

Punyashlok Ahilyadevi Holkar Solapur University, Solapur



Name of the Faculty: Science & Technology

CHOICE BASED CREDIT SYSTEM

Syllabus: Botany

Name of the Course: B.Sc. I Sem. I & II (Liberal Science)

(Syllabus to be implemented from June 2022)



Punyashlok Ahilyadevi Holkar Solapur University, Solapur

B. Sc. First Year (Liberal Science) Semester- I

Core Course: BOTANY (Paper-I)

Teaching Scheme:

Lectures – 3 Hours/week, 2 Credits

Practical – 4 Hours/week, 4 Credits

Examination Scheme:

UA – 40 Marks

CIE – 10 Marks

About Course:

The objective of any programme at Higher Education Institute is to prepare their students for the society at large. The PAH Solapur University envisions all its programmes in the best interest of their students and in this endeavour it offers a new vision to all its Under-Graduate courses. It imbibes a Learning Outcome-based Curriculum Framework (LOCF) for all its Under Graduate programmes.

The LOCF approach is envisioned to provide a focused, outcome-based syllabus at the undergraduate level with an agenda to structure the teaching-learning experiences in a more student-centric manner. The LOCF approach has been adopted to strengthen students' experiences as they engage themselves in the programme of their choice. The Under-Graduate Programmes will prepare the students for both, academia and employability.

Each programme vividly elaborates its nature and promises the outcomes that are to be accomplished by studying the courses. The programmes also state the attributes that it offers to inculcate at the graduation level. The graduate attributes encompass values related to well-being, emotional stability, critical thinking, social justice and also skills for employability. In short, each programme prepares students for sustainability and life-long learning.

The new curriculum of B.Sc. (Hons) Botany offer essential knowledge and technical skills to study plants in a holistic manner. Students would be trained in all areas of plant biology using a unique combination of core and elective papers with significant inter-disciplinary components. Students would be exposed to cutting-edge technologies that are currently used in the study of plant life forms, their evolution and interactions with other organisms within the ecosystem. Students would also become aware of the social and environmental significance of plants and their relevance to the national economy.

- 1) Introduction: This course includes four papers Paper I: Microbiology & Phycology Paper II: Fungi & Archegoniate Paper III: Plant ecology & Paper IV: Taxonomy of Angiosperms. Each paper consists of two units. All these papers help students to improve their basic knowledge about microbes, algae, fungi, ecology, and Taxonomy.
- 2) Advantages of Course: All these papers will be helpful to improve their skills in microbiology field, identification of algae, fungi, and different plant species their ecological & medicinal importance. Practical based on these papers will be helpful to develop skills & understanding all the basic loopholes in every technique. These papers act as baseline to their next year studies.

Course Prerequisite:

Student shall have knowledge of Botany

Preamble**Course Objectives:**

- 3) Objectives of the Course: To get the knowledge about the characters, structure, and economic importance of viruses. Knowledge about the forms, size, and diversity of bacteria and about the Mycoplasma, knowledge about the characters, classification, and economic importance of algae. To get the knowledge about the general characters, occurrence, classification, thallus organization & reproduction of Cyanophyta division along with the example Nostoc, of Chlorophyta division along with the example Spirogyra. To get the knowledge about characters, mode of nutrition & classification of the true fungi. To get the knowledge about the fungal division Zygomycota, Ascomycotina, To get knowledge about introduction & general characters of Archegoniate get the knowledge about the Bryophytes with suitable example, get the knowledge about the Pteridophytes with suitable example, get the knowledge about the Gymnosperms with suitable example. To get the knowledge about the climatic and edaphic factors of environment, ecological adaptations, the forms & structure of community along with qualitative and quantitative characters of community, To get the knowledge about introduction, components of ecosystem, ecological pyramids with food chain and food webs, about the ecological succession, To get knowledge about different concepts in taxonomy understand different classification systems and its merit & demerits, understand

identification methods, nomenclature, principles and rules of ICBN, technique of herbarium preparation and its significance, study morphological & reproductive characters of families.

Course Outcomes:

1. Fascinating world of Microbes and Plants.
 2. Hands on Training will help students learn use of microscope, mounting, section-cutting and staining techniques for the study of plant materials.
 3. Making Drawings in Practical Records will enhance understanding morphological and structural details and related functional aspects in diverse plant groups.
 4. Use of Illustrations, Photographs, Charts, Permanent Slides, Museum and Herbarium Specimens along with ICT Methods will provide an interesting insight into the beautiful world of microbes and plants.
 5. Scope of Biodiversity includes Medicinal field, Industry, Agriculture, Research and Study, Job Opportunities and Environmental Conservation. This paper is both informative and interesting and will enable students to learn about Biodiversity not only as a plant or nature lover, but also for higher academic pursuits, particularly in the field of Biological Sciences, Environment and Biodiversity Conservation.
 6. The relationship between the properties of macromolecules, their cellular activities and biological responses.
 7. Understanding of Cell metabolism, chemical composition, physiochemical and functional organization of organelles.
 8. Contemporary approaches in modern cell and molecular biology.
 9. Understand how plant sciences and microbiology is applied in manufacturing of industrial products
 10. Know about design of bioreactors, factors affecting growth and production
 11. Comprehend the techniques and the underlying principles in upstream and down- stream processing
 12. Learn the occurrence, abundance and distribution of microorganism in the environment and their role in the environment and also learn different methods for their detection
 13. Understand various biogeochemical cycles – Carbon and Nitrogen, and microbes involved.
 14. Understand the basic principles of organism and environment interaction and application of the same in solving environmental problems – waste water treatment and bioremediation
 15. Learn the basic concepts, principles and processes in plant biotechnology.
 16. Have the ability of explanation of concepts, principles and usage of the acquired knowledge in biotechnological, pharmaceutical, medical, ecological and agricultural applications.
 17. Use basic biotechnological techniques to explore molecular biology of plants Explain how biotechnology is used to for plant improvement and discuss the biosefty concern and ethical issue of that use.
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Punyashlok Ahilyadevi Holkar Solapur University, Solapur

B. Sc. First Year (Liberal Science) Semester-I

Core Course: BOTANY (Paper-I)

Paper No-I: Microbiology & Phycology

Teaching Scheme:

Lectures – 3 Hours/week, 2 Credits

Practical – 4 Hours/week, 4 Credits

Examination Scheme:

UA – 40 Marks

CIE – 10 Marks

Unit 1: Introduction of Microbiology

Objective: To get the knowledge about the basic concepts in microbiology

Outcome: The student can understand the basic concept of microbiology:

Microbes

Objective: To get the knowledge about the characters, structure, and economic importance of viruses. Knowledge about the forms, size, and diversity of bacteria and about the Mycoplasma.

Outcome: The student can understand in detail about the viruses, diversity of bacteria and about the Mycoplasma

Unit 2 : Phycology

Objective: To get the knowledge about the characters, classification, and economic importance of algae

Outcome: The student can understand importance of algae

Cyanophyta

Objective: To get the knowledge about the general characters, occurrence, classification, Thallus organization & reproduction of Cyanophyta division along with the example *Nostoc*.

Outcome: The student can understand in detail about the division Cyanophyta along with example of *Nostoc*.

Xanthophyta

Objective: To get the knowledge about the general characters, occurrence, classification, Thallus organization & reproduction of Cyanophyta division along with the example *Vaucheria*.

Outcome: The student can understand in detail about the division Cyanophyta along example of *Vaucheria*

Chlorophyta

Objective: To get the knowledge about the general characters, occurrence, classification, Thallus organization & reproduction of chlorophyta division along with the example *Nostoc*.

Outcome: The student can understand in detail about the division chlorophyta along with example of *Spirogyra*

Rhodophyta

Objective: To get the knowledge about the general characters, occurrence, classification, Thallus organization & reproduction of chlorophyta division along with the example *Polysiphonia*.

Outcome: The student can understand in detail about the division chlorophyta along example of *Polysiphonia*



Punyashlok Ahilyadevi Holkar Solapur University, Solapur

B. Sc. First Year (Liberal Science) Semester-I

Core Course: BOTANY (Paper-II)

Paper- II Fungi and Archegoniate

Teaching Scheme:

Lectures – 3 Hours/week, 2 Credits

Practical – 4 Hours/week, 4 Credits

Examination Scheme:

UA – 40 Marks

CIE – 10 Marks

Unit 1: Fungi

Objective: To get the knowledge about characters, mode of nutrition & classification of the true fungi.

Outcome: The student can understand about the general introduction of true fungi.

Zygomycotina

Objective: To get the knowledge about the fungal division Zygomycotina

Outcome: The student can understand about division of Zygomycotina.

Ascomycotina

Objective: To get the knowledge about the fungal division Ascomycotina.

Outcome: The student can understand about the division of Ascomycotina

Unit 2: Archegoniate

Objective: To get Knowledge about Introduction & general characters of Archegoniate

Outcome: The student gets a detailed idea about Archegoniate

Bryophytes

Objective: To get the knowledge about the Bryophytes with suitable example

Outcome: The student can understand about the Bryophytes and life cycle of *Riccia* with its economic importance.

Pteridophyta

Objective: To get the knowledge about the Pteridophytes with suitable example.

Outcome: The student can understand about the Pteridophytes and life cycle of *Selaginella* with its economic importance.

Gymnosperms

Objective: To get the knowledge about the Gymnosperms with suitable example.

Outcome: The student can understand about the Gymnosperms and life cycle of *Cycas* with its economic importance.



Punyashlok Ahilyadevi Holkar Solapur University, Solapur

B. Sc. First Year (Liberal Science) Semester-II

Core Course: BOTANY (Paper-III)

Paper No. III Plant Ecology

Teaching Scheme:

Lectures – 3 Hours/week, 2 Credits

Practical – 4 Hours/week, 4 Credits

Examination Scheme:

UA – 40 Marks

CIE – 10 Marks

Unit 1: Introduction

Objective: To get the knowledge about the climatic and Edaphic factors of environment

Outcome: The student can understand about the Climatic and Edaphic factors of environment.

Ecological Adaptations

Objective: To get the knowledge about the ecological adaptations.

Outcome: The student can understand about the ecological adaptations in plants.

Unit 2: Plant communities

Objective: To get the knowledge about the forms & structure of community along with qualitative and quantitative characters of community.

Outcome: The student can understand about the plant communities

Ecology

Objective: To get the knowledge about introduction, components of ecosystem, ecological pyramids with food chain and food webs.

Outcome: The student can understand about the concepts of ecology

Ecological succession

Objective: To get the knowledge about the ecological succession

Outcome: The student can understand about the ecological succession



Punyashlok Ahilyadevi Holkar Solapur University, Solapur

B. Sc. First Year (Liberal Science) Semester-II

Core Course: BOTANY (Paper-IV)

PAPER IV: Taxonomy of Angiosperms

Teaching Scheme:

Lectures – 3 Hours/week, 2 Credits

Practical – 4 Hours/week, 4 Credits

Examination Scheme:

UA – 40 Marks

CIE – 10 Marks

Unit 1: Introduction

Objective: To get knowledge about different concepts in taxonomy

Outcome: The student can understand about importance of taxonomy

Classification

Objective: To understand different classification systems and its merit & demerits

Outcome: The student can understand about classification systems in taxonomy

Unit 2: Identification and nomenclature

Objective: To understand Identification methods, Nomenclature, Principles and Rules of ICBN

Outcome: The student can understand different methods of classification and rules of nomenclature

Herbarium and Botanical Garden

Objective: To understand technique of herbarium preparation and significance

Outcome: The student can understand technique and botanical gardens in India

Study of Angiosperm families

Objective: To study morphological & reproductive characters of 4 families

Outcome: The student can understand detailed identifying characters of family

Unit- 1: Microbiology

- 1.1- Introduction- Microbiology (2 L)
- 1.2-Viruses: General characters, structure, classification, and economic importance of viruses. (3 L)
- 1.3- DNA virus: (T- Phage), RNA Virus (TMV). (2 L)
- 1.4- Bacteria: General characters of bacteria, structure, Economic importance, Modes of reproduction vegetative, asexual & recombination (conjugation, transformation & transduction). (5 L)
- 1.5- Mycoplasma: General characters, Structure, classification and significance, Economic importance. (3 L)

Unit- 2: Phycology

- 2.1- Introduction; general characters and classification of algae (As per Smith-1955) up to class; Economic Importance of Algae. (3 L)
- 2.2- Cyanophyta: General Characters; Study of *Nostoc*- occurrence, classification, thallus structure and reproduction (excluding developmental stages). (3 L)
- 2.3- Xanthophyta: General characters; Study of *Vaucheria*- occurrence, classification, thallus structure and reproduction (excluding developmental stages). (3 L)
- 2.4- Chlorophyta: General Characters; Study of *Spirogyra*- occurrence, classification, thallus structure and reproduction (excluding developmental stages). (3 L)
- 2.5- Phaeophyta: General characters & life cycle of *Sargassum* occurrence, classification, thallus structure and reproduction (excluding developmental stages). (3 L)
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• **References Book**

1. Lee, R.E. (2008). Phycology, Cambridge University Press, Cambridge. 4th edition.
 2. Prescott, L.M., Harley J.P., Klein D. A. (2005). Microbiology, Mc Graw Hill, India. 6th edition.
 3. Kumar, H.D. (1999). Introductory Phycology. Affiliated East-West Press, Delhi.
 4. Sahoo, D. (2000). Farming the ocean: seaweeds cultivation and utilization. Aravali International, New Delhi.
 5. Campbell, N.A., Reece J.B., Urry L.A., Cain M.L., Wasserman S.A. Minorsky P.V., Jackson R.B. (2008). Biology, Pearson Benjamin Cummings, USA. 8th edition.
 7. Pelczar, M.J. (2001) Microbiology, 5th edition, Tata Mc Graw-Hill Co, New Delhi.
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Paper-II: Fungi & Archegoniate (Lecture 30)

Unit- 1: Fungi **(15 L)**

- 1.1- General characters; Nutrition and classification of fungi up to class (as per Ainsworth) ; Economic importance of Fungi. **(3 L)**
- 1.2- Zygomycotina: General characters; study of *Mucor*- occurrence, thallus organization, classification, and life cycle (excluding developmental stages). **(3 L)**
- 1.3- Ascomycotina: General characters; study of *Yeast*- occurrence, thallus organization, classification, and life cycle (excluding developmental stages). **(3 L)**
- 1.4- Basidiomycotina: General characters: study of *Agaricus* occurrence, thallus organization, classification, and life cycle (excluding developmental stages). **(3L)**
- 1.5- Oomycota: General characters: Study of *Albugo*- occurrence, thallus organization, classification, and life cycle (excluding developmental stages). **(3 L)**

Unit- 2: Archegoniate **(15 L)**

- 2.1- Introduction & General character. **(2 L)**
- 2.2- Bryophytes: General characters and Classification (as per G. M. Smith); Study of *Riccia*- occurrence, classification, thallus structure (external & internal), and reproduction (excluding development); Economic importance of Bryophytes. **(3 L)**
- 2.3- Pteridophytes: General characters and classification up to class (as per G. M. Smith); Study of *Selaginella*- occurrence, classification, morphology of sporophyte, anatomy (stem) and reproduction (excluding development); Economic importance of Pteridophyte. **(3 L)**
- 2.4- **Gymnosperms:** General characters and classification (As per Sporne). **(2 L)**
- 2.5- Study of *Cycas*- classification, occurrence, morphology (sporophyte, corolloid root), anatomy of leaflet and reproduction (excluding development); Economical importance of Gymnosperms. **(5 L)**
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• **References Book**

1. Vashistha, P.C., Sinha, A.K., Kumar, A. (2010). Pteridophyta. S. Chand. Delhi, India.
2. Bhatnagar, S.P. & Moitra, A. (1996). Gymnosperms. New Age International (P) Ltd Publishers, New Delhi, India.
3. Parihar, N.S. (1991). An introduction to Embryophyta: Vol. I. Bryophyta. Central Book Depot. Allahabad.
4. Raven, P.H., Johnson, G.B., Losos, J.B., Singer, S.R. (2005). Biology. Tata McGraw Hill, Delhi.
5. Vander-Poorteri 2009 Introduction to Bryophytes. COP.
6. Agrios, G.N. 1997 Plant Pathology, 4th edition, Academic Press, U.K.
7. Alexopoulos, C.J., Mims, C.W., Blackwell, M. (1996). Introductory Mycology, John Wiley & Sons (Asia) Singapore. 4th edition.
8. Webster, J. and Weber, R. (2007). Introduction to Fungi, Cambridge University Press, Cambridge. 3rd edition.
9. Sethi, I.K. and Walia, S.K. (2011). Text book of Fungi and Their Allies, Macmillan Publishers India Ltd.
10. Sharma, P.D. (2011). Plant Pathology, Rastogi Publication, Meerut, India.
11. Lee, R.E. (2008). Phycology, Cambridge University Press, Cambridge. 4th edition.
12. Prescott, L.M., Harley J.P., Klein D. A. (2005). Microbiology, McGraw Hill, India. 6th edition.
13. Kumar, H.D. (1999). Introductory Phycology. Affiliated East-West Press, Delhi.
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15. Campbell, N.A., Reece J.B., Urry L.A., Cain M.L., Wasserman S.A. Minorsky P.V., Jackson R.B. (2008). Biology, Pearson Benjamin Cummings, USA. 8th edition.
16. Pelczar, M.J. (2001) Microbiology, 5th edition, Tata McGraw-Hill Co, New Delhi.

Semester- II

Paper No-III: Plant Ecology (Lecture 30)

Unit 1: Introduction, Climatic Factor & Ecological Adaptations (15 L)

- 1.1- Basic concept; levels of organization; interaction between living world & environment. (3 L)
- 1.2. Climatic factors- Light, Temperature, Humidity, Wind & Rainfall. (3 L)
- 1.3. Edaphic factors- Soil: origin, formation, composition, physical, chemical & biological components, classification & chemical properties of soil. (4 L)
- 1.4. Ecological adaptations: Introduction. (1 L)
- 1.5. Hydric Adaptations, Xeric Adaptations. (4 L)

Unit 2: Plant communities, Ecosystem & Ecological succession (15)

- 2.1. Plant Communities: Introduction, forms & structure, classification, qualitative and quantitative characters of community. (4 L)
 - 2.2 Ecosystem: Introduction, components of ecosystem, ecological pyramids, food chain and food webs. (4 L)
 - 2.3. Trophic level organization, basic source of energy, autotrophy, heterotrophy, symbiosis, commensalism, parasitism. (4 L)
 - 2.4. Ecological succession: Introduction, concept & process. (1 L)
 - 2.5. Hydrosere and Xerosere. (2 L)
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• **References-**

1. Kormondy, E.J. (1996). Concepts of Ecology. Prentice Hall, U.S.A. 4th edition.
 2. Sharma, P.D. (2010) Ecology and Environment. Rastogi Publications, Meerut, India. 8th edition.
 3. Odum, E.P. Ecology. Oxford & F. B. h. Publishing Co. pvt. LTD- New Delhi.
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 9. 250002 India.
 10. Prof. M.A. Khan – Environment, Biodiversity and Conservation S-B Nangia, A.P.H. Publishing Corporation, 5, Ansari Road, Daryaganj New Delhi – 110002.
 11. B.P. Pandey – Modern Practical Botany Vol – I / II Chand & Company Ltd. Ramnagar New Delhi – 110055.
 12. R.S. Shukla & P. S. Chandel. Plant Ecology. S. Chand & Company LTD. Ram Nagar, New Delhi.110055.
 13. Pavas Divan – Environ Protection – Deep & Deep Publications D-I 124, Rajouri Garden, New Delhi – 110027.
 14. P.S. Verma / V.K. Agrawal – Concept of Ecology, S. Chand & Lonpan Ltd. Ramnagar, New Delhi – 110055.
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 16. Evgene P Odum – Ecology Oxford & IBH Publishing Co. Pvt. Ltd. Culcutta, New Delhi.
 17. Ishwar Prakash. Desert Ecology. Scientific Publications, Ratandas Road, Jodhpur. - 01 India.
 18. T.W. Woodhead. Plant Ecology. Sonali Publications.New Delhi.110002.
 19. Eug. Warming. Ecology of Plant. Ambey Publications Delhi.
 20. Jonathan Silvertown. Introduction To Population Plant Ecology. Longman Singapore Publisher, LTD.
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Paper- IV: Taxonomy of Angiosperms (Lecture 30)

Unit- 1: Introduction of Taxonomy	(15 L)
1.1- Introduction and definition.	(2 L)
1.2- Aims and Principles of Taxonomy, methods of identification of plants.	(4 L)
1.3- Primitive and advanced characters of the flower; concept of taxa (family, genus, and species).	(3 L)
1.4- Types of classification: Artificial, Natural and Phylogenetic classifications.	(3 L)
1.5- Outline of Bentham and Hookers system of classification; Salient features, merits and demerits of Bentham and Hookers system.	(3 L)
Unit- 2: Identification and Nomenclature	(15 L)
2.1- Nomenclature; Binomial nomenclature of plants.	(2 L)
2.2- ICBN- Introduction & Principles of ICBN.	(2 L)
2.3- Herbarium and Botanical Garden Herbarium- Steps in preparation of herbarium specimens and significance of Herbaria.	(3 L)
2.4- Botanical gardens of India- Sir J. C. Bose Botanical Garden, Calcutta & Lead Botanical Garden of Shivaji University Kolhapur.	(3 L)
2.5- Study of Angiosperms families: Systematic position, Morphological & distinguishing characters with economic importance of following families:	(5 L)
a) Caesalpiniaceae	b) Solanaceae
c) Amaranthaceae	d) Liliaceae

- **References:**

1. Morphology of Angiosperms, J M Coulter and C J Chamberlain, Pointer Publishers, Jaipur.
2. Taxonomy of Angiosperm R Pandey, S Chand and Co. Ltd, Ramnagar New Delhi.110055
3. An Introduction to Taxonomy of Angiosperms- Pritish Shukla, Shital P Mishra, Vikas Publishing House, Pvt. Ltd. Gaziabad, UP.
4. A Text Book of Angiosperms-B P Pandey, S Chand and Co Ltd. Ramnagar, New Delhi.110055
5. A Text Book of Botany -‘Angiosperm Singh C Pande, D K Jain, Rastogi Publication, Shivaji Road Meerut.250002
6. Taxonomy of Angiosperm, Neeru Mathur, Sonali Publications, New Delhi, 110002.
7. Angiosperms-G L Chopra, Pradeep Publications, Jalandhar, 144008.
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14. Singh, G. (2012). Plant Systematics: Theory and Practice. Oxford & IBH Pvt. Ltd., New Delhi. 3rd edition.
15. Gaikwad, S. P. & Garad, K. U. (2015). Flora of Solapur District, Laxmi Book Publication Solapur

- **Continuous Internal Evaluation (CIE):**

CIE will consists of Home Assignment/Tutorials/Tests/Seminars/field visit/Industrial visit, etc.

PRACTICAL (CORE COURSE) BOTANY
B. Sc. First Year (Liberal Science)
Semester-I & II

Practical – I : Botany

Teaching Scheme:

Practical – 4 Hours/week, 4 Credits

Examination Scheme:

UA – 80 Marks

CIE – 20 Marks

List of Practicals:

(Minimum 20 Maximum 25)

Students should perform minimum 20 practical during Semester I & II

• **List of Practical (based on paper no I to IV):**

1. Study of dissecting and compound microscope.
2. Electron micrographs/Models of viruses - T-Phage and TMV (photographs/models).
3. Gram staining (demonstration) and forms of Bacteria (permanent slides/photographs).
4. Identification of Algae, Fungi, Archegonites (Volvox, Gracillaria, Polysiphonia, Rhizopus, Penicilium, Agaricus, Marchantia, Adantium, Pinus,)
5. Study of Nostoc & Spirogyra.
6. Study of Sargassum & Vaucheria
7. Study of Mucor & Yeast.
8. Study of Albugo & Agaricus
9. Study of Riccia.
10. Study of Selaginella- Morphology of sporophyte and anatomy of stem, Strobilus.
11. Study of Cycas- Morphology of sporophyte and anatomy of leaflet.
12. Reproductive structure: male cone, microsporophyll, microspore and megasporophyll, L. S. of ovule (permanent slide).
- 13-14. Study of plant families:
 - i. Caesalpiniaceae & Solanaceae
 - ii. Amaranthaceae & Liliaceae
15. Study of soil PH by Universal indicator/pH paper/pH meter & Study of Water holding capacity of different soil.

16. Study of meteorological instruments (any three)
17. Determination of Density and Frequency of plants by quadrat method.
18. Ecological adaptations of Hydrophytes (Hydrilla, Eichhornia and Typha).
19. Ecological adaptations of Xerophytes (Nerium and Aloe).
20. Excursion report.