Programme Outcomes of B.Sc. Botany

Knowledge and understanding of: 1. The range of plant diversity in terms of structure, function and environmental relationships. 2. The evaluation of plant diversity. 3. Plant classification and the flora of Maharashtra. 4. The role of plants in the functioning of the global ecosystem. 5. A selection of more specialized, optional topics. 6. Statistics as applied to biological data.

Practical skills: Students learn to carry out practical work, in the field and in the laboratory, with minimal risk. They gain introductory experience in applying each of the following skills and gain greater proficiency in a selection of them depending on their choice of optional modules. 1. Interpreting plant morphology and anatomy. 2. Plant identification. 3. Vegetation analysis techniques. 4. A range of physiochemical analyses of plant materials in the context of plant physiology and biochemistry. 5. Analyze data using appropriate statistical methods and computer packages.

Scientific Knowledge: Apply the knowledge of basic science, life sciences and fundamental process of plants to study and analyze any plant form.

Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern instruments and equipments for Biochemical estimation, Molecular Biology, Biotechnology, Plant Tissue culture experiments, cellular andphysiological activities of plants with an understanding of the application and limitations.

The Botanist and society: Apply reasoning informed by the contextual knowledge to assess plant diversity, its importance for society, health, safety, legaland environmental issues and the consequent responsibilities relevant to the biodiversity conservation practice.

Environment and sustainability: Understand the impact of the plant diversity in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work,as a member and leader in a team, to manage projects and in multidisciplinary environments.

Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Course Outcomes of B.Sc. Botany

1. Critically evaluation of ideas and arguments by collection relevant information about the plants, so as recognize the position of plant in the broad classification and phylogenetic level.
2. Accurately interpretation of collected information and use taxonomical information to evaluate and formulate a position of plant in taxonomy.
3. Students will be able to apply the scientific method to questions in botany by formulating testable hypotheses, collecting data that address these hypotheses, and analyzing those data to assess the degree to which their scientific work supports their hypotheses.
4. Students will be able to present scientific hypotheses and data both orally and in writing in the formats that are used by practicing scientists.
5. Students will be able to access the primary literature, identify relevant works for a particular topic, and evaluate the scientific content of these works.
6. Students will be able to identify the major groups of organisms with an emphasis on plants and be able to classify them within a phylogenetic framework.
7. Students will be able to use the evidence of comparative biology to explain how the theory of evolution offers the only scientific explanation for the unity and diversity of life on earth. They will be able to use specific examples to explicate how descent with modification has shaped plant morphology, physiology, and life history.
8. Students will be able to explain how Plants function at the level of the gene, genome, cell, tissue, Flower development. Drawing upon this knowledge, they will be able to give specific examples of the physiological adaptations, development, reproduction and mode of life cycle followed by different forms of plants.
9. Students will be able to explain the ecological interconnectedness of life on earth by tracing energy and nutrient flow through the environment. They will be able to relate the physical features of the environment to the structure of populations, communities, and ecosystems.
10. Students will be able to demonstrate proficiency in the experimental techniques and methods of analysis appropriate for their area of specialization within biology.

COURSE OUTCOME (Honours)

SEMESTER: 1st Semester

Paper code: BOTHCC101T

Name of Paper: Phycology and Microbiology

Total Credits: 4

Teaching lectures per unit: 12

Course outcome:

On completion of the course, students are able to:

1. Understand the diversity among Algae.
2. Know the systematic, morphology and structure, of Algae.Understand the life cycle pattern of Algae.
3. Understand the useful and harmful activities of Algae.
4. Understand the concept, principle and types of sterilization methods.
5. Know the concept and characteristics of antiseptic, disinfectant and their mode of action.
6. Know the cultivation methods of bacteria, yeast, fungi and virus.
7. Principle, working and applications of instruments viz, pH meters, spectrophotometer, centrifuge, viscometer, and laminar air flow.
8. Understand the Microbial Genetics and Recombination in Bacteria.

SEMESTER: 1st Semester

Paper code: BOTHCC102T

Name of Paper: Biomolecules and Cell Biology

Total Credits: 4

Teaching lectures per unit: 12

Course outcome:

1) Know about the genomic organization or living organisms, study of genes genome, chromosome etc.
2) Gain knowledge about the mechanism and essential component required for prokaryotic DNAreplication.
3) Understand the fundamentals of Recombinant DNA Technology.
4) Know about the Genetic Engineering.
5) Understand the principle and basic protocols for Plant Tissue Culture.
6) The concept of operon and its structure and regulation.

SEMESTER: 2nd Semester

Paper code: BOTHCC201T

Name of Paper: Mycology and Plant Pathology

Total Credits: 4

Teaching lectures per unit: 12

Course outcome:

1) Understand the Biodiversity of Fungi
2) Know the Economic Importance of Fungi
3) Know the terminologies in plant pathology.
4) Understand the scope and importance of Plant Pathology.
5) Know the prevention and control measures of plant diseases and its effect on economy ofcrops.

SEMESTER: 2nd Semester

Paper code: BOTHCC202T

Name of Paper: Archegoniate

Total Credits: 4

Teaching lectures per unit: 12

Course outcome:

1. Understand the morphological diversity of Bryophytes and Pteridophytes and Gymnosperms.
2. Understand the economic importance of the Bryophytes and Pteridophytes and Gymnosperms.
3. Know the evolution of Bryophytes and Pteridophytes and Gymnosperms.
4. Understand the morphological diversity of Bryophytes.
5. Understand the economic importance of the Bryophytes.
6. Know the taxonomic position, occurrence, thallus structure, reproduction of Bryophytes.
7. Know the scope of Paleobotany, types of fossils, its role in global economy and geological time scale.

SEMESTER: 3rd Semester

Paper code: BOTHCC301T

Name of Paper: Anatomy of Angiosperm

Total Credits: 4

Teaching lectures per unit: 12

Course outcome:

1. Know the scope and importance of the discipline.
2. Understand plant communities and ecological adaptations in plants.
3. Know various tissue systems.
4. Understand the normal and anomalous secondary growth in plants and their causes.
5. Perform the techniques in anatomy.

SEMESTER: 3rd Semester

Paper code: BOTHCC302T

Name of Paper: Economic Botany

Total Credits: 4

Teaching lectures per unit: 12

Course outcome:

1. Gain knowledge about various plants of economic use.
2. Know importance of plants & plant products.
3. Understand the chemical contents of the plant products.
4. Know about the utility of plant resources.

SEMESTER: 3rd Semester

Paper code: BOTHCC303T

Name of Paper: Genetics

Total Credits: 4

Teaching lectures per unit: 12

Course outcome:

1. Gain knowledge about “Cell Science”.
2. Understand Cell wall Plasma membrane, Cell organelles and cell division.
3. Learn the scope and importance of molecular biology.
4. Understand the biochemical nature of nucleic acids, their role in living systems, experimentalevidences to prove DNA as a genetic material.
5. Understand the process of synthesis of proteins and role of genetic code in polypeptide

SEMESTER: 4th Semester

Paper code: BOTHCC401T

Name of Paper: Molecular Biology

Total Credits: 4

Teaching lectures per unit: 12

Course outcome:

1) Know about the genomic organization or living organisms, study of genes genome, chromosome etc.
2) Gain knowledge about the mechanism and essential component required for prokaryotic DNAreplication.
3) Understand the fundamentals of Recombinant DNA Technology.
4) Know about the Genetic Engineering.
5) Understand the principle and basic protocols for Plant Tissue Culture.
6) The concept of operon and its structure and regulation.

SEMESTER: 4th Semester

Paper code: BOTHCC402T

Name of Paper: Plant Ecology and Phytogeography

Total Credits: 4

Teaching lectures per unit: 12

Course outcome:

1. Know the nitrogen metabolism and its importance.
2. These topics show the complexity of plant ecology, since it includes plants from floating single-celled algae up to large canopy forming trees.
3. In order to show up, a species must either have evolved in an area or dispersed there (either naturally or through human agency), and must not have gone locally extinct.
4. Phytogeography is concerned with all aspects of plant distribution, from the controls on the distribution of individual species ranges (at both large and small scales, see species distribution) to the factors that govern the composition of entire communities and floras.

SEMESTER: 4th Semester

Paper code: BOTHCC403T
Name of Paper: Plant Systematic
Total Credits: 4
Teaching lectures per unit: 12
Course outcome:

1) Know the conceptual development of taxonomy and sytematics.
2) Students will be able to demonstrate a systematic knowledge of learning processes and a professional attitude in classroom teaching of mathematics and IT.
3) Student are able to learn the classification and nomenclature of organisms including plants for taxonomic studies
4) Taxonomic studies can also help in studying the rules and nomenclature of plants knowing systemic position.
5) With huge varieties of plants surrounding us need an importance of human society through systemic studies.
6) Trace the history of development of systems of classification emphasizing angiospermic taxa.
7) To learn the wide activities in angiosperm and trends in classification.
8) Learn about the characters of biologically important families of angiosperms.

SEMESTER: 5th Semester

Paper code: BOTHCC501T
Name of Paper: Reproductive Biology of Angiosperm
Total Credits: 4
Teaching lectures per unit: 12
Course outcome:

1. Know fertilization, endosperm and embryogeny
2. Student will able to to interpret and analyse course database
3. Student will be able to recognize embryonic tissue and organ morphology and structure in clinical specimens.
4. Learn about the reproductive characteristics of the plant.
5. Understand the Phylogeny of angiosperms -A general account of the origin of Angiosperms

SEMESTER: 5th Semester

Paper code: BOTHCC 502T
Name of Paper: **Plant Physiology**
Total Credits: 4
Teaching lectures per unit: 12
Course outcome

1. Know importance and scope of plant physiology.
2. 2Understand the plants and plant cells in relation to water.
3. Understand the process of photosynthesis in higher plants with particular emphasis on light and dark reactions, C3 and C4 pathways.
4. Understand the respiration in higher plants with particular emphasis on aerobic and anaerobicrespiration.
5. Learn about the movement of sap and absorption of water in plant body
6. Understand the plant movements.
7. Learn and understand about mineral nutrition in plants.
8. Understand the growth and developmental processes in plants.
9. Know about Photosynthesis and Respiration in plants.
10. Understand the process of translocation of solutes in plants
11. Know the nitrogen metabolism and its importance.

SEMESTER: 5th Semester

Paper code: BOTDSE 501T
Name of Paper: **Stress Biology/ Plant breeding**
Total Credits: 4
Teaching lectures per unit: 12
Course outcome

1. Understand the science of Stress Biology.
2. To introduce the student with branch of stress biology for the survival of human being from food insecurity.
3. To study the techniques of production of new superior crop verities involving abiotic stress, and other breeding techniques.
4. Understand the modern strategies applied in Stress biology and Plant Breeding to sequence andanalyze genomes
5. Get the detail knowledge about modern strategies applied in Plant Breeding for cropimprovement i.e. Mass selection, Pureline Selection and Clonal selection.

SEMESTER: 5th Semester

Paper code: BOTDSE 502T
Name of Paper: **Analytical techniques in Plant Science**
Total Credits: 4
Teaching lectures per unit: 12
Course outcome

1. Students are able to learn for the analytical procedure and techniques with the help of basics in plant science.
2. Understand the process of synthesis of proteins and role of genetic code in polypeptideformation.
3. Know the details of Microscopy- Principles of light microscopy, electron microscopy (TEMand SEM).
4. Understand & perform Chromatography and cultural techniques in Botany.
5. Understand the methods used in Micrometry, Microtomy and Microphotography.

SEMESTER: 6th Semester

Paper code: BOTHCC 601T
Name of Paper: **Plant Metabolism**
Total Credits: 4
Teaching lectures per unit: 12
Course outcome

1) Understand the properties of Monosaccharides, Oligosaccharides and Polysaccharides.
2) They will learn about the Significance of Carbohydrates.
3) Understand the Properties of saturated fatty acids, and unsaturated fatty acids.
4) Understand lipid metabolism in plants.
5) Understand the Beta Oxidation, Gluconeogenesis and its role in mobilization of fatty acidsduring germination.
6) They will learn about the Significance of lipids.
7) They will be able to understand Brief outline of biosynthesis of amino acid.
8) Understand the protein - structure and classification and protein biosynthesis in prokaryotesand eukaryotes.
9) They will learn about the nucleic acid metabolism.
10) Understand the process of translocation of solutes in plants
11) Know the nitrogen metabolism and its importance.

SEMESTER: 6th Semester

Paper code: BOTHCC 602T
Name of Paper: **Plant Biotechnology**
Total Credits: 4
Teaching lectures per unit: 12
Course outcome

1) Gain knowledge about the mechanism and essential component required for prokaryotic DNAreplication.
2) Understand the fundamentals of Recombinant DNA Technology.
3) Know about the Genetic Engineering.
4) Understand the principle and basic protocols for Plant Tissue Culture.
5) The concept of operon and its structure and regulation.

SEMESTER: 6th Semester

Paper code: BOTDSE 601T
Name of Paper: **Research Methodology**
Total Credits: 4
Teaching lectures per unit: 12
Course outcome

1. Using research methodology based knowledge and research methods including helps design of experiments, analysis and interpretation of data, and development of the information to provide valid conclusions.
2. To expose the students to different processes used in industries and in research field
3. To develop skills required in various industries, research labs and in the field of humanhealth.
4. To develop skills required in various industries, research labs and in the field of agriculture, food, human health.
5. It is a tool of research, major industrial importance in the area of plant propagation, diseaseelimination, plant/cropimprovement and production of secondary metabolites.

SEMESTER: 6th Semester

Paper code: BOTDSE 602T
Name of Paper: **Industrial and Environmental Microbiology**
Total Credits: 4
Teaching lectures per unit: 12
Course outcome

1. It gives basic idea regarding the isolation of industrially important microbes, fermenter design, fermentation media preparation and the downstream processing of theproduct.
2. Become aware of applications of different plants in various industries.
3. To highlight the potential of these studies to become an entrepreneur.
4. To equip the students with skills related to laboratory as well as industries based studies.
5. To understand the scope andapplications of microbiology in various fields like medical, food, industrial microbiology.

COURSE OUTCOME (Pass)

Paper code: BOTDSC/GE 101T

Name of Paper: **Plant Biodiversity (Microbes, Algae, Fungi and archegoniate)**

Total Credits: 4, Teaching lectures per unit: 12

Course outcome:

1) Understand the useful and harmful activities of Algae.
2) Understand the Biodiversity of Fungi
3) Know the Economic Importance of Fungi
4) Understand the morphological diversity of Bryophytes

Paper code: BOTDSC/GE 201T

Name of Paper: **Plant Ecology and Taxonomy**

Total Credits: 4, Teaching lectures per unit: 12

Course outcome:

1. Understand the plants and plant cells in relation to water.
2. Understand the process of photosynthesis in higher plants with particular emphasis on lightand dark reactions, C3 and C4 pathways.
3. Understand the respiration in higher plants with particular emphasis on aerobic and anaerobicrespiration.
4. Understand plant communities and ecological adaptations in plants.
5. Know the concept of methodology in taxonomy.

Paper code: BOTDSC/GE 301T
Name of Paper: **Plant Anatomy and Embryology**
Total Credits: 4, Teaching lectures per unit: 12
Course outcome:

1. Know the scope and importance of the discipline.
2. Understand plant communities and ecological adaptations in plants.
3. Understand Bioremediation, Global warming and climate change.

Paper code: BOTDSC/GE 401T
Name of Paper: **Plant Physiology and Metabolism**
Total Credits: 4, Teaching lectures per unit: 12
Course outcome:

1. Know importance and scope of plant physiology.
2. Understand the plants and plant cells in relation to water
3. Understand the properties of Monosaccharides, Oligosaccharides and Polysaccharides.
4. They will learn about the Significance of Carbohydrates.
5. Understand the Properties of saturated fatty acids, and unsaturated fatty acids.
6. Understand lipid metabolism in plants.
7. Understand the Beta Oxidation, Gluconeogenesis and its role in mobilization of fatty acidsduring germination.
8. They will learn about the Significance of lipids.
9. They will be able to understand Brief outline of biosynthesis of amino acid.
10. Understand the protein - structure and classification and protein biosynthesis in prokaryotesand eukaryotes.
11. They will learn about the nucleic acid metabolism.

Paper code: BOTDSE 502T
Name of Paper: **Analytical techniques in Plant Science**
Total Credits: 4, Teaching lectures per unit: 12
Course outcome

1. Students are able to learn for the analytical procedure and techniques with the help of basics in plant science.
2. Understand the process of synthesis of proteins and role of genetic code in polypeptideformation.
3. Know the details of Microscopy- Principles of light microscopy, electron microscopy (TEMand SEM).
4. Understand & perform Chromatography and cultural techniques in Botany.
5. Understand the methods used in Micrometry, Microtomy and Microphotography.

Paper code: BOTDSE 602T
Name of Paper: **Industrial and Environmental Microbiology**
Total Credits: 4, Teaching lectures per unit: 12
Course outcome

6. It gives basic idea regarding the isolation of industrially important microbes, fermenter design, fermentation media preparation and the downstream processing of theproduct.
7. Become aware of applications of different plants in various industries.
8. To highlight the potential of these studies to become an entrepreneur.
9. To equip the students with skills related to laboratory as well as industries based studies.
10. To understand the scope andapplications of microbiology in various fields like medical, food, industrial microbiology.