BS COURSES REVISED AS PER NEW HEC POLICY

CURRICULAM OF BS BOTANY

Course Code	Course Title	Credit Hours
BOT-301	Cell Biology	3(2-1)
BOT-301	Diversity of Plants	3(2-1)
BOT-302	Fundamentals of Plant Taxonomy	3(2-1)

Course Title: Cell Biology
Course Code: Bot-301
Credit Hours: 3(2-1)
Course Developed by: Dr. Nusrat Parveen and Dr Sohail Akram

Course Objectives

- By the end of this course, students will be able to: Understand the structure, function and molecular organization of plant cell and its organelles.
- Describe the processes of cell division in plants.
- Explain how cells transport materials across cellular membranes.
- Use microscopy to study plant cells.

Course Outline:

I. Introduction to Cell Biology

- Overview of cell biology and cell theory
- Cell types from all life domain i.e. viruses, prokaryotes, eukaryotes
- Importance of cell biology in understanding life

II. Cell Structure, Composition and Function

- Cell wall and support (comparison among bacteria, algae, fungi and plants)
- Cell membrane and transport (comparison among bacteria, plants and animals)
- Cytoplasm and organelles (mitochondria, endoplasmic reticulum, golgi apparatus, ribosomes, Vacuole, chloroplast etc.)
- Nucleus and genetic material
- Cytoskeleton and cell shape

III. Structure and function of Bio-molecules

- Carbohydrates
- Proteins
- Lipids
- Nucleic acids

IV. Cell Division and Growth

- Mitosis and meiosis
- Cell cycle regulation
- Apoptosis and cell death

V. Cellular Transport

- Passive and active transport

VI. Applied Cell Biology

- Applications of cell biology in medicine, agriculture, and biotechnology

Lab Outlines:

1. Understanding Microscope (Magnification power, resolving power), types of microscopes.

2. Study of cell structure using compound microscope

3. Measurement of cell size

4. Cell culture and staining techniques

5. Study of mitosis and meiosis by smear/squash method and from prepared slides

6. Study of chromosome morphology and variation in chromosome number

Books Recommended:

1. Paul C. Bressloff (2021). Stochastic Processes in Cell Biology. Springer Link.
2. Thomas D. Pollard, William C. Earnshaw, Jennifer Lippincott-Schwartz, Graham Johnson (2017). Cell Biology, Elsevier
3. Leland J. Cseke, Ara Kirakosyan, Peter B. Kaufman, Margaret V. Westfall (2011). Handbook of Molecular and Cellular Methods in Biology and Medicine, Third ... CRC Press.
4. William Bechtel (2006). Discovering Cell Mechanisms: The Creation of Modern Cell Biology. Cambridge University Press
5. Ron Milo, Rob Phillips (2005). Cell Biology by the Numbers. Garland Science. Taylor & Francis group.
6. Gary S. Stein, Arthur B. Pardee (2004). Cell Cycle and Growth Control: Biomolecular Regulation and Cancer. John Wiley & Sons.
7. Michele Pagano (1998) Cell Cycle Control. Springer.
8. Terrell L. Hill (1987). Linear Aggregation Theory in Cell Biology. Springer-Verlag.
9. Nuri Akkas (1986). Biomechanics of Cell Division. Springer.
10. Wilfred Stein (1986) Transport And Diffusion Across Cell Membranes. Elsevier.

Renato Baserga (1985). The Biology of Cell Reproduction. Harvard University Press

Course Title: **Diversity of Plants**

Course Code: **BOT-301 (BS 1st semester)**

Credit Hours: **3(2-1)**

Course developed by: **Bazgha Zia**

Course Learning Outcomes: By the end of this course, students will be able to:

- Identify major plant groups.
- Describe the structure, function, reproduction, and adaptation of plants.
- Assess the ecological roles and significance of plant diversity in different habitats.

Course Outlines:

1. Introduction: Brief description of microbes (cyanobacteria, algae, fungi), their significance in plant diversity, key factors responsible for diversity of plants.

2. Bryophytes: General characters, structure, classification, reproduction, importance (ecological role, nutrient cycling, conservation) of bryophytes, adaptations and distribution patterns, and its various types.

- **Mosses:** Sphagnum, Cushion, Feather
- **Liverworts:** Porella, Pellia, Frulania
- **Hornworts:** Anthocerose, Phaeoceros

3. Pteridophytes: General characters, structure, classification, reproduction, importance (ecological, horticulture, medicine) of pteridophytes, adaptations and distribution patterns and its types.

- **Ferns:** (*Nephrolepis exaltata*, *Adiantum*, *Pteridium aquilinum*)
- **Horsetails:** (*Equisetum arvense*, *Equisetum hyemale*)
- **Club Mosses:** (*Lycopodium clavatum*, *Huperzia lucidula*)
- **Quillworts:** (*Isoetes*)
- **Seed habit**

5. Gymnosperms: General characters, Classification, morphology, reproduction, importance (ecological, horticulture, medicine, food) of gymnosperms, adaptations and distribution patterns and its types.

- **Conifers:** (Pinus, Redwood)
- **Cycads:** (Sago palm, Zamia, Dioon)
- **Ginkgo:** (*Ginkgo biloba*)
- **Gnetophytes:** (*Ephedra*, *Gnetum*, *Welwitschia*)

6. Angiosperms: General characters, structure, reproduction, importance (ecological, agriculture, horticulture, medicine) of angiosperms, adaptations and distribution patterns.

- **Monocots**
- **Dicots**

Lab Outlines:

1. Field visits to study the factors responsible for diversity of different plant groups.
2. Identification of various types and organisms mentioned in the syllabus from fresh / preserved specimens and prepared slides.
3. Study of morphology and reproductive structures of the types mentioned in theory (Specimens/prepared slides).

Recommended Books:

1. Chopra, R. N. (2005). *Biology of bryophytes*. New Age International.
2. Della, A. P., & Falkenberg, D. D. B. (2019). Pteridophytes as ecological indicators: an overview. *Hoehnea*, *46*, e522018.
3. Mangla, Y., Khanduri, P., & Gupta, C. K. (2023). *Reproductive Biology of Angiosperms: Concepts and Laboratory Methods*. Cambridge University Press.
4. Meng, H-H., Song, Y-G., (2024). Ecology, Evolution and Diversity of Plants, Mdpi AG.
5. Nlauseth. J.D. (2003). Botany and Introduction to Plant Biology (3rd Ed.) Jones & Bartlett Pub UK.
6. Pandey, B. P. (2001). *A Textbook of Botany: angiosperms*. S. Chand Publishing.
7. Pearson, L. C., (2023). The Diversity and Evolution of Plants, 1st Edition, CRC Press.
8. Prescott, L.M., Harley, J.P. and Klein, A.D. (2004). Microbiology, (3rd Ed.) WM. C. Brown Publishers.
9. Sambamurty, A.V.S.S. (2005). A Textbook of Bryophytes, Pteridophytes, Gymnosperms and Pale botany. l.K. International Pvt. Ltd. New Delhi, Banglore, Mumbai.
10. Sethi, I.K. and Walia, S.K. (2011). Text book of Fungi & Their Allies, MacMillan Publishers Pvt. Ltd., Delhi.
11. Sripathy, K. V., & Groot, S. P. (2023). Seed development and maturation. In *Seed science and technology: Biology, production, quality* (pp. 17-38). Singapore: Springer Nature Singapore.
12. Vashishta, P.C., Sinha, A.K., Kumar, A., (2010). Pteridophyta, S. Chand. Delhi, India.
13. Wertz, J. L., & Perez, S. (2024). *Algae in the Bioeconomy*. CRC Press.

Recommended Journals/ Periodicals: Bryophyte Diversity and Evolution, American Journal of Botany, Phyton, Planta, Flora, Plant Diversity, **American Fern Journal**, Pakistan Journal of Botany, Journal of Phycology, Mycologia, The Bryologist, Journal of Pteridology, Journal of Plant Research

Course Title: **Fundamentals of Plant Taxonomy**

Course Code: **BOT-302 (BS 2nd semester)**

Credit Hours:**3(2-1)**

Course developed by: **Dr Ali Noman**

Course Title: **Fundamentals of Plant Taxonomy**

Course Code: **BOT-302 (BS 2nd semester)**

Credit Hours:**3(2-1)**

Course developed by: **Dr Shagufta Perveen and Dr. Ali Nouman**

Course Learning Outcomes: By the end of this course, students will be able to:

- Understand the principles of plant taxonomy.
- Understand the basics for plant nomenclature, identification, and classification.
- Understand the different systems of classification.
- Use taxonomy to address real-world issues in biodiversity conservation, agriculture, and ecological studies.

Course Outlines:

I. Introduction to Plant Taxonomy: Plants and kingdoms of life, classification, taxonomy and systematics, phylogenetic systematics. scope of plant taxonomy, historical development of plant classification systems, importance of taxonomy in biology, agriculture, and conservation.

II. Plant Nomenclature: Plant nomenclature, need for scientific names, botanical codes, principles of ICN, names of taxa, the type method, author citation, publication of names, rejection of names, principle of priority, names of hybrids, names of cultivated plants, plant identification, plant collection and documentation, herbarium and data information system.

III. Classification Systems: Overview of classification systems: artificial (Carolus Linnaeus), natural (George Bentham and Sir J.D. Hooker) and phylogenetic systems (transitional, international and modern phylogenetic systems), hierarchical categories: species, genus, family, order, class, division, and kingdom, comparative study of different classification approaches.

IV. Description Terminology: Habit and life form, habitat, study of plant morphology, vegetative (roots, stems, leaves) and reproductive structures (flowers, fruits, seeds), key morphological characteristics

used for plant identification, variation and adaptation in plant structures, plant anatomy (wood anatomy, trichomes, epidermal features, leaf anatomy, floral anatomy), embryology, palynology (pollen aggregation, pollen wall and pollen aperture).

V. Plant Identification Tools and Techniques: Types of identification keys: dichotomous, multi-access, and computerized keys, role of herbarium specimens and field guides in plant identification, practical skills in using keys and identifying plant specimens, methods of collecting and preserving plant specimens, documentation, labeling, and curation of herbarium samples, ethical considerations in plant collection and conservation.

VI. Major Plant Families and Their Characteristics: Introduction to major families of pteridophytes, gymnosperms and angiosperms, diagnostic features and identification of common species within each family.

VII. Applications of Plant Taxonomy in Various Fields: Role of taxonomy in biodiversity conservation and environmental management, applications in agriculture, horticulture, and medicinal plant research, case studies of how taxonomy informs ecological studies and conservation efforts

Lab Outlines:

- ✓ Technical description of local plants and families along with plant identification.
- ✓ Plant collection, documentation and preparation of herbarium.
- ✓ Preparation of identification keys for at least 10 specimens based on morphological features.
- ✓ Field trips within the campus and across the country; compilation of field notes

Recommended Books:

1. Festscrift P. (2021). Plant Taxonomy Past, Present, and Future. nhbs Publishers. TERI India
2. Judd, W. S., C. S. Campbell, E. A. Kellogg, P. F. Stevens, and M. J. Donoghue. (2008). Plant Systematics: a phylogenetic approach. Third edition. Sinauer Inc., Sunderland, MA.
3. Judd, W.S., Campbell, C.S, Kellogg, E.A., Stevens, P.A. and Donoghue, M.J. (2016). Plant Systematics: A Phylogenetic Approach. Sinauer Associaes, Inc., Massachusetts.
4. McSteen and Kellogg (2022) Molecular, cellular, and developmental foundations of grass diversity. Science, 377(6606), 599-602.
5. Pandey AK, Kasana S. Plant Systematics. (2021). Ist Edition CRC Press.
6. Patil DA. (2021). Plant Taxonomy Theory,Principles & Parctices. Ist Edition. Scientific Publishers, India
7. Peruzzi, L., (2023). Advances in Plant Taxonomy and Systematics. MDPI, Basel, Beijing, Tokyo.
8. Simpson, M. G. (2019). Plant Systematics. India: Elsevier Science.
9. Singh G. (2019). Plant Systematics: An Integrated Approach, Fourth Edition CRC Press.
10. Stuessy, T.F. (2009). Plant Taxonomy: The systematic Evaluation of Comparative Data. Columbia University Press, New York.

Recommended Journals/ Periodicals: American Journal of Botany, Botanical Journal of the Linnean Society, Taxon, Phyton, Planta, Flora, Plant Systematics, South African Journal of Botany, Plant Diversity, Pakistan Journal of Botany.