NAVOI STATE UNIVERSITY

TAY11210 SOIL SCIENCE & AGROECOLOGY — COURSE SYLLABUS

Faculty of Natural Sciences & Medicine | Department of Biology | Program: 60520200 Ecology & Environmental Protection

COURSE PASSPORT & ACADEMIC METADATA

Course Title: Soil Science and Agroecology (TAY11210)

Course Type: Mandatory

Field of Study: 500000 Natural Sciences / 520000 Environment

Program: 60520200 Ecology & Environmental Protection

Academic Years: 2026–2027 (Semesters 1 & 2)

Form of Education: Full-time

Language: Uzbek / English

Total Workload Allocation: 90 Hours Contact (Lectures, Practical, Lab) + Independent Study

Assessment: Examination

Aligned UN SDGs: SDG 2 (Zero Hunger), SDG 15 (Life on Land), SDG 12 (Responsible Consumption)



1. Course Description & Soil Ecosystems

Soil Science & Agroecology covers pedogenesis, soil physical/chemical/biological properties, humus dynamics, soil biota (microflora, microfauna), agro-ecosystem balance, soil salinization, erosion control, pesticide/heavy metal contamination, and organic farming.

In alignment with SDG 2 (Zero Hunger) and SDG 15 (Life on Land), the course trains environmental specialists in soil quality monitoring, land bonitation, agro-ecological forecasting, and sustainable agricultural land management.

2. Course Aims & Professional Competencies

Course Aim: To provide theoretical expertise and field/laboratory competencies in evaluating soil profile morphology, soil fertility maintenance, agroecological monitoring, and land degradation remediation.

- Pedological Competency: Understand soil forming factors, soil profile horizons, soil organic matter (humus) synthesis, soil structure, and water/thermal regimes.
- Agro-Ecological Skills: Assess soil salinization, waterlogging, wind/water erosion, chemical contamination, and pesticide dynamics in agro-ecosystems.
- Laboratory Diagnostics: Determine soil bulk density, porosity, Tyurin humus quantification, aqueous extract salt analysis, heavy metal screening, and available NPK.
- SDG Competencies: Implement sustainable land management (SLM) and organic agriculture practices to preserve soil health for future generations (SDG 2, SDG 15).

3. Prerequisites

Prerequisites: General Ecology (EKO1504), Zoography/Zoology (ZOO13410), Botany (BOT11210).

4. Course Structure & Workload Allocation

Semester / Activity	Contact & Laboratory Focus	Workload Allocation
Semester 1: Pedogenesis & Soil Physics	Lectures, Field Profile & Lab Assays	Contact Hours
Semester 2: Agroecology & Soil Remediation	Lectures, Agro-monitoring & Lab Assays	Contact Hours
Independent Research & Projects	Soil Mapping, Salinization & Organic Farming	Self-Directed Hours
Total Workload (Full Course)	Comprehensive 2-Semester Module	90 Hours Contact + Self-Study

5. Detailed Course Curriculum Outline

5.1 Lecture Syllabus Outline

• **L1: Introduction & Fundamentals of Soil Science:** Scope, historical development, role of soil in global biosphere and food security.

• **L2: Pedogenesis — Soil Forming Factors & Processes:** Parent rock, climate, organisms, relief, time, and human impacts on soil formation.

• **L3: Soil Physical & Mechanical Properties:** Soil texture, bulk density, porosity, structure, aggregate stability, and compaction.

• **L4: Soil Organic Matter & Humus Dynamics:** Humification, Tyurin method, humus composition, and role in soil fertility.

• **L5: Soil Organisms as Ecological Drivers:** Soil microflora (bacteria, fungi, algae), microfauna, edaphic ecological groups.

• **L6: Soil Hydrological, Aeration & Thermal Regimes:** Soil water balance, field capacity, wilting point, soil air composition, and thermal conductivity.

• **L7: Soil Salinization & Reclamation Strategies:** Saline and alkali soils, salt transport mechanics, leaching protocols, and phytomelioration.

• **L8: Soil Erosion & Land Degradation Control:** Water and wind erosion, gully formation, shelterbelts, terracing, and conservation tillage.

• **L9: Soil Geography & Classification of Uzbekistan:** Serozems (grey soils), hydromorphic soils, desert soils, and soil mapping systems.

• **L10: Agro-Ecosystems & Organic Farming:** Agrocenosis stability, eco-friendly crop production, bio-fertilizers (vermicompost), and IPM.

5.2 Practical & Laboratory Outline

- Field profile excavation (full pit, half pit) and morphological horizon identification.
- Measuring soil bulk density, specific gravity, total porosity, and compaction.
- Determining soil aggregate stability and dry/wet sieving structural analysis.
- Quantifying soil organic matter (humus) using Tyurin's dichromate oxidation method.
- Aqueous extract analysis for soil salinity: Total dissolved solids (TDS), chlorides, sulphates.
- Atomic absorption / colorimetric screening for heavy metals in contaminated soils.
- Quantifying plant-available soil nutrients: Nitrate-nitrogen, plant-available phosphorus, and exchangeable potassium.
- Measuring soil transpirational pull and plant heat tolerance under soil moisture stress.
- Formulating agro-technical crop rotation charts and weed management maps.
- Assessing soil microbial biomass and enzymatic activity (dehydrogenase, urease).

5.3 Independent Study & Case Study Tasks

- Preparing a comprehensive report on soil types of Uzbekistan and their ecological vulnerabilities (Sem 1).
- Analyzing negative impacts of technogenic factors and heavy metal pollution on agrocenoses (Sem 1).
- Project proposal: Chemical-free organic crop production and agroecological sustainability (Sem 2).
- Statistical review of soil salinization trends and leaching efficiency in Navoi region (Sem 2).

6. Recommended Literature & Information Sources

- Jurazbayev I.U., Xoljayeva N.J., Qudratov J. Soil Biology and Ecology (Textbook). Samarkand, 2024.
- Hakimov Sh.Z. Agroecology and Soil Reclamation. Qarshi, 2024.

- Tursunov H.X. Soil Science (Study Guide). Tashkent: Universitet, 2017.
- Anderson C. et al. Agroecology: Transforming Food Systems. Academic Press.