

**NATIONAL UNIVERSITY OF LIFE AND ENVIRONMENTAL SCIENCES OF
UKRAINE**

Department of Agricultural Machines and System Technologies named after Academician
P.M. Vasylenko

"APPROVED"

Dean of the Faculty of Agrarian Management PhD (Economics), Associate Professor

_____ A. D. Ostapchuk

« _____ » _____ 20__ year.

REVIEWED AND APPROVED

At the meeting of the Department of Agricultural Machines and System Technologies
named after Academician P.M. Vasylenko Protocol No. 16 from 20th of April, 2023.

Head of the Department:

Ph.D., Associate Professor _____ Y. O. Humeniuk

"REVIEWED"

Garand OPP Management _____ (Dr. V. Lutsiak)

WORK PROGRAM OF THE DISCIPLINE

"Technology systems: crop production"

(agricultural machinery)

(name of the discipline)

Specialty

073 «Management»

(code and name of the field of study)

Educational program

«Management»

Faculty

Agricultural management

(name of the faculty)

Developer: Borys V. Onyshchenko, docent of the Department of Agricultural Machines and
System Technologies named after Academician P.M. Vasylenko, Ph.D.

Kyiv - 2023.

1. Description of the subject "Systems of technologies: crop production" (agricultural machinery)"

Field of study, specialty, educational program, educational degree		
Educational degree	<u>Bachelor's degree</u> (bachelor's, specialist's, master's)	
Specialty.	<u>073 "Management"</u> (code and name)	
Educational program	<u>"Management"</u>	
Characteristics of the discipline		
View	Required	
Total number of hours	30	
Number of ECTS credits	1	
Number of content modules	1	
Form of control	Examination	
Indicators of the discipline for full-time and part-time students		
	full-time education	part-time education
Year of study (course)	I	I
Semester	I	1
Lecture classes	8 hours.	2
Workshops and seminars	-	-
Laboratory classes	8 hours.	2
Independent work	14 h	-
Individual tasks	-	-
Examination	-	-
Number of weekly classroom hours for full-time students:	1,067	

2. Purpose, tasks and competencies of the discipline

The purpose of the discipline "Systems of technologies: crop production" (Agricultural machinery) is to form the applicant's knowledge and skills in the discipline of agricultural machinery (purpose, technical and economic characteristics, structure, settings and features of the equipment of major world suppliers), for the future specialist in marketing of agricultural machinery, organizer of agro-industrial production of technical and technological support of agricultural production of crop production. The ability to apply the acquired knowledge in sectional activities.

The tasks of the discipline "Systems of Technology: Crop Production" (Agricultural Machines) are to gain knowledge of the purpose, general structure and technical and economic indicators of agricultural machines, as well as to acquire skills in preparing machines for use and assessing the quality of their work.

As a result of studying the discipline, the student must:

to know:

- state and prospects of machine use in crop production;
- machine complexes, classification and purpose of agricultural machinery;
- the general structure of machines and their components;
- process and operating modes of machines;
- automated systems (mechatronics) for setting up and controlling the quality of mechanization processes;
- main technical and economic indicators
- preparing the machine for operation;
- basics of machine use in crop production

be able to:

- plan and organize the use of agricultural machinery to perform work processes in crop production;
- use agricultural machinery to ensure high-quality performance;
- prepare and set up the machine-tractor units for a specific technological operation.
- identify deficiencies and malfunctions in the operation of agricultural machines, make decisions to eliminate deficiencies, and notify service providers of detected malfunctions;
- to monitor the quality of the machine's operation, compliance with agrotechnical requirements and apply the achievements of science and best practices in production;
- ensure the production of high-quality, environmentally friendly products with minimal energy and environmental impact;
- independently master the designs and working processes of world agricultural machines and tools.

Acquiring competencies of the OKY 4:

Integral competence

IK The ability to solve complex specialized tasks and practical problems characterized by complexity and uncertainty of conditions in the field. In management or in the learning process, which involves the application of theories and methods of social and behavioral sciences.

general competencies (ZK):

ZK5. Knowledge and understanding of the subject area and understanding of professional activities.

ZK11 Ability to adapt and working in a new situation.

professional (special) competencies (FK): _____

SK 2. Ability to analyze the results of the organization's activities, compare them with the factors of influence of the external and internal environment.

SK 4. Ability to identify the functional areas of the organization and the links between them.

3. Program and structure of the discipline for:
full-time (part-time) study;

Names of content modules and topics	Number of hours													
	full-time form							Correspondence form						
	we eks	all	including					all	including					
			l	p	lb	ind	md		l	p	lb	ind	md	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	
Content module 1: Tractors and machines for growing crops														
Topic 1: General issues of the discipline. Tractors and cars. Machines for tillage, fertilization and planting of crops.	9	7	2		2		3	2						
Topic 2. Machines for plant protection, green harvesting and harvesting of cereal crops - 2 hours.	10	7	2		2		3	2						
Topic 3. Machines for post-harvest processing of cereals, harvesting corn and potatoes - 2 hours.	11	6	2		2		4	2						
Topic 4. Machines for harvesting root crops of beets, flax, vegetables and fruit and berry crops - 2 hours.	12	6	2		2		4	2						
Total for content module 1		30	8		8		14	4						
<u>Total hours</u>		30	8		8		14	4						

4. Topics of seminar (lecture) classes

No. of work	Topic title	Number of hours
1.	Topic 1: General issues of the discipline. Tractors and cars. Machines for tillage, fertilization and planting of crops	2
2.	Topic 2. Machines for plant protection, green harvesting and harvesting of cereal crops.	2
3.	Topic 3. Machines for post-harvest processing of cereals, harvesting corn and potatoes.	2
4.	Topic 4. Machines for harvesting root crops of beets, flax, vegetables, fruits and berry crops.	2
Total		8

5. Topics of laboratory classes:

- for full-time students:

	No. of work	Topic of the laboratory session	Number of hours
Mod. 1.	1.	Topic 1: General issues of the discipline. Tractors and cars. Machines for tillage, fertilization and planting of crops	2
	2.	Topic 2. Machines for plant protection, green harvesting and harvesting of cereal crops.	2
	3.	Topic 3. Machines for post-harvest processing of cereals, harvesting corn and potatoes.	2
	4.	Topic 4. Machines for harvesting root crops of beets, flax, vegetables, fruits and berry crops.	2
Current control (Module)			
Total			8

- for part-time students:

No. of work	Topic of the laboratory session	Number of hours

6. Topics for independent work

No. of work	Name of the topic	Number of hours
1.	Setting up a machine for tillage, fertilizing and planting of crops.	3
2.	Setting up a machine for plant protection, green harvesting and harvesting of cereal crops.	3
3.	Setting up a machine for harvesting corn for grain, root and tuber crops, and post-harvest grain processing.	4
4.	Setting up the machine for harvesting flax, vegetables, fruits and berry crops.	4
Total:		14

7. Samples of control questions, sets of tests to determine the level of knowledge acquisition by students

7.1. Control questions

1. Specific features of agricultural production and its difference from the specifics of industry.
2. The role and importance of machinery in agricultural production.
3. Ways to plan and create new equipment for agricultural production.
4. What do such concepts as "technical characteristics of the machine", "general structure of the machine", "basic technological adjustments" include and mean?
5. The main directions of agricultural machinery development.
6. What are the characteristics of tractors and cars? Their purpose, type, and relative position of the main mechanisms.
7. General structure of tractors. The purpose of the components.
8. What is the essence of complex mechanization of agricultural production? Its significance, positive and negative consequences.
9. Technology, technological processes and operations. Example.
10. Technological means of mechanization. The concept of working and auxiliary bodies. Example.
11. The main directions of scientific and technological progress in the development of mechanization for crop production.
12. What is the technical characteristic of a machine? What is its purpose? What indicators does it consist of? Give an example.
13. Tasks of soil cultivation. Technological operations and types of tillage.
14. A set of tillage machines. The purpose of the groups of machines that make up the complex. Their working bodies.
15. Describe the structure, operation, and adjustment of a mounted plows. Draw a diagram of its working parts.

16. Types of plows, their technical and economic characteristics.
17. Cultivators for continuous tillage. General structure, operation and adjustment.
18. Provide a brief overview of machines used for soil cultivation in areas of wind erosion. Example.
19. Explain the need for soil rolling. Types of rollers, their working bodies and adjustment.
20. Types of fertilizers. Methods and technologies of their application to the soil. Characteristics.
21. A set of machines for applying fertilizers to the soil. Purpose of the groups of machines included in it.
22. Explain the need to prepare mineral fertilizers before application. Draw a functional diagram, describe the process of operation and adjustment of the unit for melting and grinding mineral fertilizers.
23. Methods of drilling and planting crops. Their characteristics.
24. What are the characteristics of drilling and planting machines?
25. What are the types of seeding units of seeders? Structure and operation of the coil sowing machine.
26. Types of coulters. Structure and operation of disk coulters
27. What working tools are used for seed wrapping after sowing and planting seedlings. Their characteristics.
28. Describe the purpose, types, and conditions of use of seed lines.
29. What are markers and track markers for? How do I calculate the required length of the left and right markers?
30. What technological operations are performed during crop care?
31. What working tools are used on row cultivators? Their characteristics.
32. The general structure, operation and adjustment of the cultivator-plant feeder for sugar beet crops.
33. What are the methods of plant protection? General characteristics.
34. Methods of chemical plant protection. Characteristics.
35. A set of machines for chemical plant protection. Purpose of the groups of machines included in it.
36. What are the characteristics of sprayers? What are their characteristics?
37. Explain the need to treat seeds before sowing. Methods of dressing.
38. A set of machines for harvesting loose and pressed hay. Purpose of the machine groups included in it.
39. Mowers. General structure, types of cutting units, operation and technological adjustments.
40. Mower-conditioner. Purpose, general structure, drawing, operation, adjustment. The purpose of flattening the mowed mass.
41. Wheel and finger rake. Purpose, general structure, drawing, operation and adjustment.
42. Transverse rake. Purpose, structure, operation and adjustment.
43. Rotary rake. Purpose, structure, drawing, operation and adjustment.
44. Rectangular baling machine for forming bales. Purpose, general structure, operation and adjustment. Draw a diagram of the technological process.

45. Forage harvester KSK-100. Purpose, general structure, operation and adjustment. Draw a diagram of the technological process.
46. Methods of harvesting grain crops. Advantages and disadvantages.
47. Technologies and machine complexes for harvesting the non-grain part of the crop.
48. What are the possible losses of the grain part of the crop during harvesting? Ways to eliminate them.
49. Purpose, general structure, operation and adjustment of the reaping section of a self-propelled combine harvester.
50. Purpose, general structure, operation and adjustment of the threshing unit of a self-propelled combine harvester.
51. Methods of harvesting corn for grain. The complex of machines. Characteristics.
52. To describe the principles of separation of grain heaps by the main physical and mechanical properties of its components.
53. Types and classification of grain cleaning machines.
54. Agricultural requirements for grain drying and classification of grain dryers.
55. Methods of potato harvesting, their characteristics. The complex of machines.
56. Methods and technologies of sugar beet harvesting. Classification of machines.
57. Methods of harvesting flax. Classification of flax harvesting machines.
58. A set of machines for growing vegetables in the open field.
59. Describe the structure, operation, and adjustment of a seedling planting machine.
60. Describe the structure, operation, and adjustment of a self-propelled tomato harvester.
61. Describe the structure, operation, and adjustment of a cucumber harvester.
62. Describe the structure, operation, and adjustment of the machine for the construction of an open irrigation network.
63. Describe the structure, operation, and adjustment of the planner.
64. What economic indicators characterize and evaluate the performance of agricultural machinery? Example.
65. What initial data does the economic evaluation of machines depend on? Example.
66. What is a machine-tractor unit? Classification of units.
67. What are the requirements for completing machine and tractor units?
68. How to determine the number of agricultural machines in a machine-tractor unit?
69. Productivity of machine and tractor units and how is it determined?
70. How to determine labor costs per unit of output. Give an example.
71. The main operational and economic indicators of the use of machine and tractor units.
72. Basic rules for putting equipment in storage.

7. Sample tests for determining the level of students' knowledge

NATIONAL UNIVERSITY OF LIFE AND ENVIRONMENTAL SCIENCES OF UKRAINE			
Bachelor's degree Specialty 073 "Management"	Department of Agricultural Machines and System Technologies named after Academician P.M. Vasylenko 20__ - 20__ academic year	Exam paper No. 1 in the discipline "System of technologies: crop production" of the agricultural machinery "	"Approved" Head of the Department _____ (signature) Humeniuk Y.O. 16 th of April , 2023
<i>Exam question</i>			
<i>1. General structure of wheel and track type tractors. The purpose of the components.</i>			
<i>2. Machines for applying mineral fertilizers. General structure and operation.</i>			

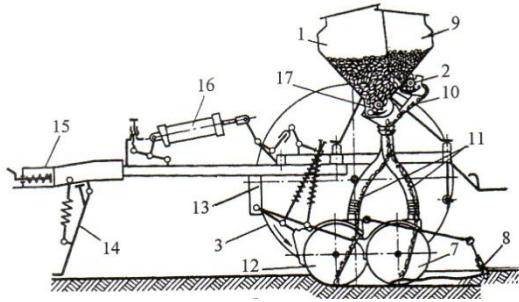
Test tasks of different types

Question #1

What information is contained in the numerical part of the gasoline brand designation?	
1	About the anti-detonation properties of gasoline
2	About the manufacturer
3	About the seasonality of application
4	About the country of origin

Question #2

Make naming the working elements of the seeder and indicate their numbers in the figure.



Question #3.

What the purpose of the internal combustion engine

1	To do useful work
2	For transmitting torque to the undercarriage of a tractor or vehicle
3	To convert the chemical energy of the fuel into mechanical energy on the crankshaft
4	To drive the working auxiliary equipment

Question #4

Which working elements of the seed cleaning machine are designed to sort the grains mixture by the length of its components?

1	Aspiration system
2	Triple cylinders
3	Sieves with round holes
4	Sieve with rectangular holes

Question #5

The essence of precision farming technology is to:

1	Application of variable rates by technological materials (fertilizers, seeds) in the soil accordance to locally determined properties
2	Minimizing the number of passes for machine and tractor units across the field
3	Precise driving of machine and tractor units in the field
4	Maximum uniform placement of seeds and fertilizers in the field surface

_____ (B. Onyshchenko) (signature)

NATIONAL UNIVERSITY OF LIFE AND ENVIRONMENTAL SCIENCES OF UKRAINE

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Exam questions

1. Purpose, general structure, working elements of cultivators.

2. General structure, working elements and main technological adjustments of the potato digger

Test tasks of different types

Question number 1

What technological operations must be making by the forage harvester?	
1	Raking
2	Selection
3	Flattening
4	Grinding
5	Downloading
6	Pressing
7	Transportation
8	Mowing

Question #2

What type of tillage makes by a disk cultivator?	
1	Special
2	Main
3	Minimal

4	Superficial
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Question # 3

Why we use the chisel plow?	
1	For plowing developed (drained) lands with shrubs
2	For deep, moldboard-free loosening of the soil
3	For plowing of sodden soils
4	For cultivation of soils contaminated with radionuclide's

Question #4

What purpose of the tractor transmission	
1	To change the amount of torque transmitted from the motor to the thrusters
2	For turning the tractor
3	To transmit torque from the engine to the thrusters
4	For transmitting torque to the equipment (connected to the tractor)
5	To change the direction of the torque transmitted from the motor to the actuators

Question # 5

In the phrase "Combine harvesting of grain crops can be carried out by... and ... ways", insert the missing words.

(B. Onyshchenko)

(signature)

8. Teaching methods

The main methods of teaching:

classroom training:

- lecture classes;
- practical classes.

extracurricular activities:

- independent work;
- training practice.

9. Forms of controls

Ongoing: surveys, testing (by modules)

Final: exam (written test)

10. Distribution of points received by students. Student knowledge is assessed on a 100-point scale and converted into national grades according to Table 1 "Regulations on Exams and Tests in NULES of Ukraine" (Order of implementation dated 27.12.2019 No. 1371)

Student rating, points	National grade the results of the examination	
	examinations	credits
90-100	Excellent	Enrolled
74-89	Good.	
60-73	Satisfactory	
0-59	Unsatisfactory	Not credited

For determine the student's (trainee's) rating in mastering the discipline $R_{\text{ДИС}}$ (up to 100 points) , the received rating for certification (up to 30 points) is added to the student's (trainee's) rating for academic work $R_{\text{НР}}$ (up to 70 points): $R_{\text{ДИС}} = R_{\text{НР}} + R_{\text{АТ}}$.

11. Methodological support

Practical classes are held in the training laboratories of the Department of Agricultural Machinery and System Engineering named after Academician P.M. Vasylenko, namely: the joint "Training and Technology Center of KUHН", training laboratories "Tillage and Sowing Machines", "Machines for Chemical Plant Protection and Forage Harvesting", "Machines for Harvesting Crops and Post-Harvest Processing of Grain" and "Precision Agriculture". Practical training takes place on the basis of the NULES Research Institute of Agricultural Engineering (including the laboratory of technological adjustment of agricultural machinery at the Agronomic Research Station) and the department's training laboratories. Lectures are held in lecture halls with the use of multimedia equipment.

12. List of available equipment for laboratory work

1. Working elements of agriculture equipments:

- plows;
- cultivators;
- disk harrows;
- seeders;
- sprayers.
- a working model of the pneumatic sowing section.

2. Posters of the main agriculture machines

3. Full-scale samples of machines:

- general-purpose plow;
- reversible plow;
- longitudinal plow;
- deep-ripper / subsoiler / cultivator
- chisel plow;
- steam cultivator;
- of a row crop cultivator-plant fertilizer;
- tillage cutter;
- machines for applying granular mineral fertilizers;
- machines for applying liquid organic fertilizers;
- seeders;
- potato planters;
- seed treatment;
- sprayers;
- pollinators;
- aerosol generators;
- mowers (rotary and with a segment-finger cutter bar);
- rakes;
- grain harvesters;
- seed cleaning machine;
- pneumatic sorting table;
- corn harvester;
- corn cob threshers;
- root harvester;
- machines for harvesting fodder beets;
- potato harvester;
- the potato sorting station;
- flax reaper;
- flax harvester.

10. Recommended reading books

Main literature

1. Voytyuk D.G. Agricultural machines: textbook / D.G. Voytyuk, L.V. Aniskevych, V.V. Ishchenko, Kyiv. Agrosvita 2015 – 679 p.
2. Rud A.V. Mechanization, electrification and automation of agricultural production / [A.V. Rud, I.M. Bender, D.G. Voytyuk, et al. Textbook in 2 volumes: Vol. 1. - K. Agrosvita, 2012. - 584 p.
3. Voytyuk D.G. Agricultural machines / D.G. Voytyuk, Gavryliuk G.R. - K.: Karavela, 2004.
4. Agricultural and land reclamation machines: Textbook / D.G. Voytyuk, V.O. Dubrovin, T.D. Ishchenko and others; Edited by D.G. Voytyuk - K.: Higher Education, 2004.
5. Voytyuk D.G., Havryliuk G.R. Agricultural machines. K.: Urozhay, 1994.

Supporting literature

1. Handbook on the regulation of agricultural machinery / V.I. Kochev, A.S. Kushnarev, V.D. Rogovyi, et al. - K.: Urozhay, 1993. - 264 c.
2. Catalog of devices for technological adjustment of agricultural machines / Compiled by. Oleinichuk G.T., Rochev M.F., Ryabaya L.G.. - K.: Gosagroprom USSR, 1989 - 44 p.
3. Pogorelets O.M., Zhyvolup G.I. Grain harvesters. - K.: Urozhay, 1994. - 232 c.
4. Workshop on technological adjustment and troubleshooting of agricultural machines / G.R. Gavrilyuk, G.I. Zhyvolup, P.S. Korotkevych and others; Edited by G.R. Havryliuk. - K.: Urozhay, 1995. - 280 c.
5. Rud AV, Konovalenko OM, Moshenko IO Workshop on agricultural machines and tools. - K.: Urozhay, 1996-202 p.
6. Sotnikov V.A. Regulation of machines for chemicalization of agriculture. - Minsk: Urajai, 1989, - 229 p.
7. Bubnov V.Z., Kuzmin M.V. Eksploitation mashinotraktornogo parka. Moscow: Kolos, 1980.
8. Mechanization of agricultural production and plant protection. Textbook (D.G. Voytyuk, I.V. Adamchuk, G.R. Havryliuk, O.S. Marchenko) -K.: Vysha Shkola, 1983.
9. Methodical instructions for the study of the discipline "Mechanization, Electrification, Automation" (agricultural machinery) for the direction of training "Agronomy" / S.V. Smolinsky, O.O. Brovarets // - Kyiv, 2012. 62 p.
10. Workbook for laboratory work in the discipline "Mechanization, Electrification, Automation" (agricultural machinery) for the direction of training "Agronomy" / S.V. Smolinsky, O.O. Brovarets, O.M. Vechera, V.V. Teslyuk, Y.O. Humeniuk // - Kyiv, 2013. 61 p.
11. Report on the training practice in the discipline "Mechanization, electrification, automation" (agricultural machinery) for the direction of training "Agronomy" / O.O. Brovarets // - Kyiv, 2012. 25 p.

12. Information resources

1. https://www.youtube.com/watch?v=rF4wq_iCxfc
2. <https://www.youtube.com/watch?v=-DYgmzUIfC4>
3. <https://www.youtube.com/watch?v=tjN6l3FKKRg>
4. <https://www.youtube.com/watch?v=OvugVWmvEjQ>
5. <https://www.youtube.com/watch?v=1EYgKdMLHuw>
6. <https://www.youtube.com/watch?v=2R5CsQAdVPM>
7. <https://www.youtube.com/watch?v=2xtUXj9cMWc&t=39s>
8. <https://www.youtube.com/watch?v=kaWxaOqCm5k>
9. <https://www.youtube.com/watch?v=brk0llsTTvg&t=154s>
10. <https://www.youtube.com/watch?v=oMhB97BdVQ4>
11. https://www.youtube.com/watch?v=1Jee_Vx7ytM
12. <https://www.youtube.com/watch?v=wWcVaAa44VY>
13. <https://www.youtube.com/watch?v=J6Gp06G51Iw>
14. <https://www.youtube.com/watch?v=rQWXXZX94TE>
15. <https://www.youtube.com/watch?v=KiJTsozDiV8>

16. <https://www.youtube.com/watch?v=29qizxJ6YNA>
17. <https://www.youtube.com/watch?v=wBGIZ4eojkQ>
18. <https://www.youtube.com/watch?v=zsJvbkB7MkI>
19. https://www.youtube.com/watch?v=YC7_HFZZZjs
20. <https://www.youtube.com/watch?v=swrCn6l9Ic8>
21. <https://www.youtube.com/watch?v=pQZpZ72StOQ>
22. <https://www.youtube.com/watch?v=3bg9Di1oDYU>
23. <https://www.youtube.com/watch?v=nViNh77kQhs>
24. <https://www.youtube.com/watch?v=wi42LYOvqN8>
25. <https://www.youtube.com/watch?v=TE57dPT0tCw>
26. <https://www.youtube.com/watch?v=q0eVALkjhkI>
27. https://www.youtube.com/watch?v=BIzI_tJ7zMI
28. <http://www.agroexpert.ua/>
29. <http://agronom.com.ua/>
30. <http://www.propozitsiya.com/>
31. <http://www.zerno-ua.com>
32. http://archive.nbu.gov.ua/portal/Chem_Biol/Titapk/index.html
33. <http://www.profi.com/>
34. <http://www.agrotimes.net/3-the-ukrainian-farmer.magazine>
35. Websites of agricultural machinery manufacturers.