



# UNIVERSITÀ DEGLI STUDI DI PALERMO

|                                     |   |                                 |                  |
|-------------------------------------|---|---------------------------------|------------------|
| <b>DEPARTMENT</b>                   | Scienze Agrarie, Alimentari e Forestali   |                                 |                  |
| <b>ACADEMIC YEAR</b>                | 2023/2024   |                                 |                  |
| <b>BACHELOR'S DEGREE (BSC)</b>      | AGRICULTURAL SCIENCES AND TECHNOLOGIES  |                                 |                  |
| <b>SUBJECT</b>                      | PLANT MORPHOLOGY AND PHYSIOLOGY   |                                 |                  |
| <b>TYPE OF EDUCATIONAL ACTIVITY</b> | A   |                                 |                  |
| <b>AMBIT</b>                        | 50122-Discipline biologiche   |                                 |                  |
| <b>CODE</b>                         | 18803   |                                 |                  |
| <b>SCIENTIFIC SECTOR(S)</b>         | BIO/03  |                                 |                  |
| <b>HEAD PROFESSOR(S)</b>            | MIRABILE GIULIA   | Ricercatore a tempo determinato | Univ. di PALERMO |
| <b>OTHER PROFESSOR(S)</b>           |   |                                 |                  |
| <b>CREDITS</b>                      | 7   |                                 |                  |
| <b>INDIVIDUAL STUDY (Hrs)</b>       | 115   |                                 |                  |
| <b>COURSE ACTIVITY (Hrs)</b>        | 60  |                                 |                  |
| <b>PROPAEDEUTICAL SUBJECTS</b>      |   |                                 |                  |
| <b>MUTUALIZATION</b>                |   |                                 |                  |
| <b>YEAR</b>                         | 1   |                                 |                  |
| <b>TERM (SEMESTER)</b>              | 1° semester   |                                 |                  |
| <b>ATTENDANCE</b>                   | Not mandatory   |                                 |                  |
| <b>EVALUATION</b>                   | Out of 30   |                                 |                  |
| <b>TEACHER OFFICE HOURS</b>         | <b>MIRABILE GIULIA</b><br>Friday      11:00    13:00    Dipartimento Scienze Agrarie, Alimentari e Forestali,<br>Edificio 5, Ingresso C. Tutti gli altri giorni il ricevimento può<br>essere concordato previo appuntamento via mail. |                                 |                  |

DOCENTE: Prof.ssa GIULIA MIRABILE

|                               |   |
|-------------------------------|---|
| <b>PREREQUISITES</b>          | Basic knowledge of the main plants biological processes.  |
| <b>LEARNING OUTCOMES</b>      | <p>Knowledge and understanding.</p> <p>Acquisition of basic knowledge on Plant Morphology and Physiology.</p> <p>Ability to use the specific language of the basic discipline and of other specialized disciplines. Ability to approach the teachings foreseen by the course of study which will use Plant Biology as a knowledge base.</p> <p>Ability to apply knowledge and understanding</p> <p>The student will be able to recognize and make observations on cytological, histological, anatomical and physiological aspects of plants.</p> <p>Judgment autonomy</p> <p>The methodological knowledge and skills provided by the course will be useful for the interpretation of scientific texts and reports, with the possibility of transferring the results to professional activity (forestry sectors, environmental requalification, nature conservation, etc.).</p> <p>Communication skills</p> <p>The course tends to provide the basis for a correct presentation of the concepts of General Botany and Plant Physiology.</p> <p>Learning ability</p> <p>The student will be able to follow related disciplines, as well as in-depth courses and specialist seminars relating to General Botany and Plant Physiology. He will also be able to understand the disciplines of the study plan which will employ the concepts of Plant Biology as a cognitive basis.</p>   |
| <b>ASSESSMENT METHODS</b>     | <p>The evaluation of the learning level will be carried out through 2 tests, an intermediate one (written) and a final one (oral).</p> <p>1) Test in itinere (for attending students) - To facilitate a continuous commitment in students, a written test will be carried out during the course (6 questions relating to the topics covered in Cytology and Plant Histology). Each question will be evaluated with a variable score between 0 and 5 points.</p> <p>2) Final test (for attending students who obtained a score between 18 and 30 in the mid-term exam) - The (oral) exam will be divided into three questions - one of which concerning the mid-term exam - each of which can be evaluated with a score variable between 0 and 10 points. The overall mark, out of thirty, is given by the average of the marks obtained in the two tests.</p> <p>3) Final test (for other students) - The (oral) exam will be divided into five topics, each of which can be evaluated with a score ranging from 0 to 6 points. The following evaluation criteria will be used: a) in-depth and widespread knowledge of the topics proposed, excellent ability to apply the concepts promptly and correctly, excellent analytical and presentation skills (grade 30-29, with "honours" which will be attributed to students who will show complete mastery of the subject); b) in-depth knowledge of the subjects dealt with and ability to apply it to biological phenomena, good ability to summarize and explain the procedures followed (grade 28-26); c) good knowledge of the topics dealt with and ability to connect and apply the contents, good ability to analyze and explain (score 25-22); d) basic knowledge of the main topics dealt with, limited ability to apply the notions to the questions proposed and sufficient description of the procedures followed (score 21-18).</p> |
| <b>EDUCATIONAL OBJECTIVES</b> | The course provides the basic knowledge on the concepts of plant morphology and physiology, aimed at an overall view of the ultrastructure, anatomy and functional aspects of Cormophytes. Therefore, topics relating to Cytology (the plant cell, the nucleus, the cytoplasm, the plastids, the cell wall, the vacuole), Histology (meristematic, parenchymatic, integumental, mechanical, conductor tissues), Organography (root, stem, leaf, flower and fruit) and plant physiology (the transport of water and other substances in the plant; hormones; energy and vital processes; the role of plants in the biosphere; photosynthesis) will be explored.  |
| <b>TEACHING METHODS</b>       | Lectures and laboratory exercises   |
| <b>SUGGESTED BIBLIOGRAPHY</b> | Arrigoni O., 1973 – Elementi di Biologia vegetale. – Casa Editrice Ambrosiana, Milano.<br>Evert R.F. & Eichhorn S.E, 2013 – Biologia delle piante di Raven. – Zanichelli, Bologna.  |

## SYLLABUS

| Hrs | Frontal teaching  |
|-----|---|
| 2   | Introduction to general botany - Structural organization of plants. Autotrophic and heterotrophic organisms. Prokaryotes and eukaryotes.  |
| 2   | Cytology - The plant cell. Protoplasm. Endoplasmic reticulum  |
| 2   | The nucleus. Mitosis. Golgi apparatus. Mitochondria.  |
| 2   | Plastids (classification, ultrastructure and function) - Chloroplasts: origin, role, structure and chemical composition. Proplastids and etioplasts. The amyloplasts. The chromoplasts. |
| 2   | Vacuoles (origin, development and function) - Tonoplast. The vacuolar juice. The osmotic phenomena.   |

## SYLLABUS

| Hrs | Frontal teaching  |
|-----|---|
| 2   | Cell wall (role, biogenesis and chemical composition) - Middle lamella. Primary wall and secondary wall. Wall modifications. Punctuations and plasmodesmata.  |
| 2   | Histology - Cell aggregates. Real and pseudo-tissues. Tissues classification.   |
| 2   | Tissues - Meristematic tissues: apical meristems, meristemoids, lateral meristems (cribro-vascular and phellogenous exchange).  |
| 2   | Tissues - Integumental tissues (epidermal tissue; stomata; hairy coverings). Mechanical tissues (collenchyma and sclerenchyma). Secretory tissues.  |
| 2   | Tissues - Parenchyma (or fundamental) tissues. Conductive tissues.  |
| 2   | Root anatomy - From the apex to the primary structure. Meristematic zone (cap, apical meristems; theories on the organization of meristems). Distension zone. Hair area.  |
| 2   | Root anatomy - Secondary structure zone (cribro-vascular and phellogenous exchange). Secondary xylem. Secondary phloem. Lateral and adventitious roots.   |
| 2   | Stem anatomy - Primary structure zone (epidermis, cortex, collenchyma, sclerenchyma, central cylinder).   |
| 2   | Stem anatomy - Zone of secondary structure (cribro-vascular and phellogenous exchange). Secondary xylem. Secondary phloem.  |
| 2   | Stem anatomy - Zone of secondary structure in Monocotyledons, Dicotyledons and Gymnosperms. Sapwood. Heartwood  |
| 2   | Leaf anatomy - Modifications and adaptations to the environment (dorsoventral and isolateral leaf). Lamina (epidermis, mesophyll, conducting system) and petiole.   |
| 2   | Absorption of water and ascent of raw sap - Imbibition; diffusion; osmosis; plasmolysis. Movement of water from the plant to the atmosphere through the stomata. Stomata physiology. Perspiration.                                  |
| 2   | Ontogenetic cycle of the plant. Fertilization. Meiosis. Embryo formation. Seed development, maturation and accumulation of reserves. Seed germination and seedling development. Annual, biennial and perennial plants.              |
| 2   | Plant growth and development. Hormonal regulation: Auxin, Gibberellic acid, Cytokinins. Ethylene and Absciscic acid. Flowering physiology: photoperiodism and vernalization.  |
| 2   | Photosynthesis chlorophyll (definition and meaning). Photosynthetic requirements: chloroplasts and pigments, absorption of light energy, excitation of atoms or molecules. C3, C4 and CAM plants. Translocation of organic solutes. |
| Hrs | Practice  |
| 2   | Microscope or computer observations (images, slides) of biological samples - Plant cell and cellular organelles (nucleus, protoplasm, endoplasmic reticulum, Golgi apparatus, mitochondria, plastids).                              |
| 2   | Microscope or computer observations (images, slides) of biological samples - Plant tissues.   |
| 2   | Microscope or computer observations (images, slides) of biological samples - The root: function and organization of the root system; comparison between roots of Monocotyledons, Dicotyledons and Gymnosperms.                      |
| 4   | Microscope or computer observations (images, slides) of biological samples - Root anatomy: cross sections of roots (comparisons between Monocotyledons, Dicotyledons and Gymnosperms).  |
| 2   | Microscope or computer observations (images, slides) of biological samples - The stem: modifications and adaptations of the stem to the environment; bulb, rhizome and tuber; structure of the shoot apex.                          |
| 2   | Microscope or computer observations (images, slides) of biological samples - Stem anatomy; cross sections of stems of monocotyledons, dicotyledons and gymnosperms.   |
| 2   | Microscope or computer observations (images, slides) of biological samples - Anatomy of the leaf (dorsoventral and isolateral); lamina (epidermis, mesophyll, conducting system) and petiole.                                       |
| 2   | Microscope or computer observations (images, slides) of biological samples - Flower and fruit.  |
| Hrs | Workshops   |
| 2   | Verification on the topics of Cytology and Plant Histology.   |