility. Stationary and mobile robots. Classification of industrial robots by type of power drive. Classification of industrial robots by accuracy class. Classification of industrial robots by type of control. Classification of industrial robots by type of movement according to individual degrees of mobility. Use of collaborative robots in production.*	8	8
Offset			

6. Independent work of a student/graduate student

Independent work is provided by topics:

Topic 1 *Technical and economic aspect of automation of machine-building production.*

Topic 2 *Classification of additional technological equipment.*

Topic 3 *Transport technological equipment.*

Topic 4 *Orientation technological equipment.*

Topic 5 *Feed technological equipment.*

Topic 6 *Accumulate technological equipment.*

Topic 7 *Industrial robots.*

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