



**Department of Biology**

**College of Education**

**Salahaddin University-Erbil**

**Subject: Plant anatomy (theory) 2 hr/ week**

**Course Book – (Year: 2)**

**Lecturer's name: Asst.prof. Dr. Zhian Rashid Salih**

**Academic Year: 2022/2023**

# Course Book

<b>1. Course name</b>	<b>Plant anatomy</b>
<b>2. Lecturer in charge</b>	<b>Zhian Rashid Salih</b>
<b>3. Department/ College</b>	<b>Biology Dept./ College of Education</b>
<b>4. Contact</b>	e-mail: zhian.salih@su.edu.krd Tel: ()
<b>5. Time (in hours) per week</b>	<b>(2 theory)</b>
<b>6. Office hours</b>	<b>Approximately 16 hours per week</b>
<b>7. Course code</b>	
<b>8. Teacher's academic profile</b>	<p>I pursuit the biology department, college of education, Salahaddin university in 1989 as assistance biology and awarded an M.Sc. in plant physiology in 1997 and Ph.D. in 2019. Then, I started to work in the same department, as an assistant lecturer. And then upgrading to lecturer in 2005 and assistant professor in 2009. The teaching experience is both theoretical and practical including plant physiology, plant anatomy, plant nutrition, scientific debate, and botany.</p> <p>The researches published are:</p> <ol style="list-style-type: none"> <li>1- The effect of salt stress on leaf water relations, growth, and yield in wheat varieties. Journal of Babylon University, 10 (3), 2005.</li> <li>2- Morphological responses of wheat and lentil crops to ultraviolet radiation, 12(3), 2005.</li> <li>3- Effect of different auxins and type of cuttings on rooting ability of orange (Citrus sinensis L.local Cv.) cutting. Zanco Journal for Pure and Applied Sciences, 19(2), 2007.</li> <li>4- - Effect of Foliar Application of Zinc on Growth, Yield and some Chemical Constituents of Faba Bean (Vicia faba L. sham local CV.). JOURNAL OF DUHOK UNIVERSITY, 10(2), 2007.</li> <li>5- Rooting ability responses of (Olive europaea L. Dugal) to different kinds of auxins and type of cuttings.</li> </ol>

	<p>JOURNAL OF DUHOK UNIVERSITY, 12(1), 2009.</p> <ol style="list-style-type: none"><li>6- Interaction effect of iron and plant growth regulators on growth and chemical components of broad bean plant. Zanco Journal for Pure and Applied Sciences, 1(2), 2010.</li><li>7- Effect of Foliar Application of Boron on Growth, Yield, and Photosynthetic Pigments of Wheat plant (<i>Triticum aestivum</i> L. Rizgarie). 4th international scientific conference of Salahaddin university, 2011.</li><li>8- EFFECT OF FOLIAR APPLICATION OF MAGNESIUM ON GROWTH, YIELD, AND PHOTOSYNTHETIC PIGMENTS OF BARLEY PLANT. First International Scientific Conference of Zakho University, 2013.</li><li>9- Response of barley (<i>Hordeum vulgare</i> L.) plants to foliar fertilizer with different concentration of Hoagland solution. Journal of uloom science-Mosul university, 2014.</li><li>10- Some Physiological Parameters of the Growth of Wheat Plant Soaking with Zamzam and Well Water. First International Scientific Conference of Kirkuk University, 2015.</li><li>11- Effect of foliar and soil application of sulfur on growth, yield, and photosynthetic pigments of the wheat plant. The journal of Raparin university, 2015.</li><li>12- Heavy Metals Accumulation in Leaves of Five Plant Species as a Bioindicator of Steel Factory Pollution and their Effects on Pigment Content. Polish Journal of Environmental studies. Journal With impact factor 1.867, 2019.</li><li>13- Heavy Metal Accumulation in Dust and Workers' Scalp Hair as a Bioindicator for Air Pollution from a Steel Factory. Polish Journal of Environmental studies. Journal With impact factor 1.867, 2020.</li></ol> <p><b>Teaching:</b></p> <p><b>Undergraduate:</b></p> <p>Plant anatomy, plant physiology, botany, plant nutrition, scientific debate.</p> <p><b>Scientific conference and training courses in which I participated are:</b></p>
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	<ol style="list-style-type: none"> <li>1- Teaching method training in 1997.</li> <li>2- Computer training in 2009.</li> <li>3- English language proficiency certificate 2014.</li> <li>4- 4th international scientific conference of Salahaddin University, 2011.</li> <li>5- First International Scientific Conference of Zakho University, 2013.</li> <li>6- First International Scientific Conference of Kirkuk University, 2015.</li> </ol>
<p><b>9. Keywords</b></p>	<p>Plant anatomy, academic profile.</p>
<p><b>10. Course overview:</b></p> <p>The plant anatomy is the branch of botany concerned with the internal structure of plants. Plant anatomy is a division of the more general botanical discipline of plant morphology as it is understood in the broad sense—that is, the study of the microscopic structure of plant tissues and organs. In its narrow sense, plant morphology studies only the external forms of plants and their organs. Plant anatomy is closely related to plant physiology, the science of the vital processes which take place in plants. Plant anatomy, in turn, has given rise to the independent science of cytology, which is the study of the cell, a rapidly developing field that plays a great role in the understanding of vital processes in general and of the phenomena of heredity and mutability in particular.</p> <p>The basic method used in plant anatomy, or the study of internal plant structure, is the preparation of thin slices which are studied microscopically. From this, the science “derives its name (in Greek, anatomē means “dissection”). New research techniques are in use as well—for example, polymerization; ultraviolet, luminescence, and phase-contrast methods; electron microscopy; histochemical methods; and X-ray diffraction analysis. Anatomical research is carried out to answer questions regarding the origin of plants and to provide information about the effect of external conditions on various crops. Such research also helps to solve many problems in fields other than biology and agronomy, such as technology, the history of culture, criminology, and several branches of industry—food, furniture, pharmaceuticals, cellulose-paper production, and so forth. For example, plant anatomy offers a means of detecting the presence of impurities in flour through the use of the microscopic study of starch grains; it can also be used to determine the species and condition of medicinal raw material.</p>	
<p><b>11. Course objective:</b></p> <p>1-To provide students with skills necessary to section and stain fresh plant material in preparation for the study of plant anatomy.</p>	

2-To train students in the proper use of the compound light microscope and to give them experience in interpreting images that they see through the microscope in terms of how plant structure is related to function.

3- To learn About types of tissue – Meristem and Permanent tissue

4. To learn all about primary and secondary growth of stem and root.

5. To learn how different cells and tissue systems are arranged internally by studying the sectional view of stems, roots, and leaves of dicot and monocot plants.

6. To learn the importance of studying plant anatomy.

7. To learn how bark and wood are formed.

8. To learn the importance of wood and cork.

In the past, the chief objects of study in plant anatomy were the vegetative organs (stem, root, and leaf); today, attention is also given to the structure of flowers, fruits, and seeds. Within the field of plant, anatomy is (1) physiological plant anatomy, which is concerned with the links existing between plant structure and internal processes; (2) ecological plant anatomy, which is the study of environmental effects on plant structure; (3) pathological plant anatomy, which is the study of the effect of disease-producing agents of a biological, physical, and chemical character on plant structure; and (4) comparative, or systematic, plant anatomy, which introduces the comparative study of representatives of the different systematic groups (taxa)—species, genera, families, and so forth—for clarification of their phylogenetic bonds.

## 12. Student's obligation

The role of students and their obligations throughout the academic year include:

- A. Quizzes and daily activities.
- B. Discussion.
- C. 1<sup>st</sup> examination
- D. 2<sup>nd</sup> examination
- E. Final examination

## 13. Forms of teaching

In this course different ways are used; this way is characterized by simplicity, and distinct. The best important one is using PowerPoint presentations which give benefits tools for observation statements, diagrams, and pictures.

## 14. Assessment scheme

### No. Exam (Evaluation)

15 theory + 35 practical = 50

Final examination theory =50

**15. Student learning outcome:**

1. Understanding the plant cell and cell wall components.
2. Understanding plant tissues and types of plant tissues.
3. Understanding the internal structure of plant organs.
4. Understanding the differences between dicotyledonous and monocotyledonous root.
5. Understanding the differences between dicotyledonous and monocotyledonous stem.
6. Understanding the differences between dicotyledonous and monocotyledonous leaf.
7. Understanding secondary growth in dicot stem and root.
8. Understanding the healing of wounds.
9. Understanding plant structure in relation to the environment.
10. Understanding the structure of the flowers.
11. Understanding the structure of the fruits.
12. Understanding the structure of seeds.

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

▪ **Key references:**

1. Kurshed, M.Q. (2010). Course Book of plant anatomy for the biology department.
2. David, F. Culter, Ted, B., and Dennis, W. Stevensen. (2007). Plant anatomy, an applied approach.

▪ **Useful references:**

- 1- Charles B. Bech. (2010). An introduction to plant structure and development. 2nd edition. Cambridge University Press.
- 2- David, W.M. (2005). Plant Anatomy and Morphology Reed, Texas A&M University.
- 3- Dickison, W. C. (2002). Integrative Plant Anatomy. Academic Press.
- 4- Evert, R. F. (2006). Esau's Plant Anatomy. Meristems, Cells, and Tissues of the Plant Body: Their Structure, Function, and Development. 3rd edition. John Wiley & Sons, Inc.
- 5- Rudall, P.G. (2007). Anatomy of flowering plants. An Introduction to Structure and Development. Cambridge University Press.

▪ **Magazines and review (internet):**

Plant anatomy, plant tissues, botany, plant components.

**17. The Topics:**

**Date and times**

<p>1- Plant cell components</p> <ul style="list-style-type: none"> <li>-Cell wall (primary cell wall, secondary cell wall)</li> <li>- Plasmodesmata</li> <li>- pits</li> </ul>	
<p>2- Protoplast</p> <ul style="list-style-type: none"> <li>-plasma membrane</li> <li>-nucleus</li> <li>-cytoplasm</li> </ul>	
<p>3- Protoplast</p> <ul style="list-style-type: none"> <li>- mitochondria</li> <li>- ribosome</li> <li>- endoplasmic reticulum</li> </ul>	
<p>4- Protoplast</p> <ul style="list-style-type: none"> <li>- Peroxisome, glyoxisome, lysosomes</li> <li>- Golgi apparatus</li> <li>- Cytoskeleton</li> </ul>	
<p>5- Organelles unique to plants</p> <ul style="list-style-type: none"> <li>- Plastid</li> <li>- vacuoles</li> </ul>	
<p>6- Ergastic cell contents</p> <ul style="list-style-type: none"> <li>- Starch grain</li> <li>- Crystal</li> <li>- Aleurone grain</li> </ul>	
<p>7- Plant tissues</p> <ul style="list-style-type: none"> <li>- types of tissues</li> <li>- meristematic tissues</li> </ul>	
<p>8- Classification of meristematic tissues</p> <ul style="list-style-type: none"> <li>- theories of the shoot and root apex organization</li> </ul>	
<p>9- Permanent tissues</p>	

<ul style="list-style-type: none"> <li>- simple tissues (parenchyma, collenchyma, sclerenchyma)</li> </ul>	
<p>10- Permanent tissues</p> <ul style="list-style-type: none"> <li>- complex tissues (xylem and phloem)</li> </ul>	
<p>11- Secretory tissues</p> <ul style="list-style-type: none"> <li>- Secretory tissues</li> <li>- Glandular tissue</li> <li>- Laticiferous tissue</li> </ul>	
<p>12- Types of tissue system</p> <ul style="list-style-type: none"> <li>- The epidermal tissue system</li> </ul>	
<p>13- Types of tissue system</p> <ul style="list-style-type: none"> <li>- Ground or fundamental tissue system</li> </ul>	
<p>14- Vascular tissue system</p> <ul style="list-style-type: none"> <li>- Types of vascular bundle</li> </ul>	
<p>15- Internal structure of plant organs</p> <ul style="list-style-type: none"> <li>- internal structure of the dicotyledonous stem</li> <li>- internal structure of monocotyledonous stem,</li> </ul>	
<p>16- Internal structure of the dicotyledonous root</p> <ul style="list-style-type: none"> <li>- the internal structure of the monocotyledonous root</li> </ul>	
<p>17- Internal structure of dicot lea</p> <ul style="list-style-type: none"> <li>- internal structure of the monocotyledonous leaf</li> </ul>	
<p>18 - Secondary growth</p> <ul style="list-style-type: none"> <li>- secondary growth in dicot stem,</li> <li>- secondary growth by the vascular cambium</li> </ul>	
<p>19 - Secondary growth in dicot stem</p> <ul style="list-style-type: none"> <li>- Annual ring</li> <li>- Porous and non-porous wood</li> <li>- Heart root and sap root</li> </ul>	
<p>20- secondary growth in dicot stem</p> <ul style="list-style-type: none"> <li>- Secondary growth by the cork cambium</li> <li>- Kind of bark</li> </ul>	

<p>21- Secondary growth in dicot root</p> <ul style="list-style-type: none"> <li>- The activity of vascular cambium</li> <li>- The activity of cork cambium</li> <li>- Healing of wood</li> <li>- Secondary growth in monocotyledons</li> </ul>	
<p>22- Plant structure in relations to the environment</p> <ul style="list-style-type: none"> <li>- Anatomical modification in mesophytes</li> <li>- Anatomical modification in xerophytes</li> <li>- Anatomical modification in hydrophytes</li> </ul>	
<p>23- The structure of flowers</p> <ul style="list-style-type: none"> <li>- Internal structures of flowers</li> <li>- Types of flowers</li> <li>- life cycle of an angiosperm</li> </ul>	
<p>24- The structure of fruits</p> <ul style="list-style-type: none"> <li>- Internal structures of fruits</li> </ul>	
<p>25- The structure of seeds</p> <ul style="list-style-type: none"> <li>- Internal structures of monocot and dicot seeds</li> <li>- External structures of monocot and dicot seeds</li> <li>- Germination</li> </ul>	

**19. Examinations:**

**1- Write the reasons for the following:**

- 1- The lateral roots are endogenous in origin, while the lateral branches of the stem are exogenous in origin.
- 2- The companion cells are closely associated with the sieve tube elements in their origin, position, and function.

**2- Complete the following sentences with suitable words:**

- 1- Types of specialized parenchyma including..... , .....
- 2- Collenchyma is absent in ....., and .....
- 3- The extra-xylary fibers are of five types ....., ....., ....., ....., and .....
- 4- Macrosclerides is .....
- 5- Types of collateral vascular bundle include....., ....., and .....

**3- Write the difference between the following:**

- 1- Libriform fibers and fiber tracheids.

2-Dicot and monocot roots.

4- Draw and labels the following:

- 1- Primary tissue system in leaf (dicot leaf structure).
- 2- Cross-section of monocot stem.

5- Define the following:

- 1- Lysosome.
- 2- Stem cells.
- 3- Fibers.
- 4- Hydathodes

6-Write the origin of the following:

- 1- Cortex.
- 2- Epidermis.
- 3- Secondary cortex (phelloderm).

7-

- A- Write the function of the endoplasmic reticulum.
- B- Write only 4 anatomical modifications in xerophytes.
- C- Count the important role of the vacuole

20. Extra notes:

21. Peer review

The contents of this coursebook include all aspects of the subject plant anatomy and she covered all information and knowledge about this subject.

Signature: