
**RAJARSHI SHAHU MAHAVIDYALAYA (AUTONOMOUS), LATUR**

**AFFILIATED TO**

**SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED**

# Syllabus

**(2022-2023)**

**Under CBCS**

**Two Year Degree Program Botany**

**Department of Botany**

**M.Sc.-I**

**Semester-I and II**

**Syllabi Approved by the Board of Studies in Botany**

**With Effect From, June2022**

# Rajarshi Shahu Mahavidyalaya (Autonomous), Latur

## Department of Botany

### Program Structure of M.Sc.I &II Botany Syllabus (CBCS)

### To be implemented from June 2022

**SEMESTER-I**

| Course No. | Course code | **Core Course Title** | L/P | Marks | | | **Credits** |
|---|---|---|---|---|---|---|---|
| | | | | Internal Evaluation | External Evaluation | Total | |
| BOCC-1 | P-CEB-171 | Cell Biology | 60 | 40 | 60 | 100 | 04 |
| BOCC-2 | P-PLB-172 | Biochemistry | 60 | 40 | 60 | 100 | 04 |
| BOCC-3 | P-DMC-173 | Diversity of Microbes and Cryptogams. | 60 | 40 | 60 | 100 | 04 |
| BOCC-4 | P-INB-174 | Instrumentation and Biostatistics | 60 | 40 | 60 | 100 | 04 |
| BOLC-I | P-LAC-175 | Lab course on Cell Biology | 15 | 20 | 30 | 50 | 02 |
| BOLC-II | P-LAC-176 | Lab course on Biochemistry | 15 | 20 | 30 | 50 | 02 |
| BOLC-III | P-LAC-177 | Lab course on Diversity of Microbes and Cryptogams | 15 | 20 | 30 | 50 | 02 |
| BOLC-IV | P-LAC-178 | Lab course on Instrumentation and Biostatistics | 15 | 20 | 30 | 50 | 02 |
| | P-SEM-179 | Students Seminars-I | | | | 25 | 01 |
| **Total** | | | | | | **625** | **25** |

**SEMESTER-II**

| Course No. | Course code | **Core Course Title** | L/P | Marks | | | **Credits** |
|---|---|---|---|---|---|---|---|
| | | | | Internal Evaluation | External Evaluation | Total | |
| BOCC-5 | P-DPG-271 | Diversity of Pteridophytes, Gymnosperms and Fossil Plants. | 60 | 40 | 60 | 100 | 04 |
| BOCC-6 | P-PPM-272 | Plant Physiology and Metabolism | 60 | 40 | 60 | 100 | 04 |
| BOCC-7 | P-PEE-273 | Plant Ecology and Evolution | 60 | 40 | 60 | 100 | 04 |
| BOCC-8 | P-PSD-274 | Plant Structure Development &Reproduction in Angiosperms | 60 | 40 | 60 | 100 | 04 |
| BOLC-V | P-LAC-275 | Lab course on Diversity of Pteridophytes, Gymnosperms and Fossil Plants | 15 | 20 | 30 | 50 | 02 |
| BOLC-VI | P-LAC-276 | Lab course on Plant Physiology and Metabolism | 15 | 20 | 30 | 50 | 02 |
| BOLC-VII | P-LAC-277 | Lab course on Plant Ecology and Evolution | 15 | 20 | 30 | 50 | 02 |
| BOLC-VIII | P-LAC-278 | Lab course on Plant Structure Development &Reproduction in Angiosperms | 15 | 20 | 30 | 50 | 02 |
| | P-SEM-279 | Students Seminars-II | | | | 25 | 01 |
| **Total** | | | | | | **625** | **25** |

**SEMESTER: III**

| Course No. | Course code | Core Course Title | L/ P | Marks | | Total | Credits |
|---|---|---|---|---|---|---|---|
| | | | | Internal Evaluation | External Evaluation | | |
| BOCC-9 | P-ANS-372 | Angiosperms Systematics | 60 | 40 | 60 | 100 | 04 |
| BOCC-10 | P-MOB-373 | Molecular Biology | 60 | 40 | 60 | 100 | 04 |
| BOCC-11 | P-PBG-374 | Plant Biotechnology and Genetic Engineering | 60 | 40 | 60 | 100 | 04 |
| BODSE-1 | P-PLP-375 | Plant Pathology-I/Genetics-I/Plant Biotechnology- I | 60 | 40 | 60 | 100 | 04 |
| BOLC-IX | P-LAC-376 | Lab course on Angiosperms Systematics | 15 | 20 | 30 | 50 | 02 |
| BOLC-X | P-LAC-377 | Lab course on Molecular Biology | 15 | 20 | 30 | 50 | 02 |
| BOLC-XI | P-LAC-378 | Lab course on Plant Biotechnology and Genetic Engineering | 15 | 20 | 30 | 50 | 02 |
| BOLC-XII | P-LAC-379 | Lab course on Plant Pathology-I/Genetics-I/Plant Biotechnology- I | 15 | 20 | 30 | 50 | 02 |
| | P-SEM-380 | Students Seminars-III | | | | 25 | 01 |
| **Total** | | | | | | **625** | **25** |

**SEMESTER: IV**

| Course No. | Course code | Core Course Title | L/P | Marks | | Total | Credits |
|---|---|---|---|---|---|---|---|
| | | | | Internal Evaluation | External Evaluation | | |
| BOCC-13 | P-CPB-468 | Cytogenetics and Plant Breeding | 60 | 40 | 60 | 100 | 04 |
| BOCC-14 | P-PLN-469 | Immunology, Plant Nanotechnology and Forensic Botany | 60 | 40 | 60 | 100 | 04 |
| BODSE-2 | P-PLP-470 | Plant Pathology-II / Genetics-II / Plant Biotechnology-II | 60 | 40 | 60 | 100 | 04 |
| BODSE-3 | P-PLP-471 | Plant Pathology-III / Genetics - III/ Plant Biotechnology-III | 60 | 40 | 60 | 100 | 04 |
| BOLC-XIII | P-LAC-472 | Lab course on Cytogenetics and Plant Breeding and Immunology, Plant Nanotechnology and Forensic Botany | 15 | 20 | 30 | 50 | 02 |
| BOLC-XIV | P-LAC-473 | Lab course on Plant Pathology-II and Plant Pathology-III | 15 | 20 | 30 | 50 | 02 |
| PROJECT | P-PRW-474 | Project (Dissertation/Review writing | | 40 | **60** | 100 | 04 |
| | P-SEM-475 | Students Seminars-IV | | | | 25 | 01 |
| | | | | | **Total** | **625** | **25** |
| **Grand Total of Marks and Units of all Semesters** | | | | | | **2500** | **100** |

**BOCC=Botany Core Course, BODSE-Botany Discipline Specific Elective, BOLC=Botany Laboratory Course, L/P=Lectures / Practical**

S.N.Shinde
Chairman
Board of studies in Botany
Rajarshi Shahu Mahavidyalaya (Autonomous), Latur

# Department of Botany

## Program Structure of M.Sc.I &II Botany Syllabus (CBCS)

## To be implemented from June 2022

## M. Sc. I and II

**SEMESTER-I**

| Course No. | Course code | Core Course Title | L/P | Marks | | | Credits |
|---|---|---|---|---|---|---|---|
| | | | | Internal Evaluation | External Evaluation | Total | |
| BOCC-1 | P-CEB-171 | Cell Biology | 60 | 40 | 60 | 100 | 04 |
| BOCC-2 | P-PLB-172 | Biochemistry | 60 | 40 | 60 | 100 | 04 |
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| BOLC-IV | P-LAC-178 | Lab course on Instrumentation and Biostatistics | 15 | 20 | 30 | 50 | 02 |
| | P-SEM-179 | Students Seminars-I | | | | 25 | 01 |
| | | | | | **Total** | **625** | **25** |

**BOCC=Botany Core Course, BODSE-Botany Discipline Specific Elective, BOLC=Botany Laboratory Course, L/P=Lectures / Practical**

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# Program Objectives:

- To encourage a clear comprehensive and advanced mastery in the field of Botany.
- To provide basic principles of biological sciences with special reference to Botany and its applied branches.
- To enable the students to explore the intricacies of life forms at elute, molecular and nano level.
- To sustain student's motivation and enthusiasm and to help them not only to appreciate the beauty of different life forms but also to inspire them in the dissemination of the concept of biodiversity conservation.
- To develop problem solving skills in students and encourage them to carry out innovative research projects there by enkindling in them the spirit of knowledge creation.
- To demonstrate knowledge and understanding of the molecular machinery of living cells.
- To demonstrate knowledge and understanding of the principles that governs the structures of macromolecules and their participation in molecular recognition.
- To use basic laboratory skills and apparatus to obtain reproducible data from biochemical experiments.
- To participate in and report orally on team work investigations of problem-based assignments.
- To build on their knowledge and understanding in tackling more advanced and specialized courses, and more widely to pursue independent, self-directed and critical learning.
- To ensure that the student can achieve an up-to-date level of understanding and competence that will serve as a lasting and practical basis for a career.
- To provide training in scientific and transferable skills through modular lecture courses, research projects, assignments, seminars and supervisions.
- At the end of the program student should have increased: capacity to think critically; ability to design and execute an experiment; confidence and ability in communicating ideas in desired biological sciences.

***A Good education is like a savings account, the more you put into it and the richer you are.***

***- Unknown.***

**RAJARSHI SHAHU MAHAVIDYALAYA (AUTONOMOUS), LATUR**

**M. Sc. First Year**

# Semester – I

## BOTANY

## Core Course (BOCC)-1: Cell Biology

Lectures-60 Maximum Marks – 100 Credits: 04 Course Code: P-CEB-171

**Objectives**

1. Students will understand the structures and purposes of basic components of prokaryotic and eukaryotic cells, especially macromolecules, membranes, and organelles
2. Students will understand how these cellular components are used to generate and utilize energy in cells
3. Students will understand the cellular components underlying mitotic cell division.
4. Students will apply their knowledge of cell biology to selected examples of changes or losses in cell function. These can include responses to environmental or physiological changes, or alterations of cell function brought about by mutation.

**CourseOutcomes**:

After completion of course Students are enable to:

1. Understand the basic aspects of cell biology, Genetics and evolution.
2. Apply and integrate the basic concepts of cell biology including structure and functions of organisms.
3. Study of cell structure using compound microscope and elucidation of Ultra structure from electron microphotographs.
4. Study the mitosis and meiosis by smear/ squash method and from prepared slides.

**Unit I: Cell organelles (I) (15L)**

1. **Introduction**
2. Cell wall - biogenesis, Ultra structure and functions. Growth- primary and secondary wall.
3. Cell membranes - molecular organization, Fluid mosaic model, membrane protein diffusion, transport across membranes- facilitated diffusion, carrier & channel proteins, transporters, active transport, transport of ions and solutes
4. Biogenesis of chloroplasts and mitochondria.
5. Molecular organization of chloroplast and mitochondrial membranes.
6. Plasmodesmata –Structure and role in movement of molecules.
7. Vacuoles –Tonoplast membrane biogenesis, transporters, role as storage organelle, transport across vacuolar membrane.

**Unit II: Cell organelles (II) (15L)**

1. Nucleus- Structure, organization and regulation of nuclear pore complex. Transport across nuclear membrane.
2. Endoplasmic reticulum-Role in synthesis and transport of secretary proteins
3. Golgi complex –Role in sorting, storage and secretion,
4. Lysosomes, membrane integrity and role Glyoxysomes and Peroxisomes structure and functions.
5. Ribosome –Structure, assembly and dissociation of subunits, functions.
6. Structure and function of Cytoskeleton**:** Composition and organization of microtubules, microfilaments. Tread milling, role in cell division, signaling and intracellular traffic. Role in motility. Flagella-Structure and organization.

**Unit III: Cell signaling and communication. (15L)**

A) **Cell signaling:**

1. Hormones and their receptors, cell surface receptor, signaling through G-protein coupled receptors.
2. Signal transduction pathways, secondary Messengers.
3. Regulation of signaling pathways,
4. Bacterial and plant two component systems.
5. Light signaling in plants.

**B) Cellular communication:**

1. Regulation of hematopoiesis.
2. General principles of cell communication.
3. Cell adhesion and roles of different adhesion molecules.
4. Gap junctions.
5. Extracellular matrix and integrins.
6. Neurotransmission and its regulation.

**Unit IV: Cell cycle (15L)**

**Cell Cycle**

1. Phases of Cell Cycle.
2. Functional importance of each phase.
3. Molecular events during cell cycle.
4. Regulation of cell cycle.
5. Cyclins and protein kinases.
6. MPF (maturation promoting factor)

**Cell aging and cell senescence:**

1. Programmed cell death and its molecular aspects.
2. Regulation of cell death.
3. PCD in response to stress.

**Apoptosis:**

1. Role of different genes.
2. Cell organelles during apoptosis.
3. Genetic control of apoptosis.

**Cancer:**

1. Cancer and the cell cycle.
2. Interaction of cancer cell with normal cell.
3. Metastasis.

**Reference Books:**


1. Albert's B., Bray, D., Lewis, J., Raff, M., Roberts, K. and Watson, J. D. 1989
2. Molecular biology of the Cell (2ndedition). Garland Pub. Inc., New York.
3. Karp, G. 1999. Cells and Molecular Biology: Concepts & Experiments. John Wiley and Sons, Inc., USA.
4. Lodish S, Baltimore B, Berk, C and Lawrence K,1995, Molecular Cell Biology ,3rd editions, Scientific American Books, N.Y
5. De Robertis and De Robertis, 1988, Cell and Molecular Biology, 8 edition, Info-Med, Hongkong.
6. Buchanan, Grissom and Jones, 2000, Biochemistry and Molecular Biology of Plants, American Soc. Plant Biologists, Waldorf
7. Lewin, B. 2000. GENE VII. Oxford University Press, New York, USA Cooper G M and Hausman R E,2007, The Cell: Molecular Approach 4thEdn, Sinauer Associates, USA. Johnson Lewys – 2004: Cell Biology; Sarup and sons, New Delhi.
8. E.J. Dupraw – 1970 : Cell and Molecular Biology; Academic Press, London
9. De Robertis and De Robertis – 1997: Cell and Molecular Biology (VIII); B.I. Waverly Pvt. Ltd., New Delhi
10. C. P. Swanson, T. Merz, and W.J. Young – 1982: Cytogenetics; Prentice – Hall of India Pvt. Ltd., New Delhi India
11. C. B. Powar – 1992: Cell Biology; Himalaya Publishing House.
12. Cell Biology and Genetics Dr. Veer Bala Rastogi.
13. Cell and Molecular Biology by P. K. Gupta $4^{th}$ revised edition.
14. Cell Biology Fundamental and Applications Gupta, Jangir.
15. Cell Biology S.C. Rastogi New Age International Publisher $3^{rd}$ edition.
16. Cell Biology and Molecular Biology N. Arumugam Saras Publication.

# RAJARSHI SHAHU MAHAVIDYALAYA (AUTONOMOUS), LATUR

## M. Sc. First Year

## Semester-I

### BOTANY

## Core Course (BOCC)-2: Biochemistry

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Lectures-60 Maximum Marks – 100 Credits: 04 Course Code: P-PLB-172

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## Objectives:

1.To study biomolecules and their interaction with living organism.
2.To study biomolecules and energetics.
3.To provide basic understanding of the molecular architecture of cells.
4.To understandthe biochemical nature of macromolecules and their construction.
5.To understandthe metabolism of dietary and endogenous carbohydrate, lipid, and protein;
6.To understandthe principles and major mechanisms of metabolic control and of molecular signaling by Hormones.
7. To understandthe significance for clinical and veterinary practice of the molecular approach to medical science.

## Course Outcomes:

After completion of course Students are enable to:

1) Understand Biochemical and Metabolic processes of cell.
2) Understand the Biomolecules and their interactions.
3) Understand the molecular architecture of macromolecules.

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**Unit-I: Molecules and their Interaction (15L)**

1.Structureofatoms, moleculesandchemicalbonds. (Covalent and Non - covalent bonds)

2. Stabilizinginteractions(H-bonding,hydrophobicinteractions,electrostaticinteractionsVan - DerWaals interactionsetc.)

3. PrinciplesofbiophysicalchemistrySolutions (Percentage, Molar, Normal, PPM and PPB) pH, buffer,Reactionkinetics.

4. Thermodynamics laws (Concept of entropy, Enthalpy, standard free energy, Colligativeproperties (Osmotic pressure freezing point and boiling point)

4. Gibb's free Energy.

**Unit-II: Structure and Functions of Biomolecules (15L)**

1.Composition,structureandfunctionofbiomolecules(carbohydrates, lipids, Amino acids, peptide Bonds)

2. Proteins (Primary, Secondary tertiary and quaternary structure) Conformation of Protein (Ramchandranplot, secondary structure,domains,motifandfolds.)

3. Nucleicacids. Nucleotides Conformationofnucleicacids (A,B,Z DNA),RNA.

**Unit III: Enzymology (15L)**

1. Introduction, Properties, Enzymes classification, vitamins as co-enzymes, Principlesofcatalysisand Enzymekinetics (MM equation,)

2.Types of Enzymes (Alloenzymes, isoenzymes, Apo enzymes, Ribozymes)

3.Types of Enzyme inhibition, (Competitive, noncompetitive and uncompetitive)

Allosteric enzymeregulation.

**Unit – IV: Metabolism (15L)**

1.Metabolism ofcarbohydrates(Gluconeogenesis),nucleotides Biosynthesis (De novo And salvage pathway)

2. General pathway of Lipid metabolism

3. General pathway of Amino acid metabolism

## REFRENCES

1.Biochemistry and Molecular Biology of Plants. American Society of Plant Physiologism Maryland, USA Buchanan B.B, Gruissem W. and Jones R.L 2000.

2.Plant Metabolism (Second Edition) Longman, Essex, England. Dennis D.T., Turpin, D.H. Lefebvre D.D. and Lay Zell D.B. (eds)1997.

3.Life processes in Plants. Scientific American Library, Springer Verlag, New York, USA. Gallstone A.W. 1989.

4. Biochemistry and Physiology of Plant Hormones Springer – Verlag, New York, USA. Moore T.C.1989.

5. Physiochemical and Environmental Plant Physiology (Second Edition) Academic Press, San Diego, USA. Nobel P.S1999.

6. Plant physiology (Fourth Edition) Wadsworth Publishing Company, California, USA. Salesbury F.B and Ross C.W 1992.

7. Plant Physiology (Second Edition). Sinauer Associates, Inc. Publishes, Massachusetts, USA. Taiz L. and Zeiger E. 1998.

8. A.T. B of Plant Physiology, Biochemistry and Biotechnology, Chand Publications. Verma S.K. and Verma Mohit 2007.

9. Principles of Biochemistry, CBS Publishers and Distributers (Indian Reprint) Leininger.

10. Fundamentals of Biochemistry, Dr. J. L Jain Dr. Sanjay Jain Nitin Jain S Chand Publication revised edition.

11. Textbook of Plant Physiology, Biochemistry and Biotechnology Dr. S.K. Verma, Mohit Verma S Chand publication.

12. Plant Physiology and Biochemistry by H. S. Srivastava.

13. Plant Biochemistry by Dr.V. Arunkumar Dr. N. Senthilkumar Dr. K. Sivakumar.

14. Plant Biochemistry by G.Nagaraj.

15. Biochemistry by U. Satyanarayana U. Chakrapani.

16. Biochemistry by C.B. Powar, G.R. Chatwal Himalaya Publishing House.

17. Fundametals of Plant Biochemistry and Biotechnology by N.K.Gupta , Sunita Gupta.

18.Plant Biochemistry by Dr. J.P. Kilkar.

19. Biochemistry by Pankaja Naik 4th edition.

20. Plant Biochemistry by Sonali Bej, Tushar Dilipchand Lodha et.al.

**RAJARSHI SHAHU MAHAVIDYALAYA (AUTONOMOUS), LATUR**

**M. Sc. First Year**

**Semester – I**

**BOTANY**

**Core course (BOCC)3: Diversityof Microbes and Cryptogams**

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Lectures-60 Maximum Marks –100 **Credits**: 04 Course Code: P-DMC-173

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## Objectives:

1.To support and promote research development.

2.To investigate the ecological impact of antibiotic administration on the cultivable indigenous microbiota.

3.To provide training in scientific and transferable skills through modular lecture courses, research projects.

4.To understand and competence that will serve as a lasting and practical basis for a career.

5.To study morphology, reproductive structure and anatomy of cryptogams.

**Course Outcomes**

After completion of course Students are enable to:

1. Investigate the ecological impact of antibiotic administration on the cultivable indigenous microbiota.
2. Identify the microbes on the basis of their morphology.
3. To distinguish species on morphology and anatomy basis.
4. Understand the diversity among microbes and cryptogams.

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## Unit-I:Viruses, Bacteria and Mycoplasma(15L)

1. **Viruses:** General characters, Ultra structure of plant viruses (TMV), Transmission of plant viruses and Economic importance of viruses.

**2. Bacteria**:General characters, Ultra Structure, Nutrition (Autotrophic, Heterotrophic and Symbiotic), Reproduction (Binary fission, Transformation and Transduction), Economic Importance of Bacteria.

**3. Mycoplasma:** General characters, Ultra structure, Economic importance of Mycoplasma.

## Unit-II:Fungi- (15L)

**1.**GeneralcharactersofFungi.

**2.**BiodiversityandTaxonomyofthePhylaZygomycota (*Rhizopus*), Ascomycota (*Aspergillus*), Basidiomycota (*Polyporus*), Oomycota (*Saprolgniea*), Dueteromycota (Alternaria)

**3.**Economic importance of Fungi.

## Unit-III: Algae. (15L)

**1.**Thallus organization

**2.**Cell structure, Reproduction, Pigments, Reserve food, Flagella.

**3.** Salient Features of Chlorophyta *(Volvox),* Bacillariophya (*Pillularia*), Pheophyta (*Sargasum*) and Rhodophyta *(Batrachospermum*).

**4.**Economic importance of Algae.

## Unit- IV: Bryophytes (12L)

**1**. Introduction and Origin of Bryophytes.

**2.**Distribution,Habit, Morphology,Reproduction,Phylogeny,andInter -relationship ofthe orders Marchentiales (*Riccia*), Anthocerotales (*Antheceros*), Jungermanniales (*Porella*), Sphagnales *(Sphagnum).*

**3**.Economic importanceofBryophytes.

**4.**Bryophytesasindicatorsofpollution.

## REFRENCES


1.Textbook of Algae Kumar, H.D. and H. N. Singh (1971)

2.Textbook of Algae Sharma, O.P. (1986)

3. Textbook of Botany – Algae Pandey, B. P. (1994)

4.Botany for degree students-Algae Vashista, B. R. (1995 )

5.College Botany Vol. III Gangulee, H.C. and A. K Kar(1992)

6.Taxonomy and Biology of Blue green algae Desikachary, T.V.(1)

7.Structure and Reproduction of Algae Fritsch, F. E. (1965)

8.Algae-Form and Function Venkataraman et al. (1974)

9.Textbook of Fungi Sharma, O.P. (1989)

10. Morphology and Taxonomy of Fungi Bessey, E. A.(1967)

11. College Botany Vol. I. Gangulee, H.S.and A.K Kar (1992)

12. The Myxomycetes of India. Thind K. S. (1977)

13. Aquatic Fungi of India Dayal (1995):

14. Inter-relationship of Bryophytes Cavers, R. (1964):

15. Liverworts of Western Himalayas and the Punjab Plains Part-I

16. An introduction to Embryophyta. Vol-I Bryophyta Parihar

17. Bryology in India Ram Udar (1976):

18. Cryptogamic Botany Bol. II. Smith, G. M. (1955)

19. The Structure and life of Bryophytes. Watson, E.V, (1964)

20. Botany for degree students -Bryophyta.Vashista, B.R (1996):

21.Biology of Bryophytes Chopra, R.N. and P. K. Kumra (1988).

22. Virology by P. Saravanan

23. Text book of Fungi, Bacteria and Viruses by H.C. Dubey

24. Principles of Virology by S. J. Flint and Others

25. Plant Bacteriology by D.P.Tripathi

**RAJARSHI SHAHU MAHAVIDYALAYA (AUTONOMOUS), LATUR**

**M. Sc. First Year**

**Semester – I**

**BOTANY**

## Core Course (CC)-4: Instrumentation and Biostatistics

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**Lectures: 60 Maximum Marks –100 Credits: 04 Course Code: P-INB-174**

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## Objectives

1.To focus on application of instruments in research.

2.To understand the complex optical devices, key concept and application.

3.To obtain most conclusive results.

4.To know that mixtures are composed of constituents which are not combined.

5.To apply methods of distillation, filtration, evaporation, sieving to separate mixture.

6.To store and process biological data.

7.To provide platform to develop computational biological methods.

8.To use the exact methods used to calculate the relation between biological data

**Course Outcomes**

After completion of course Students are enable to:

1. Understand principal, working and functions of different bio- instruments.
2. Understand the methods of biostatistics.
3. Understand the applications of biostatistics in biological research.

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**Unit-I: Microscopy and Spectroscopy (15L)**

**1 Microscopy:**

a. Lightmicroscope,Introduction,Principleandworking.

b. Compound microscope, Stereo microscope,Phase contrastmicroscope,

c. Electron microscope: TEM,SEM, (image processingmethodandstainingtechnique)

d. Flowcytometry.

**2. Spectroscopy:**UV-visibleandIRspectrophotometry,NMR&mass spectrometry

**Unit-II:LaboratoryTechniques-I (15L)**

**1.SeparationTechniques:**Centrifugation:Basicprinciplesofcentrifugation,types,care Andsafetyaspects ofcentrifuges,preparativeandanalyticalcentrifugation.

**2. Chromatographic Techniques:** Principles, paper, Thinlayer chromatography(TLC), HPLC, GC.

**3. ElectrophoreticTechniques:** GeneralprinciplesSupportmedia, Electrophoresisof Proteins (SDS PAGE) andnucleicacids (PAGE),Agarose electrophoresis.

**4.Culture Techniques**: Principles, types (bacterial, fungal) media preparation, Sterilization and Inoculation.

## Unit-III: LaboratoryTechniques-II (16L)

**1.BiochemistryLaboratory:**Laboratorydiscipline,safetyandcare,experimentalreport. SIunit,pHandBuffers.

**2. Microtomy:**Principleoftissuefixationformicrotomy,typesofmicrotome's, Serialsectioningandstaining.

**3. RadioactiveTechniques:**Isotopesandtheirhalf-lifeandbiologicalhalf-life Specific activity of radioisotopes,makingradioisotopesolutions.

## Unit-IV: LaboratoryTechniques-III (14L)

1. **ComputersinBiology:**Moderncomputers,tissueinbiologicalscience,Internet.

**2.Biostatistics:**a.Measuresofcentraltendencyanddispersal;

b. probabilitydistributions(Binomial,Poissonand normal).

c.RegressionandCorrelation;

d.t-test;Analysisofvariance;$X^2$t

## REFRENCES


1. Instruments of chemical analysis by H. Kaure
2. Fundamentals of Biochemistry by J L Jain and Nitin Jain
3. Textbook of Biochemistry by N. Jeya Shanthi
4. Instrumental methods of chemical analysis by Tatwal Anand
5. Fundamentals of Biochemistry by AC Deb

6.Bioinstrumentation by Veera Kumari

7.Biological instrumentations and methodology by P.K.Bajpai

8. Fundamentals of Biochemistry for Medical Students by Ambika Shanmugam.

9.Practical Biochemistry: Principles and Techniques. Ed. E. Wilson and J. Walker (2000) Cambridge Publ.

11.Biomedical instrumentation and measurements -by Leslie Cromwell and others

12.Methods in Experimental Biology. - Ralph, R. (1975). Blakie, London

13.An Introduction to Biometry- Mungikar, A. M. (1997), Saraswati Printing Press Aurangabad.

14.Biostatistics by khan and Khanum

15.Analytical quantitative methods in microscopy – G. A. Meek and H. Y. Elder

16.Microscope photometry – Horst Piller

17.Biological Ultrastructure – A. Engstrom and J. B. Finean

18.Techniques in Photomicrography – Brain and Ten Cate

19.Photomicrography: A comprehensive treatise – Roger P. Loveland.

20.Laboratory techniques in Botany – M. J. Purvis and D. C. Collier and D. Walli

21. Techniques and methods in biology by Ghatak K.L.

# RAJARSHI SHAHU MAHAVIDYALAYA (AUTONOMOUS), LATUR

## M. Sc. First Year

## Semester – I

### BOTANY

## Lab Course-I

**(Practicals based on Cell Biology)**

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Practicals-15 Maximum Marks – 50 Credits: 02 Course Code: P-LAC-175

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**Objectives:**

2. To familiarize the students with techniques of cell biology.
3. To study the cancerous cells.
4. To provide the students hands on experience in selected techniques cell biology

**Course outcomes of laboratory course**

1. Students are able to karyotype and Ideogram and their significance.
2. Able to distinguish between mitotic & meiosis.
3. They are able to justify structural aspect of DNA& RNA.

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1. Demonstration of SEM and TEM. (Photocopy)
2. Isolation of mitochondria.
3. Comparative study of normal and banded karyotype.
4. Determination of mitotic index in any plant species

5. Differential centrifugation for isolation of cell fractions –Nuclear fraction

6. Determination of permeability of living cells to acids and bases

7-10. Identification of different stages of mitosis from Onion root meristem

11-12. Identification of different stages of meiosis from suitable plant material.

1. To study cell diversity.
2. Study of electron micrographs of cell organelles

**RAJARSHI SHAHU MAHAVIDYALAYA (AUTONOMOUS), LATUR**

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**BOTANY**

## Lab Course-II

**(Practicals based on Biochemistry)**

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Practical-15 Maximum Marks-50 Credits: 02 Course Code: P-LAC-176

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## Objectives:

1. To familiarize the students with techniques of biochemistry.
2. To study the estimation methods of biomolecules.
3. To provide the students hands on isolation of DNA, RAN and Proteins.

## Course outcomes of laboratory course

1. Students are able to find out the various biomolecules.
2. Students are able to distinguish DNA,RNA and Proteins.
3. Students are able to justify structural aspect of Biomolecules.

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1. Quantitative estimation of protein by Foline -Lowry method.
2. Quantitative estimation of protein by Bradford reagent method.
3. Isolation of DNA From various sources.
4. Isolation of RNA from yeast tablets.
5. Estimation of DNA using Diphenyl Amine reagent.
6. Estimation of RNA by orcinol reagent.
8. Estimation of total Amino acid in Germinating and Non-germinating seeds.
9. Qualitative detection of Amino acid.
10. Estimation of total soluble sugars.
11. Effect of substrate concentration pH on enzyme activity.
12. Effect of pH on enzyme activity.
13. Estimation of Ascorbic acid in ripe and unripe fruits.

**N.B: 1) Any ten Practicals.**

**2) Several Short Excursions and at least one Long Excursion.**

**RAJARSHI SHAHU MAHAVIDYALAYA (AUTONOMOUS), LATUR**

**M. Sc. First Year**

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**BOTANY**

## LabCourse-III

**(Practicals based on Diversity of Algae, Fungi and Bryophytes)**

Practicals-15 Maximum Marks –50 Credits: 02 Course Code: P-LAC-177

## Objectives:

1. To practically expose the students with divers life forms .
2. To study the lifecycles of cryptogams.
3. To provide the students hands on experience with morphological and reproductive

## Course outcomes of laboratory course

1. Students are able to know the morphological features of cryptogams.
2. Able to distinguish cryptogams.
3. They are able to justify structural aspect of plants

1. Isolation of Algae from soil and water.
2. Study of Algae: - Chlorophyta: Chara.
3. Study of Algae: - Pheophyta: Sargasum.
4. Study of Algae: - Bacillariophyta: Pillularia
5. Study of Algae: - Rhodophyta: Batrachospermum.
6. Study of Bryophytes: Marchantiales: Riccia.
7. Study of Bryophytes: Anthocerotales: Anthoceros.
8. Study of Bryophytes: Polytrichales: Polytricum
9. Study of Bryophytes: Jungermanniales: Porella
10. Study of Bryophytes: Sphagnales: Sphagnum
11. Study of Fungi: Zygomycota: *Rhizopus*
12. Study of Fungi: Ascomycota: *Aspergillus*
13. Study of Fungi: Basidiomycota: *Polyporus*
14. Study of Fungi: Oomycota: *Saprolegniea*
15. Study of Fungi: Myxomycota: *Steminitis*

16-17. Preparation of culture media: PDA, Czapek, Dox Agar medium.

18-19. Isolation of Fungi from soil, air, water, and host, their inoculation on culture media.

Several Short Excursions- Submission of collected specimens and Excursion Report.

**N.B: 1) Any ten Practicals.**

**2) Several Short Excursions and at least one Long Excursion.**

**RAJARSHI SHAHU MAHAVIDYALAYA (AUTONOMOUS), LATUR**

**M. Sc. First Year**

**Semester – I**

**BOTANY**

## Lab Course-IV

## (Practicals based on Instrumentation and Biostatistics)

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Practicals-15 Maximum Marks-50 Credits: 02 Course Code: P-LAC-178

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## Objectives:

1. To practically expose the students with Microscopy, spectroscopy and chromatography.
2. To study the principles and working of bioinstrumentation.
3. To provide the students hands on experience with separation of biomolecules

## Course outcomes of laboratory course

1. Students are able to know the use of bioinstrumentation.
2. Able to know molarity, normality, percentile solutions.
3. They are able to justify structural aspect of Proteins & Nucleic acids.

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1) Preparation of Standard solutions, %, M, N, PPM, PPB
2) Determination of Absorption spectra using UV-VIS spectrophotometer. (Protein / Nucleic acid)
3) Separation of Nucleic acid using Agarose gel Electrophoresis.
4) Separation of Amino acid using paper Chromatography.
5) Separation of plant pigments using thin layer chromatography.
6) Separation of proteins using SDS-PAGE (Demonstration)
7) Demonstration and working of HPTLC.
8) Study the principle and working of compound Microscope.
9) Study the principle and working of pH meter / colorimeter / spectrophotometer and centrifuge.

10) Preparation of permanent double stained slides of plant material with the help of microtomy

11) Problems based on $X^2$ – Test

12) ANOVA use of computers.

13) pH – measurements and preparation of buffers.

14) Verification of Beer and Lamberts law

15) Micrometry

16) Study of instruments – Radioactive counters, X-ray diffraction, NMR, GC, HPLC, SEM, TEM, Fluorescence microscopy.

17) Accessing biological data bases / Email operation.

**N.B: 1) Any ten Practicals**

**2) Several Short Excursions and at least one Long Excursion**

# RAJARSHI SHAHU MAHAVIDYALAYA (Autonomous), LATUR

## DEPARTMENT OF BOTANY

### Course Structure of M. Sc.-I &II Botany Syllabus (CBCS)

**To be implemented from June 2022**

## M.Sc.-I

**SEMESTER-II**

| Course No. | Course code | Course Title | L/P | Marks | | | Credits |
|---|---|---|---|---|---|---|---|
| | | | | Internal Evaluation | ExternalEvaluation | **Total** | |
| BOCC-5 | P-DPG-271 | Diversity of Pteridophytes, Gymnosperms and Fossil Plants. | 60 | 40 | 60 | 100 | 04 |
| BOCC-6 | P-PPM-272 | Plant Physiology and Metabolism | 60 | 40 | 60 | 100 | 04 |
| BOCC-7 | P-PEE-273 | Plant Ecology and Evolution | 60 | 40 | 60 | 100 | 04 |
| BOCC-8 | P-PSD-274 | Plant Structure Development &Reproduction in Angiosperms | 60 | 40 | 60 | 100 | 04 |
| BOLC-V | P-LAC-275 | Lab course on Diversity of Pteridophytes, Gymnosperms and Fossil Plants | 15 | 20 | 30 | 50 | 02 |
| BOLC-VI | P-LAC-276 | Lab course on Plant Physiology and Metabolism | 15 | 20 | 30 | 50 | 02 |
| BOLC-VII | P-LAC-277 | Lab course on Plant Ecology and Evolution | 15 | 20 | 30 | 50 | 02 |
| BOLC-VIII | P-LAC-278 | Lab course on Plant Structure Development &Reproduction in Angiosperms | 15 | 20 | 30 | 50 | 02 |
| | P-SEM-279 | Students Seminars-II | | | | 25 | 01 |
| | | | | | **Total** | **625** | **25** |

**BOCC=Botany Core Course, BOLC=Botany Laboratory Course, L/P=Lectures / Practicals**

# RAJARSHI SHAHU MAHAVIDYALAYA (AUTONOMOUS), LATUR
## M. Sc. First Year
## Semester – II
### BOTANY

**Core Course (BOCC)-5: Diversity of Pteridophytes, Gymnosperms, and Fossil Plants**

Lectures-60 Maximum Marks –100 Credits: 04 Course Code: P-DPG-271

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**Objectives:**

1. To study evolutionary trends of cryptogams and Gymnosperms.
2. To study the connecting links between Pteridophytes and Gymnosperms
3. To study the morphology, anatomy and of Pteridophytes & gymnosperms.
4. To provide the of the conceptual knowledge about fossil plants to the students.
5. To aware the students about importance Pteridophytes & gymnosperms

**Course Outcomes:**

After completion of course Students are enable to:

1. Differentiate between the characteristics of Pteridophytes & Gymnosperms living forms.
2. Understand the phylogenetic relationship among them.
3. Compare the life form, structure, reproduction and significance of pteridophyte, Gymnosperm and Fossil Plants etc.

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**Unit: I Pteridophytes-I (15L)**

1. Introduction and characteristic features. Diversity of Pteridophytes in India and their migration to land. Affinities of Pteridophyte with Bryophyte and Algae.
2. Recent systems of classification of Pteridophytes.
3. Comparative morphology, reproduction and phylogeny of following orders with reference to the forms mentioned against each**:** Psilotales (*Tmesipteris*), Lycopodiales (*Lycopodium*), Filicales (*Adiantum*), Equisitales (*Equisetum*), Salviniales (*Salvinia*)

**Unit: II Pteridophytes-II (15L)**

1. Apogamy and Apospory.
2. Telome concept.
3. Stelar evolution.
4. Soral evolution.
5. Gametophyte evolution.
6. Heterospory and seed habit.
7. Economic importance of Pteridophytes.

**Unit: III Gymnosperms (15L)**

1. Characteristic features of Gymnosperms.
2. Recent system of classification (S.P. Bhatnagar and Alok Moitra).
3. Study of morphology and reproduction Cycadales (*Zamia*), Coniferales (*Pinus*), Gnetales (*Gnetum*), Ephedrales (*Ephedra*).
4. Gymnosperms as prospective ancestor of Angiosperms.
5. Economic importance of gymnosperms.

**Unit: IV Paleobotany (15L)**

1. Introduction Evolution time scale
2. Principles of Paleobotany: Petrification, Impression and Compression.
3. Indian fossil flora –Glossopteris flora, Rajmahal hill flora and Deccan Intertrappean flora.
4. Paleopalynological techniques- Coal maceration and Lignite maceration
5. Study of morphology and evolutionary trends of:
    - Bennettitales
    - Cycadales
    - Coniferales
6. Economic importance

**Reference Books:**


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2. Bierhorst, D.W. (1971) - Morphology of Vascular plants
3. Eames, A. J. and E. M. Giffard (1950) - Comparative morphology of vascular plants.
4. Rashid, A. (1978) - An introduction to Pteridophytes.
5. Sporne, K.R. (1966) - Morphology of Pteridophytes.
6. Bower, F. O. (1963) - The Ferns.
7. Jermy, A. G. (1973) - The Phylogeny and Classification of ferns.
8. Vashishta, B.R. (1996) - Botany for degree students – Pteridophytes.
9. Parihar, N.S. (1959) - An Introduction to Pteridophyte.
10. Arnold, C.A. (1972) - An introduction to paleobotany.
11. Darah, W.C. (1968) - Principles of paleobotany.
12. Surange, K.R. (1968) - Indian Fossil Pteridophytes.
13. Arnold, C.A. (1947): Introduction to palaeobotany, Mc-Graw Hill

Book Co. Inc., New York and London.

14. Pteridophytes and Gymnosperms, springer Verlag, New York
15. Agashe, S.N. (1995), Palaeobotany, Oxford & IBH, New Delhi.
16. Biswas, C & Johri, B.N. (2004), The Gymnosperms, Narosa

Publishing House, New Delhi.Coulter J.M. & Chamberlain C. J..(1978): Morphology of

17. Gymnosperms, Central Book Depot, Allahabad.
18. Kakkar, R.K. and Kakkar, B.R. (1995), The Gymnosperms

(Fossils& Living), Central Publishing House, Allahabad.

19. Sharma O.P. (2002) Gymnosperms, Pragati Prakashan, Meerut.
20. Vashishta P.C., A.R. Sinha, Anil Kumar. 2006. Gymnosperms. S .Chand.
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22. Parihar N.S. 1996. Biology and Morphology of Pteridophytes. Central Book Depot Allahabad.
23. A Textbook of Bryophytes, Pteridophytes, Gymnosperm and Paleobotany Chittaranjan Mohanty

24. Diversity of Pteridophytes ,Gymnosperms and Elementary Paleobotany by Satish Kumar

**Journals**


1. American Fern Journal.
2. International Journal of plant sciences.
3. Bierhorst, D.W. (1971) – Morphology of vascular plants
4. Chamberlein, C.J. (1966) - Gymnosperms, Structure and Evolution.
5. Coulter and Chumberlein, J. M. - Morphology of Gymnosperms.
6. Foster, A. S. and Gifford, E. M. (1959)- Comparative morphology of vascular plants.
7. Ramanujan, C.G.K. (1979) - Indian Gymnosperms in Time and Space.
8. Sporne, K.R. (1967) - Morphology of Gymnosperms.
9. Vasishta, P.C. (1976) - The Gymnosperms.
10. Bhatnagar, S.P. and MoitraAlok (1996)- The Gymnosperms.
11. Arnold, C. A. (1972) - An Introduction to Paleobotany
12. Andrews, H.N. (1961) - Studies in Paleobotany.
13. Darroh, W.C. (1960) - Principles of Paleobotany.
14. Surange, K. R. (1968) - Indian Fossil Pteridophytes.
15. Shukla, A.C. and Mishra, S.D. (1975)- Essentials of Paleobotany.
16. Bhatnagar, S.P. and MoitraAlok (1975) - The Gymnosperms.
17. Stewart, W. N. (1983) - Paleobotany and the evolution of plants, Cambridge U.S.

# RAJARSHI SHAHU MAHAVIDYALAYA (AUTONOMOUS), LATUR

## M. Sc. First Year

## Semester – II

### BOTANY

## Core Course (BOCC)-6: Plant Physiology and Metabolism

Lectures-60 Maximum Marks –100 Credits: 04 Course Code: P-PPM-272

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**Objectives**

1. To increase awareness and appreciation for plants in your environment, as well as to understand their diverse physiological functions.
2. To help you understand the role of plant physiology in the botanical sciences.
3. To introduce you to some methods and techniques used in plant physiological research.
4. To give you the opportunity to develop useful research skills and to improve your scientific writing skills.
5. To help you develop the knowledge and confidence to pursue advanced courses in plant biology, and to conduct your own plant physiology research.
6. Demonstrate ways to measure environmental services accomplished by plants.
7. Propose ways of using plants to preserve and improve urban, agricultural, rural, and wilderness environments.
8. Explain and provide examples of how plants interact with light, water, soil and
9. Other organisms and how humans can optimize those interactions.
10. Evaluate the idea that plants such as wheat, corn, tea and tomato have exploited

## Course Outcomes:

After completion of course Students are enable to:

1. Understand the various metabolic, physiologicalpaths in plants.
2. Understand the regulation of growth, development and influence of environment.
3. Understand the soil plant relationship with reference to environmental factors and plant physiology.

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**Unit: I Transport and translocation mechanism: (15L)**

**1. Solute transport and photo assimilates translocation**

Uptake, transport and translocation of water, ions, solutes and macromolecules from soil, through cells, across membranes, through xylem and phloem, nutrient uptake through root microbe interaction; membrane transport proteins.

**2. Nitrogen metabolism**:

1. Root nodulation and nitrogen fixation.
2. Nitrogen uptake
3. NOD factor

**Unit: II Stress physiology and Senescence (15L)**

1. **Stress physiology**: – Responses of plants to biotic (pathogen and insects) and abiotic (water, temperature and salt) stresses.
2. **Senescence: Mechanism**, physiology of senescence; role of hormones, biochemical aspects, significance in fruit ripening.

**Unit: III Photosynthesis (15L)**

1. **Photosynthesis**: Evolution of photosynthetic apparatus, photooxidation of water, Hills reaction, two-pigment system, mechanism of electron and proton H+ transport.
2. **Carbon assimilation pathways** in C3, C4 and CAM plants. Photosynthetic productivity in these plants, and significance.
3. **Photorespiration:** Glycolate pathway, Glyoxylate pathway, biochemical basis of photorespiration, significance.

**Unit: IV Plant Metabolism (15L)**

1. **Secondary metabolites** - Biosynthesis of terpenes, phenols and nitrogenous compounds and their roles.

2. **Phytohormones:** Biosynthesis and mechanism of action of Phytohormones auxin, gibberellin, cytokinin, ethylene and ABA. Brassinosteriods, Jasmoic acids, Polyamines, salicylic acid.

**References:**


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2. Galston, A.W. 1989. Life Processes in Plants. Scientific American Library, Springer-Verlag, New York, USA.
3. Hookahs, P.J.J., Hall, M.A. and Libbenga, K.R. (eds) 1999.Biochemistry and Molecular Biology of Plant Hormones, Elsevier, Amsterdam, The Netherlands.
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5. Lodish, H., Berk, A., Zipursky, S.L., Matsudaira, P., Baltimore, Dand Darnell, J. 2000. Molecular Cell Biology (fourth edition) W.H. Freeman and Company, New York, USA.
6. Moore, T.C. 1989. Biochemistry and Physiology of Plant Hormones (second edition). Springer-Verlag, New York, USA.
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8. Salisbury, F.B. and Ross, C.W. 1992. Plant Physiology (4th edition), Wadsworth Publishing Co., California, USA.
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10. Taiz, L. and Zeiger, E. 1998. Plant Physiology (2nd edition). Academic Press, San Diego, U.S.A. Westhoff, P. (1998) Molecular Plant Development: from Gene to Plant. Oxford University Press, Oxford, UK.
11. Plummer, D.T. 1988. An Introduction to practical Biochemistry. Tata McGraw Hill Publishing Co. Ltd. New Delhi.

12. Wilson, K. and Goulding, K.H. (Eds), 1992. A Biologist Guide to Principles and Techniques.
13. Practical Biochemistry (3rd Edition). Manas Saikia for Foundation Books, New Delhi.
14. Sadasivam, S. and Manickam A., 1996. Biochemical methods (2ndEdition). New Age International Publishers New Delhi.
15. Modern Plant Physiology R. K. Sinha 2nd edition.
16. Plant Physiology Kumar /Purohit 2nd edition.
17. Plant Physiology and Metabolism Dr. K. N. Dhumal, V. K. Kadam, Dr. Sayyad Iliyas, Dr. R.N. Deshmukh.
18. Basics of Plant Physiology and Metabolism Dr. Arun Joshi 4th edition.

# RAJARSHI SHAHU MAHAVIDYALAYA (AUTONOMOUS), LATUR

## M. Sc. First Year

## Semester-II

### BOTANY

## Core Course (BOCC)-7: PlantEcologyandEvolution

Lectures-60 Maximum Marks –100 Credits: 04 Course Code: P-PEE-273

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**Objectives:**

1.To create awareness among students about bioresource conservation.

2.To provide scientific basis for aims of environmentalism.

3.To understand dynamics of our surrounding and conserve it.

4.To understand trend of evolution among living organisms.

5.To provide students with an understanding of the basics of plant-environment and their interaction with other organisms.

**Course Outcomes:**

After completion of course Students are enable to:

1.Create awareness among students about bio resource conservation.

2. Understand dynamics of our surrounding and importance of its conserve.

3. Understand trend of evolution among living organisms.

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## Unit-I: Environmental Ecology (15L)

1. **HabitatandNiche:**Conceptofhabitatandniche; (nichewidthandoverlap;fundamental and realizedniche;resourcepartitioning;characterdisplacement.)
2. **Ecosystem types:** Plant interaction with abiotic factors such as climatic, edaphic, and topographic factors Plant-plant interactionconcept of allelopathy, parasitism**.** Species interaction: mutualism, commensalism, competition and predation

3. **Conservation Biology:**

**i)** Principles of conservation, major approach to management.

**ii)** Organisms of conservation concern: Rare, endangered species

## Unit-II: Population and Community Ecology (15L)

**1. PopulationEcology:**Characteristicsofa population;populationgrowthcurves; population regulation,lifehistorystrategies(randKselection);conceptofmetapopulation-demesand dispersal,agestructurepopulations.

**2.CommunityEcology:**Natureofcommunities;communitystructureandattributes;level of speciesdiversityanditsmeasurement.

**3.Diversity types and levels:** Alpha, Beta, Gamma.

**4. EcologicalSuccession:**Types;mechanisms;changesinvolvedinsuccession,concept of climax.

## Unit- III: Evolutionary Biology (18L)

**1. Emergenceofevolutionarythoughts:**Lamarck;Darwin-conceptsofvariation, Adaptationstruggle,fitnessandnaturalselection;Spontaneityofmutations;theevolutionary synthesis.

**2. Originofcellsandunicellularrevolution:**Originofbasicbiologicalmolecules;Abiotic Synthesisoforganicmonomersandpolymers;ConceptofOparaneand Haldane; ExperimentofMiller(1953);Thefirstcell;Evolutionofprokaryotes;Originofeukaryotic cells;Evolutionof unicellulareukaryotes

**3. PaleontologyandEvolutionaryHistory:**Theevolutionarytimescale;Eras,Lectures and epoch;Majoreventsintheevolutionarytimescale.

## Unit-IV Molecular evolutionary Biology (12L)

**1. MolecularEvolution:**Conceptsofneutralevolution,moleculardivergenceandmolecular clocks; originofnewgenesandproteins.

**2. TheMechanisms:**Populationgenetics-Populations,Genepool,Genefrequency;Hardy-WeinbergLaw;conceptsandrateofchangeingenefrequencythroughnaturalselection, Migrationandrandomgeneticdrift;Adaptiveradiation;Isolatingmechanisms;Speciation; AllopatricandSympatric;Convergentevolution; Sexualselection,Co-evolution.

## REFRENCES:


1.Patterns of primary production in the biosphere. H.F.W. Lieth (1978).

2.Fundamentals of Ecology. Agarwal S. K. (1992).

3.The Biosphere. Bradbury I. K. (1990)

4.Handbook of Limnology and water pollution with practical methodology Das S. M. (1989).

5.Environment and Plant Ecology. Etherington J. R. (1975).

6.Deterministic mathematical models in population ecology. Freedman H. I.(1980).

7.Quantitative Plant Ecology. Greig Smith P. (1983).

8.Comparative Plant Ecology. Grisms J. P. et .al (1988).

9.Quantitative and dynamic ecology. Kershaw K. S. (1964).

10.Concept of ecology. Kormondy E. J. (1966).

11.Ecology. Krebs C. J. (1978).

12.Manual of plant Ecology. Misra K. C. (1989).

13.Proceedings of the school of plant ecology. Misra R. and Das R. R. (1971).

14.Ecology. Odum E. P. (1971).

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17.Principles of Environment Sciences. Pandeya S. C. eta .l (1963).

18.On the Origin of Species. London: John Murray (always seek out the first edition, facsimile version, and avoid later editions). Darwin, C. 1859

19.Genetics and the Origin of Species. New York: Columbia Univ. Press (there are several later editions, and the title changed in the last). Dobzhansky, T. 1937.

20.The Genetical Theory of Natural Selection. Oxford: Oxford Univ. Press (there is a later edition). Fisher, R. A. 1930.

21.Phylogenetic Systematics. Urbana: Univ. Illinois Press (an English translation of a book published earlier in German). Hennig, W. 1966.

22.Systematics and the Origin of Species. New York: Columbia Univ. Press (there is a later edition, with a different title). Mayr, E. 1942.

23.Factors of Evolution. Philadelphia: Blakiston (publication of this book, written in the early 1940's, was delayed because of war, and then the translation from Russian to English was also delayed; it has been reprinted by Univ. Chicago Press). Schmalhausen, I. I. 1949

24.Tempo and Mode of Evolution. New York: Columbia Univ. Press (again, there is a later edition, with a different title). Simpson, G. G. 1944.

25. A Textbook of Plant Ecology Including Ethnobotany and Soil Science by Dr.R.S.Shukla, Dr.P.S.Chandel S Chand Publication.

26. A Textbook of Plant Ecology by R.S.Ambasht , N.K.Ambasht 15th edition

# RAJARSHI SHAHU MAHAVIDYALAYA (AUTONOMOUS), LATUR

## M. Sc. First Year

## Semester – II

### BOTANY

**Core Course (BOCC)-8: Plant Structure, Development & Reproduction in Angiosperms**

Lectures-60 Maximum Marks –100 Credits: 04 Course Code: P-PSD-274

**Objectives:**

1. To describe reproductive structure of a plant and compare male and female gametophytes and explain how they form in Angiosperms.
2. To describe the components of a complete flower.
3. To compare and contrast life cycles of angiosperms, gymnosperms.
4. To describe the structure and function of the flower within the angiosperm life cycle.
5. To list and explain significance of steps in angiosperm gametogenesis and fertilization, including double fertilization.
6. To explain significance of features or steps of seed maturation, dormancy, and germination.
7. To predict mechanisms of pollination or dispersal based on flower or fruit characteristics.

**Course Outcomes:**

After completion of course Students are enable to:

1. Understand anatomy in relation to basic structure of plants and their developmental structure.
2. Acquire knowledge about leaf, shoot and root development.
3. Understand basic anatomical concept of primary structure of root stem and flower.
4. Understand the idea of secondary growth.

**Unit: I: Process of Plant Development (15L)**

1. Plant development- concept, definitions and unique features.
2. Processes of development, cell growth, organization of cells, tissues and tissue system to whole plant. Cell- cell interaction.
3. Factors for development- intrinsic and extrinsic.
4. Vegetative development – structure and organization of seed embryo.
5. Seed formation and germination – Embryonal axis- meristems, establishment of seedling organ.

6. Phenomenon of development, meristems as dynamic centers of cell regeneration, organ development, primordium to organ, juvenility – characteristics, transition to adult phase. Coordinated development.

**Unit: II: Embryological Aspects of Development (15L)**

1. Transition - vegetative to reproductive phase, morphological and histochemical changes in vegetative plant body.
2. Gametophyte development, microsporogenesis and male gametophyte megasporogenesis and female gametophyte
3. Fertilization – process and its significance abnormalities in fertilization.
4. Embryo development - Development of embryo in dicots and monocot, unclassified or abnormal embryos, unorganized or reduced embryo.
5. Polyembryony – concept and classification of polyembryony, special cases and causes of polyembryony, apomixes- concept, categories- agamospermy and vegetative reproduction apospory, parthenogenesis.

**Unit III: Molecular basis of plant development [15L]**

1. Plant hormones– Biosynthesis, storage, breakdown and transport; physiological effects and mechanisms of action.
2. Organization of shoot and root apical meristem, shoot and root development, leaf development and phyllotaxy.
3. Molecular basis of plant development - Embryogenesis and seedling development, root, shoot and leaf development, gene expression during transition to flowering and flower development molecular genetics of gametophytes development, expression of cell incompatibility.
4. Transition to flowering and flower development-ABC Model.

**Unit IV: Palynology[15L]**

1. Palynology**:** Scope and branches with special suggested readings
2. Palynotaxonomy**:** Pollen morphology and plant taxonomy with suggested readings: to Gymnosperms and Angiosperms.
3. Paleopalynology: Principles, microfossil recovery theory and techniques, microfossil groups and oil exploration.
4. Aeropalynology**:** Principles, techniques, pollen analysis, pollen and spore allergy, allergic properties of pollen, pollen calendar and importance.
5. Aeropalynology**:** Pollen viability, pollen germination, pollen storage and their Significance.
6. Melitopalynology**:** Bee colony, foraging behavior of bees Unfloral multifloral honey, application in crop productivity.

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**RAJARSHI SHAHU MAHAVIDYALAYA (AUTONOMOUS), LATUR**

**M. Sc. First Year**

**Semester – II**

**BOTANY**

## Lab Course-V

Practica-15 Maximum Marks –50 Credits: 02 Course Code: P-LAC-275

**(Practicals based on Diversity of Pteridophytes, Gymnosperms, and Fossil Plants)**

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## Objectives:

1. To study the evolution of stele in pteridophytes.
2. To study the heterospory and seed habit.
3. To study the maceration techniques.

## Course outcomes of laboratory course

1. Students are able to classify Pteridophytes and Gymnospermson the basis feature.
2. Able to distinguish between reproductive stages of Pteridophytes and Gymnosperms.
3. Able to arrange systematic position of Pteridophytes and Gymnosperms.

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1-5 Morphological, anatomical and reproductive studies of the following members (available specimens / slides)

- Psilotales: Tmesipteris
- Lycopodiales: Lycopodium /Selaginella
- Filicales :Adianntum
- Equisitales: :Equisetum
- Salviniales :Salvinia
- Prepration of double stained slidepermnant slide of above mentioned plant material.

6-10Study of the morphology and anatomy of the vegetative and reproductive parts of Zamia, Pinus, Gnetum, and Ephedra from available specimens / slides.

11-12Study of following specimens (Any two as per available material)

**N.B: 1) Any ten Practicals**

**2) Several Short Excursions and at least one Long Excursion.**

# RAJARSHI SHAHU MAHAVIDYALAYA (AUTONOMOUS), LATUR

## M. Sc. First Year

## Semester – II

### BOTANY

## Lab Course-VI

**Practical**-15 Maximum Marks –50 Credits: 02 Course Code: P-LAC-276

**(Practicals based on Plant physiology and metabolism)**

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## Objective:

1. To study biochemical changes during leaf senescence.
2. To study the role of growth hormone in plant physiology.
3. To study the importance of secondary metabolites

## Course outcomes of laboratory course

1. Able to understand energy flow in plants.
2. Able to understand different physiological phenomenon of plants.

3.Able to recognize need of mineral nutrients by plants.

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1. Estimation of soluble proteins in germinating and non-germinating seeds by Lowry /Bradford'smethod
2. Estimation of total amino acids in germinating and non-germinating seeds
3. The identification of sugar in Fruit juices by TLC.
4. Isolation of Chloroplast from spinach leaves.
5. To study biochemical changes during leaf senescence.
6. Effect of time and enzyme concentration on the rate of enzyme action( Any one )
7. Estimation of stress induced amino acid (Proline)
8. Estimation of total fats in fatty seeds.
9. Separation of Alkaloids/Phenols by TLC.
10. Estimation of Phenols by chemical method.
11. Qualitative analysis of secondary metabolites.
12. Sugar/ amino acids analysis with paper chromatography.
13. Estimation of Chlorophylls

N.B: 1) Any ten Practicals

2) Several Short Excursions and at least one Long Excursion.

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**M. Sc. First Year**

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**BOTANY**

## Lab Course-VII

Practicals-15 Maximum Marks –50 Credits: 02 Course Code: P-LAC-277

**(Practicals based on Plant Ecology and Evolution)**

## Objective:

1. To determination the of frequency, Density, Abundance and Dominanceof the plant Community.
2. To evaluate of abiotic and biotic components of ecosystem.
3. To study the importance of Phytoplankton

## Course outcomes of laboratory course

1. Able to understand abiotic and biotic components of ecosystem.
2. Able to understand concept of BOD and DO.
3. Able to recognize need of mineral nutrients flow in food chain.

1. Study of Phytoplankton
2. Evaluation of Abiotic components of Aquatic ecosystem (pH, temperature, Transparency).
3. Determination of Phytomass
4. Study of species diversity index.
5. Study of Population dynamics
6. Determination of field capacity of Soil
7. Estimation of primary productivity of an Aquatic ecosystem.
8. Determination of residual chlorine from water sample.
9. Determination of frequency, Density, Abundance, Dominance and IVI of the plant Community.
10. Estimation of DO and free $CO_2$
11. Study of morphological and anatomical characteristics of plants under pollution stages.
12. Allelopathic analysis of the plants.
13. Determination of Palmers algal index.
14. Ecological reports based on tour or analysis.

**N.B: 1) Any ten Practicals.**

**2) Several Short Excursions and at least one Long Excursion**

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## M. Sc. First Year

## Semester – II

### BOTANY

## Lab Course-VIII

Practical-15 Maximum Marks –50 Credits: 02 Course Code: P-LAC-278

**(Practicals Based on Plant Structure, Development & Reproduction in Angiosperms)**

## Objective:

1. To study the reproductive structures of Angiosperms.
2. To study the growth pattern in reproductive structure.
3. To study the nutritive tissue and its types.

## Course outcomes of laboratory course

1. Able to differentiate various tissues.

2)They are able to perform sectioning of various ovules.

3) Developed approach for embryology study

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1. Isolation of vegetative and reproductive apical meristem.
2. Tracing the course of stomatal development and observations on stomatal types.
3. Anatomical studies on secondary growth (wood).
4. Origin and development of epidermal structures (Trichomes, glands and lenticels) and study of secretary structures (nectarines and laticifers).
5. Histochemical comparison between vegetative SA and reproductively induced SA.
6. Observations on Microsporogenesis and development of male gametophyte (pollen).
7. Observations on. Megasporogenesis and development of female gametophyte.
8. Observations on types of endosperm, dissection and isolation of endosperm.
9. Observations on stages of embryo development, dissection and isolation of developing embryo (3 stages).
10. In vitro germination of spore/pollen, Correlation between fertility (stain ability), viability (TTC and FDA staining) and germinability (in vitro) of pollen grains.
11. Histological analysis of secondary growth (Primary or secondary axis).
12. Dissection of haustorial endosperm.
13. Dissection of an embryo of dicot and monocot.

**N.B: 1) Any ten Practicals.**

**2) Several Short Excursions and at least one Long Excursion**