Description of individual educational component (module)	
Проектирование агромехатронных систем Design of agromechatronic systems	
Магистр Master	
B1.V.07	
Organisation	Stavropolskiy gosudarstvennyiy agrarnyiy universitet- Stavropol State Agrarian University (SSAU)
Faculty	faculty of farm mechanization
Department	mechanics and computer graphics
Responsible person	Full prof. Sultan Kapov
Type of course unit	special discipline
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	5
Total hours	180
Contact hours	24
Self-study hours	156
Mode of delivery	Face-to-face
Maximum attendance	25
Name of lecturer(s)	*Full prof. Sultan Kapov*
Prerequisites and co-requisites	Formation of knowledge systems in the design principles and methods of construction in the field of computer technology necessary for the successful activity of the bachelor, able to effectively apply modern information technologies in the field of their professional activities, as well as contributing to the further development of the individual.
Course contents	The device and the principles of the studied agricultural machines. Structural analysis of controlled machines and mechanisms for agriculture. Kinematic analysis of controlled machines and mechanisms of agricultural machines. Mechanical drive elements of driven machines. Hydro and pneumatic drive elements of 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.* *2. Chmil, V.P. Theory of mechanisms and machines: a textbook [for universities]. - St. Petersburg: Lan, 2012. - 280 p.* 3. *Goodilin, N.S. Hydraulics and hydraulic drive:. - Moscow: Mining book, 2007. - 520 p.*
Language of instruction	Russian

Learning outcomes of the course unit
LO1: Investigate complex agro-mechatronic systems using analytical, numerical and experimental research methods.
LO2: Development, calculation and analysis of the components of mechatronic systems in agriculture
LO5: Design control systems, according to the technical process requirements

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

LO2: Development, calculation and analysis of the components of mechatronic systems in agriculture	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)	
Технологии и технические средства диагностики агропромышленной техники *Technologies and technical means of diagnostics of agro-industrial equipment*	
Магистр *Master*	
B1.V.08	
Organisation	Stavropolskiy gosudarstvennyiy agrarnyiy universitet- Stavropol State Agrarian University (SSAU)
Faculty	faculty of farm mechanization
Department	mechanics and computer graphics
Responsible person	Full prof. Sultan Kapov
Type of course unit	special discipline
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	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. Anton Zakharin
Prerequisites and co-requisites	Methods and theory of reliability of agricultural machines and mechanisms, Information devices in robotics, Control robots in an unknown environment, Mechanics of agro-industrial mechatronic systems
Course contents	Basic concepts and provisions of the reliability of technical systems. Calculation of reliability indicators for agricultural machinery. Statistical analysis of wear parts. Determination of the full life of the joint and permissible without repairing the dimensions of the mating parts. Methods to improve the reliability of technical systems.
Recommended or required reading and other learning resources/tools	1. Valuev, N.V. Reliability of technical systems / N.V. Valuev, A.G. Pidyak. - Zernograd, 2001. 2. Ermolov, L.S. Fundamentals of reliability of agricultural machinery / L.S. Ermolov, V.M. Kryazkov, V.E. Cherkun. - M.: Kolos, 1974. 3. Reliability and repair of machines / under. ed. V.V. Kurchatina. - M.: Kolos, 2000.
Language of instruction	Russian

Learning outcomes of the course unit
LO1: Investigate complex agro-mechatronic systems using analytical, numerical and experimental research methods.
LO2: Development, calculation and analysis of the components of mechatronic systems in agriculture
LO5: Design control systems, according to the technical process requirements
LO6: Ability to issue research results in the form of scientific articles

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

LO2: Development, calculation and analysis of the components of mechatronic systems in agriculture	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
LO6.: Ability to issue research results in the form of scientific articles	3. Perform practical tasks on the development of methods for diagnosing agricultural robots in a group and individually, analyzing malfunctions and publishing research results

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)	
Трибтехнические основы для увеличения ресурса машин Tribotechnical basis for increasing the operating life of machines	
Магистр *Master*	
B1.V.03	
Organisation	Stavropolskiy gosudarstvennyiy agrarnyiy universitet- Stavropol State Agrarian University (SSAU)
Faculty	faculty of farm mechanization
Department	mechanics and computer graphics
Responsible person	Full prof. Sultan Kapov
Type of course unit	special discipline
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	*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. Anton Zakharin*
Prerequisites and co-requisites	Methods and theory of optimization, Methods of artificial intelligence in mechatronics and robotics, Information devices in mechatronics and robotics, Technologies and technical means of diagnostics of agro-industrial equipment
Course contents	Models tribological systems. Types of destruction of the working surfaces of parts and working bodies of machines. Selective transfer, its laws, application in friction units. Finishing antifriction non-abrasive surface treatment of parts. Systems and methods for lubricating tribomechanical systems. The practice of applying tri-bot technology
Recommended or required reading and other learning resources/tools	1. Garkunov, D.N. Tribotekhnika: textbook.book for university students in the following directions: "Automation technology and production," "Design and technology support for machine-building, production." / D.N. Garkunov, E. L. Melnikov, V.S. Gavrilyuk. - 2nd ed., Sr. - Moscow: Knorus, 2015. - 408 p. - (Undergraduate. Gr. UMO). 2. Valuev, N.V. Reliability of technical systems / N.V. Valuev, A.G. Pidyak. - Zernograd, 2001. 3. Ermolov, L.S. Fundamentals of reliability of agricultural machinery / L.S. Ermolov, V.M. Kryazkov, V.E. Cherkun. - M.: Kolos, 1974. 4. Reliability and repair of machines / under. ed. V.V. Kurchatina. - M.: Kolos, 2000.
Language of instruction	Russian

Learning outcomes of the course unit
LO1: Investigate complex agro-mechatronic systems using analytical, numerical and experimental research methods.
LO2: Development, calculation and analysis of the components of mechatronic systems in agriculture
LO7: Apply specialized programs 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
LO2: Development, calculation and analysis of the components of mechatronic systems in agriculture	2. Develop a control system for the agro-industrial robots during the practical tasks, tests and written exam part
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)	
Энергетическая оценка технологических процессов и мехатронных систем Energy evaluation of technological processes and mechatronic systems	
Магистр *Master*	
V1V.03	
Organisation	Stavropolskiy gosudarstvennyiy agrarnyiy universitet- Stavropol State Agrarian University (SSAU)
Faculty	faculty of farm mechanization
Department	mechanics and computer graphics
Responsible person	Full prof. Sultan Kapov
Type of course unit	special discipline
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	*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. Viktor Marchenko*
Prerequisites and 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	Energy equivalents. Equivalents of full expenses and methods of their calculation. The method of forming energy equivalents, the determination of the total energy intensity of agricultural production. The method of forming energy equivalents, the determination of the total energy intensity of agricultural production
Language of instruction	Russian

Learning outcomes of the course unit
LO1: Investigate complex agro-mechatronic systems using analytical, numerical and experimental research methods.
LO3: Possess skills of developing technologies for the production of agricultural products
LO5: Design control systems, according to the technical process requirements
LO6: Ability to issue research results in the form of scientific articles

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: Possess skills of developing technologies for the	3. Develop a control system for the agro-industrial robots during the practical tasks, tests and written exam part

production of agricultural products	
LO5:Apply specialized programs ROS and MATLAB for agricultural robot control	5.Apply specialized programs ROS and MATLAB to develop the control systems at the practical tasks, tests and written exam part
LO6.: Ability to issue research results in the form of scientific articles	6. Perform practical tasks on the development of methods for diagnosing agricultural robots in a group and individually, analyzing malfunctions and publishing research results

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