



**Department of Biology**

**College of Science**

**University of Salahaddin**

**Subject: Plant Physiology**

**Course Book: Fourth Class**

**Semester: 2<sup>nd</sup> Course**

**Lecturer's name: Assist. Prof. Dr Badr Qader Surchi**

**Lecturers Name: Assist. Lecturer Mahdi Hashim Ibrahim**

**Academic Year: 2023/2024**

## Coursebook

<b>1. Course name</b>	Plant Physiology
<b>2. Lecturer in charge</b>	Dr. Badr Qader Surchi (Theory) Mahdi H. Ibrahim (Practical)
<b>3. Department/ College</b>	Biology/Science
<b>4. Contact</b>	e-mail: badr.surchi@su.edu.krd    Mob. (07504564589) mahdi.ibrahim@su.edu.krd
<b>5. Time (in hours) per week</b>	Theory 2hr. and Practical 2hr./week
<b>6. Office hours</b>	To be returned to the schedule on the office door
<b>7. Course code</b>	
<b>8. Teacher's academic profile</b>	<b>Dr. Badr Qader Surchi CV:</b> B.Sc. in Biology, University of Salahaddin, College of Sciences, 1998. M.Sc. in Plant Biology, University of Salahaddin, College of Sciences, 2006. Ph.D. in Medicinal Plants, Kahramanmaraş Sütçü Imam University, 2018.
	<b>Mahdi H. Ibrahim CV:</b> <b>Education</b> 1- Department of Biology, College of Science, Salahaddin University-Erbil, Erbil, Iraq. MSc in Biology/Plant Physiology 2003-2006 Thesis project: Effects of foliar application of Zinc, GA3 and their interaction on growth and development of pepper plants. 2- Department of Biology, College of Science, Salahaddin University-Erbil, Erbil, Iraq. B.Sc. in Biology 1992-1996 Research project: Effects of light spectra on photosynthesis. <b>Professional Experiences</b> 1- Assistant Lecturer, College of Science, Salahaddin University-Erbil, Erbil, Iraq. 2006- 2022. 2- Biology Assistant, College of Science, Salahaddin University-Erbil, Erbil, Iraq. Feb. 1997 - March 2003 <b>Teaching Experiences</b> 1- Practical Mycology 2- Practical Algae and Archegoniate 3- Practical Plant Physiology 4- Practical General Botany 5- Plant Physiology and Plant growth development (Tishk university)
<b>9. Keywords</b>	Plant, physiology, hormones, growth, photosynthesis

## 10. Course overview:

Plant physiology is the study of how plants function because of a range of variables that can be divided into two categories: abiotic factors and biotic factors. Biologists, ecologists, and agronomists value plant physiology because it directly relates to yields in agriculture, complex industrial processes, and carbon sequestration. The two courses include studying plant structure, growth, development, function, and relation with surrounding living and non-living components. Photosynthesis, respiration, plant hormones, allelopathy, seed germination, and dormancy are some of the main subjects of plant physiology that the student must learn.

## 11. Course objective:

Plant physiology is an excellent way to introduce you to botany. This year, we will examine a wide range of plant-related topics. We will investigate how the plant developed from seed to the mature stage. In each step, all reactions related to plant biology, biochemistry, protein, hormones, and enzyme, will be learned: how plant bodies are built, how plants obtain and transport food and water, and how plants reproduce themselves. The Course covers plant-water relation, photosynthesis, respiration, dormancy, water translocation, plant movement, photoperiodism, plant hormones, seed germination, etc., and many other topics related to plant physiology.

## 12. Student's obligation

\*Exam policy: Student Should take two exams during the Course. There will be no make-up exams for absent students without a medical report.

\*Classroom policies:

- 1- Attendance: Students are strongly encouraged to attend class regularly.
- 2- Lateness: Lateness in class is disruptive
- 3- Electronic devices: All cell phones are to be turned off at the beginning of class and put away during the Course.
- 4- Talking: During class, please refrain from side conversations. These can be disruptive to your fellow students and your professor
- 5- No Disrespectful to both the professor and your fellow students.

## 13. Forms of teaching

Face-to-Face (Lectures and PowerPoint)

#### **14. Assessment scheme:**

The grades scheme is as follows:

##### **Theory %15**

Mid-term exams %10

Activities (Quizzes, Seminars, Reports and Assignments) %5

##### **Practical 35%**

Mid-term exams %15

Quizzes %6

Weekly reports (Results, Discussion, References) %8

Activities (Seminars, Labs, or Fields) %6

**Final examination: 50%**

#### **15. Student learning outcome:**

Students completing the Course will be able to:

1. Realize the importance of plants in the existence and development of humans.
2. Explain how plant physiology deals with plant processes and functions and their response to the environment, and detail the experimental methods by which plant research advances.
3. Understand the structure-function relationships of plant cells.
4. Describe water's unique physical and chemical properties that make it suitable for life.
5. Explain the physical processes that underpin water movement and transpiration in plants and the concept of water potential.
6. Describe how photoassimilates and nutrients are translocated and distributed in plants.
7. Describe the nutritional requirements of plants and nutrient assimilation, with particular emphasis on the roles of nitrogen and sulfur.
8. Explain the major processes of the biochemical nitrogen cycle.
9. Explain how solar energy is trapped by plants and used to synthesize organic compounds.
10. Describe the role of the chloroplast in photosynthesis, detailing both light and carbon reactions.
11. Describe how plant cells grow and overcome constraints on cell expansion.
12. Describe the principal stages of plant development and the kinetics of plant growth.

#### **16. Course Reading List and References:**

- George A. Agrios. (2005). Plant Physiology. 5<sup>th</sup> Ed. Academic Press.
- William G. Hopkins, Norman P. A. Hüner. (2008). Introduction to Plant Physiology. Wiley Publisher.
- Philip Stewart, Sabine Globig. (2012). Plant physiology. Apple Academic Press.
- Maria Duca. (2015). Plant Physiology. Springer International Publishing.
- Taiz L, Zeiger E, Moller I, Murphy A, 2015. Plant Physiology and Development. 6th ed. Sinauer Associates, Inc., Sunderland

<p><b>17. The Topics</b>  Week One  Week Two  Week Three  Week Four  Week Five  Week Six    Week Seven  Week Eight  Week Nine  Week Ten  Week Eleven  Week Twelve</p>	<p><b>The Topics: (Theory part) 2 hrs./week</b>  Introduction to plant physiology  Plant Cells and Water  Mineral Nutrition and Solute Transport  Photosynthesis: The Light Reactions  Photosynthesis: The Carbon Reactions  Respiration  <b>Examination</b>  Primary and Secondary metabolites  Regulation of plant growth and development  Seed Dormancy, Germination, and Seedling Establishment  Vegetative Growth and Senescence  Flowering and Fruit Development  Developmental and physiological mechanisms against environmental stress</p>
<p><b>18. Lab. Lec.</b>  Lab. 1  Lab. 2  Lab. 3  Lab. 4  Lab. 5  Lab. 6  Lab. 7  Lab. 8  Lab. 9  Lab. 10  Lab. 11    Lab. 12</p>	<p><b>The Practical Topics</b>  Introduction of plant physiology.  Plant-water relationship (Diffusion)  Plant-water relationship (osmosis).  Plant-water relationship (permeability)  Seed and seed germination  Photosynthesis I estimation of pigments  Photosynthesis II oxygen production  Respiration  Transpiration  Study of the plant hormone  Study of Developmental and physiological mechanisms against the environment (mineral nutrition)  Study of Developmental and physiological mechanisms against the environment (tropism)</p>
<p><b>19. Examinations: Theory:</b></p>	<p><b>The question chooses the correct answer</b>  1. Why does a cell shrink when placed in saline solution?  (a) The cytoplasm is broken down  (b) Mineral salt will break the cell wall  (c) Water comes out from the cell by osmosis  (d) Water comes out from the cell by exosmosis  Ans. (c) Water comes out from the cell by osmosis</p>

Explanation- Cells shrink as the cytoplasm decomposes when placed in a salt solution. Mineral salts will break the cell wall, causing the cells to shrink. Saltwater enters the cell and breaks the cell. Water comes out of the cell by osmosis, causing it to shrink.

Que 2. When a cell is placed in this solution, it shrinks.

- (a) Hypertonic solutions
- (b) Hypotonic solution
- (c) Isotonic solutions
- (d) Saturated solutions

Ans. (a) Hypertonic solutions

Explanation- If a cell is placed in a hypertonic solution, water will leave the cell, and the cell will shrink.

Que 3. Which of the following is present in the green pigment of the leaf?

- (a) Mg
- (b) P
- (c) Fe
- (d) Ca

Ans. (a) Mg

The explanation-Green pigment of the leaf is called chlorophyll. It has magnesium involved in the structure.

Que 4. Which of the following structures in a plant is responsible for transpiration?

- (a) Xylem
- (b) Root
- (c) Stomata
- (d) Bark

Ans. (c) Stomata

Explanation- It is a process in which excess water is lost in the form of vapours from the aerial parts of the plant, mainly through the stomates of leaves.

Que 5. Does plant cooling occur due to?

- (a) Transpiration
- (b) Guttation
- (c) Photorespiration
- (d) Assimilation

Ans. (a) Transpiration

**Q. Explain the mechanism of Ion Absorption in the plant?**

Ans. The mineral salts remain in the soil solution in dissociated condition. The essential ions are absorbed in different amounts by the root hairs and are then translocated through the xylem stream to the various parts of the plant body. Previously, it was assumed by plant physiologists that inorganic salts were passively absorbed en mass along with water. But at present, it is consistent with the notion that different mechanisms absorb ions. From time to time, various theories have been proposed by different workers to explain the mechanism of ion absorption.

Early workers continuously produced physical mechanisms and models to explain salt absorption. Finally, it has been shown that salt absorption largely depends on metabolic energy, i.e., salt uptake is predominantly active.

There are two primary ion uptake mechanisms—non—mediated and mediated. Like any other body, an ion will move in a given direction only if driven by some force.

Suppose ion transport in and out of cells occurs spontaneously down a gradient of electrochemical potential energy. In that case, it is called passive uptake, and when the ion is driven up such a gradient by some process directly coupled to metabolism, it is called metabolic or active uptake. Non-mediated transport is always passive, whereas mediated transport may be either passive or active.

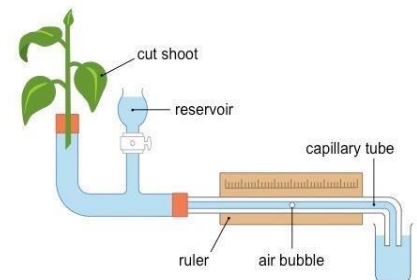
### Why are plants important?

- 1- Plants produce oxygen
- 2- Other species make their homes on, in, and around plants.
- 3- Plants are essential food sources
- 4- Plants clean the air
- 5- Plants help with soil quality
- 6- Plants help regulate the water cycle
- 7- Plants fight against climate change
- 8- Plants are used in many products Plant matter can be found in many everyday products, such as books, toilet paper, furniture, and clothing.
- 9- Plants improve mental health
- 10- Plants are essential to medicine
- 11- The economic importance

### Practical Questions

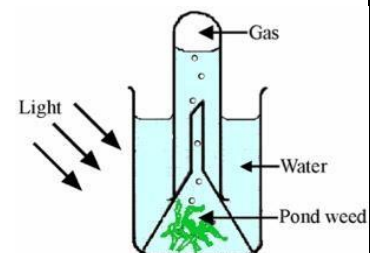
Q1/ depending on the diagram, answer the following questions:

- 1- Write the name of the apparatus.
- 2- Explain why the plant shoot must be cut underwater?
- 3- What are the disadvantages of this experiment? **(only two)**



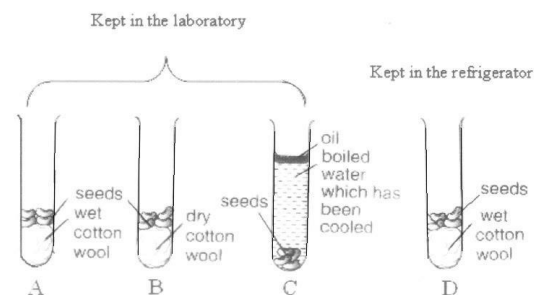
Q2/ look at the diagram and answer the following questions:

- 1- Write the name of the gas?
- 2- Why did we put soda in the water during this experiment?
- 3- What are the advantages of this experiment? **(only two)**



Q3/ look at the diagram and answer the following questions:

- 1- Write the name of this experiment?
- 2- Why do we put oil in tube C?



Q4/ look at the picture and answer the following questions:

- 1- Write the name of the instrument?
- 2- In which experiments do we use it?
- 3- What are the differences between the methods of experiments? (**only one**)



Q5/ look at the picture and answer the following questions:

- 1- Write the name of the apparatus s?
- 2- What is the purpose of using this apparatus?
- 3- Why put **NaCl** solution in a side tube?
- 4- If the result is less than one, what does it mean?



Q6/ Count the following:

- 1- Phases of aerobic cellular respiration.
- 2- Types of transpiration.
- 3- The main complex of the thylakoid membrane.

Q7/ Answer the following:

- 1- What is **chemiosmosis**?
- 2- Define **Coleorhiza**?

Q8/ Write only **on** the difference between the following:

- 1- Transpiration and Guttation.
- 2- Leaf structure of C3 and C4 plants.
- 3- NAD & FAD.
- 4- Epigeous & Hypogeous germination.



**20. Extra notes:**

**21. Peer review** پيداچونھوھى ھاوھل

This course book must be reviewed and signed by a peer. The peer approves the contents of your course book by writing few sentences in this section.

A peer is person who has enough knowledge about the subject you are teaching, he/she must be a professor, assistant professor, a lecturer or an expert in the field of your subject.

ئھم كۆرسبووكە دەھىت لھالېھن ھاوھلئىكى ئھكادىمىھوھ سھىر بكرئت و ناوھرؤكى بابھتھكانى كۆرسھكە پھسھند بكات و جھند ووشھىھك بنووسئت لھسھر شىاوى ناوھرؤكى كۆرسھكە و واژووى لھسھر بكات. ھاوھل ئھو كھسھىھ كھ زانبارى ھھبئت لھسھر كۆرسھكە و دەھبئت پلھى زانستى لھ مامؤستا كھمتر نھبئت.

**Peer reviewed by:**

**Mr. Muhammed Ali Saleem**

**Head of Biology Department**