

Department of Botany, Palamuru University M. Sc. Botany Program

PROGRAM OUTCOMES

Outcome On completion of the program students will be able to:

1. Think Critically - Get ability to apply the process of science by formulating hypotheses and design experiments based on the scientific method.
2. Analyze and interpret results generated through studies in botany, taxonomical treatments, field studies, excursion tours, and laboratory techniques used in the subject.
3. Use quantitative reasoning by using mathematical calculations and graphing skills to solve problems in plant science (Botany)
4. Effective Communication and collaborate with other disciplines by effectively communicating the fundamental concepts of Botany in a written and oral format.
5. Identify credible scientific sources to interpret and evaluate the pieces of evidence
6. Understand the relationship between science and society by recognizing and discussing logical, scientific and ethical issues in Botany subject.
7. Environment and Sustainability: Understand the issues of environmental contexts and sustainable development with respect to assessment, conservation and utilization of floral diversity.
8. Industrial algal technology has wide applications in food & feed supplies, pharmaceuticals & nutraceuticals, bio fertilisers, biofuels & fine chemicals
9. Importance of herbal origin biopesticides have to be emphasised & students have to focus on improving health, enhance environmental protection.
10. Methodology & Research to develop cheap & effective techniques for environmentally sound technologies.
11. Integrated Approach for environmental management is essential.
12. The renewable energy sources are important now a days so biofuel industries have been established by using living organisms.

13. The energy content of biodiesel is about 90% and that of petroleum diesel. Hence, study of biofuels has received importance.
14. In order to save the biodiversity and indigenous cropping pattern, use of biopesticides is always helpful rather than chemical pesticides.
15. Study of biopesticides and their manufacturing is possible with the help of this knowledge.
16. A student of botany will be a good entrepreneur.
17. Algal fuels a 3rd generation biofuels are a source of energy rich oils & can replace fossil fuels. Lipid part of algae biomass can be extracted & converted into biodiesel. Alternatively or following lipid extraction, the carbohydrates content of algae can be fermented into biobutanol.
18. Bio hydrogen a 4th generation biofuel likely to involve harvesting of solar energy with practical technologies yet to be developed.
19. Proper understanding will facilitate efforts on research & development directed towards Botany

PROGRAM SPECIFIC OUTCOMES

1. Develop a conceptual understanding of the principles and importance of Botany. Students would be benefited with knowledge of core subjects like plant diversity, physiology and biochemistry, molecular cytogenetic and application of statistics etc. which are offered in these subjects. Modules on analytical techniques, plant tissue culture and photochemistry would make them obtain skills that help in doing research.
2. Learn about practical technique in lab for detail study of plant cell structure, reproduction, anatomy, breeding procedures for hybridization. Maintain a high level of scientific excellence in botanical research with specific emphasis on the role of plants. Create, select and apply appropriate techniques, resources and modern technology in multidisciplinary way. Practice of subject with knowledge to design experiments, analyze and interpret data to reach to an effective conclusion.
3. They would identify, formulate and analyze the complex problems with reaching a substantiated conclusion. Logical thinking with application of biological, physical and chemical sciences. Learning that develops analytical and integrative problem-solving approaches.
4. Students would perform functions that demand higher competence in national/international organizations with sporty and helping spirits. Prepare the students for many competitive exams like MPSC, UPSC NET SET GATE.
5. Best problem-solving skills in students would encourage them to carry out innovative research projects thereby making them to use knowledge creation in depth. Enable the students to be resourceful in identifying the plants

6. Knowledgeable, disciplined students with good values, ethics, and kind heart will help in nation building globally. Student should be aware of ethical issues and regulatory considerations while addressing society needs for growth with honesty
7. Critical Thinking: Take informed actions after identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational, and personal) from different perspectives.
8. Communication: Speak, read, write and listen clearly in person and through electronic media in English and in one Indian language, and make meaning of the world by connecting people, ideas, books, media and technology.
9. Social Interaction: Elicit views of others, mediate disagreements and help reach conclusions in group settings.
10. Ethics: Recognize different value systems including your own, understand the moral dimensions of your decisions, and accept responsibility for them.
11. Environment and Sustainability: Understand the issues of environmental contexts and sustainable development.
12. Self-directed and Life-long Learning: Acquire the ability to engage in independent and life-long learning in the broadest context socio- technological changes

13. Identify and classify the plants by using the key characters.
14. Prepare and view specimens for examination using light microscopy
15. Use pure culture and selective techniques to isolate fungi, plant pathogens, algae and identify them growing on media.
16. Qualitative and quantitative estimate the number of floral components by using enumeration and suitable sampling and techniques.
17. Use appropriate plant molecular techniques and use of instrumentation related to it.
18. Practice safe laboratory procedures, using appropriate protective, biosafety, and emergency procedures.
19. Documentation and report writing on experimental protocols, results and conclusions, study tours and field visits etc.

SEMESTER-I : THEORY PAPER-I

PHYCOLOGY AND MYCOLOGY

COURSE OBJECTIVES

1. To understand the phycology with special reference to Indian work.
2. Algae in diversified habitats (Terrestrial, fresh water, marine) Criteria used in classification of algae, Role of algae in human welfare
3. General account of thallus organization, reproduction and life history of algae.
4. Study of important groups of algae Cyanophyta , Chlorophyta, Xanthophyta , Bacillariopyta, Phaeophyta & Rhodophyta
5. Fungi: General Characters, Classification., Economic importance of fungi in medicine, Agriculture (Biopesticide an biofertilizer), food (SCP Mushrooms)
6. Fungi as plant pathogen – General account of different groups and type study of fungi as pathogen. Mastigomycotina , Zygomycotina, Ascomycotina, Basidiomycotina & Deuteromycotina
7. Bacteria: General characters, ultrastructure, classification, Role of bacterium in crop improvement and bacterial disease of plants.
8. Phytoplasma: General characters, economic uses, classification, role, and disease of plants.
9. Viruses: General account, ultrastructure and economic importance of viruses.

COURSE OUTCOMES

1. Recognize the morphology, anatomy , physiology, reproduction and lifecycle pattern.
2. Their diversification and familiarize with various ecological niche.
3. Positive and negative values.
4. Knowledge Acquisition: Students will acquire detailed knowledge about the taxonomy, morphology, and physiology of algae and fungi.
5. Practical Skills: Students will develop practical skills in the collection, identification, and culture of algal and fungal specimens.
6. Research Competence: Students will be able to conduct research, analyze data, and apply scientific methods to solve problems related to phycology and mycology.
7. Industrial Application: Students will understand the industrial applications of algae and fungi, including their use in food, pharmaceuticals, and biotechnology.
8. Environmental Impact: Students will learn about the environmental impact of algae and fungi, particularly their role in biogeochemical cycles and potential in bioremediation.

Semester-I Theory PAPER-II

BRYOPHYTA, PTERIDOPHYTA

COURSE OBJECTIVES

1. Highlights advances made in diversity analysis, developmental, reproduction and phylogenetics of the lower plants with the female organ being archegonium present in bryophyta, pteridophyte
2. Adaptive mechanism of the lower plant.
3. Economic importance of the Bryophyta, Pteridophyta

COURSE OUTCOMES

After successful completion of this course, students will be able to:

1. To know about morphological, anatomical and developmental patterns in the Bryophyta, Pteridophyta.
2. To know about the reproductive parts their development and mechanism of reproduction and life cycle pattern.
3. Economic values of the lower plants.

SEMESTER-I THEORY PAPER-III

ANGIOSPERMS SYSTEMATICS

COURSE OBJECTIVES

1. Deals with naming and classification of plants their interrelationships and evolution.
2. Deals with recent developments in plant systematic and phylogenetics
3. Criteria used for classification; phases of plant classification and brief history on account
4. Botanical Nomenclature: Concept of nomenclature, Binomial nomenclature and its advantages.
5. Taxonomic literatures and Use of computers in angiosperms taxonomy.
6. Taxonomic evidences: Morphology, anatomy, embryology, palynology, cytology, phytochemistry and numerical taxonomy
7. Angiosperm Families: Nymphaeaceae, Hydatellaceae, Magnoliaceae, Papaveraceae, Malvaceae, Sapotaceae, Apiaceae, Asteraceae, Arecaceae and Poaceae

COURSE OUTCOMES

After successful completion of this course, students will be able to:

1. Study plant morphology
2. Description of a plant specimen.
3. Study of at least 20 locally available families of flowering plants.
4. Identification of genus and species of locally available wild plants.
5. Preparation of botanical keys at the generic level by locating key characters.
6. Study of Medicinal Plants.
7. Knowledge of Herbarium techniques
8. Secondary metabolites and their use in taxonomy.

SEMESTER-I THEORY PAPER-IV

PLANT BIOCHEMISTRY

COURSE OBJECTIVES

1. **Biochemical Principles:** To understand the basic principles of biochemistry as they apply to plant systems, including the structure and function of biomolecules.
2. **Metabolic Pathways:** To study the major metabolic pathways in plants, such as photosynthesis, respiration, and the synthesis of macromolecules.
3. **Plant Hormones:** To explore the biochemical role of plant hormones in growth and development.
4. **Stress Biochemistry:** To learn about the biochemical responses of plants to various stresses, including pathogen attack and environmental changes.
5. **Practical Skills:** To develop laboratory skills in biochemical techniques relevant to the study of plants.

COURSE OUTCOMES

1. Students will understand the importance of photosynthesis in plants. They will also understand photosynthesis is one of the most important processes that allow plants to Live.
2. Students will come to know that, energy produced by respiration is essential for normal functioning of body.
3. Students will understand the importance of metabolism to maintain the living state of cells. They also understand role of nitrogen cycle in environment.

4. Students will understand how enzymes serve important function in body, in digestion and metabolism. They have developed knowledge about pathways of water through xylem and phloem.

SEMESTER-I PRACTICAL

PAPER-I:

After the completion of Phycology and Mycology the students are able to :

1. Identification of the genera mentioned in Cyanophyceae.
2. Identification of the genera mentioned in Chlorophyceae.

3. Students are able to know basic Mycological Techniques and Lab Safety.
4. Methods of sterilization, media preparation, and culturing of fungi.
5. Students are able to Identify the fungal cultures, slides, and specimens - Synchytrium, Allomyces, Glomus, Emericella, Neurospora, Morechella, Fusarium, Colletotrichum.
6. Identification of fungal cultures, , specimens - Melampsora, Phallus, Ustilago, Pernospora, Stemonitis.
7. Study Symptomology of fungal diseases.
8. Identifying fungal diseases,

PAPER-II:

After the completion of course students are be able to identify:

I. Morphological and Structural Study using whole mount of

1. Plagiochasma
2. Fimbriaria/Asterella
3. Targionia
4. Notothylas
5. Sphagnum
6. Polytrichum

PTERIDOPHYTES: II. Morphology and Anatomy of vegetative and reproductive organs using cleared whole mount sections.

- 7) Psilotum
- 8) Isoetes
- 9) Adiantum
- 10) Salvinia
- 11) Azolla
- 12) Slides and Specimens of Bryophyta and Pteridophyta.

PAPER-III:

After the completion of Angiosperms Systematics the students will be able to :

1. Identification of locally available plant families based on the floral parts .
2. Construction of dichotomous keys – Indented and Bracketed keys for given plant material.
3. Identification of locally available (native/indigenous) plants up to species level by using Floras.
4. Study and recording of intraspecific variations in the wild taxa available locally.
5. Study and identification of key characters in a group of species of a genus and construction of keys. .
6. Study simple Nomenclatural problems.
7. Identification of genus and species by using Pollen morphology.
8. Hands-on training on Herbarium techniques & Botanical Museum (collection, pressing, poisoning, drying, mounting, and deposition) (Students required to submit at least fifty herbarium specimens of the local flora (native/indigenous) along with field notebook).
9. Hands-on training on GPS and GIS applications in plant identification and species mapping.

PAPER-IV:

After the completion of Plant Biochemistry students will be able to :

1. Preparation of Buffers, pH measurements
2. Measurement of luminous intensity of the light
3. Determination of amylase activity
4. Estimation of reducing sugars in fruits
5. Estimation of fructose
6. TLC demonstration for separation of amino acids
7. Quantitative Estimation of protein
8. Determination of iodine number
9. Extraction and estimation of total alkaloid content
10. Estimation of total phenolic content
11. Preliminary phytochemical tests for Flavonoids
12. Preliminary phytochemical tests for Phenols

Semester-II Theory PAPER-I

PHYCOLOGY AND MYCOLOGY –I

COURSE OBJECTIVES

1. Understanding the concept of fermentation and various fermentation techniques.
2. Use of fungi in food feed and various industrial products.
3. Various types of Mushroom cultivation practices and its importance and economics.
4. Screening techniques of the fungi for various industrial application.
5. To understand the diversity, structure, and function of algae and fungi.
6. To explore the ecological significance and economic importance of these organisms.
7. To learn about the cultivation methods and uses of algae and fungi in various industries.
8. To study the role of algae and fungi in biotechnology and environmental management.

COURSE OUTCOMES

1. Describe the microorganisms that participate in fermentation – production & processes.
2. Evaluate the impact of different types of microorganisms on the final characteristics of the product.
3. Identify the origin of the principal microorganisms of importance in the industrial environment.
4. Know procedures and strategies for mushroom cultivation.
5. Know the role of microorganisms in different production processes in order to improve these processes and ensure their success.
6. Students will be able to identify and classify different types of algae and fungi.
7. They will gain practical skills in culturing, harvesting, and utilizing these organisms.
8. Students will understand the impact of algae and fungi on ecosystems and their potential in bioremediation.
9. They will be able to apply their knowledge in industrial, pharmaceutical, and agricultural sectors.

SEMESTER-II THEORY PAPER-II

GYMNOSPERMS AND EMBRYOLOGY OF ANGIOSPERMS

COURSE OBJECTIVES

1. Highlights advances made in diversity analysis, developmental biology, reproductive biology, and phylogenetics of the lower plants with the female organ being archegonium present in bryophytes, pteridophytes, and some most gymnosperms.
2. Adaptive mechanism of the lower plant.
3. Economic importance of the gymnosperms
4. Gymnosperm Biology: To study the general characteristics, classification, and evolutionary history of gymnosperms.
5. Life Cycle: To understand the life cycle of gymnosperms, including reproduction, pollen grain development, and fertilization processes.
6. Embryology: To gain insights into the embryological development in plants, including gametogenesis, seed formation, and development.
7. Comparative Analysis: To compare the embryological stages of gymnosperms with those of other plant groups.
8. Practical Skills: To develop practical skills in identifying gymnosperm species and understanding their ecological significance.

COURSE OUTCOMES

After successful completion of this course, students will be able to:

1. To know about morphological, anatomical and developmental patterns in the bryophytes, pteridophytes and gymnosperms.
2. To know about the reproductive parts their development and mechanism of reproduction and life cycle pattern.
3. Gymnosperms wood anatomy, Mechanical tissues (Collenchyma, Sclerenchyma, Stone cells and Xylem) , Secretary tissues (Mucilage Canals, Resin canals, Nectaries, and oil glands), laticifers (Latex cells and Vessels).
4. Economic values of the Gymnosperms.
5. Understand life cycles of lower groups and Gymnosperms.
6. Understand the structure and habitats of lower groups and gymnosperms.
7. Discuss the economic importance of lower groups and gymnosperms
8. Gymnosperms based on morphology and internal anatomy.
9. Understand the significance of geological time scale in the history and evolution of earths flora
10. Compare the living lower groups and gymnosperms with fossil types to decipher their evolutionary affinities

SEMESTER-II THEORY PAPER-III

PLANT ANATOMY AND PALYNOLOGY

COURSE OBJECTIVES

1. To impart detailed knowledge of the internal structure and organization of plants.
2. To understand the development processes from a cellular level to the whole plant.
3. To study the form, function, and differentiation of plant cells, tissues, and organs.
4. To explore the applications of palynology in various fields such as taxonomy, archaeology, and forensic science.

COURSE OUTCOMES

1. Students will be able to identify and describe the different tissues and organs in plants.
2. They will gain proficiency in microscopic techniques and the preparation of slides for examination.
3. Students will develop the ability to analyze and interpret palynological data.
4. They will be equipped with the skills to apply their knowledge in practical fields, including environmental assessment and biodiversity conservation.
5. Understand the development and differentiation of tissues.
6. Understand the reproductive biology of angiosperms.
7. Demonstrate skill in sectioning and to prepare permanent micro and macro
8. preparations.
9. Comparison of the taxonomic evidence from anatomy, embryology
10. and palynology
11. Distinguish different taxa and identify stress related signatures in
12. plant anatomy through the wood Anatomy
13. Apply the knowledge of reproductive biology to solve issues related to
14. sexual incompatibility of seed plant

SEMESTER II THEORY PAPER-IV

PLANT PHYSIOLOGY

COURSE OBJECTIVES

1. **Understanding Plant Functions**: To provide students with a thorough understanding of the physiological processes and metabolic pathways in plants.
2. **Photosynthesis and Respiration**: To delve into the mechanisms of photosynthesis and respiration, exploring how plants convert light energy into chemical energy and how they utilize this energy.
3. **Nutrient Uptake and Transport**: To study the uptake, transport, and utilization of nutrients by plants, which is crucial for their growth and development.
4. **Plant Hormones and Growth Regulators**: To examine the roles of different plant hormones and growth regulators in the life cycle of plants, including their impact on growth, development, and responses to environmental stimuli.
5. **Stress Physiology**: To understand how plants respond to various biotic and abiotic stresses and the physiological changes that occur as a result.
6. **Metabolic Pathways**: To explore the complex metabolic pathways involved in plant growth and development, including nitrogen metabolism and secondary metabolite production.

COURSE OUTCOMES

After completion of the course the students are familiar with various physiological aspects involved in the plant development.

1. Also the role of enzymes in it and mechanism of photosynthesis, respiration, nitrogen and lipid metabolism.
2. The students are able to isolate starch, pectine and various nutritive products from the plants.
3. Qualitative and quantification of the plant contents and its biochemistry and modemechanism of synthesis etc.
4. Know about the requirement of mineral nutrition for plant growth
5. Understand the process of Photosynthesis, Respiration and Nitrogen metabolism
6. Learn about Sensory photobiology
7. Know about the Plant Growth hormones (Auxins, Gibberellins. Cytokinins, Ethylene)
8. Understand the biosynthesis of terpenes, phenols and nitrogenous compounds
9. Stress physiology – Responses of plants to biotic and abiotic stresses

SEMESTER-II PRACTICAL

PAPER-I (Phycology and Mycology):

1. After the completion of Phycology and Mycology the students will be able to :
2. Identification of the genera mentioned in Xanthophyceae, Bacillariophyceae, Phaeophyceae, and Rhodophyceae.
3. Identification of bloom-forming algae.
4. Preparation of Algal biofertilizers.
5. Identification of toxic algae.
6. Identification of fungal cultures, slides, and specimens of Rhizopus/Mucor, Aspergillus, Penicillium, Saccharomyces, Fusarium, Alternaria, Cercospora, Pythium, VAM fungi, Trichoderma, Beauveria.
7. Study of Mycorrhizal colonization in roots of Parthenium and Tagetes.
8. Mushroom cultivation
9. Staining of Gram-positive and Gram-negative Bacteria.

PAPER-II(Gymnosperms And Embryology of Angiosperms):

After the completion of Gymnosperms And Embryology of Angiosperms students will be able to: understand

1. Gymnosperms: i) Pityales ii) Acroglyptales iii) Prototypales. Specimens or images to be displayed for study.
2. Fossil gymnosperms - Pteridospermales, Pentoxylales, Bennettitales and Cordaitales. Specimens or Images to be displayed for study.
3. Extant/living gymnosperms - Study of the vegetative, reproductive parts (pollen and seed cones) and anatomy (primary root, stem, leaf/leaflet) of the following: a) Cycas / Zamia., b) Araucaria/ Cupressus/Thuja c) Cedrus / Podocarpus/Pinus d) Ephedra/ Gnetum / Welwitschia.
4. Students able to understand Wood anatomy of Conifers
5. Pollen (microspore) viability
6. Students are able to identify endosperm types and embryo ty

PAPER-III(Plant Anatomy And Palynology):

After the completion of Plant Anatomy And Palynology the students will be able to :

1. Study of angiosperm leaf epidermis stomata, trichomes in the available taxa: *Crotalaria*, *Portulaca* or *Talinum*, *Tridax*, *Petunia* or *Datura*. *Tradescantia spathacea* or *Commelina*, *Cyperus* and Grass.
2. Estimation of stomatal frequency and stomatal index in any available leaf material.
3. Maceration of wood and identification of various elements in *Magnolia champaca*, *Bombax ceiba*, *Tectona grandis*, *Terminalia arjuna* and *Azadirachta indica*.
4. Study of wood structure : a) *Tectona grandis* b) *Dalbergia sissoo* c) *Mangifera indica* d) *Vachellia nilotica*.
5. Histochemical tests for identification of the following: a) Cellulose b) Lignin c) Pectin d) Starch e) Suberin.
6. Study of the pollen grains of *Vachellia*, *Azadirachta*, *Cocos* and Grass.
7. Acetolysis technique.

PAPER-IV(Plant Physiology):

After the completion of Plant Physiology students will be able to :

1. Determination of water potential by Sclando's methods.
2. Determination of total and titrable acidity.
3. Separation of chloroplast pigments by solvent method.
4. Determination of chlorophyll a, chlorophyll b, and total chlorophylls in C3 and C4 plants.
5. Determination of Anthocyanin Pigments.
6. Estimation of I.A.A.

SEMESTER-III THEORY PAPER-I

CELL BIOLOGY, GENETICS, AND BIostatISTICS

COURSE OBJECTIVES

To understand the concepts and details of heredity and variation at molecular and cellular levels.

Deals with more recent developments which have taken place in the field of genetics besides providing an introduction to methods of plant breeding of improvement of crop plants with respect to

The main objective of the course is to make students aware of -

1. Prokaryotic and eukaryotic Cell: The ultra-structural details and comparative assessment.
2. Plasma membrane: Molecular organization, current models and functions. Cell wall architecture, biosynthesis, assembly, growth and cell expansion.
3. Plasmodesmata: Structure and role in movement of molecules and macromolecules.
4. Cytoskeleton: Organization and role of microtubules and microfilaments. Implications in flagellate and other movements.
5. Plant vacuole: Tonoplast membrane, ATPases, transporters, as storage organelle.
6. Chloroplast and Mitochondria: Ultrastructure, function and biogenesis. The organization of genome and patterns of gene expression.
7. Nucleus: Microscopic and submicroscopic organization. Structure and function of nuclear envelope.
8. Envelope. The ultrastructure of nucleolus and its role in rRNA biosynthesis.
9. Ribosomes: Structure and site of protein synthesis. Mechanism of translation, details of initiation, elongation and termination. The structure and role of RNA.
10. Genetics of prokaryotic and eukaryotic organelles
11. Chromatin organization
12. Structural and Numerical alterations in chromosomes
13. DNA Damage and repair mechanism
14. Cytogenetics of aneuploids and structural heterozygotes

COURSE OUTCOMES

After successful completion of this course, students will be able to understand :

1. The cell structures in relation to function of cells the fundamental unit of life, are concerned in this course along with molecules present in cells.
2. Apply the principles of cell biology in designing experiment, statistical analysis, and interpretation of results

3. Operate and solve exercise using computation statistics software.
4. Get acquainted with basic approach in the research methodology.
5. Know about the induction of polyploidy in plants using colchicines, methods of application of colchicine.
6. Isolation of biochemical mutants following physical and chemical mutagenic
7. Isolation of chlorophyll mutants following physical and chemical mutagenic treatments.
8. Isolation of morphological mutants following physical and chemical mutagenic treatments.
9. Karyotype analysis, Meiosis of complex translocation heterozygotes.
10. Meiotic behavior of monosomy, trisomy in plants and its effect.
11. Chromosomal behaviour in mutagen-treated plants.
12. Chromatin organization, Structural and Numerical alterations in chromosomes

SEMESTER-III THEORY PAPER-II

ENVIRONMENTAL POLLUTION AND PROTECTION

COURSE OBJECTIVES

1. Understand population and community ecology and major global environmental challenges
2. Discuss global initiative and regional initiatives for the environment
3. protection
4. Discuss the important environmental protection laws in India and Indian environmental activists.
5. Discuss the impact of climate change on the ecosystem and the role of people movements of biodiversity conservation
6. Explain the different biodiversity information resources,
7. Metadatabases and virtual libraries
8. Analyse biodiversity in terms of wild and agrobiodiversity and its conservation practices
9. Evaluate different types of habitats with reference to Kerala
10. Apply conservation strategies in global perspective for the use and restoration of a threatened ecosystem

COURSE OUTCOMES

1. Enable students to develop a comprehensive understanding of various facets of life forms,
2. ecological processes and how humans have impacted them during the Anthropocene era.
3. Capability to identify relevant environmental issues, and analyse the various underlying causes.

4. evaluate the practices and policies, and develop a framework to make informed decisions.
5. Develop empathy for various life forms and appreciate the various ecological linkages within the web of life.
6. Gaining in-depth knowledge on natural processes that sustain life and govern
7. economy.
8. Predicting the consequences of human actions on the web of life, global economy and quality of human life.
9. Developing critical thinking for shaping strategies (scientific, social, economic and legal) for environmental protection and conservation of biodiversity, social equity and sustainable development.
10. Acquiring values and attitudes towards understanding complex environmental-economic-social challenges, and participating actively in solving current environmental problems and preventing the future ones.
11. Adopting sustainability as a practice in life, society and industry.
12. Graduates will evolve into ecologically informed and socially responsible citizens who are empowered to protect the natural resources while ensuring sustainable lifestyle and developmental model.
13. Gain in-depth knowledge on natural processes that sustain life, and govern economy.
14. Predict the consequences of human actions on the web of life, global economy and quality of human life.
15. Develop critical thinking for shaping strategies (scientific, social, economic and legal) for environmental protection and conservation of biodiversity, social equity and sustainable development.
16. Acquire values and attitudes towards understanding complex environmental-economic-social challenges, and participating actively in solving current environmental problems and preventing the future ones.
17. Adopt sustainability as a practice in life, society, and industry.

SEMESTER-III THEORY PAPER-III

PRINCIPLES OF PLANT PATHOLOGY

COURSE OBJECTIVES

1. **Fundamental Understanding**: To comprehend the basic concepts, definitions, and importance of plant diseases, including their history and development within the field of plant pathology.
2. **Disease Causation**: To study the biotic and abiotic causes of plant diseases, understanding how various pathogens and environmental factors contribute to disease development.
3. **Disease Management**: To learn about the strategies and methods used in the management and control of plant diseases, emphasizing both traditional practices and modern technological approaches.
4. **Research Skills**: To develop research skills necessary for identifying, isolating, and analyzing plant pathogens, as well as designing and conducting experiments related to plant pathology.
5. **Applied Knowledge**: To apply the principles of plant pathology to real-world scenarios, particularly in the context of agriculture and horticulture, to improve crop health and productivity.

COURSE OUTCOMES

1. The students will get introduced to plant pathology, history and objectives, concept of plant disease, classification, causes, plant disease epidemiology and forecasting. The students will also learn about various Bacterial, mollicutes, viral and Nematode diseases of plants.
2. The students will also learn about various stages of infection, effect of pathogens on plant physiology, the enzymes and toxins involved in disease development.
3. Applied aspects such as effect of environmental factors on disease development, genetics of plant pathogen interaction, plant defense mechanism, molecular aspects of host pathogen interaction and post-harvest diseases of fruits, vegetables and seeds will be learn by the students.
4. Where as in disease management and related aspectthe students will learn about detection of pathogene, breeding to improve crop, chemical and bio-control, disease assessment.
5. The student will then enable to do research in the field of plant pathology, may have the consultancy.
6. The student gets basic knowledge of various plant pathogens causing harmful diseases
7. The student knows the preparation of media, isolation, and identification of plant pathogens using microscopy

8. The student knows management strategies based on the type of pathogen
9. Acquire knowledge about plant pathogens, diseases, and their management
10. Gain skills in the isolation and identification of plant pathogens
11. Acquaintance with various lab equipment and their uses in Plant Pathology.

SEMESTER-III THEORY PAPER1V APPLIED MYCOLOGY

COURSE OBJECTIVES

1. Deals with all microbes especially fungi and the technologies for their effective uses in industry and mitigation of environmental concerns.
2. Introduction to fungi & their significance to human
3. Cultivation of Mushrooms.
4. Fermentation of Alcohol - Microorganism, Alcohol as fuel Source, Use of ethanol in vehicles as fuel, Sugar containing raw material, Starch raw materials

COURSE OUTCOMES

1. Ideas about use of fungi and exploring the fungal organisms for their valuable products
2. Cultivation of fungi for food, fermentation and other microbial products
3. Familiar with Fermentation technology
4. After completion of the course the students are able to cultivate mushrooms.
5. Design the media for fermentation.
6. Maintain the interested fungal organism in the proper condition.
7. Pilot to large-scale production techniques.
8. Application and management of industrial effluents
9. Screening of fungi for acid, alcohol, cellulose, amylase and various organic acid production

SEMESTER-III PRACTICAL

PAPER-I(Cell Biology, Genetics And Biostatistics):

After the completion of Cell Biology, Genetics And Biostatistics the students will be able to :

1. Cytological Squash preparation of onion root tips to study mitosis.

2. Problems in Genetics:

Mendelian inheritance and gene interaction.

Chromosome mapping in eukaryotes

Population Genetics.

3. Problems in Biostatistics:

Mean, Variance, Standard Deviation and Standard Error.

Chi-square and Student's "t" test

Problems on Probability.

4. Demonstration of plant tissue culture methods.

5. Maintenance of Practical Record.

PAPER-II(Environmental Pollution And Protection):

After the completion of Environmental Pollution And Protection students will be able to :

1. To Understand the Estimation of the following in water:

a. Total hardness

b. Calcium

c. Organic matter

d. BOD

2. To Understand the Estimation of noise.

3. To Understand the Qualitative estimation of the following:

a. Solid waste

b. Coal

c. Fly ash

- d. Sugarcane bagasse
- e. Wood
- f. Cow dung

PAPER-III(Principles Of Plant Pathology):

After the completion of Principles Of Plant Pathology the students will be able to :

1. To demonstrate Techniques of isolation of fungi: Dilution method, soil plate method, agar plate method and single spore isolation.
2. To implement the Collection, isolation and identification and of fungi from soil, water, air, leaf, root and seed.
3. Calculation of spore count using Haemocytometer.
4. Isolation and identification of AM Fungi and estimation of root colonization.
5. Mushroom cultivation.
6. To implement Demonstration of antagonistic fungi
 - a) Antibiosis b) Competition c) Mycoparasitism.

PAPER-IV(Applied Mycology):

After the completion of Applied Mycology students will be able to :

1. To Understand the Estimation of organic acids in fungal culture filtrates.
2. To Understand the Estimation of enzymes: Cellulases, Pectinases, Chitinases and Amylases.
3. To Understand the Estimation of sugars, proteins and amino acids in fungal mycelium and culture filtrate.

SEMESTER IV THEORY PAPER-I

ECOLOGY AND PHYTOGEOGRAPHY

COURSE OBJECTIVES

Strategies adopted by the organisms under changing environment in relation to their biogeographic distribution. The students are made conversant with the following topics-

1. Structure of ecosystem:
2. Functions of ecosystem:
3. Community ecology:
4. Biogeography:
5. Environmental pollution in relation to air, water and soil. Use of fertilizer, pesticides and other chemicals in agriculture and hygiene and their disposal.
6. Climate change: Greenhouse gases, their sources, trends and role, Ozone layer and its depletion (Global warming, Sea level rise, UV radiation) acid rain, Bioindicator and biomarkers of environmental health.
7. Biodiversity: Concept, types and situation in India. IUCN categories. Strategies of conservation: In situ conservation & Ex situ conservation measures.
8. Various act related to Bio Diversity conservation and protection and international conventions.

COURSE OUTCOMES

1. On completion of this course the students are able to analyze various types of ecosystems, correlate different ecosystems.
2. To analyze the threat and suggest conservative measures.
3. The students are also trained in the environmental impact analysis
4. Students are able to analyze, monitor various physical, chemical and biological properties of soil water and air.
5. Approaches to the study of Ecology (Autecology, Synecology and Genecology)
6. Population Ecology - concept of metapopulation
7. Community Ecology - General account on Forests of Tamilnadu
8. Principles of Toxicology and types of Toxins, sources, metabolism and Biological monitoring

SEMESTER-IV THEORY PAPER-II

HORTICULTURE AND PLANT BREEDING

COURSE OBJECTIVES

1. The course aims to provide comprehensive knowledge in the fields of horticulture and plant breeding.
2. It covers various aspects of plant cultivation and the development of new plant varieties.
3. Students will learn about the principles and practices of horticulture along with the scientific basis of plant breeding.
4. Understanding Horticultural Practices: Students will gain an in-depth understanding of modern horticultural practices, including cultivation techniques, crop management, and sustainable practices.
5. Plant Breeding Techniques: The course will cover advanced plant breeding techniques, aiming to equip students with the knowledge to develop new plant varieties with desirable traits such as disease resistance, improved yield, and better nutritional value.
6. Research Skills: Students will be trained in research methodologies relevant to horticulture and plant breeding, preparing them for careers in research and development.
7. Practical Application: The syllabus is designed to provide hands-on experience through practical labs, where students can apply their theoretical knowledge to real-world scenarios.
8. Innovation in Horticulture: Encouraging innovation and critical thinking to address challenges in horticulture and plant breeding, with a focus on genetic engineering and biotechnology applications.
9. Sustainability and Environmental Impact: Understanding the environmental impact of horticultural practices and breeding programs, and promoting sustainable methods to minimize negative effects.

COURSE OUTCOME

1. Learn the importance of horticulture – career and occupational opportunities
2. Know about hydroponics and its importance
3. Learn the techniques of gardening - Types, Methods & Tools
4. Learn about Olericulture - Cultivation of commercial flower crops
5. Learn the techniques in Pomology - Cultivation of important fruit crops & tree species
6. Know in detail about breeding systems
7. Learn the techniques of Hybridization
8. Learn about the selection methods for self pollinated, cross pollinated plants
9. Understand the role of mutations in plant breeding
10. Understand the history, Scope and Concepts in plant tissue culture

11. Learn the Techniques in Commercial plant
12. Know about the significance of secondary metabolites in tissue culture
13. Know about the application of tissue culture in forestry, horticulture, agriculture and pharmaceutical industry.

SEMESTER IV PAPER-III THEORY

MOLECULAR PLANT PATHOLOGY

COURSE OBJECTIVES

1. To understand the concepts in prokaryotic, eukaryotic Plant system with respect to-
2. To study the central dogma of molecular biology (replication, transcription, and translation)
3. Understanding the molecular basis of plant diseases and the interactions between plants and pathogens.
4. Exploring the genetic and biochemical mechanisms that plants use to defend against pathogens.
5. Learning about the latest molecular techniques used in the diagnosis, study, and management of plant diseases.
6. Applying molecular tools to develop disease-resistant plant varieties and sustainable disease management strategies.

COURSE OUTCOMES

1. After successful completion of this course, students will be able to:
2. Acquaint with concepts in prokaryotic, eukaryotic, and viral genetics
3. Explain central dogma of molecular plant pathology (replication, transcription, and translation)
4. Enlist and explain types of mutation, gene regulation and transposable element
5. Molecular techniques in plant pathology. Analysis of PCR products
6. Isolation and separation of fungal nucleic acids ,protiens by gelelectrophoresis and its quantification.
7. Estimation of seed proteins
8. Amplification of Fungal DNA by PCR

SEMESTER IV PAPER-IV THEORY

PLANT DISEASES

COURSE OBJECTIVES

1. to provide knowledge on the insects, how they develop, the damage they can cause to crops in the mountain environment and forests, -
2. learn the techniques of environmental management in a perspective of sustainable development
3. provide the fundamental knowledge on the different pathogenic agents, how they attack the plants and the kind of alterations and damages that can induce in the hosts.
4. It also deal with the fundamental principles necessary to set up the modern methods of prevention and pest control especially on diseases connected with natural environments and cultures typical of mountain habitats.
5. Identify and list the causes of plant diseases.
6. Discuss the ability of pathogen to distribute in nature
7. Describe how the pathogen can penetrate into the host
8. Recognize how the pathogen can overcomes the unfavorable environmental conditions
9. List the different ways of pathogen reproduction.
10. Recognize the various symptoms in diseased plants.
11. Describe the plant diseases caused by fungi and their control.
12. List some examples of bacterial plant diseases
13. State the viral diseases and their important symptoms.
14. Summarize the way of distribution of plant diseases caused by viruses
15. Discuss the plant diseases caused by nematodes.
16. List the effect of environmental conditions on severity of plant diseases
17. Summarize the different methods of plant diseases control

COURSE OUTCOMES

1. to know the dynamics and issues related to the arthropods present in a forest environment or correlated to crops in mountain habitats.
2. to recognize the different agents that can damage cultivated and spontaneous plants, to weigh their dangerousness and to propose preventive measures and criteria of pest control that can be adopted by different kind of agriculture managements preserving natural environments and human health and biodiversity.
3. Identify the causes of plant diseases.
4. List the different causes of plant diseases.
5. Discuss the ability of pathogen to distribute in nature
6. Describe how the pathogen can penetrate into the host
7. Recognize how the pathogen can overcomes the unfavorable
8. environmental conditions

9. List the different ways of pathogen reproduction.
10. Recognize the various symptoms in diseased plants.
11. Describe the plant diseases caused by fungi and their control.
12. List some examples of bacterial plant diseases
13. State the viral diseases and their important symptoms.
14. Summarize the way of distribution of plant diseases caused by viruses
15. Discuss the plant diseases caused by nematodes.
16. List the effect of environmental conditions on severity of plant diseases.
17. Summarize the different methods of plant diseases control.

SEMESTER-IV PRACTICAL

PAPER-I(Ecology And Phytogeography):

After the completion of Ecology And Phytogeography the students will be able to :

1. To understand the Determination of quantitative characters by random quadrat method - Abundance, Density, Frequency, IVI and Dominance : Similarity And Dissimilarity Index
2. To understand the Estimation of Carbonates, Bicarbonates, Chlorides and Dissolved Oxygen
3. To understand the Morphology And Anatomy of Hydrophytes and Xerophytes And their Adaptations

PAPER-II(Horticulture And Plant Breeding):

After the completion of Horticulture And Plant Breeding students will be able to :

1. Identification of Horticultural tools & implements and their use.
2. Study of containers, preparation of potting mixture, potting, de-potting and repotting.
3. Estimation of moisture content in soils. Determination of pH, electrical conductivity, sodium adsorption ratio and exchangeable sodium percentage of soils.
4. Propagation through seeds, methods to overcome the seed dormancy - a) Mechanical scarification b) Soaking the seeds in water c) Acid scarification d) Stratification
5. Rapid tissue test, seed dormancy, seed viability by tetrazolium test.
6. Vegetative propagation by corms, bulbs, rhizomes etc.
7. Propagation methods like cutting, layering, budding and grafting.
8. Micropropagation.

9. Identification and description of important fruit varieties: Mango, Guava and Citrus, Grape,

Sapota, Banana and Papaya; Commercial flower varieties: Roses, Chrysanthemums, Dahlias, Orchids OLLERICULTURE

10. Study of plant breeding techniques.

12. Identification of synthetic plant hormones and growth retardants, preparations of hormonal

solution and induction of rooting in cuttings, ripening of fruits and control of flower and fruit drop.

PAPER-III(Molecular Plant Pathology):

After the completion of Molecular Plant Pathology the students will be able to :

1. Isolation and separation of fungal nucleic acids and proteins by gel electrophoresis.
2. RFLPs of fungal nucleic acids and RAPDs of fungal DNA.
3. Amplification of Fungal DNA by PCR.
4. Fungal Protoplast isolation.
5. Elaboration of phytoalexins by TLC methods.
6. Record and Herbarium of diseased plants.

PAPER-IV(Plant Diseases):

After the completion of Plant Diseases students will be able to :

1. Diagnosis of plant diseases and proof of pathogenicity according to Koch's postulates.
2. Measurement of plant diseases- Disease scoring.
3. Plant disease diagnosis by studying symptoms in the field.
4. Preparation of semi-permanent slides of diseased material, eg. Leaf spots, blights, mildews, rots, wilts, rusts and smuts.
5. Micrometry and standardization of microscope.
6. Measurement of fungal spores and mycelium and camera lucida drawings