# TITLE OF THE Curricula/Module

# GEOINFORMATION SYSTEMS

## TAI/Turkmenistan

## May, 2020

# Template of the Curriculum/Module DESCRIPTION

| Short Name of the University/Country code<br>Date (Month / Year) | TAI-TKM<br>05/2020 |
|---|---|
| **TITLE OF THE Curricula/Module** | **Code** |
| **GEOINFORMATION SYSTEMS** | |

| Teacher(s) | Department |
|---|---|
| **Coordinating:**<br>**Batyr Nuryyev**<br>**Others:**<br>**Shatlyk Pygamov**<br>**Babageldi Kurbanov**<br>**Dovlet Durdyyev** | Computer technology<br>Agricultural land reclamation |

| Study cycle | Level of the module | Type of the Module |
|---|---|---|
| BA/MA/PhD | Bachelor's degree | |

| Form of delivery | Duration | Language(s) |
|---|---|---|
| offline | 16 week | English |

| Prerequisites | |
|---|---|
| **Prerequisites:**<br>To know:<br>Mathematics<br>Physics<br>Computer technology<br>Geodesy<br>Soil science | **Co-requisites (if necessary):** |

| ECTS<br>(Credits of the module) | Total student workload hours | Contact hours | Individual work hours |
|---|---|---|---|
| 3 | 80 | 64 | 16 |

| Aim of the module (course unit): competences foreseen by the study module | | |
|---|---|---|
| The aim of the course is to form students' knowledge, skills and abilities based on the theory and practice of geographic information systems. The student needs to study the rules of operation of the GIS programs of the world's leading companies and become familiar with their main functions. This course also explores the most common GIS software. All this will enable future professionals to resolve emerging issues. | | |
| **Learning outcomes of module (course unit)** | **Teaching/learning methods** | **Assessment methods** |
| To know:<br>– Basic concepts of GIS;<br>– The main stages and modern state of the development of GIS technologies;<br>– Basics of data organization in GIS;<br>– General features of basic models for displaying spatial information in GIS. | General trainings, presentations, seminars, practical trainings, self-employment | Annual work, software management, test questions, summaries, account, examination |
| To be able to:<br>– grammatical use of GIS;<br>– the construction and use of geoinformation models to describe and predict different phenomena in agriculture, environmental management and economy; | Execution of the annual work | Presentation of the implementation of the curriculum |

| | | |
|---|---|---|
| – To Perform geographic information processing and analysis using geoinformation systems. | | |
| Possess:<br>Should be able to work with any geographic information system, for example, with the QGIS program. | Execution of the annual work | Presentation of the implementation of the curriculum |

| Themes | Contact work hours | | | | | | | Time and tasks for individual work | |
|---|---|---|---|---|---|---|---|---|---|
| | Lectures | Consultations | Seminars | Practiacl work | Laboratory work | Placements | **Total contact work** | **Individual work** | **Tasks** |
| The concept of geographic information systems | 2 | | | | | | **2** | | |
| GIS software | 2 | | | 2 | | | **4** | | |
| The concept of a graphical user interface in QGIS | 2 | | | 2 | | | **4** | | |
| Coordinate systems and map projections | 2 | | | 2 | | | **4** | | |
| GIS and the Internet | 2 | | | 4 | | | **6** | | |
| QGIS Module Concept | 2 | | | 2 | | | **4** | | |
| GIS and navigation systems | 2 | | | 2 | | | **4** | | |
| Spatial data and their scientific basis | 2 | | | 2 | | | **4** | | |
| Reception of spatial data in GIS | 2 | | | 2 | | | **4** | | |
| General methods for representing spatial data | 2 | | | 2 | | | **4** | | |
| Raster model for representing spatial data in GIS | 2 | | | 2 | | | **4** | | |
| Vector model of representation of spatial data in GIS | 2 | | | 2 | | | **4** | | |
| Digital elevation models | 2 | | | 2 | | | **4** | **8** | Creation of a relief of the terrain surface<br>Development of a 3D model of the earth's surface |
| The concept of vegetation indices in GIS | 2 | | | 2 | | | **4** | **4** | Creating a map of vegetation indicators |
| Geostructuring rules | 2 | | | 2 | | | **4** | **4** | Creation of a digital topographic map |
| Using GIS | 2 | | | 2 | | | **4** | | |
| **Total** | **32** | | | **32** | | | **64** | **16** | |

| Assessment strategy | Weight in % | Deadlines | Assessment criteria |
|---|---|---|---|
| Running control 1 | 10 | Week 4 | Computerized test |
| Running control 2 | 15 | Week 8 | Computerized test |
| Running control 3 | 15 | Week 12 | Computerized test |
| Running control 4 | 10 | Week 15 | Annual work protection |
| Final exam | 50 | | Final exam |

| Compulsory literature/ Author | Year of issue | Title | No of periodical or volume | Place of printing. Printing house or internet link |
|---|---|---|---|---|
| Gurbanguly Berdimuhamedow | 2015 | Ösüşiň täze belentliklerine tarap. Saýlanan eserler. 8-nji tom | | Aşgabat: Türkmen döwlet neşirýat gullugy |
| | 2019 | Türkmenistanyň Prezidentiniň ýurdumyzy 2019-2025-nji ýyllarda durmuş-ykdysady taýdan ösdürmegiň Maksatnamasy | | Aşgabat: Türkmen döwlet neşirýat gullugy |
| | 2016 | Paýhas çeşmesi | | Aşgabat: Türkmen döwlet neşirýat gullugy |
| | 2019 | Türkmenistanda Bilim, ylym, saglygy goraýyş, sport we arhiw ulgamlaryny ösdürmegiň 2019-2025-nji ýyllar üçin maksatnamasy | | Aşgabat: Türkmen döwlet neşirýat gullugy |
| Soltanow S. | 2009 | Geoinformasiýa ulgamlary. Ýokary okuw mekdepleri üçin okuw gollanmasy | | Aşgabat: TDKP |
| Allakow M. | 2010 | Geodeziýanyň esasynda topografiýa. Ýokary okuw mekdepleri üçin okuw kitaby | | Aşgabat: Ylym |
| Гурьянова Л.В. | 2009 | Введение в географические информационные системы: пособие для студентов географических факультетов | | Минск: БГУ |
| Гурьянова, Л.В. | 2003 | Аппаратно-программные средства ГИС: курс лекций | | Миынск: БГУ |
| Свидзинская Д.В., Бруй А.С. | 2014 | Основы QGIS | | Киев |
| **Additional literature** | | | | |
| Капралов Е.Г., Кошкарев А.В., Тикунов В.С. и др. | 2004 | Основы геоинформатики. Учебное пособие для студ. вузов в 2-х книгах | | Москва: Академия |
| Ковин В., Марков Н.Г. | 2008 | Геоинформационные системы: учебное пособие. | | Томск: Изд-во Томского политехнического университета |
| Курлович Д.М. | 2013 | Геоинформационные методы анализа и прогнозирования погоды: учебн.-метод. пособие | | Минск.: БГУ |

1. www.turkmenistan.gov.tm
2. www.nicopa.eu
3. www.qgis.org
4. www.qgistutorials.com
5. www.gisinfo.ru
6. www.maps.google.ru

**ANOTATION /course summery**

Recently, geoinformation research has become more widespread in Turkmenistan. Geo-information systems (GMUs) are the main means of solving the problems ahead. These systems are designed to work with large-scale spatial data and address collection, storage, visualization, and analysis.
It serves to teach students how to operate modern geographic information systems (GIS) and to acquire practical skills in using GIS in addressing geographical issues related to environmental and agricultural management, forecasting, modeling, analysis, and inventory.
To develop knowledge, skills and skills on the basis of the theory and practice of geo-information systems in students. The student should learn the rules of operation of the GIS programs of the world's leading companies and get acquainted with their main functionality. This course also explores the most common GIS software. All of this will make it possible for future professionals to address issues that arise.

**List of themes and short description**

| Themes | Contact work hours |
|---|---|
| **The concept of geographic information systems**<br>Introduction. Purpose of the course Geographic information systems. GIS overview. Connection of the course Geoinformation systems with other sciences. Stages of GIS development. | 2 |
| **GIS software**<br>Software companies used in GIS. GIS software concept. Their advantages and disadvantages. Current state of GIS software and development capabilities. The concept of the QGIS program (Quantum GIS). | 4 |
| **The concept of a graphical user interface in QGIS**<br>User graphical interface Main menu bar items. Creation and storage of SHP files. Basic data types. Creation of spatial databases. OGC service. | 4 |
| **Coordinate systems and map projections**<br>Concept of cartographic projections and coordinate systems. Geographic coordinate system. Using cartographic projections and coordinate systems in GIS. Working with projections in QGIS. | 4 |
| **GIS and the Internet**<br>Finding information on the Google Maps website. Finding information in Google Earth, OpenStreetMap, etc. Commercial GIS. Mobile GIS. Working with the Internet in QGIS. | 6 |
| **QGIS Module Concept**<br>Types of modules. Loading and using modules in QGIS. Modules used to calculate calculations. Using the QuickMapServices, QWeather and ImportPhotos modules. Modules used for agricultural purposes. | 4 |
| **GIS and navigation systems**<br>Satellite location systems. Space segment. Control segment. User segment. GPS (USA). GLONASS (Russia). Galileo (European Union). DORIS (France). BEIDOU (China). IRNSS (India). QZSS (Japan). Working with the GPS module in QGIS. | 4 |
| **Spatial data and their scientific basis**<br>GIS data concept. The importance of scale and clarity in space sciences. Vector and raster data, metadata. Cartographic materials. Location remote sensing data. Geodetic technology data. Load the data into QGIS. | 4 |
| **Reception of spatial data in GIS**<br>Expression of features. The main types of reception of geographic objects. Obtaining attributive information. Geographic data collection methods. Storage, processing and management of spatial data. Combining attribute and geospatial data. Acceptance of spatial data in QGIS. | 4 |
| **General methods for representing spatial data**<br>Vector data representation. Symbols. Formation of point, line, field and text objects. Thematic map. The concept of thematic change. Range, chart, point density methods. Separate assessment method. Displaying raster data. Generalization problem. | 4 |
| **Raster model for representing spatial data in GIS**<br>Raster method for digital display of spatial information in GIS. Advantages and disadvantages of the raster model. Spatial reference of raster data and modification of projections. The concept of manual, semi-automatic and automatic vectorization of rasters. Providing data in the QGIS program in the form of a raster model. | 4 |

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| **Vector model of representation of spatial data in GIS**<br>Vector method for digital display of spatial information in GIS. Key vector concepts: point, line, polygon. Display of point objects in GIS. Demonstration of linear objects in GIS. Demonstration of polygonal objects in GIS. Vector data representation in QGIS. | 4 |
| **Digital elevation models**<br>The concept of digital elevation models. Terrain representation in raster, vector and triangulation models. Creation of digital elevation model by triangulation method. Creation of a digital elevation model using the topo-raster method. Cartographic version of digital elevation model. Digital height models. GRID and TIN method for displaying spatial data in QGIS. Hydrological numerical height model. Creation of a hydrological digital elevation model. Automatic selection of drainage basins using a numerical elevation model. | 4 |
| **The concept of vegetation indices in GIS**<br>Calculation and use of vegetation indices NDVI, RVI, SVI. Creation of maps with vegetation indices. Quantification of the result. Determination of the values of the vegetation index at individual points. Assessment of the statistical distribution of the vegetation index in the study areas. Extract from the NDVI index. Create an NDVI map in QGIS. | 4 |
| **Geostructuring rules**<br>Foundations and classification of geostructuring. Comparison of maps. Data display methods. Composition of digital maps. Basics of creating digital maps. Principles of creating digital maps. Rules for creating electronic maps. Generalization of cartographic data. Methods and tools for visualizing geographic data. | 4 |
| **Using GIS**<br>Application of GIS in industrial production. The use of GIS in geology. The use of GIS in the management of public and private property. | 4 |