NAVOI STATE UNIVERSITY

O‘FZ1606 PLANT PHYSIOLOGY — COURSE SYLLABUS

Faculty of Natural Sciences & Medicine | Department of Biology | Program: 60510100 Biology

COURSE PASSPORT & ACADEMIC METADATA

Course Code: O‘FZ1606

Course Title: Plant Physiology

Course Type: Mandatory (60510100-1.05)

Field of Knowledge: 500000 Natural Sciences, Mathematics & Statistics

Field of Education: 510000 Biological Sciences

Academic Year: 2026–2027

Semester: VI

Form of Education: Full-time

Language of Instruction: English / Uzbek

Total Workload Allocation: 180 Hours Total (90 Classroom Contact Hours: 44 Lectures, 46 Laboratory + 90 Independent Study)

Credits: 6 ECTS

Aligned UN SDGs: SDG 2 (Zero Hunger & Sustainable Agriculture), SDG 13 (Climate Action), SDG 15 (Life on Land & Ecosystem Resilience)







1. Course Purpose & Scientific Objectives

The primary purpose of the course is to provide students with a deep scientific understanding of physiological and biochemical processes occurring in plant cells and tissues, water relations, photosynthesis, respiration, mineral nutrition, phytohormonal regulation of growth and development, and stress physiology.

The course focuses on yield physiology and the physiological adaptation mechanisms of plants to adverse environmental conditions (drought, salinity, temperature extremes).

2. Intended Learning Outcomes (LO)

Upon completing the course, students will master the following competencies:

- LO1–LO3 (Knowledge): In-depth knowledge of plant cell ultrastructure, trans-membrane solute transport, light and dark reactions of photosynthesis (C3, C4, CAM pathways), Hatch-Slack-Karpilov cycle, respiratory catalytic systems, and phytohormones.
- LO4–LO5 (Practical Skills): Practical skill in determining transpiration rates, microscopic observation of plasmolysis/deplasmolysis, isolation of chloroplast pigments via Kraus method, paper chromatography, and evaluating plant response to abiotic stressors.

3. Prerequisites

Prerequisites: Botany (BOT111), Cytology, Histology & Embryology (SGE11208).

4. Course Structure & Workload Allocation

Semester / Academic Activity	Curriculum Focus & Practical Modules	Workload Allocation
Semester VI: Interactive Lectures (M)	44 Hours of Theoretical and Interactive Lectures	44 Contact Hours
Semester VI: Laboratory Work (L)	46 Hours of Practical and Experimental Work	46 Contact Hours
Semester VI: Independent Study	90 Hours of Analytical Projects & Research	90 Hours
Total Workload (O‘FZ1606 Module)	Full 1-Semester Mandatory Course	180 Hours Total (6 ECTS)

5. Detailed Course Curriculum Outline

5.1 Lecture Syllabus Outline

• **M1: Scope, Subject & History of Plant Physiology:** Aims, research methods, historical landmarks, and position in natural sciences.

• **M2: Structural Organization & Functions of Plant Cells:** Physicochemical properties of protoplasm and functional organelle interdependence.

• **M3-M4: Plasma Membrane & Membrane Transport Mechanisms:** Ionophores, diffusion, adenylate system, cell wall structure, and vacuolar transport.

• **M5-M6: Water Relations & Transpiration Dynamics:** Osmosis, suction force, root pressure, guttation, cuticular vs. stomatal transpiration.

• **M7-M9: Photosynthesis Mechanism & Environmental Control:** Chloroplast pigments, light and dark reactions (C3, C4, CAM pathways), Hatch-Slack cycle.

• **M10-M11: Plant Respiration & Bioenergetics:** Respiratory catalytic systems, mitochondrial electron transport chain, oxidative phosphorylation, anoxia.

• **M12-M13: Mineral Nutrition & Solute Transport:** Macro- and microelements, symplastic vs. apoplastic transport, mycorrhiza, nitrogen cycle.

• **M14-M17: Plant Growth, Development & Phytohormones:** Auxins, gibberellins, cytokinins, ethylene, abscisic acid, phytochrome system, photoperiodism.

• **M18: Plant Reproduction Mechanisms:** Microsporogenesis, megasporogenesis, sexual and asexual reproduction in lower/higher plants.

• **M19-M22: Stress Physiology & Pathogen Defense Systems:** Drought, salinity, thermal stress resistance, heavy metal toxicity, phytoalexins, systemic acquired resistance.

5.2 Laboratory & Practical Sessions Outline

- Microscopic observation of plasmolysis, deplasmolysis, and turgor pressure.
- Determining suction force of plant tissue and observing guttation.
- Microscopic observation of stomatal movements.
- Determining water exchange and transpiration rate in woody shoots using a torsion balance.
- Extraction of green leaf pigments (Kraus method) and observing fluorescence.
- Separation and identification of leaf pigments using paper chromatography.
- Effect of light intensity and temperature on photosynthesis rate and oxygen evolution.
- Qualitative and quantitative analysis of ash elements, macro/microelements, and alkaloids in plants.
- Assessing thermal tolerance and cold hardiness of plant cells.

5.3 Independent Study Assignments

- Cellular structures, organelle function, and biochemical composition.
- Osmotic properties of plant cells and water transport mechanisms.
- Light and dark reaction dynamics of photosynthetic pathways.
- Energy metabolism, growth, and development regulation in plants.
- Biological defense mechanisms of plants against pathogens and phytophages.

6. Recommended Literature & Information Sources

- Xo‘jayev J.X. Plant Physiology (Textbook). Tashkent: O‘qituvchi, 2004.
- Beknazarov B.O. Plant Physiology (Textbook). Tashkent: University Press, 2009.
- Taiz L., Zeiger E., Møller I., Murphy A. Plant Physiology and Development (7th Ed.). Sinauer Associates, 2024. (* International Benchmark)
- Abdullayev R.A. et al. Practical Exercises in Plant Physiology. Tashkent, 2004.
- Sagdiyev M.T., Alimova R.A. Plant Physiology. Tashkent, 2007.