NAVOI STATE UNIVERSITY

GVG15612 HYDROECOLOGY AND GEOECOLOGY — COURSE SYLLABUS

Faculty of Natural Sciences | Department of Ecology and Environmental Protection

| COURSE PASSPORT & ACADEMIC METADATA

- **Course Title:** Hydroecology and Geoecology (GVG15612)

- **Field of Study:** 600000 – Environmental and Natural Sciences
- **Degree Program:** 60520200 – Ecology and Environmental Protection

  2026–2027

- **Language of Instruction:** Uzbek / Russian
- **Weekly Hours:** 4 hrs/week (Sem 5 & 6)

- **Assessment:** Examination (Assessments and Tests)
- **International Benchmark:** Aligned with QS Top-100 Lomonosov Moscow State University (MSU) and ETH Zurich Curricula

SDG 6: Clean Water and Sanitation



1. Course Description & International Benchmarking
Hydroecology and Geoecology is an interdisciplinary course studying the complex ecological balance between the hydrosphere, lithosphere, and biosphere, the degradation of aquatic ecosystems, geoecological hazards, and methods for their monitoring and management. Benchmarked against leading global universities in QS rankings, this curriculum encompasses sustainable water resources management, geoecological mapping, predictive modeling of climate change impacts on regional ecosystems, and hydrobiocenosis dynamics.

2. Course Aims & Learning Outcomes

- **Course Aim:** To provide students with a theoretical foundation and practical skills in evaluating the geoecological state of aquatic and terrestrial ecosystems, modeling hydroecological processes, preventing water body degradation, and applying practical methods of landscape geoecology.

Knowledge and Understanding:

- Understand biogeochemical cycles in the hydrosphere and lithosphere and the trophic state of water bodies;
- Comprehend principles of geoecological zonation, landscape-geochemical stability, and hazardous geological processes;
- Evaluate qualitative and quantitative parameters of water resources using bioindication and chemical analytical methods.

Practical Skills:

- Perform hydrochemical and geoecological analysis of water and soil samples;
- Construct and analyze geoecological and hydroecological maps using GIS (Geographic Information Systems);
- Determine saprobity levels in aquatic bodies and the composition of hydrobiocenoses using hydrobiological methods.

Practical Competency:

- Conduct geoecological assessment and monitoring of water bodies and regional environments;
- Formulate practical solutions for modern geoecological issues in the Aral Sea basin and the Amu Darya/Syr Darya river basins.

3. Prerequisites & Postrequisites

- **Prerequisites:** General Chemistry, General Physics, Biogeography, Soil Science and Agroecology, Fundamentals of Ecology.
- **Postrequisites:** Environmental Impact Assessment (EIA), Environmental Monitoring, Waste Management, Environmental Expertise.

4. Course Structure & Workload Allocation

Activity Type	Sem 5 Hours	Sem 6 Hours	Total Hours
Lectures	30 Hours	30 Hours	60 Hours
Practical Classes	30 Hours	30 Hours	60 Hours
Laboratory Classes	30 Hours	30 Hours	60 Hours

Independent Study	90 Hours	90 Hours	180 Hours
Total Workload	**180 Hours**	**180 Hours**	**360 Hours (12 ECTS)**

5. Detailed Course Curriculum Outline

5.1. Lecture Syllabus Outline

- **L1: Introduction to Hydroecology and Geoecology:** Subject matter, goals, and role in modern environmental protection.
- **L2: Structure and Functions of Aquatic Ecosystems:** Lenthic and lotic ecosystems, their bionomic and ecological zones.
- **L3: Ecological Groups of Hydrobionts:** Plankton, nekton, benthos, periphyton, and their role in forming water quality.
- **L4: Eutrophication of Water Bodies:** Biofragmentation, nitrogen and phosphorus cycles, cultural eutrophication issues.
- **L5: Fundamentals of Geoecology and Landscape Geochemistry:** Tectonic, geomorphological, and anthropogenic impacts on the lithosphere.
- **L6: Technogenic Geoecological Processes:** Geoecology of mining industries, erosion, and post-erosion technogenic landscapes.
- **L7: Regional Hydroecological and Geoecological Issues:** The Aral Sea disaster, transboundary water management in Central Asia.
- **L8: Geoecological Monitoring and GIS Technologies:** Ecological mapping based on Remote Sensing (RS) and GIS.

5.2. Practical & Laboratory Outline

1. Express-determination of pH, mineralization, and dissolved oxygen levels in water objects.
2. Assessment of saprobity levels in water bodies using bioindicators (Pantle-Buck and Sládeček methods).
3. Investigation of geoecological toxicity levels of heavy metals in soil and groundwater.
4. Hydrochemical analysis of agricultural and industrial runoff wastewater.
5. Construction of geoecological cartographic models for the Kashkadarya and Zarafshan river basins.
6. Generating maps of geoecological hazards and degradation zones in ArcGIS/QGIS software.

5.3. Independent Study Topics

- Analysis and forecasting of the hydroecological status of transboundary rivers in Central Asia.
- Geoecological impact assessment project of mining-industrial complexes in the Navoiy region on surrounding land and water resources.
- Remote sensing monitoring of desertification and salinization processes using GIS technologies.
- Assessment of microplastic distribution in aquatic ecosystems and their geoecological risks to hydrobionts.

6. Recommended Literature & Information Sources

1. **Shukurov E.S., Akbarov H.A.** *Geoecology and Environmental Protection*. Tashkent: Universitet, 2021.

2. **Ergashev A.E., Ergashev T.A.** *Hydroecology and Protection of Water Bodies*. Tashkent: O'zbekiston, 2018.
3. **Allan J.D., Castillo M.M.** *Stream Ecology: Structure and Function of Running Waters*. Springer, 2021.
4. **Pedersen S.A., et al.** *Principles of Hydroecology and Geoecology*. Cambridge University Press, 2020.
5. **International Scientific Databases:** ScienceDirect, Scopus, SpringerLink, USGS HydroSciences Portal.