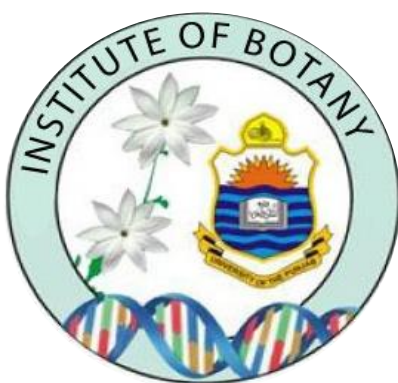
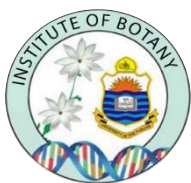


CURRICULUM
OF
BOTANY
Associate Degree Program
(For Affiliated Colleges)



INSTITUTE OF BOTANY
UNIVERSITY OF THE PUNJAB
LAHORE (PAKISTAN)



INSTITUTE OF BOTANY
UNIVERSITY OF THE PUNJAB, LAHORE

CONTENTS

Sr. No.	Item	Page
1	Introduction	2
2	Program mission, Objective and Outcomes	3
3	Program Objective	4
4	Detailed outline of courses BS (4-year program) 1st to 8th semester	09 - 26
7	Detailed outline of courses of special subjects (SS)/ elective subjects (ES)	46 - 91

Supervised by: **Dr. Najam ul Sehar Afshan**
Coordinator, BS program

(Prof. Dr. Abdul Nasir Khalid)
Convener BOS Botany

<u>Program Title:</u>	Associate Degree Program
<u>Department:</u>	Institute of Botany
<u>Faculty:</u>	Faculty of Life Sciences
<u>Paper Code:</u>	NBOT-110

1. **Mission of the Institute**

Our mission is to impart concept-based education in various areas of Plant Sciences together with inculcating a problem-solving approach in research to produce top quality scientists and teachers, capable of playing a useful role in society. We are trying to deliver the youth the latest knowledge in Plant Sciences, incorporating modern trends. It is our hope and belief that our students master the analytical and methodological skills required to evaluate and conduct research in their areas of specialization. We intend to create and demonstrate an ability in the students to work effectively with other people from various ethnic, educational, and work experience backgrounds.

2. **Introduction of the Institute**

The Institute of Botany, University of the Punjab, Lahore is the oldest in the country and has produced many distinguished scholars ever since its establishment in 1924. Initially it was housed in the premises of Government College, Lahore and M.Sc. teaching was conducted jointly by the staff of Government College, Lahore and the University of the Punjab, Lahore. The Institute moved to the Quaid-e-Azam Campus in 1963 and was housed in various buildings until its present building was constructed in 1973. The whole faculty (03 Professors, 03 Associate Professors, and 09 Assistant Professors) is actively engaged in teaching and research activities. The Institute is known for its outstanding research in major areas of plant sciences. Until the year 2000, the Institute was running only the regular two-year M.Sc. degree program in the Annual System of examination. The B.Sc. Honors (3 year) and M.Sc. Honors (2 year) programs were launched in the year 2001 in the semester system. The regular M. Phil and Ph.D. programs were also started in the department in the year 2001, Ph.D. in the semester system and M.Phil in the semi-annual (term) system. In the year 2005, B.Sc. (Hons.) and M.Sc. (Hons.) programs were converted to B.S. (4 year) and M.S. (2 year) programs and M.Phil/M.S. leading to Ph.D. programs were also introduced in the Semester System of examination. Each year students in all courses are inducted in the fall semester commencing in September. Currently BS, M.Sc., MS/M.Phil and Ph.D. Programs are being run in the department. At present, there is one auditorium (for seminars, Ph.D. defense and other academic activities), four moderately sized and seven small lecture rooms for regular classes. There are five general laboratories and one central resource laboratory which are moderately equipped. The Institute has eleven research laboratories according to subject specialization with an elaborate research program involving national and international collaborations with academia, industry and government organizations. Currently, many research projects are being run by the faculty members. The Institute has a Library, Computer laboratory, a Common Room, Herbarium, Botanical Garden, Seed Centre, Greenhouses and Climatic rooms for research experiments. Since its establishment in 1924, as Department of Botany, it has played a leading role at national level by producing active and trained teachers and researchers.

3. **Program Introduction**

Knowing about plants is fundamental to keeping a sustainable biosphere, as well as, securing well-being of mankind on long term basis. Getting knowledge and doing research on plant's visual appearance, growth, evolution, breeding, utilization and environmental interactions is highly important. Studying Botany can help one excel in the basic disciplines such as, Anatomy, Biochemistry, Biophysics, Bryology, Cytology, Ecology, Genetics, Lichenology, Molecular Biology, Microbiology, Morphology, Mycology, Paleobotany,

Pteridology, Phycology, Physiology, Systematics, Systems Ecology and Taxonomy. poverty. The Associate Degree is a two-year post-intermediate or equivalent academic degree to be awarded by public & private Universities/DAIs. The concept behind introducing the associate degree program is to offer a skilled based degree. Associate degree is offered primarily in market driven subjects based on local and regional community and industry needs to be determined through a comprehensive survey to be carried out by the University/Institution concerned. The main objective of this program is to produce trained manpower with the trait of independent thinking, that can play a leading role in teaching, research, industry, forestry, research organizations etc. This program is a blend of theoretical and practical knowledge to equip students with current data in their particular field. This Program is being offered at the affiliated colleges.

4. Program Objectives

The educational objectives of the Associate degree program are to produce graduates who are able to:

- Specialize at least one sub-discipline of Botany
- Keep current with the latest advancements in the various fields of Botany
- Possess a good moral and ethical character
- Pursue graduate studies leading to graduate degree
- Define and diagnose research problems in the various fields of Botany and implement solutions
- Communicate effectively with technically and professionally diverse audiences
- Master the analytical and methodological skills required to evaluate and conduct research in their area of specialization.
- Demonstrate an ability to work effectively with other people from various ethnic, educational, and work experience backgrounds.

5. Market Need / Rationale of the Program

Basic and applied research is a continuum and they are inter-dependent. Whether at basic or applied level, the study of plants stands central amongst several disciplines. Institute of Botany is playing its role in disseminating knowledge and doing research on different aspects of plant sciences. This degree program will enable the students to professionally excel in the field of Plant Sciences through meeting today's market requirements. Job opportunities usually depend upon educational training and experience. New positions in Botany are expected to increase at an above-average rate in next few decades. Growing world population continues to increase the need for better food supplies. Environmental concerns, such as air, water and soil pollution, will create openings for Ecologists in government and industry. The search for new drugs and medicines and useful genes for improving crop plants will continue to create a need for botanical explorers. Further entrepreneurial initiatives are also likely to be seen in the near future as this particular aspect is also the current focus of the teaching faculty at the Institute of Botany.

a) Scope

i. Public Sector:

- Public Sectors Departments
- School, Education Departments/Programs
- Research and Teaching Institutes
- International Organizations: UNICEF, UNDP, WHO, FAO, World Bank
- Non-Governmental Organizations
- Community Development Program

- Motivational speaker
- ii. **Private Sector:**
 - Multinational Companies
 - Independent Private Practice
 - Forestry Department
 - Food Industries
 - Pharmaceuticals Industry
 - Hospitality industry
 - Private Companies and Hospitals
- iii. **Foreign Countries:**
 - Public Departments in Middle East, Europe etc.
 - Independent Private Practices
- 6. **Admission Eligibility Criteria**
 - As provided by the University
- 7. **Duration of Degree Program**
 - Minimum duration 4 Years
 - Total number of Credit hours (Flexible from 124-137)
 - Semester duration 16-18 weeks
 - Semesters 8
 - Course Load per Semester 12-18 Cr hrs
 - Number of courses per semester 4-6
- 8. **Assessment Criteria**
 - Sessional Work: 25 marks
 - Midterm Exam: 35 marks
 - Final Exam: 40 marks

THEORY:**Introduction of the Course:**

The course is organized to provide an adequate knowledge about different plant groups with their representatives along with their Taxonomy, Morphology, Anatomy, Biochemistry, Genetics, Physiology and Ecology. It is generally aimed to familiarize students with the morphological and systematic knowledge of different plant groups, their evolution and Economic importance.

Course Objectives:

The course is designed:

1. To provide an adequate knowledge about basic concepts of different plant groups and their morphological/anatomical characteristics.
2. To give an insight into plant cell structure with an emphasis on their Biochemistry, Genetics and Evolution.

Contents:**1. Plant Diversity:**

- 1.1. General account of plant structures including morphology, habitat and reproduction of different plant groups including Viruses (TMV), Bacteria (including Cyanobacteria), Algae, Fungi, Lichens, Bryophytes, Pteridophytes, Gymnosperms and Angiosperms (Dicots and Monocots), their general characteristics with representative types/examples.

2. Plant Taxonomy:

- 2.1. Binomial Nomenclature with an Introduction to International Code of Botanical Nomenclature (ICBN).

3. Morphology/Anatomy:

- 3.1. Structure of plant cell
- 3.2. Simple Tissues (Parenchyma, Collenchyma, Sclerenchyma)
- 3.3. Complex Tissues (Xylem, Phloem)
- 3.4. Morphological and Anatomical Structure of Root, Stem, Leaf and Flower

4. Cell Biology:

- 4.1. Brief description of different Cellular Organelles with special emphasis on Chloroplast and Mitochondria.

5. Biochemistry & Genetics:

- 5.1. Brief description of Biomolecules (Carbohydrates, Lipids, Proteins, Structure and function of Nucleic Acids)
- 5.2. Mitosis and Meiosis
- 5.3. Mendelian inheritance
- 5.4. Linkage and crossing over
- 5.5. Sex linked inheritance

6. Plant Physiology & Ecology:

- 6.1. Mechanism of Transpiration
- 6.2. Mechanism of Photosynthesis
- 6.3. Mechanism of Respiration
- 6.4. Ecosystem and its components
- 6.5. Biogeochemical cycles
- 6.6. Food Chain and Food Web

7. Evolution

8. Economic importance of plants

Practicals:

1. Study and staining (where applicable) of some representative types (Bacteria/ Cyanobacteria/Algae/Fungi).
2. Identification of representative types of plant groups mentioned in the course from fresh / preserved specimens and prepared slides.
3. Study of cell structure using compound microscope and measurement of cell size.
4. Study of mitosis by smear/squash method and from prepared slides.
5. Study of Transverse Section of Stem/Root and Leaf of Angiosperms.
6. Extraction of Chlorophyll from the leaves and separation of Component Pigments on a Paper Chromatogram.
7. Measurement of Vegetation by Quadrat and Line Intercept Methods.
8. Extraction and estimation of Biomolecules (Carbohydrates/Proteins/Lipids).
9. Field surveys to study and observe/collect representative members of various plant groups mentioned in syllabus.

Teaching-learning Strategies

1. Lectures
2. Group Discussion

3. Laboratory work
4. Seminar/ Workshop

Learning Outcome:

1. Students are expected to get familiarized with the morphological and systematic knowledge about different plant groups.
2. They will be able to describe, apply and integrate the basic concepts of Cell Biology including Genetics and Evolution, Biochemistry, Physiology as well as Structure and Functions of different Organelles.
3. This will enable them qualify for basic to moderate level jobs involving knowledge of plants and their environment.
4. The obtained knowledge shall also enable the students to enter into various entrepreneurial activities involving general introduction to botany.

Assessment Strategies:

1. Lecture Based Examination (Objective and Subjective)
2. Assignments
3. Class discussion
4. Quiz
5. Tests

Recommended Readings:

1. Bretscher, A. (2007). *Molecular Cell Biology*. W. H. Freeman and Company.
2. Campbell, N. A., Reece, J. B., Taylor, M. R and Simon, E. J. (2008). *Biology: Concepts and Connections*, (6th Ed.), Benjamin Cummings.
3. Esau, K. (1960). *Anatomy of Seed Plants*. John Wiley, New York.
4. Fahn, A. (1990). *Plant Anatomy*. Pergamon Press, Oxford.
5. Jones, R. L., Ougham, H., Thomas, H., Waaland, S. (2012) *The Molecular Life of Plants*, Wiley Blackwell, ISBN: 978-0-470-87011-2012.
6. Karp, G. (2002). *Cell and Molecular Biology. Concepts and Experiments*. John Wiley and Sons. New York.
7. Lee, E. R. (2007). *Phycology*. (4th Ed.) Cambridge University Press, U.K.
8. Mauseth. J. D. (2003). *Botany: An Introduction to Plant Biology*. (3rd Ed.) Jones & Bartlett Pub.,UK.
9. Niklas, K. J. (2016). *Plant Evolution: An introduction to the history of life*. Chicago; London: The University of Chicago Press, 566 pp.
10. Prescott, L. M., Harley, J. P. and Klein, A. D. (2004). *Microbiology*, (3rd Ed.) W. M. C. Brown Publishers.
11. Reece, J. B., Urry, L. A., Cain, M. L and Wasserman, S. A. (2010). *Campbell Biology*, (9th Edition), Benjamin Cummings.
12. Sambamurty, A. V. S. S. (2005). *A Textbook of Bryophytes, Pteridophytes, Gymnosperms and Paleobotany*. I.K. International Pvt. Ltd. New Delhi, Bangalore, Mumbai. 573 pp.
13. Schultz, E. (2005). *Plant Ecology*. 2nd Ed. Springer-Verlag, Berlin.

14. Smith, R. L. (2002). *Ecology and Field Biology*. Harper and Row Publishers, New York.
15. Strickberger, M. W. (1985). *Genetics*, (3rd Ed.), Macmillan publishers.
16. Taiz, L., Zeiger, E., Møller, I. M. and Murphy A. (2015). *Plant Physiology and Development*, (6th Ed.), Sinauer Associates Inc., Sunderland MA. ISBN: 0-87893-831-1, 700pp.
17. Webster, J. and Weber, R. (2007). *Introduction to Fungi*. Cambridge University Press.
