Description of individual educational component (module)	
Механика агропромышленных мехатронных систем Mechanicsofagro-industrialmechatronicsystems	
Магистр *Master*	
B1.V.DV.01.01	
Organisation	*Platov South-Russian State Polytechnic University (NPI)*
Faculty	*Mechanical*
Department	*Mechatronics, Hydraulics and Pneumatics Automation*
Responsible person	*Full prof. Mikhail Shoshiashvili*
Type of course unit	Optional
Level of course unit	Second cycle
Year of study (if applicable), semester/trimester when the individual educational component is delivered	1 semester
Number of ECTS credits allocated	4
Total hours	144
Contact hours	16
Self-study hours	128
Mode of delivery	Face-to-face
Maximum attendance	25
Name of lecturer(s)	*Full prof. Mikhail Shoshiashvili*
Prerequisites and co-requisites	**Co-requisites:** Methods and theory of optimization, Methods of artificial intelligence in mechatronics and robotics, Information devices in mechatronics and robotics, Control robots in an unknown environment
Course contents	Structural analysis of controlled machines and mechanism of agricultural mechatronic systems. Kinematic analysis of controlled machines and mechanisms of agricultural mechatronic systems. Dynamics of controlled machines. Dynamic characteristics of controlled machines. Mechanical drive elements of controlled machines. Hydro- and pneumatic drive elements of controlled machines
Recommended or required reading and other learning resources/tools	*1. Shoshiashvili M.E., Shoshiashvili I.S. Mechanics of controlled machines and mechatronic systems: textbook [for universities]. Novocherkassk: YURSTU (NPI), 2012. - 188 p. [in Russian]* *2. Chmil, V.P. Theory of mechanisms and machines: a textbook [for universities]. - St. Petersburg: Lan, 2012. - 280 p. [in Russian]* 3. *Goodilin, N.S. Hydraulics and hydraulic drive:. - Moscow: Mining book, 2007. - 520 p. [in Russian]*
Language of instruction	Russian

Learning outcomes of the course unit
LO1: Investigate complex agro-mechatronic systems using analytical, numerical and experimental research methods. LO3:Design control systems, according to the technical process requirements. LO5:Apply specialized programs ROS and MATLAB for agricultural robot control

Planned learning activities and teaching methods
lectures, practical classes, group practical (practice sessions supervised by technician)

Mapping Programme Key Learning Outcomes to Module Learning Outcomes	
Programme Key Learning Outcomes	**Module Learning Outcomes**
LO1: Investigate complex agro-mechatronic systems using analytical, numerical and experimental research methods.	On successful competition of this module students should be able to: 1. Demonstrate the ability to solve kinematics and dynamics of agricultural robots problems in practical test tasks and the written exam part
LO3:Design control systems, according to the technical process requirements.	2. Develop a control system for the agro-industrial robots during the practical tasks, tests and written exam part

LO5:Apply specialized programs ROS and MATLAB for agricultural robot control	3.Apply specialized programs ROS and MATLAB to develop the control systems at the practical tasks, tests and written exam part

Assessment methods and criteria
The practical tasks report is an admission to the exam. The final grade is set on a five-point system. It may consist of the results of formative tests (40%), a final written assignment for the exam (40%) and an oral answer (20%) according the «**Assessment criteria table»**

Assessment criteria table				
Attribute	**Grade 5 (81-100 points) (Excellent)**	**Grade 4 (71-80 points) (Good)**	**Grade 3 (51-70 points) (Satisfactory)**	**Grade 2 (0-50 points) Failed / Insufficient**
Exam – written part (40%)	The complete solution of the task without serious flaws is given. The correct answer is provided.	The complete solution of the task. The correct answer is received, but with some weaknesses in interim steps.	The content of the task was of a good standard but with several weaknesses regarding evidence and/or some lack of clarity.	The task of the work fell short of that required to pass due to lack of evidence base/or very poor clarity.
Exam – oral part (20%)	All questions received full reasoned answers with no serious missing points.	All questions received the answers, but with some weaknesses in argumentations or explanations.	Some questions received answers with several weaknesses regarding evidence and/or some lack of clarity	Most of questions received answers with several weaknesses regarding evidence and/or some lack of clarity, or received no correct answers.
Intermediate Testing (40%)	All test items solved correctly	From 70% to 90% of test tasks solved correctly	From 50% to 70% of test tasks solved correctly	Less than 50% of test items solved correctly

Description of individual educational component (module)	
Методы и технические средства диагностики агропромышленной техники *Methods and technical means of agro-industrial machinery diagnostics*	
Магистр *Master*	
B1.V.DV.02.01	
Organisation	*Platov South-Russian State Polytechnic University (NPI)*
Faculty	*Mechanical*
Department	*Mechatronics, Hydraulics and Pneumatics Automation*
Responsible person	*Dr. PhD. Tatiana Kruglova*
Type of course unit	Optional
Level of course unit	Second cycle
Year of study (if applicable), semester/trimester when the individual educational component is delivered	2 semester
Number of ECTS credits allocated	4
Total hours	*144*
Contact hours	*16*
Self-study hours	*128*
Mode of delivery	Face-to-face
Maximum attendance	25
Name of lecturer(s)	*Dr. PhD. Tatiana Kruglova*
Prerequisites and co-requisites	**Prerequisites:** Methods and theory of optimization, Methods of artificial intelligence in mechatronics and robotics, Information devices in mechatronics and robotics, Control robots in an unknown environment, Mechanics of agro-industrial mechatronic systems **Co-requisites:** Mathematical modelling and optimization of multilink systems motion, Control systems of mechatronic and robotic complexes
Course contents	Conditions and operating modes of equipment of robotic and mechatronic systems and complexes. Reliability of Mechatronic Agricultural Machines. Methods for calculating the reliability of equipment of robotic and mechatronic systems. Investigation of the reliability of equipment and complexes. Methods of increasing reliability of Agricultural Machines. Diagnostics of agricultural equipment. Technical diagnostics and control tools
Recommended or required reading and other learning resources/tools	*1. Glebov N.A. Reliability and diagnostics of control devices for robotic and mechatronic systems. Novocherkassk, 2004. - 92 p. [in Russian]* *2. Kashtanov V.A. The theory of reliability of complex systems - Moscow, FIZMATLIT, 2010. - 245 p. [in Russian]* 3. *Dorokhov A.N. Ensuring the reliability of complex technical systems:. - St. Petersburg: Lan, 2011. - 349 p. [in Russian]* *4. R. Isermann Fault-Diagnosis Applications Model-Based Condition Monitoring:Actuators, Drives, Machinery, Plants, Sensors, and Fault-tolerant Systems Springer-Verlag Berlin Heidelberg 2011*
Language of instruction	Russian

Learning outcomes of the course unit
LO2: Development, calculation and analysis of the components of mechatronic systems in agriculture LO4:Ability to issue research results in the form of scientific articles LO6: Work effectively in a team

Planned learning activities and teaching methods
lectures, practical classes, group practical (practice sessions supervised by technician)

Mapping Programme Key Learning Outcomes to Module Learning Outcomes	
Programme Key Learning Outcomes	**Module Learning Outcomes**
LO2: Development, calculation and analysis of the components of mechatronic systems in agriculture	On successful competition of this module students should be able to: 1. Perform reliability calculations agro mechatronic systems during practical classes, tests and the written part of the exam
LO4:Ability to issue research results in the form of scientific articles	2. Perform research to improve agricultural robots reliability and issue their results as a scientific article
LO6.: Work effectively in a team	3.Perform practical tasks to develop diagnosing agricultural robots methods in a group and individually

Assessment methods and criteria
The scientific article and practical tasks report is an admission to the exam The final grade is set on a five-point system. It may consist of the results of formative tests (40%), a final written assignment for the exam (40%) and an oral answer (20%) according the «**Assessment criteria table»**

Assessment criteria table				
Attribute	**Grade 5** **(81-100 points)** **(Excellent)**	**Grade 4** **(71-80 points)** **(Good)**	**Grade 3** **(51-70 points)** **(Satisfactory)**	**Grade 2** **(0-50 points)** **Failed / Insufficient**
Exam – written part(40%)	The complete solution of the task without serious flaws is given. The correct answer is provided.	The complete solution of the task. The correct answer is received, but with some weaknesses in interim steps.	The content of the task was of a good standard but with several weaknesses regarding evidence and/or some lack of clarity.	The task of the work fell short of that required to pass due to lack of evidence base/or very poor clarity.
Exam – oral part(20%)	All questions received full reasoned answers with no serious missing points.	All questions received the answers, but with some weaknesses in argumentations or explanations.	Some questions received answers with several weaknesses regarding evidence and/or some lack of clarity	Most of questions received answers with several weaknesses regarding evidence and/or some lack of clarity, or received no correct answers.
Intermediate Testing (40%)	All test items solved correctly	From 70% to 90% of test tasks solved correctly	From 50% to 70% of test tasks solved correctly	Less than 50% of test items solved correctly

Description of individual educational component (module)	
Управление роботами в неизвестной среде *Robot control in an unknown environment*	
Магистр *Master*	
B1.V.DV.03.01	
Organisation	*Platov South-Russian State Polytechnic University (NPI)*
Faculty	*Mechanical*
Department	*Mechatronics, Hydraulics and Pneumatics Automation*
Responsible person	*Dr. PhD. Tatiana Kruglova*
Type of course unit	Optional
Level of course unit	Second cycle
Year of study (if applicable), semester/trimester when the individual educational component is delivered	1 semester
Number of ECTS credits allocated	4
Total hours	144
Contact hours	16
Self-study hours	128
Mode of delivery	Face-to-face
Maximum attendance	25
Name of lecturer(s)	*Dr. PhD. Tatiana Kruglova*
Prerequisites and co-requisites	**Co-requisites:** Methods and theory of optimization, Methods of artificial intelligence in mechatronics and robotics, Information devices in mechatronics and robotics, Mechanics of agro-industrial mechatronic systems
Course contents	Robotic Operation system (ROS). Robotics System Toolbox. Follow the path. Homing and Path Following. Bypassing obstacles in an unknown environment. Obstacle Avoidance.
Recommended or required reading and other learning resources/tools	*1. Jason M. O'Kane, A Gentle Introduction to ROS, https://cse.sc.edu /~jokane/agitr/, 2015* *2. K. Waldron, J. Schmiedeler, Kinematics, Springer Handbook of Robotics, Springer, http://link.springer.com/eferenceworkentry/10.1007/978-3-540-30301-5 - 2, 2015* *3. D. Fox, KLD Sampling: Adaptive Particle Filters, Department of Computer Science and Engineering, University of Washington, NIPS, 2001.Jason M. O'Kane, A Gentle Introduction to ROS, https://cse.sc.edu/~jokane/agitr/, 2015* *4. K. Waldron, J. Schmiedeler, Kinematics, Springer Handbook of Robotics, Springer, http://link.springer.com/referenceworkentry/10.1007/978-3-540-30301-5_2, 2015* *5. D. Fox, KLD Sampling: Adaptive Particle Filters, Department of Computer Science and Engineering, University of Washington, NIPS, 2001.*
Language of instruction	English

Learning outcomes of the course unit
LO1: Investigate complex agro-mechatronic systems using analytical, numerical and experimental research methods.
LO3:Design control systems, according to the technical process requirements.
LO5:Apply specialized programs ROS and MATLAB for agricultural robot control
LO7:Prepare and present effective and convincing presentations both in native language and in English

Planned learning activities and teaching methods
lectures, practical classes, group practical (practice sessions supervised by technician

Mapping Programme Key Learning Outcomes to Module Learning Outcomes	
Programme Key Learning Outcomes	**Module Learning Outcomes**
LO1: Investigate complex agro-mechatronic systems using analytical, numerical and experimental research methods.	On successful competition of this module students should be able to: 1. Employ analytical, numerical and experimental research methods to set the agricultural robot trajectory at the practical tasks
LO3:Design control systems, according to the technical process requirements.	2.Demonstrate ability to develop robot control systems in an unknown environment, according to the technical process requirements during the practical tasks, tests and the written part of the exam
LO5:Apply specialized programs ROS and MATLAB for agricultural robot control	3.Apply ROS and MATLAB to develop robot control systems for agricultural application
LO7:Prepare and present effective and convincing presentations both in native language and in English	4.Implementation and protection of practical work allow effectively and convincingly present the results of their scientific work both in their native language and in English

Assessment methods and criteria
Report on practical tasks in the presentation format in English is the admission to the exam. The final grade is set on a five-point system. It may consist of the results of formative tests (40%), a final written assignment for the exam (40%) and an oral answer (20%) according the «**Assessment criteria table»**

Assessment criteria table				
Attribute	**Grade 5** **(81-100 points)** **(Excellent)**	**Grade 4** **(71-80 points)** **(Good)**	**Grade 3** **(51-70 points)** **(Satisfactory)**	**Grade 2** **(0-50 points)** **Failed / Insufficient**
Exam – written part(40%)	The complete solution of the task without serious flaws is given. The correct answer is provided.	The complete solution of the task. The correct answer is received, but with some weaknesses in interim steps.	The content of the task was of a good standard but with several weaknesses regarding evidence and/or some lack of clarity.	The task of the work fell short of that required to pass due to lack of evidence base/or very poor clarity.
Exam – oral part(20%)	All questions received full reasoned answers with no serious missing points.	All questions received the answers, but with some weaknesses in argumentations or explanations.	Some questions received answers with several weaknesses regarding evidence and/or some lack of clarity	Most of questions received answers with several weaknesses regarding evidence and/or some lack of clarity, or received no correct answers.
Intermediate Testing (20%)	All test items solved correctly	From 70% to 90% of test tasks solved correctly	From 50% to 70% of test tasks solved correctly	Less than 50% of test items solved correctly

Description of individual educational component (module)	
Агропромышленные робототехнические системы и комплексы *Agro-industrial robotic systems and complexes*	
Магистр *Master*	
B1.V.DB.04.01	
Organisation	*Platov South-Russian State Polytechnic University (NPI)*
Faculty	*Mechanical*
Department	*Mechatronics, Hydraulics and Pneumatics Automation*
Responsible person	Dr. PhD. Tatiana Kruglova
Type of course unit	Optional
Level of course unit	Second cycle
Year of study (if applicable), semester/trimester when the individual educational component is delivered	1 semester
Number of ECTS credits allocated	3
Total hours	108
Contact hours	16
Self-study hours	92
Mode of delivery	Face-to-face
Maximum attendance	25
Name of lecturer(s)	Dr. PhD. Tatiana Kruglova
Prerequisites and co-requisites	**Co-requisites**: Methods and theory of optimization, Methods of artificial intelligence in mechatronics and robotics, Information devices in mechatronics and robotics, Robot control in an unknown environment
Course contents	The role of agriculture in the world economy. The structure of the agro-industrial complex. Scientific and technological progress in the agro-industrial complex. Robots in agriculture. The main directions of agricultural robotization. Construction of agricultural robots. Features of robots control in agriculture. Control systems for agricultural robots and mechatronic systems
Recommended or required reading and other learning resources/tools	*1. Yurevich E.I. Fundamentals of robotics: training. - 3rd ed., Pererab. and additional. - St. Petersburg, 2010. - 368 p. [in Russian]* *2. Aniskin V.I. Prospects of technical support of agriculture // Mechanization and electrification of agriculture. №12 1999 [in Russian]* *3. Gerasun VM, Nesmiyanov IA Control systems of manipulators based on spatial actuators // Mechatronics, automation, control. Moskov. 2010 [in Russian]* *4. Robert H. Bishop The mechatronics handbook1229 p. CRC Press LLC 2002* *5. Dan Zhang Bin Wei Mechatronics and Robotics Engineering for Advanced and Intelligent Manufacturing. Lecture Notes in Mechanical Engineering. Springer International Publishing Switzerland 2017*
Language of instruction	English

Learning outcomes of the course unit
LO3:Design control systems, according to the technical process requirements.
LO4:Ability to issue research results in the form of scientific articles
LO5:Apply specialized programs ROS and MATLAB for agricultural robot control
LO7:Prepare and present effective and convincing presentations both in native language and in English

Planned learning activities and teaching methods
lectures, practical classes, group practical (practice sessions supervised by technician)

Mapping Programme Key Learning Outcomes to Module Learning Outcomes	
Programme Key Learning Outcomes	**Module Learning Outcomes**
LO3:Design control systems, according to the technical process requirements.	On successful competition of this module students should be able to: Develop a control systems for agricultural robots and mechatronic systems during the practical tasks, tests and written exam part

LO4:Ability to issue research results in the form of scientific articles	Perform research for design the agricultural robots and issue their results as a scientific article
LO5:Apply specialized programs ROS and MATLAB for agricultural robot control	Apply ROS and MATLAB to develop a control system for agricultural robots and mechatronic systems during the practical tasks, tests and written exam part
LO7:Prepare and present effective and convincing presentations both in native language and in English	Implementation and protection of practical work allow effectively and convincingly present the results of their scientific work both in their native language and in English

Assessment methods and criteria
Report on practical tasks and scientific article in English is the admission to the exam The final grade is set on a five-point system. It may consist of the results of formative tests (40%), a final written assignment for the exam (40%) and an oral answer (20%) according the «**Assessment criteria table»**

Assessment criteria table				
Attribute	**Grade 5 (81-100 points) (Excellent)**	**Grade 4 (71-80 points) (Good)**	**Grade 3 (51-70 points) (Satisfactory)**	**Grade 2 (0-50 points) Failed / Insufficient**
Exam – written part (40%)	The complete solution of the task without serious flaws is given. The correct answer is provided.	The complete solution of the task. The correct answer is received, but with some weaknesses in interim steps.	The content of the task was of a good standard but with several weaknesses regarding evidence and/or some lack of clarity.	The task of the work fell short of that required to pass due to lack of evidence base/or very poor clarity.
Exam – oral part(20%)	All questions received full reasoned answers with no serious missing points.	All questions received the answers, but with some weaknesses in argumentations or explanations.	Some questions received answers with several weaknesses regarding evidence and/or some lack of clarity	Most of questions received answers with several weaknesses regarding evidence and/or some lack of clarity, or received no correct answers.
Intermediate Testing (20%)	All test items solved correctly	From 70% to 90% of test tasks solved correctly	From 50% to 70% of test tasks solved correctly	Less than 50% of test items solved correctly