Module Handbook

The MSc: 70812306 – Water-saving Irrigation Technologies degree program

Name of the module/subject and code	**ITM5102- Research Methodology**
Semester	*1*
Responsible teacher of the module/subject, full name, degree and title	*Yangiev Asror Abdikhamidovich, doctor of technical sciences, professor*
language to be taught	*Uzbek*
place in the curriculum	*Compulsory*
Teaching methods	*Lecture, practical lesson*
Workload (incl. contact hours, self-study hours)	*Total workload: 60 hours.* *Contact hours: 30 hours:* - *lecture – 20 hours;* - *practical lessons – 10 hours;* - *self-learning - 30 hours.*
Credit points	*2*
Required and recommended prerequisites for joining the module	*"Soil mechanics", "Grounds and foundations", "Irrigation and melioration", "Use of hydromelioration systems", "Water-saving irrigation technologies", "Hydrometry", "Hydraulics", "Construction mechanics", "Engineering construction", "Hydrotechnical constructions".*
Module objectives/intended learning outcomes	*After mastering the discipline, the student will:* ***know and understand:*** *-knowledge such as determining the unique features of the scientific research method and methodology, the proportionality of the scientist's intellectual capabilities and socio-economic conditions, the creative process of setting a problem in scientific creativity and finding its solutionto have insights about.* ***Be able to:*** *- to have the ability to scientifically analyze philosophical categories such as scientific research, explanation and understanding, problems and problematic situations, which are the main factors of the methodology of scientific creativity.* ***form competences in:*** *- to carry out scientific research and research in the field of science and to have an idea about scientific creativity;* *- to carry out scientific research and research in the field of science and to have and be able to use different conceptual approaches in the field of scientific creativity;* *- to conduct scientific research and research in the field of science and to have the skills of scientific creativity;*

Content: The discipline includes. The *level of difficulty*: (1 – low, 5 high):	*Subjects and tasks of the science of scientific research methodology. Science and creativity. Science is one of the oldest objects of philosophy. The concept of creativity. Difficulty level: 2* *Scientific research methods, Theoretical research methodology, Experimental research methodology, Field research methodology. Difficulty level: 2* *Modeling problems in scientific creation. Concept of "modeling". Modeling problems in scientific cognition. The role of modeling and analogy in cognition. Similarity theory. Newton's law of similarity. Geometric similarity. Kitematic and dynamic similarity terms. Difficulty level: 3* *Analogy of hydrodynamic processes. From the Nave-Stokes equation to the criteria Fr, Re, Sh, Ei. Dimensional theory: basic concepts and principles, dimensional formulas. Difficulty level: 4* *Experiment planning: purpose, factors, types of experiments, randomization. Analysis of experimental data, tasks, differentiation and integration of obtained functions, comparison. finding functional relationships, tables, graphs, interpolation and extrapolation. Difficulty level: 5*
Exams and assessment format	*To fully master the theoretical and methodological concepts of science, to be able to accurately reflect the results of analysis, to independently observe the studied processes and to fulfill the assignments and assignments given in the interim control forms, to submit a written work for the final control.*
Study and exam requirements	*Students who successfully pass the science* *The total maximum marks will be the sum of the final exam (40%), Midterm (60%), and allotment points. To pass the subject successfully, the student must score 60% or more of the allotted points.*
Reading list	*1. Maidanov A.S. Methodology of scientific creation.-M., 2008.* *2. Zimnyaya I.A. Nauchno-issledovatelskaya rabota: methodology, theory, practical organization and implementation. - M., 2000.* *3. Rahmatullaev Sh. Fundamentals of scientific research. - T., 2002.* *4. Sabitov R.A. Basic scientific research. Uchebnoe posobie. - Chelyabinsk, 2002.* *5. Bakiev M., Majidov I., Nosirov B., Khojakulov R., Rahmatov M., Yangiev A. Hydrotechnical facilities. Tashkent, Intellect publishing house, 2022. 506 pages.*

Module designation	**SME5104-Irrigation melioration**
Semester(s) in which the module is taught	*1*
Person responsible for the module	*Khamidov Mukhamadkhan Khamidovich, doctor of agricultural sciences, professor*
Language	*Uzbek*
Relation to curriculum	*Compulsory*
Teaching methods	*Lecture, practical lesson*
Workload (incl. contact hours, self-study hours)	*Total workload: 120 hours.* *Contact hours: 60 hours:* - *lecture – 30 hours;* - *practical lessons – 30 hours;* - *self-learning - 60 hours.*
Credit points	*4*
Required and recommended prerequisites for joining the module	*"Scientific Research Methodology", "Global Climate Change and Water Supply and Water Resources Measurement and Instrumentation".*
Module objectives/intended learning outcomes	After mastering the discipline, the student will: **Know and understand:** *-scientifically based methods of irrigation of crops;* *- irrigation methods and their improvement;* *- elements of water-saving irrigation techniques* *- water-saving irrigation technologies and their design;* *- reconstruction of irrigation systems;* *- construction norms and rules and other normative documents.* ***To be able to:*** *- constructions of irrigation networks;* *-hydraulic calculation of channels, design of longitudinal and transverse cuts;* *-irrigation erosion and complex measures against it;* *- identification of water sources for irrigation;* *- irrigation by mechanical lifting of water.* **To form competences in:** *- selection of elements of water-saving irrigation technology, methods and techniques,* *- to find economically viable options for placing irrigation networks* *the effect of irrigation procedures on crop yield.* *- the ability to design and build irrigation networks;* *- exploitation of irrigation systems and their automation;* *- the main directions and methods of scientific and technical development in the field of irrigation melioration;* *- to have an idea about the main directions of scientific research work on water-saving irrigation technologies;* *- methods of determining water sources and their irrigation capacity;* *- selection of irrigation schemes with mechanical lifting of water*.

Content: The discipline includes. The *level of difficulty*: (1 – low, 5 high):	*Content of science: History of irrigated agriculture. Irrigated farming in the world and in Uzbekistan. Irrigation and its types. Water consumption of agricultural crops. Difficulty level: 1.* *Irrigation method of agricultural crops and factors affecting it. Hydromodule zoning of irrigated lands. Difficulty level: 1.* *Crop irrigation methods, techniques and technologies. Water-efficient surface irrigation technologies. Rainfall, dispersed, subirrigation and soil irrigation methods. Drip irrigation method and technologies. Difficulty level: 2.* *Classification of irrigation networks, estimated water consumption. Useful work coefficients of irrigation networks and systems. Water wastage in irrigation networks and its control. Difficulty level: 3.* *Water sources and requirements for them. Management of the mode of the water source. Use of local stream, waste and ditch water. Difficulty level: 2.* *Schemes and devices of irrigation with mechanical lifting of water. Difficulty level: 3.*
Exams and assessment formats	*One written midterm assessments (30 minutes), take-home written assignments and one final oral exam (40 minutes).*
Study and examination requirements	*Requirements for successfully passing the module:* *The final grade in the module is composed of 40% performance on exams, 20 % independent work, 20 % practical work, 20 % mid-term control tests. Students must have a final grade of 60% or higher to pass*
Reading list	*1. Khamidov M., Suvanov B., Isabaev K. "Irrigation melioration" Training manual. T.: 2020, 266 p.* *2. Khamidov M.Kh., Begmatov I.A., Isaev S.Kh., Mamatov S.A. "Water-saving irrigation technologies" Training manual. T.: TIMI, 2015, 232 p.* *3. Khamidov M.Kh., Shukurlaev Kh.I., Mamataliev A.B. "Agricultural hydrotechnical melioration". Textbook. T. East, 2009, 379 pages.* *4. Shukurlaev X.I., Baraev A.A., Mamataliev A.B. "Selskohozyaystvennye hydrotechnicheskie melioratsii". Uchebnoe posobie. T. 2007, 300 pages.*

Module designation	**GST5l04-Global climate and water supply**
Semester(s) in which the module is taught	*1*
Person responsible for the module	*Akmalov Shamshodbek Baxtiyarovich, PhD for technical sciences, docent.* *Kodirov Sobir Mamadiyorovich, senior teacher*
Language	*Uzbek*
Relation to curriculum	*Compulsory*
Teaching methods	*Lecture, practical lesson*
Workload (incl. contact hours, self-study hours)	*Total workload: 120 hours.* *Contact hours: 60 hours:* - *lecture – 30 hours;* - *practical lessons – 30 hours;* - *-self-learning - 60 hours.*
Credit points	*4*
Required and recommended prerequisites for joining the module	*Geography, Geology, Climatology, Hydrology, Physics*
Module objectives/intended learning outcomes	After mastering the discipline, the student will: **Know and understand:** *- laws of climate formation;* *- main geographical and circulation factors;* *- classification,* *- distribution of climate indicators on the surface of the earth;* *- to have an idea about changes;* ***To be able to:*** *- identification and analysis of factors affecting climate change;* *- change of solar energy in the atmosphere and geographical distribution of radiation;* *- annual change of the heat balance of the earth's surface and its components;* *- temperature changes and geographical distribution, - precipitation, humidity, evaporation, wind effects and the ability to use modern means of their determination;* **To form competences in:** *- organization of hydrological and metrological studies and observations;* *- analysis and assessment of factors affecting climate change;* *- calculation of heat balance and its components, - use of modern metrological instruments and tools and acquire skills to solve other climatic problems.*

Content: The discipline includes. The *level of difficulty*: (1 – low, 5 high):	*Introduction to the science of "Global climate and water supply", Climate formation processes, Methods of studying global climate and its changes, Global and regional climate systems, External and internal factors of climate formation, Atmospheric circulation in climate formation. Level of difficulty: 1.* *Distribution of climate indicators on the globe, geographical factors of climate, solar radiation and energy balance, radiation and heat balance of the Earth's surface, climate classification and zoning processes. Circulation indicators in climate formation, climate classification. Meso and microclimate. Level of difficulty: 2.* *Distribution of climate indicators on the planet Earth, methods of climate restoration, current changes, anthropogenic influences. Climate of Central Asia and its changes, consequences of climate change. Impact of climate change on weather. Level of difficulty: 2.* *Distribution of water resources by river basins and their study. Impact of climate change on water resources. Changes in the hydrological regime of water bodies, their distribution throughout the year. Level of difficulty: 3.* *Methods of determining and calculating water balance elements, input and output elements, importance of climate for the activity of the national economy, study of climate indicators related to the activity of economic sectors, anthropogenic influence on global and regional climate. , the concept of global warming. Possibility of climate recovery. Level of difficulty: 3.*
Exams and assessment formats	*One written midterm assessments (30 minutes), take-home written assignments and one final oral exam (40 minutes).*
Study and examination requirements	*Requirements for successfully passing the module:* *The final grade in the module is composed of 40% performance on exams, 20 % independent work, 20 % practical work, 20 % mid-term control tests. Students must have a final grade of 60% or higher to pass*
Reading list	*1. Akbarov A., Nazaraliev D., Djumbaeva G. Climate science. Study guide TIMI. 2015 114 pages.* *2. Petrov Yu.V., Egamberdiev Kh.T., Aloviddinov M., Kholmatjonov B.M. Climate science. University. Textbook. Tashkent: Publisher, 2010. 168 p.* *3. Akbarov A., Nazaraliev D., Abdullaev H. Textbook of meteorology. TIMI. 2008 154 pages.*

Module designation	**SOV-5104-Hydrometrics**
Semester(s) in which the module is taught	*1*
Person responsible for the module	*Khamidov Mukhamadkhan Khamidovich, doctor of agricultural sciences, professor*
Language	*Uzbek*
Relation to curriculum	*Compulsory*
Teaching methods	*Lecture, practical lesson*
Workload (incl. contact hours, self-study hours)	*Total workload: 120 hours.* *Contact hours: 60 hours:* - *lecture – 30 hours;* - *practical lessons – 30 hours;* - *-self-learning - 60 hours.*
Credit points	*4*
Required and recommended prerequisites for joining the module	*Scientific Research Methodology, Global Climate Change and Water Supply and Irrigation Reclamation*
Module objectives/intended learning outcomes	After mastering the discipline, the student will: **Know and understand:** *- methods of rational management and effective use of water resources in the face of global climate change and scarcity of water resources;* *- water calculation;* *-water measuring equipment, including digital instruments and their use.* ***To be able to:*** *- water measurement methods, structures, equipment and their use in the calculation of water resources in irrigation water sources, irrigation system;* *- "Smart water" digital technologies and their implementation in the management and consumption of water resources;* *- conducting scientific research on the creation of new water measuring devices.* **To form competences in:** *- standardization of water measuring devices used in irrigation systems, "taring" them;* *- placement of water measuring devices in the water body;* *- getting data from cuv measurement tools and analyzing them;* *- determination of the amount of discharge in water resources;* *- innovative technologies in measuring water resources*

Content: The discipline includes. The *level of difficulty*: (1 – low, 5 high):	*Content of the subject: Introduction to the subject of "Measurement and tools of water resources". The purpose and tasks of science. Water resources. Their management and use. Difficulty level: 1.* *Water measuring stations, their locations and types. Water level measuring systems and tools. Water depth and flow rate measuring tools. Difficulty level: 2.* *Measurement of water consumption of rivers. Water measuring tools. Determination of pollutants in river water. Sampling tools. Sizot waters. Means of determining their level and mineralization. Soil water and methods of their determination. Difficulty level: 2.* *Measurement of water consumption of irrigation networks. Measuring tools. Innovative technologies in the measurement of water resources. Difficulty level: 3.*
Exams and assessment formats	*One written midterm assessments (30 minutes), take-home written assignments and one final oral exam (40 minutes).*
Study and examination requirements	*Requirements for successfully passing the module:* *The final grade in the module is composed of 40% performance on exams, 20 % independent work, 20 % practical work, 20 % mid-term control tests. Students must have a final grade of 60% or higher to pass*
Reading list	*1. M.Khamidov, Sh.Ch.Botirov, B.U.Suvanov, D.G.Yulchiev "Measurement and tools of water resources" Training manual. T., TIQXMMI printing house, 2019. 185 pages.* *2. Khamidov M.Kh., Begmatov I.A., Isaev S.Kh., Mamatov S.A. "Water-saving irrigation technologies" Training manual. T., TIMI printing house, 2015. 243 pages.* *3. A. Akbarov, D. Nazaraliev, F. Hikmatov. HYDROMETRY. Study guide. T., TIMI printing house, 2014. 144 pages.*

Module designation	**SFA5104-Use and automation of irrigation networks**
Semester(s) in which the module is taught	*2*
Person responsible for the module	*PhD Amanov Baxodir To'xtasinovich*
Language	*Uzbek*
Relation to curriculum	*Compulsory*
Teaching methods	*Lecture, practical lesson*
Workload (incl. contact hours, self-study hours)	*Total workload: 120 hours.* *Contact hours: 60 hours:* - *lecture – 30 hours;* - *practical lessons – 30 hours;* - *self-learning - 60 hours.*
Credit points	*4*
Required and recommended prerequisites for joining the module	*"Hydraulics", "Hydro automatics", "Use of pumps and pumping stations".*
Module objectives/intended learning outcomes	After mastering the discipline, the student will: **Know and understand:** - *students are taught how to manage and design a system-wide water environment through an automated operating model system, learning how to implement water use planning principles.* - *advance advanced systems for automatic water supply forecasting and water quality management project support.* - *system data center, system control center, to have an idea about the distribution of irrigation water by channels through the model.* ***To be able to:*** - *knowledge of the basics of various automatic devices used in the field of water management and reclamation, the types, structure, scope of their use,* - *calculation bases and their selection in accordance with specific conditions, as well as the methods of developing measures to improve the conditions based on the information received, and from them can use.* ***To form competences in:*** - *drawing up water use plans and finding economically viable options,* *analysis of irrigation and reclamation networks.*
Content: The discipline includes. The *level of difficulty*: (1 – low, 5 high):	*In the automation of hydromelioration systems, it is necessary to have the skills to apply the methods of analysis of technical events and processes, to accept solutions to technical problems. Level of difficult:2* *determining the hydromodule of irrigation in irrigation systems, determining the procedure for watering agricultural crops. Level of difficult:2* *identification of elements of irrigation technology, methods and techniques, rational use of irrigation and reclamation systems. Level of difficult:2*
Exams and assessment formats	*One written midterm assessments (30 minutes), take-home written assignments and one final oral exam (40 minutes).*

Study and examination requirements	*Requirements for successfully passing the module:* *The final grade in the module is composed of 40% performance on exams, 20 % independent work, 20 % practical work, 20 % mid-term control tests. Students must have a final grade of 60% or higher to pass*
Reading list	*1. Brian Wahlin, Darell Zimbelman, "Canal Automation for Irrigation Systems" ASCE Publications. USA 2014.* *2. Serikbayev B, Dostnazarova S. "Use and automation of irrigation systems" Textbook. Tashkent TIIAME, 2020. – 258 p;* *3. Serikbayev B.S., Sherov A.G., Ibragimova H.R. "Modernization of hydromelioration systems", Textbook. Tashkent. "TIQHMMI" 2018y.-467 b;* *4. Baraev F.A., Serikbaev B.S. i second. Operation and automation of the hydromelioration system. Textbook. Tashkent. "TIMI", 2013. - 270 p.* *5. Automation of hydromelioration systems. Methodical instructions for conducting practical training in science. Tashkent-2020.*

Module designation	**LI5104-Landscape irrigation**
Semester(s) in which the module is taught	*2*
Person responsible for the module	*Begmatov Ilkhom Abduraimovich, candidate of technical sciences, professor*
Language	*Uzbek*
Relation to curriculum	*Compulsory*
Teaching methods	*Lecture, practical lesson*
Workload (incl. contact hours, self-study hours)	*Total workload: 120 hours.* *Contact hours: 60 hours:* - *lecture – 30 hours;* - *practical lessons – 30 hours;* - *self-learning - 60 hours.*
Credit points	*4*
Required and recommended prerequisites for joining the module	*"Irrigation amelioration", "Water resources measurement and tools".*
Module objectives/intended learning outcomes	After mastering the discipline, the student will: **To know and understand:** *- to have an idea about landscape irrigation;* *- construction standards and regulations and other regulatory documents, irrigation procedures, irrigation technologies and methods in designing water-saving irrigation technologies;* **To be able to:** *- know and be able to use elements of irrigation technology;* *- design of hydraulic calculations and cuttings, irrigation erosion and complex measures against it;* **To form competences in:** *- the composition and characteristics of the natural landscape, the selection of elements of landscape irrigation;* *- methods and techniques, and the ability to find technical and economic options for placing irrigation networks.*
Content: The discipline includes. The *level of difficulty*: (1 – low, 5 high):	*Content of the subject: Introduction to the subject of "Landscape irrigation". Concept and basic principles of landscape science. The composition and nature of the natural landscape. Geochemistry of landscapes. Anthropogenic landscapes. Irrigation melioration. Level of difficult: 1.* *Techniques and technology of irrigation of agricultural crops. The method of irrigation over the soil. The technology of dividing the Egat water along the length of the Egat. Discrete irrigation technology. Automated watering cans. Leveling of irrigation fields. Sprinkler irrigation technology. Level of difficult: 2.* *Impulse sprinkler irrigation technology. Irrigation technology from inside the soil. Drip irrigation technology. The technology of drip irrigation from the soil. Underground irrigation technology. Sprinkler irrigation technology. Water sources for irrigation. Use of surface water for irrigation. Formation of collector water and its use for irrigation purposes. Level of difficult: 3.*
Exams and assessment formats	*There are two midterms (20 minutes each) and a final oral exam (40 minutes), a short computerized test and written homework.*

Study and examination requirements	*The total maximum points awarded will be the sum of the points allocated to the final exam (60%), Midterm (20%), homework (10%) and classroom activity (10%). In order to successfully pass the subject, the student must score 60% or more of the allotted points.*
Reading list	*1. Бегматов И.А. "Ландшафная ирригация" -Ташкент: ТИМИ, 2019. -251 стр.* *2. Khamidov M.Kh., Begmatov I.A., Isaev S.Kh., Mamatov S.A. "Water-saving irrigation technologies" Training manual. T., TIMI printing house, 2015. 243 pages*

Module designation	**STS-5108 “Water-saving irrigation technologies”**
Semester(s) in which the module is taught	*2, 3*
Person responsible for the module	*Prof., Dr. Matyakubov Bakhtiyar*
Language	*Uzbek*
Relation to curriculum	*Compulsory*
Teaching methods	*Lecture, practical lesson*
Workload (incl. contact hours, self-study hours)	*Total workload: 240 hours.* *Contact hours: 120 hours:* - *lecture – 60 hours;* - *practical lessons – 60 hours;* - *-self-learning - 120 hours.*
Credit points	*8*
Required and recommended prerequisites for joining the module	*"Higher mathematics", "Mathematical modeling", "irrigation improvement", "irrigation and improvement", "technologies of efficient use of water in agriculture".*

Module objectives/intended learning outcomes	After mastering the discipline, the student will: **To know and understand:** *- knowledge of construction norms and rules and other regulatory documents in the selection and design of irrigation melioration, water-saving irrigation technologies;* *- know how to apply the theoretical and practical knowledge gained in the field in practice;* *- principles of organizing field experiments using water-saving irrigation technologies;* *- to know how to collect information on the design of water-saving irrigation technologies, scientific analysis of data;* *- to be familiar with international standards during the design process; to know construction standards and regulations and to be familiar with foreign experiences;* *- the ability to use software to determine the rate, duration and timing of irrigation according to water-saving irrigation technologies;* *- the ability to find technical and economic options in the design of water-saving irrigation technology;* *- to know how to prepare recommendations and conclusions on the practical application of water efficient use technologies.* **To be able to:** *- selection of water-saving irrigation technology, irrigation method and technology, elements of irrigation technique;* *- design, construction and development of water-saving irrigation technologies and perform hydraulic calculations;* *- scientific substantiation of determining crop irrigation procedures in the application of water-saving irrigation technologies;* *- scientific justification of technical and economic calculations of the use of water-saving irrigation technologies;* *- to be able to process the experimental results obtained in field conditions using mathematical statistics.* **To form competences in:** *- formation of qualified personnel working in the field of water management in the future;* *- forming a methodological approach to the field and a scientific outlook;* *- choosing and justifying the use of water-saving irrigation technologies;* *- expansion of planning depending on the type of crop in the selection and justification of water-saving irrigation technologies;* *-scientific justification of determining optimal crop irrigation periods and irrigation rate;* *- finding technical and economic options for deploying water-saving irrigation technologies;* *- planning and conducting independent scientific research;* *- economic calculation on the use of water-saving irrigation technologies* *- should have the ability to make decisions on the implementation of books, selection and recommendations.*

Content: The discipline includes the following topics. The level of difficulty: (1 – low, 5 high):	*Soil specific gravity, relative resistance, viscosity, etc. Mechanical and physical properties of the soil are indicators that determine soil fertility. Bulk density, porosity, water permeability, water holding capacity. Soils with light, medium and heavy sandy loam and clay mechanical composition. Water permeability. Level of difficulty: 3.* *Water in the soil. Soil water properties: moisture content. Soil moisture capacities: Total soil moisture capacity (TNS). Capillary moisture capacity of the soil (KNS). Boundary moisture capacity of the soil (ChDNS). Maximum molecular moisture capacity of soil (MMNS). Total moisture capacity of the soil, capillary moisture capacity. Limit field moisture capacity of the soil, maximum - molecular moisture capacity. Gravity water. Level of difficulty: 3.* *Soil permeability, water carrying capacity, etc. Forms of water in the soil and their importance for plants. Soil moisture capacities and their importance in irrigated agriculture. Properties of water supply, transmission and lifting of the soil. Level of difficulty: 3.* *Amounts of humus in the soil. Humus is the composition of the organic part of the soil. The dependence of soil moisture on the amount of humus. Amounts of humus in the soil. Methods of determining the amount of sweetness. Humus is the composition of the organic part of the soil. The dependence of soil moisture on the amount of humus. Ways to increase the amount of humus in irrigated fields. Level of difficulty: 3.* *Agrochemical and agrophysical indicators of soil. Agrochemical and agrophysical properties of soil. The principle of soil moisture conservation. Types of local fertilizers. The basis of local fertilizers. Factors of manure storage and quality improvement. A method of eliminating salinity in irrigated areas. Preparation of manure-soil compost. Compost storage. Compost and principles of its preparation. Biohumus is an effective tool. Terms of use of fertilizers. Level of difficulty: 3.* *The order of crop irrigation, water balance, total water consumption. Irrigation method of crops. Methods of determining the order of irrigation of agricultural crops. Factors affecting irrigation of agricultural crops. Water consumption of crops. Total water balance. Formulas for determining total water consumption. Balance of water balance. Level of difficulty: 4.* *Determination of crop irrigation and seasonal irrigation standards. Brief description for hydromodule zoning. Irrigation method of crops. Soil moisture capacity. Total water consumption. Seasonal and irrigation standards. Irrigation hydromodule. Hydromodule zoning of irrigation areas. Conditions that ensure the normal development of agricultural crops. Water consumption of agricultural crops. Seasonal watering and watering rates. Hydromodule types. Ordinate graphs. Irrigation mode of rice. Hydromodule zoning of irrigated lands. Law of absorption of water into the soil. Level of difficulty: 4.* *Irrigation methods and irrigation techniques. Irrigation methods and techniques. Requirements for irrigation methods and techniques. Overland irrigation technique and its improvement. Level of difficulty: 5.*

	Irrigation over the ground, sprinkler, drip, underground and finely dispersed (mist). Above ground irrigation equipment. Sprinkler, subsoil and subirrigation irrigation methods. Drip and spray irrigation techniques. Drip irrigation design. Irrigation methods, types of irrigation techniques, requirements for them and their selection. Elements of surface irrigation technique. Watering rice. Overground irrigation equipment. Drip irrigation of orchards, grapes and rice crops, watering with the help of cotton soft portable irrigation pipes and film laid on egates. Leveling of irrigation fields. Level of difficulty: 3. *Application conditions, advantages and disadvantages of irrigation methods. Irrigation methods. The essence, techniques, conditions of use of raining, spraying, drip, subirrigation (raising the level of seepage waters) and irrigation from the soil. Functions of irrigation methods. Advantages and disadvantages of irrigation methods. Level of difficulty: 3.* *Water use plan. Principles of planned water use. Information needed for drawing up a water use plan. Basic principles of planned water use. Theoretical basis of development of water use plan. Level of difficulty: 4.* *Structure of water use plan. Limited use of water. Structure of water use plan. Drawing up a water use plan. The procedure for calculating the water use plan. Water limit. The main indicators of the water use plan (SFR). Water distribution chart. The basis of planned use of water. Level of difficulty: 4.* *Operational hydrometry and water accounting in hydromelioration systems. The simplest water measuring devices in small canals and ditches. Vodoslivs. Installation of water pipes. Measurement of water consumption passing through Vodosliv. An unchanging soul. Level of difficulty: 4.* *Principles of choosing water measuring stations and their construction sites. Measurements of water consumption in inter-farm and intra-farm canals, their theory and practice. Thomson and Chipoletti water meters, conditions of their use. Organization of water measurement in parabolic troughs. The scheme of choosing a place for a hydroelectric plant. Level of difficulty: 3.* *Constructions of water measuring devices and structures. Hydrometric ruler and its application. Water measuring devices. Constructions of water measuring devices and structures. Hydrometric ruler and its application. An improved hydrometric tube. Water measuring tools and their selection. Basic morphometric characteristics of the flow. Conditions for determining the distance between the speed verticals. Determination of observation points depending on the depth of the velocity verticals. Level of difficulty: 4.* *Hydraulic calculation of drip irrigation system. Hydraulic calculation in drip irrigation. Hydraulic calculation methods. Principles of pressure detection in the pipeline. Calculation of pressure in the system. Calculation of indicators in the irrigation system. Level of difficulty: 5.* *Drip irrigation system drippers, type of dripper. Droppers of the drip irrigation system. Technical justification of the choice of the type of dropper. Level of difficulty: 5.*

	Dropper tapes and their selection. The structure of drip tapes. Calculations to be performed when choosing dropper tapes. Structure of tape. Economic justification of tape selection. Level of difficulty: 5. *Technological basics of dropper tapes. Organization of irrigation in drip tapes. Micro-currents. Technological basics of drip tapes. The role of the drip tape in organizing drip irrigation. Micro-currents and their management. Level of difficulty: 5.* *Method of sprinkler irrigation, conditions of use. Advantages and disadvantages. The method, goals and tasks of sprinkler irrigation. Terms of use. Advantages and disadvantages. Level of difficulty: 4.* *Sprinkler irrigation technology. Improvement of sprinkler irrigation system. Sprinkler irrigation technology. Improvement of the irrigation system. Technical measures. Level of difficulty: 4.* *Sprinkler irrigation, technical elements: rain speed, rain drop diameter. Sprinkler irrigation technique. Elements of irrigation technology. Principles of detection. Rain intensity. Raindrop diameter. Level of difficulty: 5.* *Impulse sprinkler irrigation technology. Movement of water in pipes in closed irrigation networks. Pressurized and non-pressurized system. Pressure closed irrigation networks. Closed irrigation networks without pressure. Dependence of water movement on slope. Level of difficulty: 5.* *Subirrigation, application conditions, advantages and disadvantages, scientific justification. The method of irrigation from under the soil (subirrigation). Terms of use. Subirrigation irrigation method, theoretical basis, advantages and disadvantages. Scientific justification of the subirrigation method. Level of difficulty: 3.* *Discrete irrigation technology. Selection principles. Terms of use. Discrete irrigation method. Irrigation technology. Principles of irrigation method selection. Terms of use. Theoretical foundations. Problems observed in the application of the discrete irrigation method and recommendations for their elimination. Level of difficulty: 4.* *Advantages and disadvantages of using discrete irrigation technology. Automated watering cans. Advantages and disadvantages of using discrete irrigation technology. Use of discrete irrigation technology in providing water to crops. The principles of using automated rods for irrigation. Level of difficulty: 4.* *Pulsar irrigation method, technology. Selection principles. Terms of use. Advantages and disadvantages. Pulsar irrigation method. Irrigation technology. Principles of irrigation method selection. Terms of use. Advantages and disadvantages. Level of difficulty: 3.* *Spray irrigation method, technology. Selection principles. Terms of use. Advantages and disadvantages. Spray irrigation method, goals and tasks. Irrigation technology. Selection principles and conditions of application. Advantages and disadvantages. Improvement of the irrigation method. Level of difficulty: 4.*

	Principles of using water-saving irrigation technology in the Republic and in foreign countries. Principles of using water-saving irrigation technology in the Republic of Kazakhstan and in foreign countries. Observed problems and suggestions and recommendations for their elimination. Level of difficulty: 5. *The results of the application of water-saving irrigation technology. Importance of water-saving irrigation technology in production. The results of the application of water-saving irrigation technology. The role and importance of water-saving irrigation technology in production. Level of difficulty: 5.*

	1. Irrigation procedure of farm crops, irrigation hydromodule and its graph. Level of difficulty: 3. *2. Elements of irrigation technique of irrigation methods. Accepting the elements of irrigation technology. Level of difficulty: 2.* *3. Methods of designing drip irrigation in field conditions. Determining estimated water consumption. Implementation of hydraulic calculation. Level of difficulty: 5.* *4. Methods of designing sprinkler irrigation in field conditions. Sprinkler machines and mechanisms. Determining estimated water consumption. Implementation of hydraulic calculation. Level of difficulty: 5.* *5. Methods of designing sprinkler irrigation in field conditions. Sprinkler machines and mechanisms. Level of difficulty: 3.* *6. Subirrigation irrigation method. Application, positive and negative principles. Calculation of water standards for crop irrigation by subirrigation method. The main indicators for using the subirrigation method. Areas of application of subirrigation method and crops. Level of difficulty: 5.* *7. Management of water resources. Associations of water consumers. Level of difficulty: 3.* *8. The method of watering from inside the soil. Application, positive and negative principles. Calculation of irrigation and seasonal irrigation rate for in-soil irrigation. Dispersion curve formation. The main indicators when using the irrigation method. Level of difficulty: 5* *9. The method of watering by creating fog. Application, positive and negative principles. Irrigation rate calculation. Dispersion curve formation. The main indicators when using the irrigation method. Level of difficulty: 4.* *10. The main requirements for fields in the design of water-saving irrigation technologies. Basic information on water-saving irrigation technologies. Level of difficulty: 4.* *11. Using the device for preparing fertilizer solution and adding it to water. Level of difficulty: 3.* *12. Analysis of research on water-saving technologies. Analysis of rainfed and subirrigation research. Level of difficulty: 5.* *13. Irrigation by laying a film on the ground, watering the ground by cutting and spreading the ground, using portable flexible pipes and their calculation. Level of difficulty: 4.* *14. Deployment of water-saving irrigation technologies in the field. Calculation and field placement and application of sprinkler irrigation method. Level of difficulty: 5.* *15. Recommendations and proposals for the use of water-saving technologies, positive principles of implementing water-saving technologies. Level of difficulty: 5.*
Exams and assessment formats	*One written midterm assessments (30 minutes), take-home written assignments and one final oral exam (40 minutes).*
Study and examination requirements	*Requirements for successfully passing the module:* *The final grade in the module is composed of 40% performance on exams, 20 % independent work, 20 % practical work, 20 % mid-term control tests. Students must have a final grade of 60% or higher to pass*

Reading list	*1. Mamatov S.A., Khamrayev Sh.R., Karshiyev R.J., Zaks I.A., Burkhonjonov B.Sh. "Fundamentals of water-saving irrigation technologies". Tashkent-2022, Info Capital Books. 382 p. (uzbek).* *2. José Manuel Gonçalves, Qingfeng Miao, Isabel Maria Duarte, Haibin Shi. "Water-Saving Techniques and Practices for On-Farm Surface Irrigation Systems", May 2021, Biol. Life Sci. Forum 2021, 3(1), 46; https://doi.org/10.3390/IECAG2021-09675* *3. David Molden. "Water for Food Water for Life: A Comprehensive Assessment of Water Management in Agriculture" // 23 July 2013* *4. Mamatov S.A. "Drip irrigation system". Manual. T. "Mehridarya", 2012, 80 pages. (uzbek).*

Module designation	**6102-Methodology of teaching a special subject MFO**
Semester(s) in which the module is taught	*3*
Person responsible for the module	*Ismailova Zukhra Karabaevna - doctor of pedagogic sciences* *Mustafaeva Durdona Asilovna - candidate of pedagogical sciences, associate professor*
Language	*Uzbek*
Relation to curriculum	*Compulsory*
Teaching methods	*Lecture, practical lesson*
Workload (incl. contact hours, self-study hours)	*Total load: 60 hours* *Auditorium Hours:* *Lecture - 10 hours;* *Practical training - 20 hours* *Independent education - 30 hours*
Credit points	*2*
Required and recommended prerequisites for joining the module	*Vocational education methodology* *Pedagogical technologies and pedagogical skills*
Module objectives/intended learning outcomes	After mastering the discipline, the student will: ***To know and understand:*** *to have an idea about the educational normative documents and methodical works of a special subject teacher, their planning, organization, implementation methodology;* *• the structure, laws and principles of the teaching process of special subjects, the tasks of the professor and the organization of students' educational activities in the process of teaching special subjects, methods and means of attracting students' attention and increasing the effectiveness of training, forms of teaching special subjects (lecture, seminar, practical, know and be able to use methods of laboratory, independent education, course work, graduation qualification work, educational practice and production efficiency improvement;* ***To be able to:*** *ability to develop didactic support of special subjects, prepare and implement training programs;* *to have knowledge and skills in the development of educational and methodological complexes of special subjects, the use of the rating system in the process of teaching special subjects;* **To form competences in:** *drawing up the plan and technology of training in the teaching of special subjects, preparing the text of the lecture, the rules for preparing demonstration materials and multimedia, developing projects and cases related to the specialty, methods of conducting open trainings and formalizing documents, fully mastering the theoretical and practical concepts of the subject, accurately reflecting the results of analysis should have the skills of independent thinking about the studied processes.*

Content	*It is the formation of methodical professional knowledge, skills and qualifications that will help masters to overcome the difficulties that arise in the process of education and upbringing of students during their future activities in the educational system, and to conduct general engineering, special technology and production education classes. Level of difficulty: 1.* *Formation of basic knowledge necessary for successful mastering of specialized subjects, "Pedagogical technologies and pedagogical skills", "Methodology of professional education", "Methodology of scientific-pedagogical research" and similar subjects, education based on the methodology of teaching subjects related to their field in masters conveying to the recipients, monitoring and analyzing the pedagogical process, using interactive methods in place, forming the skills of preparing the technological developments of classes, developing the ability to think analytically, work with information and systematize it. Level of difficulty: 2.*
Exams and assessment formats	*One mid-term control (20 minutes) in the form of an assessment and a final oral exam (40 minutes), a short computerized test is provided*
Study and examination requirements	*Students who successfully pass the science;* *The total maximum points will be the sum of the points allocated to the final exam (60%), Midterm control (20%), homework (10%) and activity in classroom activities (10%). To pass the subject, the student will be allocated 60% of points and above. must collect the amount.*
Reading list	*1. Ismailova Z.K., Makhsudov P.M. Ergashev O.K., Matkarimov K.J. Methodology of teaching special subjects. Study guide, T.: "Navroz", 2019.* *2. Akimova O.B., Ismailova Z.K., Maksudov P.M. Utkina S.N. Методика профессионального обучения.Учебное пособие. Т. "Navroz", 2020.* *3. Ismailova Z.K., Makhsudov P.M., Ergashev O. Methodology of teaching special subjects. Textbook. "Lesson Press" 2021.228 pages*

Module designation	**Hydraulic Engineering**
Semester(s) in which the module is taught	*1*
Person responsible for the module	*Docent, Otakhanov M. Y.*
Language	*Uzbek*
Relation to curriculum	*Elective*
Teaching methods	*Lecture, practical lesson*
Workload (incl. contact hours, self-study hours)	*Total download: 120* *Auditorium Hours:* *Lecture - 30 hours;* *Practical training - 30 hours* *Independent education - 60 hours*
Credit points	*4*
Required and recommended prerequisites for joining the module	*"Physics, Mathematics", "Hydrometry", "Terrestrial Hydrology", "Theoretical Mechanics", "Hydraulics".*
Module objectives/intended learning outcomes	After mastering the discipline, the student will: ***To know and understand:*** *- it is necessary to have knowledge of performing hydraulic calculation of simple and complex pipes;* *- it is necessary to have knowledge of hydraulic calculation of channels;* *- it is necessary to have the knowledge to carry out hydraulic calculation of mud pressure and washing processes in channels;* *- it is necessary to have knowledge about the stable non-uniform movement of liquid flow;* ***To be able to:*** *- it is necessary to have knowledge of the classification of aqueducts and their hydraulic calculation;* *- Must have knowledge of hydraulic jump process, hydraulic jump function and its graph construction.* ***To form competencies in:*** *- it is necessary to know how to independently perform hydraulic calculations on the stable smooth and uneven movement of water in open valleys;* *- must be able to perform hydraulic calculation of hydrotechnical facilities independently;* *- it is necessary to know the connection of pipes, the hydraulic calculation of the energy quenching pool.*
Content: The discipline includes. The *level of difficulty*: (1 – low, 5 high):	*• the student is doing from the science program, but mastered, cannot explain the topic of science, has an idea about science (subject), but cannot tell or express it. Level of difficulty: 2* *• understands and knows the essence of science, tells some aspects, has an idea about science (topic). Level of difficulty: 3* *• understands, knows and can tell the essence of science, can apply the acquired knowledge in practice, the student observes independently, has an idea about science (topic). Level of difficulty: 4* *• understands, knows and can tell the essence of science, has the ability to apply the acquired knowledge in practice, can think creatively, can observe independently, has the ability to make conclusions and decisions. Level of difficulty: 5*
Exams and assessment formats	*One midterm (60 minutes) and final oral exam (60 minutes), short computerized test, written homework and self- study*

Study and examination requirements	*Requirements for successfully passing the module* *The total maximum points awarded will be the sum of the points allocated to the final exam (40%), Midterm (20%), homework (10%), classroom activity (10%) and independent study (20%). In order to successfully pass the subject, a student must score 60% or more of the allotted points.*
Reading list	*А.М.Арифжанов. Гидравлика. Тошкент 2022.* *А.Л.Зуйков. Гидравлика. Том 2. Напорные и открытые потоки. Гидравлика сооружений. Москва 2017.* *И.В.Качанов. Гидравлика,гидрология,гидрометрия. Минск 2017.* *Н.В.Васильева. Гидравлика гидравлические расчеты открытых потоков и сооружений. Горки 2022.* *А.Арифжанов, Қ.Рахимов, А.Ходжиев Гидравлика. Тошкент. ТИМИ 2016й. – 189б.* *А.Арифжанов, Х.Файзиев, А.Тошхўжаев «Гидравлика», Тошкент, Фан ва технология, 2019й.-366 б.* *Латипов К.Ш., Арифжанов А.М., Файзиев Х «Гидравлика», Тошкент, ТАҚИ, 2015 й.-459 б.* *Melvyn Kay “Practical Hydraulics”, Taylor & Francis, 2008y.-253 pages.* *T.Kaletova, A.Arifjanov “Hydromechanika”, Nitra, 2019y, -160 pages.* *А.М.Арифжанов, П.Н.Гурина, Т.У.Апакхужаева “Гидравлика”, Тошкент, ТИҚХММИ, 2018г, -171 с.*

Module designation	**Patenting, licensing and certification**
Semester(s) in which the module is taught	*1*
Person responsible for the module	*Turkmenov Khasan Ishimovich, candidate of technical sciences, associate professor*
Language	*Uzbek*
Relation to curriculum	*Elective*
Teaching methods	*Lecture, practical training*
Workload (incl. contact hours, self-study hours)	*Total load : 60* *Auditorium hours: 30* *Lecture - 10 hours;* *Practical training 20 hours* *Independent education 30 hours*
Credit points	*2*
Required and recommended prerequisites for joining the module	*Mathematics; physics; chemistry; basics of metrology, standardization and certification.*
Module objectives/intended learning outcomes	After mastering the discipline, the student will: ***To know and understand:*** *- to know the methods of patentability of inventions, features of patent legislation in leading industrial countries;* ***To be able to:*** *- to have the skills of comparative analysis of new technical solutions with analogues and creation of description and formulation of the invention;* ***To form competencies in:*** *- to have competencies in searching and analyzing patent information, drawing up international applications and foreign patenting, the main types of license agreements and their use.*
Content	*Understanding of intellectual property objects. Two areas of intellectual property rights. Legislation of the Republic of Uzbekistan in the field of protection of intellectual property objects*. Level of difficulty: 2 *Drawing up an application for patenting inventions. Drawing up applications for patenting industrial designs.* Level of difficulty: 3 *Drawing up applications for trademark registration. Certification overview. Legal basis of certification.* Level of difficulty: 4 *Carrying out patent research. Examination of patentability of inventions. International patent systems. Licensing of intellectual property objects.* Level of difficulty: 5
Exams and assessment formats	*1 intermediate control of scientific lectures is conducted in oral form, it consists of 3 questions and 30 min is allotted for it.* *Short computerized tests are conducted 3 times (each test lasts 20 minutes and consists of 30 test questions* *The final control will be conducted in written form, 4 questions will be asked and 40 min will be allocated.* *Homework is provided for practical training.*
Study and examination requirements	*In order to successfully pass the course, students must collect the following points* *The total maximum points will be the sum of the points for the final exam (60%), Midterm control (20%), homework (20%) and classroom activity (10%), and 10% for quizzes. In order to successfully pass the subject, a student must score 60% or more of the allotted points.*

Reading list	S.*A.Salikhov, A.Sh.Bakhronov "Patentology, Licensing and Certification" subject (study). T.: - TDIU, 2010. 272 pages.* *J.M.Qurbanov Patent studies, licensing and certification, textbook, 2018. 295 pages*

Module designation	**Economics**
Semester(s) in which the module is taught	*1*
Person responsible for the module	*Sattorov Orif Boymurodovich, PhD, associated prof.*
Language	*Uzbek*
Relation to curriculum	*selection*
Teaching methods	*Lecture, practical training*
Workload (incl. contact hours, self-study hours)	*Total workload: - 60 hours* *Auditorium Hours:* *Lecture - 10 hours;* *Practical training- 20 hours* *Independent education - 30 hours*
Credit points	*2*
Required and recommended prerequisites for joining the module	*For example: Economic theory, Water resources management and melioration, Hydrology*

Module objectives/intended learning outcomes	After mastering the discipline, the student will: ***To know and understand:*** *- within the framework of the discipline, the student must master the fundamental provisions and categories of modern economic theory in relation to the patterns of functioning of a market economy, the mechanisms of price formation, production volumes, the behaviour of the main economic entities in various types of markets, the fundamentals of consumer behaviour and the production process, the relationship and dynamics of the volume of national production, inflation, employment, the fundamentals of the world economy, features of the functioning of the economy of Uzbekistan in the conditions of modernization and structural adjustment;* *- basic philosophical concepts and categories, patterns of economic development of society;* *- basic concepts and models of microeconomic theory, macroeconomics and world economy;* ***To be able to:*** *- the student will master economic thinking skills.* *- the student acquires practical skills in studying economic processes.* *- the student will expand his knowledge in the field of economic theory and form a scientific socio-economic worldview.* *- the student develops the ability to assess the effectiveness and socio-economic consequences of specific government measures used in the implementation of state economic policy.* *- the student will gain an understanding of the application of methods for analyzing the processes of economic development of the national economy and the economy of industrialized countries.* *- the student independently makes economic decisions on economic problems.* ***To form competences in:*** *- basic methods of quantitative analysis and modeling, theoretical and experimental research;* *-culture of thinking, ability to perceive, generalize and analyze information, setting a goal and choosing ways to achieve it;* *- analytical skills in the field of applied aspects of economic theories;* *- carry out professional communication and communication on issues of organization and managing one's own professional activities;* *- the student must have the skills to think economically, conduct research on economic phenomena, identify patterns, establish correlations between individual phenomena, justify their point of view, check the reliability of research findings, and make decisions.* *- apply the conceptual and categorical apparatus, basic economic laws in professional activities;* *- must have the skills of a holistic approach to the analysis of economic phenomena; use the acquired knowledge to express your own assessment of economic phenomena and processes*.

Content: The discipline includes. The *level of difficulty*: (1 – low, 5 high):	*Basic issues of economics and ways to Economic theory as a science. Subject and methods of research Subject and methods of economic science. Principles of Economics. Positive and normative analysis. Rational behavior. Free and economic benefits. Factors of production. Income of owners of production factors. Limited (scarce) factors of production and limitless needs: the problem of choice. Society's production possibilities frontier. Opportunity costs. Comparative advantage. Division of labor, specialization and exchangesolve them in various economic systems. Level of difficulty: 3.* *Market, its structure and functions. Institutional foundations of a market economy. The essence of the market, its functions. Market structure. Market mechanism. Demand, supply, price. Explanations for changes in quantity demanded as a result of changes in price. Non-price determinants of demand. Normal and inferior goods. Interchangeable and complementary goods. Individual and market demand. Constructing a market demand curve. A change in the quantity supplied as a result of a change in price. Non-price determinants of supply. Shifts in the supply curve when non-price determinants change. Construction of the market supply curve. The concept of elasticity. Price elasticity of demand and its factors. Elastic and inelastic demand and revenue of sellers. Income elasticity of demand. Cross elasticity. Price elasticity of supply. Partial equilibrium in a perfectly competitive market in the short run. The effect of changes in supply and demand on equilibrium price and equilibrium quantity. The concept of general equilibrium. Level of difficulty: 4.* *Marginal utility theory and consumer behavior. Consumer preferences. Rational consumer choice. Preference relations among consumption bundles. Examples of preferences: complements, substitutes, indifferent goods, anti-goods. Utility in economic theory and problems of its measurement. Total and marginal utility. Utility function. Law of diminishing marginal utility of a good. Consumer equilibrium from cardinalist positions. Consumer choice from an ordinalist position. Level of difficulty: 5.*
Exams and assessment formats	*Educational results are evaluated in a 100-point rating system. One midterm (60 points) and final oral exam (40 points)*
Study and examination requirements	*Requirements for successfully passing the module* *To pass the subject successfully, the student must score 60% or more of the allotted points.*
Reading list	*1. David L. Debertin. A. Agricultural Production Economics. Second Edition, Amazon Createspace 2012. 242 p.* *2. Umurzoqov O'.P.,Sultonov A.S. Rashidov J.X. Water economy and management. Textbook. TIIAME. 2016 y.* *3. U. Sangirova, Kh. Yakubova, U. Kholiyorov, G. Kholmurodova "Economics and Management" Textbook TIIAME – 2021 г.* *4. Sangirova U.R., Sattorov O.B., Economics and management of water management. Textbook. "TIIAME" MTU. 2022*

Module designation	**Ameliorative hydrogeology**
Semester(s) in which the module is taught	*1*
Person responsible for the module	*Ph.D., Associate Professor Nurjanov Satbay Eshjanovich* *Ph.D., associate professor Ruziev Ilkhom Makhmudovich*
Language	*Uzbek*
Relation to curriculum	*selection*
Teaching methods	*Lecture, practical training*
Workload (incl. contact hours, self-study hours)	*Total workload: - 60 hours* *Auditorium Hours:* *Lecture - 10 hours;* *Practical training- 20 hours* *Independent education - 30 hours*
Credit points	*2*
Required and recommended prerequisites for joining the module	*For example: Physics, Chemistry,*
Module objectives/intended learning outcomes	After mastering the discipline, the student will: ***To know and understand:*** *- to analyze the hydrogeological conditions of the irrigated areas;* *- to calculate the regime and balance of seepage waters;* *- - assessment of geological and hydrogeological conditions of land, underground water flows, their prediction;* *- making hydrogeological maps,* *- drilling techniques and technologies, drilling equipment, drilling methods used in geological and hydrogeological research* ***To be able to:*** *- use in hydrogeological-ameliorative maps;* *- knowledge of negative processes and events that occur during the implementation of meliorative measures, and their prediction; - to prevent possible negative processes; assessment of hydrogeological improvement conditions of irrigated lands, results of geological and hydrogeological maps and studies,* *-hydrogeological indicators of underground water flows and aquifers and their use in solving reclamation issues,* *- negative events and processes related to the implementation of melioration and water supply measures,* *- basic physical and physical-mechanical parameters of soils, equipment of wells,* *- -opening of aquifers, aquifers, well construction, filters, preparation of filters, calculation of basic parameters* ***To form competences in:*** *- specific aspects of geological and hydrogeological conditions* *- drilling methods, several methods of groundwater flow estimation,* *- prediction of changes in hydrogeological conditions,* *- geological and hydrogeological maps and research results, hydrogeological dimensions of aquifers and underground water flows,* *- methods of establishing the water balance of the region, hydrogeological data of observations, conducting hydrogeological and engineering, geological researches,* *- able to clearly state their opinions and conclusions regarding the analysis of research results and their use,* *- assessment of hydrogeological-ameliorative conditions,*

Content: The discipline includes. The *level of difficulty*: (1 – low, 5 high):	*- Tasks and content of reclamation hydrogeology in the reclamation of agricultural lands, urban and industrial areas. General information about irrigation and drainage. Elements of hydromelioration systems. Irrigation methods and water injection technology. Tasks of studying the hydrogeological-ameliorative conditions. Factors of hydrogeological-ameliorative conditions: Level of difficulty: 2.* *- General concepts and definition of hydrogeological process stages. Development laws of hydrogeological processes and their analysis in land reclamation. Factors determining hydrogeological processes (climate, relief, geomorphological, geological factors) and their description. Hydrogeological regions and their hydrodynamic description, regions of feeding and transit, consumption, re-reduction and spread of streams: Level of difficulty: 2.* *- Mode types. Natural and disturbed modes. Syzot water regime genetic types. Characteristics of seepage water regime distributed in different natural regions and irrigation areas. Regime of mineralization and chemical composition of Sizot waters. Principles of management of the regime of seepage waters. Water balance in land under reclamation. Balance types. Total water balance, aeration zone balance, seepage water balance. Balance components. Studying the balance and researching the balance plots. Analysis of the balance sheet: Level of difficulty: 2.* *- Factors of formation of irrigation nutrition during irrigation and salt washing. Specificity of irrigation nutrition in different climatic regions. Basing irrigation nutrition on the basis of modeling moisture transport in the aeration zone. Damping of seepage water in newly irrigated lands: Level of difficulty: 3.* *- Hydrodynamic indicators and boundary conditions necessary for land reclamation assessment, forecasting, and the design of reclamation structures. Hydrodynamic indicators - definition of their concepts. Methods of determining hydrodynamic parameters. Division into hydrogeological - reclamation districts. Definition of concepts; division into regional and local districts, taking into account the specificity of the hydrogeological process in the arid climate region and the distribution of stormwater in the regions. Geofiltration schemes of reclamation lands, general concepts about filtration schemes, a brief history of the issue. Geofiltration sections: Level of difficulty: 3.* *- The role and importance of boreholes in irrigation and water supply systems. Concepts of drilling wells and their main elements. A brief history of drilling techniques and technology in Uzbekistan and abroad. Development of drilling science. The connection of this science with other sciences. Basic requirements for a drilling well. Types of rocks by drilling, sedimentary, igneous, metamorphic rocks and their properties. Types of damage to rocks during drilling: Level of difficulty: 4.* *The main factors determining the design of the borehole. The elements of the construction of the borehole: wellhead, conductor, diverter, technical, operational and strainer pipelines. Justification of the choice of water-absorbing operational layer. Basic information on the hydrogeological calculation of the Burgi well. Determination of borehole indicators based on experimental water withdrawal results. Taking into account the interaction of drill wells: Level of difficulty: 3.* *- Strainers of boreholes. The main elements of strainer strings. Reasons for strainer failure. Perforated filters for catching small particles: perforated, various, wire, gravel, etc. Filter selection and their calculation. Structure of salniks. Strainer wells. Conditions of use, specific features of the device. Perforated filters for catching small particles: perforated, various, wire, gravel, etc. Filter selection and their calculation. Structure of salniks. Strainer wells. Conditions of use, specific features of the device: Level of difficulty: 5.*

Exams and assessment formats	*One midterm control (20 minutes) and final oral exam (40 minutes).*
Study and examination requirements	*Students who successfully pass the science* *The total maximum points awarded will be the sum of the points allocated to the final exam (60%), Midterm (20%), homework (10%) and classroom activity (10%). In order to successfully pass the subject, a student must score 60% or more of the allotted points.*
Reading list	*1. Yusupov G.U., Kuvvatov D.A. Study guide on reclamation hydrogeology - Tashkent "TIQXMMI" MTU 2015-250 b* *2. Yusupov G.U., Kuvvatov D.A. Reclamation hydrogeology fanidan amaliy mashғulotlarni bazharish bўyicha services kўrsatma- Toshkent 2015-100 b*

Module designation	**Method of scientific research in reclamation**
Semester(s) in which the module is taught	*2*

Person responsible for the module	*Khamidov Mukhamadkhan Khamidovich, doctor of agricultural sciences, professor*
Language	*Uzbek*
Relation to curriculum	*selection*
Teaching methods	*Lecture, practical training and seminar*
Workload (incl. contact hours, self-study hours)	*Total download: 120* *Auditorium Hours:* *Lecture - 30 hours;* *Practical training - 30 hours* *Independent education - 60 hours*
Credit points	*4*
Required and recommended prerequisites for joining the module	*Scientific research methodology, Reconstruction of hydromelioration systems, Automation of hydromelioration systems, Water-saving irrigation technologies,*
Module objectives/intended learning outcomes	After mastering the discipline, the student will: ***Know and understand:*** *- general rules for field experiments;* *- selection of pilot plots for field experiments;* *-procedures and technologies of crop irrigation;* *- saline soils and their washing technologies;* *- amelioration activities on soils prone to erosion.* ***Having the skills to:*** *- taking into account the type of soil, water-physical properties, meliorative condition during the experiment;* *-hydromelioration systems, methods of FIK increase;* *-research of scientifically based methods of irrigation of crops to increase the coefficient of use of water resources;* *-research of water-saving irrigation technologies;* *-methods of conducting field experiments in saline and eroded lands.* ***Formation of competences:*** *- rational management and efficient use of water resources in the face of global climate change, increasing water scarcity, limited irrigated land and water resources;* *- effective use of hydromelioration systems and use of modern HAT technologies to improve the melioration conditions of irrigated lands;* *- use of computer technologies and mathematical methods to predict the duration of wind erosion;* *- use of high-precision digital laboratory equipment in field research;* *-mathematical processing of research results.*
Content: The discipline includes. The *level of difficulty*: (1 – low, 5 high):	*Content of science: Introduction to the methodology of conducting field experiments. Subject, purpose and tasks of science. General rules for field experience. Level of difficulty: 1.* *Lysimetric experiments. Studying the order of Sizot waters. Conducting field experiments and research in saline lands. Experiments on irrigation procedures. Level of difficulty: 2.* *Experiments on irrigation technologies. Phenological observations and various calculations in field experiments Level of difficulty: 2.* *Methods of determining and calculating crop yield. Determination of FIK i and reliability of irrigation systems. Features of conducting field experiments on soils prone to erosion. Level of difficulty: 3.*
Exams and assessment formats	*The assessment consists of two mid-term tests (20 minutes) and a final test (40 minutes).* *Mid-term tests are short computerized tests, and the final test is an oral exam.*

Study and examination requirements	*Requirements for passing the course. Total maximum marks for the final exam (40%), Mid-term tests (50%), homework-presentations (10%) To pass the subject successfully, the student must score 60% or more of the allotted points.*
Reading list	*1. Khamidov M.Kh., Soliev B.K., Mukhamedov A.K. "Scientific research works in melioration and irrigated agriculture". Study guide. Tashkent, TIMI. 2011-176 pages.* *2. Nurmatov Sh.N, Mirzajonov Q.M. and others. - "Methods of conducting field experiments". Methodical guide. Tashkent 2007, page 147.* *3. Isabaev A. Fundamentals of scientific research. Methodological instruction. Tashkent, TIKHMII 2010.* *4. Khamidov M.Kh., Begmatov I.A., Isaev S.Kh., Mamatov S.A. "Water-saving irrigation technologies" Training manual. T., TIMI printing house, 2015. 243 pages.*

Module designation	**Humidifier in irrigated lands fechnologies**
Semester(s) in which the module is taught	*2*

Person responsible for the module	*Bekmirzaev Gulom Tashpulatovich, PhD, associate professor.*
Language	*Uzbek*
Relation to curriculum	*selection*
Teaching methods	*Lecture, practical training*
Workload (incl. contact hours, self-study hours)	*Total load: - 120 hours;* *Auditorium hours: - 60 hours;* *Lecture - 30 hours;* *Practical training - 30 hours.*
Credit points	*4*
Required and recommended prerequisites for joining the module	*"Landscape irrigation", "Water-saving irrigation technologies".*
Module objectives/intended learning outcomes	After mastering the discipline, the student will: ***Know and understand:*** *-scientifically based methods of irrigation of crops;* *- irrigation methods and their improvement;* *- elements of water-saving irrigation techniques* *- water-saving irrigation technologies and their design;* *- reconstruction of irrigation systems;* *- construction norms and rules and other normative documents.* ***Having the skills to:*** *- constructions of irrigation networks;* *-hydraulic calculation of channels, design of longitudinal and transverse cuts;* *-irrigation erosion and complex measures against it;* *- identification of water sources for irrigation;* *- irrigation by mechanical lifting of water.* ***Formation of competences:*** *- selection of elements of water-saving irrigation technology, methods and techniques,* *- to find economically viable options for placing irrigation networks* *the effect of irrigation procedures on crop yield.* *- the ability to design and build irrigation networks;* *- exploitation of irrigation systems and their automation;* *- the main directions and methods of scientific and technical development in the field of irrigation melioration;* *- to have an idea about the main directions of scientific research work on water-saving irrigation technologies;* *- methods of determining water sources and their irrigation capacity;* *- selection of irrigation schemes with mechanical lifting of water*.
Content: The discipline includes. The *level of difficulty*: (1 – low, 5 high):	*The subject, tasks and directions of the science "Humidifier in irrigated lands fechnologies" and the requirements for it. Basic information about irrigation. The essence, forms and types of irrigation. The impact of irrigation on the external environment. Irrigation systems, their elements and functions. Components of irrigation networks and their functions. Soils of Uzbekistan. Soil types and water-physical properties. Level of difficulty: 1.* *Soil-ameliorative conditions of Uzbekistan and demand for irrigation. Methods of maintaining moisture in the soil. Importance of moisture preservation technologies in Uzbekistan. Application of moisture conservation technologies in the cultivation of agricultural crops. Water balance between plants and soil. Level of difficulty: 2.* *Application of agrotechnical measures to conserve moisture in irrigated lands. Importance of irrigation methods in maintaining soil moisture. Methods of using hydrogel granules in arid regions. Level of difficulty: 3.*

Exams and assessment formats	*There are two midterms (20 minutes each) and a final oral exam (40 minutes), a short computerized test and a written homework assignment.*
Study and examination requirements	*The total maximum points awarded will be the sum of the points allocated to the final exam (60%), Midterm (20%), homework (10%) and classroom activity (10%). In order to successfully pass the subject, the student must score 60% or more of the allotted points.*
Reading list	*1. Khamidov M.Kh., Mamataliyev A.B. Irrigation and reclamation. Study guide. Tashkent. IS IT CLOSED? 2019. -210 pages.* *2. Mamataliyev A.B. Land reclamation, recultivation and protection. Textbook. -Tashkent: "ILM-ZIYO-ZAKOVAT" publishing house, 2019. -230 pages.* *3. Khamidov M.Kh., Shukurlaev K.I., Lapasov K.O. Instruction manual on practical training in "Agricultural hydrotechnical melioration". -Tashkent: TIMI, 2014. -320 pages.*

Module designation	**Remedial regime**
Semester(s) in which the module is taught	*2*
Person responsible for the module	*PhD Amanov Bahodir Tukhtasinovich*
Language	*Uzbek*
Relation to curriculum	*Elective*
Teaching methods	*Lecture, practical training*
Workload (incl. contact hours, self-study hours)	*Total workload: - 120 hours ;* *Contact hours:* *lecture - 30 hours;* *Practical training - 30 hours ;* *Self-learning -60 hours*
Credit points	*4*

Required and recommended prerequisites for joining the module	*Land reclamation monitoring in irrigated lands. Irrigation and land reclamation, water conservation technologies, engineering service in hydromelioration systems.*
Module objectives/intended learning outcomes	***To know and understand:*** *- for students to know how to conduct observations on the state and regime of reclamation of irrigated lands, irrigation canals and ditches,* *- to analyze the current situation and to develop measures and solutions to improve the situation and to know how to form their practical skills* ***To be able to:*** *- to have an idea about irrigation and drainage networks in man-made-disturbed agrolandscapes,* *- to know and be able to use water-salt balances and melioration regimes,* *- to have the skills to determine the productivity of irrigation water in the conditions of automorphic melioration regimes* ***To form competences in:*** *- to have the ability to use deep theoretical and practical knowledge in the field of hydromelioration systems,* *- to have the ability to create new ideas and independently conduct scientific and research work, as well as the skills to work in a scientific team*
Content	*Irrigation and reclamation regimes of cotton. Productivity of irrigation in conditions of semi-hydromorphic melioration regimes. Level of difficult:2* *Evaluation of the reclamation condition of irrigated lands and the technical condition of hydromelioration systems. The method of assessing the ecological - meliorative condition of irrigated lands. Level of difficult:3* *Biological and geological water-salt cycle in irrigated lands. General and private water-salt balances. Level of difficult:3*
Exams and assessment formats	*One midterm assessment (20 minutes) and one final (40 minutes)* *Midterm: short computer-based quizzes,* *Final: oral exam*
Study and examination requirements	*Requirements for successfully passing the module* *e.g. the final grade in the module is composed of 60% performance on exams, 10% quizzes, 10% take-home assignments, 10% in-class participation. Students must have a final grade of 60% or higher to pass*
Reading list	*1. Gouri Sankar Bhunia. Land Reclamation and Restoration Strategies for Sustainable Development November 17, 2021.* *2. Zeeshan Mustafa Maan (Author) Reclamation of Soil Salinity By Using Control Drainage.2010.* *3. R.K. Ikramov, G.U. Yusupov, F.A. Baraev, N.M. Karimova. "Melioration monitoring and cadastre of irrigated lands", Textbook. Tashkent "TIMI" 2010 240b.* *4. From the science of melioration regime. Complex. Tashkent-2020.* *5. Methodical instructions for conducting practical training in the field of melioration regime*

Module designation	**Soil-plant-water relationship.**
Semester(s) in which the module is taught	*1*
Person responsible for the module	*Kasimbetova Saltanat Associate Professor Ph.D.*
Language	*Uzbek*
Relation to curriculum	*Elective*
Teaching methods	*Lecture, practical training*
Workload (incl. contact hours, self-study hours)	*Total download: 120* *Auditorium Hours:* *Lecture - 30 hours;* *Practical training - 30 hours* *Independent education - 60 hours*
Credit points	*4*
Required and recommended prerequisites for joining the module	*"Botany", "Biology", "Geology and Hydrogeology", "Geodesy", "Hydraulics", "Ecology", "Chemistry", "Soil Science and Agriculture", "Irrigation and melioration", "Improvement of Natural Conditions".*

Module objectives/intended learning outcomes	After mastering the discipline, the student will: ***Know and understand:*** *--observation, analysis and measurement of types, properties, composition of soil, plants, water and the processes occurring in them with the help of equipment;* *- management of the water regime of the soil, determination of the volume and quality of water resources;* *-soil, plant, water dependence laws, plant species, changes in water demand during growth; - about the dependence of harvesting on water consumption, soil-ameliorative conditions* ***Having the skills to:*** *- laws of connection between climate, soil, vegetation, water;* *- types of plants, salt-resistant plants, with the help of which to improve land reclamation;* *- water-physical properties of soils, their changes under the influence of water and plants;* *- the physiological role of water in plants.* ***Formation of competences:*** *- types of water in the soil and their role in plant life;* *- physiological characteristics of plants and resistance to salt;* *- distribution of water in the plant organism;* *methods of determining water demand and water consumption of plants;* *- the plant's ability to use soil moisture;* *- ways to ensure that the osmotic pressure in the cells of the plant root system is higher than the osmotic pressure of the soil solution and the ability to use them.*
Content: The discipline includes. The *level of difficulty*: (1 – low, 5 high):	*Introduction to the science of soil, plant, water dependence. Soil-ameliorative conditions of Uzbekistan, processes of soil formation and land fund. Difficulty level: 2* *Water-physical properties of soils, their changes under the influence of water and vegetation. Forms of water in soil. Movement of water in soil and plants. Physiological role of water in plants. Difficulty level: 2* *Methods of determining water demand and water consumption of plants. Adaptation of the plant root to the water regime of the soil. Difficulty level: 3* *Soil water evaporation property and soil water balance. Evaporation of water from the soil surface and plants. Movement of water in the soil-plant atmospheric system. Level of difficulty: 3* *Methods of determining the plant's demand for water, the water consumption of plants. The proportion of water in the plant and the soil. Determination of osmotic pressure in plant cells. Difficulty level: 4* *Regime of seepage waters and prevention of soil salinization. Methods for determining the concentration of cell sap in plant leaves. Using a tensiometer to determine moisture in soil layers. Difficulty level: 5*
Exams and assessment formats	*To fully master the theoretical and methodological concepts of science, to be able to accurately reflect the results of analysis, to independently observe the studied processes and to fulfill the assignments and assignments given in the interim control forms, to submit a written work for the final control.*
Study and examination requirements	*Requirements for passing the course* *The total maximum marks will be the sum of the final exam (40%), Midterm (60%), and allotment points. To pass the subject successfully, the student must score 60% or more of the allotted points.*
Reading list	*Matyakubov B. Sh., Kasimbetova S.A., Bekmirzaev G. T. "Soil - plant - water dependence" Study guide, "TIIIAME" NRU. 2019. -150 pages.*

Module designation	**Biomelioration**
Semester(s) in which the module is taught	*2*
Person responsible for the module	*Isaev Sabirjan, doctor of agricultural science*
Language	*Uzbek*
Relation to curriculum	*selection*
Teaching methods	*lecture, seminar*
Workload (incl. contact hours, self-study hours)	*Total workload:120* *Lecture:30* *Seminar:30* *Self-study:60*
Credit points	*4*
Required and recommended prerequisites for joining the module	*Methods of scientific research in land reclamation, Water conservation technologies in irrigated lands, Soil-plant-water relationship, Land reclamation and land reclamation, Measurement and tools of water resources, Landscape irrigation.*

Module objectives/intended learning outcomes	After mastering the discipline, the student will: ***To know and understand:*** *- soils and their properties* *- to determine the agrophysical-agrochemical properties of the soil* *- determination of saline soils, primary and secondary salinity* *- phytomelioration, halophytic plants* *- forest reclamation* ***To be able to:*** *- factors to eliminate salinity* *- use of biosanvet preparation in saline washing* *- the role of repeated crops after winter wheat in increasing soil fertility* *- structure and calculation of collector systems* ***To form competencies in:*** *- organization of scientific research on phytomelioration* *- organization of efficient use of collector ditch water* *- reducing the migration of collector ditch waters with the help of microphytes* *- biological and reclamation plants* *- organization of scientific research on biological drainage*
Content: The discipline includes. The *level of difficulty*: (1 – low, 5 high):	*The main soils of Uzbekistan and their characteristics. Biological drainage. Biomeliorant plants and their classification. Level of difficulty: 2* *Halophytic plants, their types and characteristics. Phytovit plants and soil fertility restoration with their help. Phytomelioration. Level of difficulty: 3* *Use of biological compounds in irrigation and saline washing. Biological technologies in wastewater treatment. Level of difficulty: 4* *Biological reclamation of water bodies. Soil strengthening plants. Methods of biomelioration of dry lands. Forest melioration. Level of difficulty: 5*
Exams and assessment formats	*There are two midterm exams (20 minutes each) and a final oral exam (40 minutes), a short computerized test and written homework.*
Study and examination requirements	*The total maximum points awarded will be the sum of the points allocated to the final exam (60%), Midterm (20%), homework (10%) and classroom activity (10%). In order to successfully pass the subject, the student must score 60% or more of the allotted points.*
Reading list	*1. Kasimbetova S.A., Akhmedjanova G.T., Ergashova D.T.- Biomelioration. Methodical guide. Tashkent 2019, page 135.* *2. Isaev S.Kh. etc. Pasture reclamation, Training manual. Tashkent, TIMI. 2020-186 pages.* *3. Recommendations on accelerating food production in cultural pastures in Uzbekistan, Tashkent, 2015, p. 23.* *4. Norkulov U., Allanov Kh. "Lecture materials on the science of pasture land reclamation" T. 2011. 142 pages.*

Module designation	**In irrigation and reclamation geoinformation systems**
Semester(s) in which the module is taught	*3*
Person responsible for the module	*Professor Pulatov A.S.*
Language	*Uzbek*
Relation to curriculum	*selection*
Teaching methods	*lecture, seminar*
Workload (incl. contact hours, self-study hours)	*Total workload:120* *Lecture:30* *Seminar:30* *Self-study:60*
Credit points	*4*
Required and recommended prerequisites for joining the module	*«Geography», «Cartography».*

Module objectives/intended learning outcomes	***To know and understand:*** *- The main object of this module is to enable the geoinformation system in the field of Irrigation and Melioration to analyze data, study problems, solve and assess situations, and to form appropriate knowledge and skills in geographic information systems.* ***To be able to:*** *To gain an understanding of map projection and georeferencing, geographic data visualization, global positioning systems, and spatial data infrastructure; (knowledge).* ***To form competencies in:*** *Knowledge of and ability to use ArcCatalog and ArcMap computer programs; (skill).* *should have the skills to perform geometric correction and geolinking of images, vector and raster operations. (qualification)*
Content	*Geoinformation Sytems in Irrigation and Melioration are to organize the data of the geo-information system of water management, to collect, store, manage, process, analyze and describe spatial-geographical data, and based on them to prepare a database necessary in Irrigation and Melioration. Level of difficulty: 2.*
Exams and assessment formats	*Two Midterm assessments (80 minutes each) and one final exam (80 minutes), take-home written assignments*
Study and examination requirements	*Requirements for successfully passing the module* *The final grade in the module is composed of 60% performance on exams, 20% take-home assignments, 20% in-class participation. Students must have a final grade of 60% or higher to pass*
Reading list	*Chang K.T., 2011. Introduction to Geographic Information Systems. Fourth Edition. McGRAW – HILL International Edition.*

Module designation	**Automation of irrigation**
Semester(s) in which the module is taught	*3*
Person responsible for the module	*PhD Amanov Boxodir Tukhtasinovich*
Language	*Uzbek*
Relation to curriculum	*selection*
Teaching methods	*lecture, seminar*
Workload (incl. contact hours, self-study hours)	*Total workload:120* *Lecture:30* *Seminar:30* *Self-study:60*
Credit points	*4*
Required and recommended prerequisites for joining the module	*«Hydraulics», «Hydro automatics», «Use of pumps and pumping stations».*
Module objectives/intended learning	After mastering the discipline, the student will:

outcomes	***To know and understand:*** *- It consists of a set of methods and tools that allow masters to automate the distribution of water in canals and manage water distribution without direct human intervention, or to facilitate the work of operational staff in distributing water between consumers,* *- knowledge bases in the automation of hydromelioration systems, improvement of the state of improvement of the existing hydromelioration network, mechanization and automation of water distribution processes, mechanization of work in production processes, having a vision of systematically increasing the yield of sustainable agricultural crops from meliorated areas by implementing complex water management activities.* ***To be able to:*** *- to know the basics of various automatic devices used in the field of water management and land reclamation, their types,* *- scope of use, basis of calculation and their selection in accordance with specific conditions, as well as the methods of developing measures to improve the conditions based on the received information and be able to use them.* ***To form competences in:*** *- In the automation of hydromelioration systems, it is necessary to have the skills to apply the methods of analysis of technical events and processes, to accept solutions to technical problems,* *- in the design of water-saving innovative techniques and technologies, the rules of construction standards and other normative documents,* *- the selection of modern innovative techniques and technologies, methods and elements of water-saving irrigation,* *finding technical and economic convenient options for placing irrigation networks.*
Content: The discipline includes. The *level of difficulty*: (1 – low, 5 high):	*Components of hydromelioration systems. Purpose and objectives of water use planning in irrigated agriculture. Level of difficult:2* *Use and automation of irrigation networks. Level of difficult:2* *Cluster, automation of crop irrigation on the farm, use and automation of irrigation networks. Level of difficult:3* *Plans for development and reconstruction in the use and automation of irrigation networks. Production and scientific research works on the use and automation of irrigation networks Level of difficult:5*
Exams and assessment formats	*One midterm control (30 minutes each) and final oral exam (40 minutes), a short computerized test and written homework are provided.*
Study and examination requirements	*Requirements for passing the course* *The total maximum marks for the final exam (60%), Midterm exam (20%), homework (10%) and classroom activity (10%). In order to successfully pass the subject, the student must score 60% or more of the allotted points.*
Reading list	*1. Brian Wahlin, Darell Zimbelman, "Canal Automation for Irrigation Systems" ASCE Publications. USA 2014.* *2. Serikbaev B, Dostnazarova S. "Irrigation automation" Methodological manual. Tashkent TIIAME, 2020. – 82 p;* *3. Serikbaev B.S., Sherov A.G., Ibragimova H.R. "Modernization of hydromelioration systems", Textbook. Tashkent. "TIIAME" 2018y.-467 b;* *4. Baraev F.A., Serikbaev B.S. second. Operation and automation of the hydromelioration system. Textbook. Tashkent. "TIIM", 2013. - 270 p.* *5. Automating the flow. Methodical instructions for conducting practical training in science. Tashkent-2019.*

Module designation	**Hydromelioration systems modernization**
Semester(s) in which the module is taught	*3*
Person responsible for the module	*PhD O'ribekov Sadriddin Komilovich*
Language	*Uzbek*
Relation to curriculum	*selection*
Teaching methods	*lecture, seminar*
Workload (incl. contact hours, self-study hours)	*Total workload:120* *Lecture:30* *Seminar:30* *Self-study:60*
Credit points	*4*
Required and recommended prerequisites for joining the module	*«Use of hydromelioration systems», «Irrigation and reclamation».*

Module objectives/intended learning outcomes	***To know and understand:*** - *know how to equip hydromelioration systems with modern technologies of operation and use,* - *know how to introduce technologies that allow reducing water wastage,* - *understand the modernization of water distribution processes,* - *know how to modernize the processes of taking water from the source within the specified time and delivering it to consumers without wasting it.* ***To be able to:*** - *to have an idea about the improvement and development of irrigation and reclamation systems,* - *In the process of modernization of hydromelioration systems, to know the causes of salinization of irrigated lands and their effect on the productivity of agricultural crops, and to be able to use them.* ***To form competences in:*** - *In the modernization of hydromelioration systems, it is necessary to have the skills of reconstruction and improvement of irrigation networks and collector-sources and their implementation, operation and maintenance of irrigation networks, ditches and collector systems, in the use of hydromelioration systems, the monitoring of hydromelioration systems carried out on the order of farms, and the development of instructions and recommendations for the rational management of irrigation and melioration systems based on scientific research.*
Content	*He can determine the hydromodule of irrigation in irrigation systems, determine the procedure for watering agricultural crops, determine the elements of irrigation technology, methods and techniques, rational use of irrigation and melioration systems, draw up water use plans. Level of difficult:2* *When designing water-saving modern innovative techniques and technologies, the rules of construction standards and other normative documents can adopt modern innovative techniques and technologies of water-saving irrigation. Level of difficult:1* *He knows how to use hydromelioration systems, monitor hydromelioration systems on the order of farms, and develop instructions and recommendations for rational management of irrigation and melioration systems based on scientific research. Level of difficult:3*
Exams and assessment formats	*One midterm (30 minutes each) and final oral exam (40 minutes), a short computerized test and written homework are provided.*
Study and examination requirements	*Students who successfully pass the science* *The total maximum points awarded will be the sum of the points allocated to the final exam (60%), Midterm (20%), homework (10%) and classroom activity (10%). In order to successfully pass the subject, a student must score 60% or more of the allotted points*
Reading list	*1. Sherov A., Serikbayev B.S. Modernization of hydromelioration systems. Textbook. Tashkent, TIIAME, 2018.-380 p.* *2. Sherov A. Modernization of hydromelioration systems. Study guide Tashkent, TIIAME, 2020.-230 p.* *3. Methodological instruction on the science of modernization of hydromelioration systems. Tashkent - 2020.* *4. Barayev F.A., Serikbayev B.S., Bazarov R.Kh., "Use of hydromelioration systems", Textbook. Tashkent Institute of Irrigation and Reclamation. "TIMI", 2012. - 260 p;* *5. Baraev F.A., Serikbaev B.S. i second. Operation hydromelioration system. Textbook. Tashkent. "TIIM", 2013. - 270 p.*