

COURSE OBJECTIVE:-

The program of M.Sc. Botany is designed with an objective to encourage and support the growing demands and challenging trends in the educational scenario. The program focuses on the all-round development of the students to face the competitive world. The objectives of the program are as follows:

- To understand the scope and significance of the discipline.
- To imbibe love and curiosity towards nature through the living plants.
- To make students open-minded and curious, we try our best to enhance and develop a scientific attitude.
- To make the students exposed to the diverse life forms.
- To make them skilled in practical work, experiments, laboratory equipment and to interpret correctly on biological materials and data.
- To encourage the students to do research in related disciplines.
- To develop the ability of the students to transform the society through their education.
- To acquaint the students about the methods used in the maintenance of different natural resources.
- Critical Thinking: to include creative thinking, innovation, inquiry and analysis, evaluation and synthesis of information.
- Topics include the study of plant form, function and reproduction, and an overview of plant diversity including bryophytes, ferns, and seed plants.

Programme Outcome (M.Sc. Botany)

1. Students have understood the scope and significance of the program.
2. Students have developed the scientific temperament after completion of the program.
3. Students have developed the skills to identify different types of plants.
4. Students have developed the skills to do laboratory work from different equipments.
5. Students have developed the skills related to scientific research in the area of Botany.
6. Students are ready to transform the society and can explain the importance of different plants to human beings.

Programme Specific Outcome (M.Sc. Botany)

- Describe the evolution, anatomy, morphology, systematic, genetics, physiology and ecology of plants.
- The ecological and evolutionary features of the flora and fauna in environment
- Knowledge about identify and analyze scientific problems and environmental issues using oral and written communication skills.
- Knowledge about the continually developing and is dynamic; students can find new scientific information and compare it with existing information.
- Describe how all scientific knowledge is continually developing and is dynamic; students can find new information and compare it with existing information

Biology and Diversity of Algae, Bryophytes, Pteridophytes and Gymnosperms

COURSE OBJECTIVES:-

To acquaint the students about the morphology, biology and importance of algal organisms, Bryophytes, Pteridophytes and gymnosperms

Syllabus:

- UNIT – I** Algae Classification, thallus organization and economic importance of algae. A general account on structure, reproduction, ecology and phylogenetic relationship of Cyanophyta, Chlorophyta, Charophyta, Xanthophyta, Bacillariophyta, Phaeophyta and Rhodophyta.
- UNIT – II** Bryophytes Classification, general characters, range of thallus organization, reproduction and evolutionary trends in Hepaticopsida, Anthocerotopsida and Bryopsida.
- UNIT-III** Pteridophytes Origin and evolution of early vascular plants. Study of morphology, anatomy and reproduction of Psilopsida, Lycopsida, Sphenopsida and Pteropsida. Evolution of stele in Pteridophytes. Heterospory and origin of seed habit.
- UNIT - IV** Gymnosperms Classification, distribution and economic importance. Structure and reproduction in Pteridospermales, Bennettitales, Pentoxylales, Cycadales, Cordaitales,
- UNIT – V** General characters of Coniferales, Ephedrales. Structure and reproduction in Ginkgoales, Coniferales, Ephedrales, Welwitschiales and Gnetales.

COURSE OUTCOMES:-

The course will enable students to know the earlier plants, their vegetative and reproductive structures and their importance.

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Biology and Diversity Of Viruses, Bacteria And Fungi

COURSE OBJECTIVES:-

To acquaint the students about the morphology, characters and importance of different microorganisms

Syllabus:

- UNIT – I** Brief account of discovery of viruses. General properties, structure, cultivation, purification, replication and transmission of viruses. Brief account of bacteriophages and plant viruses. Economic Importance.
- UNIT – II** Morphology and ultrastructure of bacteria. Nutritional types (autotrophs and heterotrophs), growth of bacteria. Recombination in bacteria (transformation, transduction and conjugation).
- UNIT – III** General characters of Actinomycetes, Mycoplasmas and Cyanobacteria. Economic importance of bacteria. Status of fungi – Kingdom Mycota. General characters, nutrition, reproduction.
- UNIT – IV** Heterothallism and parasexuality. Edible and poisonous mushrooms. Mushroom cultivation. Importance of fungi in agriculture and industry
- UNIT – V** Classification of fungi (Einsworth System). General account of Myxomycota, Mastigomycotina, Zygomycotina, Ascomycotina, Basidiomycotina and Deuteromycotina

COURSE OUTCOMES:-

The course will enable students to know about different types of microorganisms viz. Bacteria. Viruses. Fungi and Cyanobacteria

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Morphology, Anatomy and Taxonomy Of Angiosperm Plant

COURSE OBJECTIVES:-

1. To understand the various kinds of plants on the surface of earth with their names, affinities, geographical distribution, habit characteristics and their economic importance.
2. To understand the diversities of plant kingdom and their relation to evolution of plants. A systematic reconstruction of plant kingdom can be made only after the complete knowledge of the individual plants.
3. To understand the various aspects of plant nomenclature and classification.
4. To understand the classical and modern trends of Angiosperm taxonomy
5. To understand the salient features of angiosperm families

Syllabus:

- UNIT - I** Taxonomy and Systematics. Principles of Plant taxonomy. Principles of ICBN. Systems of angiosperm classification. A comparison of PreDarwinian and Post Darwinian classification.
- UNIT-II** Phylogenetic systems – relative merits and demerits of major systems of classification. Hierarchical classification. Taxonomic evidence – morphology, anatomy, palynology, Embryology, Cytology, Phytochemistry etc.
- UNIT - III** Process of plant identification and preparation of herbarium. Taxonomic tools – Herbarium, floras, botanical gardens (National and International), Serological and Molecular techniques.
- UNIT-IV** Modern taxonomy – Secondary metabolites in plants (Chemotaxonomy), Phenetic (Numerical) and Phylogenetic (Cladistic) methods. Plant explorations and introductions.
- UNIT - V** Give the taxonomic account of following families; Ranunculaceae, Malvaceae, Asteraceae, Rubiaceae, Fabaceae, Lamiaceae, Bignoniaceae, Acanthaceae, Apocynaceae, Asclepiadaceae, Poaceae, Liliaceae.

COURSE OUTCOMES:-

On completion of this course, the students will be able to:

- Acquire basic skills on the plant taxonomy with special reference to Angiosperms
- Illustrate the types; merits and demerits of various system of classification
- Identify the angiosperms families with specific key characters; learn various advanced tools to study plant taxonomy

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PLANT STRUCTURE AND DEVELOPMENT

COURSE OBJECTIVES:-

To enable the students:

- To understand the development of SAM and RAM
- To understand the Mechanism of Seed Germination and growth
- To understand the principles of microscopy

Syllabus:

- UNIT- I** Introduction Unique features of plant development; differences between animal and plant development. Shoot development; Organization of the shoot, apical meristem (SAM); cytological and molecular analysis of SAM; control of cell division and cell to cell communication; secretory ducts and laticifers. Structure, differentiation and phylogenetic specializations of xylem and phloem.
- UNIT – II** Dormant and active vascular cambium and its abnormal activity, Wood development in relation to environmental factors. Leaf growth and differentiation; determination phyllotaxy, control of leaf form; differentiation of epidermis (with special reference to stomata and trichomes) and mesophyll.
- UNIT - III** Root development Organization of root apical meristem (RAM); cell fates and lineages; vascular tissue differentiation; lateral roots; root hairs; root microbe interaction.
- UNIT - IV** Seed germination and seedling growth Metabolism of nucleic acids, Proteins and mobilization of food reserves; tropisms; hormonal control of seedling growth; gene expression; use of mutants in understanding seedling development.
- UNIT – V** Latent life dormancy Importance and types of dormancy, seed dormancy, overcoming seed dormancy, bud dormancy; Senescence and programmed cell death (PCD); Basic concepts; types of cell death, PCD in the life cycle of plants, metabolic changes associated with senescence and its regulation, influence of hormones and environmental factors on senescence; Principles of microscopy (Light and electron microscopy).

COURSE OUTCOMES:-

On completion of this course, the students will be able to:

- Understand the various developments of SAM and RAM
- Describe the mechanism of seed germination and seed growth
- Understand the process of microscopy

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PRACTICAL (LABORATORY –I):-

1. Study and identify the permanent slide of Algae, fungi, Bryophyte, pteridophyte.
2. Section cutting of plant material.
3. To study the External morphology and taxonomy of plant.
4. To study and identify the permanent slide of Gymnosperms.
5. Study the specimen of diseased plants.
6. To culture Bacteria in different media.
7. Study of viruses and bacteria using electron photo micrographs (TMV, Bacteriophage, HIV, Cocci, Bacillus, Spirillum bacteria).
8. Gram staining technique.
9. Knowledge of Equipment used Spirit lamp, Inoculation loop, Hot-air oven, Autoclave/Pressure cooker, laminar air flow chamber and Incubator.
10. Preparation of liquid and solid media for culturing of microbes (Demonstration).
11. Study of viruses and bacteria using electron photo micrographs (TMV, Bacteriophage, HIV, Cocci, Bacillus, Spirillum bacteria).
12. Gram staining technique.
13. Study of Plant disease symptoms caused by Bacteria (Citrus canker, leaf blight of rice, Angular leaf spot of Cotton) and viruses (TMV, Bendi vein clearing and Leaf curl of Papaya),Fungi (Late blight of potato, Red rot of Sugarcane and Paddy blast).

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PRACTICAL (LABORATORY –II):-

1. Description and identification of plant species belonging to Family with their floral formulae and floral diagrams
2. To study the transverse section of plants of different families.
3. To collect and prepare herbarium file.
4. To study the parts of flower.
5. To study the transverse section of anther, pollen grain, megasporophyte.
6. To study the T.S. of dicot monocot embryo.

Paper IV:

- Examination of shoot apices in a monocotyledon in both T.S. and L.S. to show the origin and arrangement of leaf primordia.
- Study of alternate and distichous; alternate and superposed; opposite and superposed; opposite and decussate leaf arrangement. Examination of rosette plants (Launaea, Mullugo, Raphanus, Hyoscyamus, etc.) and induction of bolting under natural conditions as well as by GA treatment.
- Microscopic examination of vertical sections of leaves such as Cannnabis, Nicotiana, Nerium, Zea mays and Triticum to understand the internal structure of leaf tissues and trichomes, glands, etc. Also study the C3 and C4 leaf anatomy of plants.
- Study of epidermal peels of leaves such as Coccinia, Gaillardia, Tradescantia, Notonea, etc. To study the development and final structure of stomata and prepare stomatal index. Demonstration of the effect of ABA on stomatal closure.
- Study of whole roots in monocots and dicots. Examination of L.S. of root from a permanent preparation to understand the organization of root apical meristem and its derivatives (use maize, aerial roots of banyan, Pistia, Jussiena, etc.). Origin of lateral roots. Study of leguminous roots with different types of nodules.
- Study of permanent tissues.

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Plant Physiology, Biochemistry and Metabolism

COURSE OBJECTIVES:-

1. Demonstrate an understanding of how water moves in plants at both molecular and organismal levels.
2. Demonstrate an understanding of the biochemical processes of photosynthesis, glycolysis, citric acid cycle, and electron transport.
3. Use simple laboratory skills in scientific measurements.
4. Write a scientific research paper.
5. The field of plant physiology includes the study of all the internal activities of plants—those chemical and physical processes associated with life as they occur in plants.
6. A program that focuses on the scientific study of the cell and molecular plant biology and physiology, water relations and transpiration and mineral nutrition, especially nitrogen metabolism.
7. Fundamental processes such as photosynthesis, respiration and plant hormone functions. During this course you also will learn how plant growth and development and their tropisms, nastic movements, photoperiodism, photomorphogenesis, circadian rhythms under different environmental conditions.
8. Identify the organs and tissue systems of plants, and explain their respective functions.
9. Describe the principal cell types comprising each tissue system.
10. Identify location and function of apical meristems, and describe their general structure.
11. Distinguish secondary from primary tissues in woody stem and root growth
12. Understand how to apply the basic concepts of Plant Physiology in other disciplines of agriculture.
13. To understand, to know and discuss the concept of physiological processes of plants.
14. Understand and describe the distribution of metabolic processes in the cell.
15. Understand the importance of mineral nutrition, transpiration, photosynthesis and respiration of plant organisms.
16. To understand and explain the processes of growth and development of plants.

Syllabus:

UNIT – I

- Fundamentals of enzymology: General aspects,
- allosteric mechanism, regulatory and sites,
- isoenzyme, kinetics of enzymatic catalysis,
- Michaelis-Menten equation, and its significance,
- Mechanism of enzyme action.

UNIT – II

- Photochemistry and Photosynthesis: General concept and Historical back ground,
- evolution of photosynthetic apparatus,
- photosynthetic pigment and light harvesting complexes,
- Photo oxidation of water,
- mechanism of electron and proton transport,
- Carbon assimilation,
- Calvin cycle,
- Photorespiration and its significant,
- C-4 cycle,
- CAM path way physiological and ecological consideration.

UNIT – III

- Respiration : Overview of plant respiration,
- Glycolysis, TCA cycle,
- Electron Transport,
- Structure,
- function & synthesis of ATP,
- oxidative pentose phosphate pathway.

UNIT – IV

- Structure classification and function of carbohydrate Biosynthesis of sucrose and starch,
- Structure and function of Lipids,
- Fatty acid biosynthesis,
- Synthesis of membrane lipids,
- structural lipids and storage lipids, , and their catabolism,
- Glyoxilate cycle and alternative oxidases system.

UNIT – V

- Nitrogen fixation, (chemical and biological) Nodule formation,
- Mechanism of Nitrate uptake and reduction,
- ammonium assimilation,
- Sulphate uptake, transport and assimilation.
- Sulphur metabolism, Vitamins (structure and role).

COURSE OUTCOMES:

1. Understand how to apply the basic concepts of Plant Physiology in other disciplines of agriculture.
2. To understand, to know and discuss the concept of physiological processes of plants.
3. Understand and describe the distribution of metabolic processes in the cell.
4. Understand the importance of mineral nutrition, transpiration, photosynthesis and respiration of plant organisms. 5. To understand and explain the processes of growth and development of plants.

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Biology and Diversity of Gymnosperms

COURSE OBJECTIVES:-

1. Be able to compare and contrast the characteristics of seed, nonseed, and nonvascular plants. To do this completes the table below.

Characteristic	Nonvascular Plants	Nonseed Plants	Seed Plants
Dominant Phase of Plant Life Cycle			
Swimming Sperm			
Pollen Tube			
Pollen or Spores			
Homosporous or Heterosporous or Mixed			
Examples of Plants in this Group			

2. Be able to list the uses of some common gymnosperm plants, such as pines and ginkgoes.
3. Be able to list some of the uses of flowering plants.
4. It has been stated that the ancestor of flowering plants most likely was a gnetalean plant (or at least a plant closely related to them). What evidence supports this?
5. How might the fact that a species is monoecious or dioecious affect your decision to use it as a crop plant? As a landscape plant?
6. Discuss the type of seeds produced by gymnosperms, as well as other characteristics of gymnosperms.
7. State which period saw the first appearance of gymnosperms and explain when they were the dominant plant life.
8. List the four groups of modern-day gymnosperms and provide examples of each.

Syllabus:

UNIT- I

- General Characteristics,
- Classification,
- Distribution of Gymnosperms in India,,
- Economic Importance,
- Evolutionary Tendencies in Gymnosperms Indian Contribution to Gymnosperms.

UNIT – II

- General Characteristics of fossil Gymnosperms,
- (Pteridospermales): Lygenopteris, Medullosa,
- Glossopteris, Caytonia, Pentoxylon,

UNIT - III

- General characteristics of (Cycadeoidales&Cycadales):
- Bennettitales,
- Williamsonia,
- Cycadeoidea,
- Cycas,
- Zamia Nillsonia.

UNIT – IV

- General Characteristics of Ginkgoales,
- Corditales and Coniferales: Ginkgo,
- Cordites,
- Cedrus,
- Pinus,
- Araucaria,
- Cryptomeria,
- Thuza,
- Cupressus,
- Podocarpus,
- Taxux.

UNIT – V

- General Characteristics of Ephedrales,
- Welwitschiales And Gnetales :
- Ephedra,
- Welwitschia,
- Gnetum.

COURSE OUTCOMES:

- List the feature of an organism that is needed to qualify it as a plant.
- List examples of plants.
- Define the term *alternation of generations*.
- Diagram the life cycle of a moss and compare it to the life cycle of a fern.
- Know the differences among the plant groups.
- Describe the evolutionary relationships among plants.
- Explain how plants adapted to terrestrial habitats.
- Describe the advantage of vascular tissue to plants.
- Differentiate among roots, stems, and leaves.
- Distinguish between vascular and nonvascular tissue.
- Compare gymnosperms and angiosperms.
- .defneand contrast homosporous and heterosporous
- discuss the evolutionary advantage of heterosporous over homosporous
- identify the parts of a seed and discuss why reproducing by seeds is an advantaged compared to reproducing by spores
- discuss the life cvcle of a pine

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Plant Resource Utilization and Conservation

COURSE OBJECTIVES:-

To enable the students:

- To understand the threats of air, soil and water pollution
- To understand the economic importance of different plants
- To understand the various threats of biodiversity and the strategies for conservation

Syllabus:

- UNIT - I:** Air pollution Classification and properties of air pollutants and their effects on plants; Ozone layer and Ozone hole; climate change. Water pollution: Domestic and industrial water pollution; oil pollution; Soil pollution; acidification, agrochemical pollution; contamination by metalliferous wastes.
- UNIT – II** Botany, cultivation and uses of: 1) Food crops: Rice, Wheat and Sorghum. 2) Vegetable crops: Potato, tomato and chillies Distribution, description and uses of: 3) Timber yielding plants: *Tectona, Dalbergia and Rosewood*. 4) Medicinal plants: *Rawolfia, Withania, Emblica, Andrographis, Aloe and Neem*. 5) Production and applications of biofuels – Biogas, hydrogen and methane.
- UNIT – III** Phytogeography – Hotspots of India and world. General account on activities of DBT, Botanical Survey of India and NBPGR.
- UNIT - IV** Biodiversity – Current concept and status in India. Conservation of Biology. Current practice in conservation in India and abroad. Organisations involved in resource conservation IUCN, WWF, UNEP, UNESCO.
- UNIT – V** Strategies for *in situ* conservation – Protected areas, Wildlife sanctuaries, National parks, Biosphere reserves, mangroves. Strategies for *ex situ* conservation – Botanical Gardens, Seed banks, Field gene banks, *in vitro* conservation

COURSE OUTCOMES:-

On completion of this course, the students will be able to:

- Understand the various uses of plants; biodiversity status, loss and management strategies.
- Describe economically important plants with binomial names, family and uses
- Analyse the biogeography, status and loss of biodiversity, initiatives for biodiversity conservation

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Cell Biology and Genetics

COURSE 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.
5. Students will learn the basic principles of inheritance at the molecular, cellular and organismal levels.
6. Students will understand causal relationships between molecule/cell level phenomena ("modern" genetics) and organism-level patterns of heredity ("classical" genetics)
7. Students will test and deepen their mastery of genetics by applying this knowledge in a variety of problem-solving situations

Syllabus:

UNIT – I

- Structure and Organization of Plant Cell,
- Structure and Function of Cell wall,
- Plasma Membrane,
- Ion carriers,
- Channels and pumps,
- Receptors,
- Plasmodesmata, and Sites for ATPases.

UNIT – II

- Structure and Function of Cell organelles:
- Chloroplast,
- Mitochondria,
- Vacuole,
- E.R. Lysosomes,
- Ribosome,
- Golgi Body.

UNIT - III

- Structure and Function of Nucleus,
- Nucleosome,
- Chromosome Structure and Packaging of DNA,
- Euchromatin,
- Heterochromatin,
- Karyotype,
- Binding patterns and special types of chromosomes.

UNIT – IV

- Cell division,
- Cell cycle,
- Programmed cell death,
- Structural changes in Chromosomes (Duplication, Deletion, Inversion, and Translocation),
- Numerical changes in Chromosomes (Aneuploids and Euploids, Haploids)

UNIT - V

- Mendel's laws,
- Genetics of Mitochondria and Chloroplast Polygenic inheritance,
- Crossing over and linkage,
- Transposable elements.

COURSE OUTCOMES:-

- After completing this course, the students will be able to:
- Understand how to apply the basic concepts of Plant Physiology in other disciplines of agriculture.
- To understand, to know and discuss the concept of physiological processes of plants.
- Understand and describe the distribution of metabolic processes in the cell.
- Understand the importance of mineral nutrition, transpiration, photosynthesis and respiration.
- To understand and explain the processes of growth and development of plants.

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PRACTICAL (Laboratory –I):-

Paper I

- Isolation and quantification of plant lipids.
- Isolation of chloroplast from fresh leaves and estimation of chlorophyll proteins.
- Chlorophyll survey of five plants. Quantification, absorption spectra of chlorophyll and carotenoids using different solvents.
- Demonstration of stomatal activity from suitable plant material.
- Understand and describe the distribution of metabolic processes in the cell.
- Understand the importance of mineral nutrition, transpiration, photosynthesis and respiration of plant organisms.
- Separation of pigments by paper chromatography.
- Isolation, assay and determination of specific activity of plant enzymes of germination.
- Extraction and estimation of soluble proteins by Bradford method.
- Estimation of reducing sugars.

Paper II

- Study of Gymnosperms -morphological, anatomical and preparing slide.
- Study of Cycas cone and preparing slide
- Study of Thuza(young,old stem) and preparing a temporary slide.
- Study of Pinus, morphological, anatomical and preparing slide.
- Study of Thuza(young,old root) and preparing a temporary slide.
- Study of various meristems and plant tissues by permanent and temporary slides.
- Identification of plant organs on the basis of anatomy
- Study of anatomy of root, stem and leaves by double staining method
- Comparative study of anatomy of vegetative and reproductive parts of To study permanent slide of various Gymnosperms

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PRACTICAL (Laboratory –II):-

Paper III

1. To study the medicinal plants and its taxonomic description.
2. To study the food crops plants and its taxonomic description.
3. To study the timber yielding plants and its taxonomic description.
4. Production and applications of biofuels.
5. To Study of national park and Botanical garden.

Paper IV

- Separation of membrane and demonstration of permeability.
- Isolation and demonstration of mitochondria activity.
- Isolation of chloroplast and demonstration of chloroplast activity.
- Histochemical localization of nucleus and nucleolus.
- Isolation quantification of RNA.
- Isolation quantification of DNA.
- Isolation quantification of Proteins.
- To study chromosomal banding pattern.

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Biotechnology and Tissue Culture

COURSE OBJECTIVES:-

- To develop understanding of industrial processes for production of antibiotics, enzymes etc.
- To develop understanding of techniques for tissue culture, cell culture and organ transplantation.
- Explain the various components of plant tissue culture media, e.g. minerals, growth factors, hormones, and what governs the choice of components,
- Explain the various steps taken to establish and optimise media for particular purposes in particular species, without the aid of texts
- Explain and perform some of the more advanced techniques, e.g. embryo rescue, and protoplasting.
- Establish and maintain plants in tissue culture and micropropagation, including morphogenesis
- Investigate and define a protocol to establish an unknown species and test its response
- Explain the various cell lines used in tissue culture and their origins and uses

Syllabus:

UNIT – I

- Plant cell and tissue culture: General introduction, history, scope,
- concept of cellular differentiation and
- Totipotency Establishment of Lab,
- Aseptic technique and Sterilization of Glassware
- Different types and Preparation of Media,
- Ex plant technique of tissue culture,
- Meristem,
- anther,
- embryo culture,
- Organogenesis.

UNIT – II

- Somatic Hybridization,
- Protoplast isolation, Fusion and culture,
- Somatic cell genetics,
- application of tissue culture,
- Artificial seed,
- Somaclonal variation,
- Production of Secondary metabolites,
- cryopreservation, and germplasm storage.

UNIT – III

- Biotechnology Principles and Application of biotechnology in Agriculture, horticulture, forestry,
- food, and industries,
- health care and immunology,
- environment biotechnology, and ethics.
- Intellectual Property right-genetic engineering of plants, aims,
- strategies of Transgenic Agrobacterium,

- T-DNA, Gene tagging microbial genetic manipulation
- genetic improvement of industrial microbes,
- fermentation technology,

UNIT – IV

- Recombinant DNA technology : gene cloning, principle and technique,
- construction of genomic and c-DNA library Vector,
- Plasmid,
- DNA synthesis polymerase chain reaction,
- DNA fingerprinting.

UNIT – V

- Genomics and proteomics, molecular markers,
- Artificial chromosomes,
- High thought sequencing,
- genome projects,
- bioinformatics,
- microarrays,
- protein profiling and its significance,

COURSE OUTCOMES:-

- Discuss the different applications of biotechnology
- Understand the importance of cells to genetic engineering.
- Know the natural function of restriction endonucleases and how a normal bacterial cell protects its DNA from their activity.
- Understand how insulin is produced using bacterial cells and importance to gene technology.
- Describe techniques used to characterize DNA and Axenic culture of cell

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Molecular Biology of Plants

COURSE OBJECTIVES:-

To enable the students:

- An in-depth study on Structure and organization of D.N.A., Replication Process, Transcription process, Translation process and Mutagenesis.
- To expose the students on the understanding of various techniques of gene mapping and sequencing for molecular studies.

Syllabus:

- UNIT - I** Chemistry of the gene Evidence for DNA as genetic material, Physical and chemical structure of DNA, Eukaryotic genome – Repeated DNA sequences, mechanism of DNA replication, DNA damage and DNA repair mechanisms.
- UNIT - II** Gene Expression Transcription in prokaryotes and Eukaryotes, mRNA processing and other RNA processing events, mechanism of Translation, RNA splicing, genetic code
- UNIT – III** Protein biosynthesis. Targeting of proteins to organelles. Transposons, mechanism of , IS elements, genetic consequences of transposition.
- UNIT – IV** Gene regulation Principles of gene regulation, in prokaryotes (e.g. lactose and tryptophan operons) strategies of gene regulation in Eukaryotes (e.g. DNA methylation only).
- UNIT – V** Mapping and sequencing the genome Linkage mapping and restriction mapping. C value and C value paradox. Cot curves, methods of DNA sequencing, microsatellites, Bioinformatics, microarray technology and its applications.

COURSE OUTCOMES:-

On completion of this course, the students will be able to:

- Understand in-depth knowledge on Molecular Biology
- Understand in detailed mechanisms of DNA Replication
- Understand the overall concepts of Transcription, Translation
- Understand the process of Mapping and sequencing of genome

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Discipline Specific Elective-I Plant Pathology

COURSE OBJECTIVES:-

To introduce concepts and principles of plant pathology. Study of interaction between plant and pathogen in relation to the overall environment and mechanism of disease development by pathogens.

Syllabus:

- UNIT - I** Plant diseases Definition of plant disease, Nature and Concept of diseases in plant, importance of plant diseases and their effect on human affairs, classification of plant diseases, definition and terms in plant pathology history and development of plant pathology, methods of studying plant diseases (Air born, soil born and Water born diseases), Koch's Postulates.
- UNIT - II** Plant disease epidemiology Detail study of symptoms, Fungi, etiology, epidemiology and control of fungal disease of plants: Late blight of potato, Damping off vegetables, Taphrina leaf spot of turmeric, Black rust of wheat, Red rot of sugarcane, Tikka disease of groundnut, Powdery mildew of apple, Rust of linseed, Rust of coffee, Smut disease of grasses.
- UNIT - III** Seed Pathology Principles of plant disease control, plant quarantine, seed treatment, methods of studying seed born disease, collection, preservation, isolation of pathogens and biological control of plant diseases.
- UNIT - IV** Host – Pathogen Interaction Distribution on plant pathogens, mode of infection, entry of pathogen in to host, roles of enzymes, toxins, phytoalexins in plant pathogenesis, physiological changes in diseased plants.
- UNIT – V** Plants Bacteriology And Virology Nomenclature and Classification of plant viruses, detail study of symptoms, symptoms caused by plant pathogenic bacteria and viruses, control of bacterial and viral disease : Bacterial leaf blight of rice, Citrus canker, Little leaf of brinjal, Tobacco mosaic disease, Potato scab, Crown gall of apple and grapes, Leaf curl of papaya, Bud blight disease.

COURSE OUTCOMES:-

Students will know about concept of diseases, knowledge and awareness of diseases, causal agents of plant diseases, identification methods and management of crop diseases.

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Discipline Specific Elective-I Plant Reproduction

COURSE OBJECTIVES:-

To enable the students:

- To understand the various aspects of plant floral parts, development and reproduction
- To understand the various aspects of embryology and apomixis

Syllabus:

- UNIT – I** Flower Calyx, corolla, Androecium, Gynoecium; **Microsporangium:** Anther Wall, Endothecium Middle layers, Tapetum, Nuclear behaviour in tapetal cells, Sporogenous tissue; **Male Gametophyte:** Formation of vegetative and generative cells, Formation of Sperms, Pollen wall, Abnormal features. **Megasporangium:** Types of ovule, Integuments, Nucellus, Megasporogenesis, Special features. **Female Gametophyte:** Types of female gametophytes, Mature Embryo sac, Haustorial behaviour of embryo sac, Nutrition of Embryo sac.
- UNIT - II** Pollination Anther dehiscence, pollen transfer, self pollination, cross pollination, artificial pollination, pollen storage; **Fertilization:** Pollen germination and pollen tube growth. Path of pollentube, pollentube discharge, Double fertilization, Syngamy. **Endosperm:** Types of endosperm, ruminant endosperm, cytology of endosperm, functions of endosperm.
- UNIT - III** Embryo Zygote, proembryo, Embryogeny in dicotyledons, Embryogeny in monocotyledons, suspensor, under developed and reduced embryos, Nutrition of embryo. **Polyembryony:** Causes of polyembryony, experimental induction of polyembryony, classification of polyembryony practical value of polyembryony.
- UNIT - IV** Embryology in relation to Taxonomy Importance of Embryological characters in taxonomic considerations, families with special embryological features, examples of the value of embryology in taxonomy,
- UNIT - V** Apomixis Vegetative reproduction, apospory, causes of apomixis, significance of apomixis.: **Experimental Embryology:** Palynology in relation to Taxonomy. Effects of young seeds on fruit growth, Parthenocarpy, parasexual hybridization.

COURSE OUTCOMES:-

On completion of this course, the students will be able to:

- Discuss the structural elements of plants floral parts and reproduction
- Discuss the Pollination, embryology and apomixis

Discipline Specific Elective-II Plant Ecology

COURSE OBJECTIVES:

To Distinguish between species, populations, communities, ecosystems biomes and Understand the factors that affect population size, density, distribution, and dynamics.

Syllabus:

- UNIT - I** The Environment Physical environment; biotic and abiotic interactions.
Habitat and Niche: Concept of habitat and niche
Ecosystem Ecology: Ecosystem structure and function; Food Chain, Food Web, Energy flow and Mineral cycling (C,N); Primary production and Methods of measurement of primary productivity;
- UNIT - II** Population Ecology Characteristics of a population(Density ,Natality, Mortality ,Dispersion Population size, Age structure , Life tables); Population growth curves; Population regulation; life history strategies (r and K selection);
- UNIT - III** Species Interactions Types of Interactions,Positive interactions- Mutualism,Symbiosis, commensalism, Negative interactions – Exploitation, Herbivores, Carnivores, antibiosis, competition.
- UNIT - IV** Community Ecology Characteristics of communities Analytical Quantitative – Frequency, density, Abundance, Cover and Basal area. Qualitative – Physiognomy, Phenology,Stratification, sociability, vitality and Life form and Synthetic - Prensence and constance, Fidelity Dominance.); Raunkiaer concept ; Levels of species diversity and its measurement; Ecotones. Biodiversity: Monitoring; Hotspots (with reference to India), Major drivers of biodiversity change; **Ecological Succession:** Types; mechanisms; Changes involved in succession; Concept of climax- Monoclimax and Polyclimax theories.
- UNIT - V** Applied Ecology Pollution -Global environmental change -Atmosphere composition and structure, Green house gases , Global warming, Ozone depletion.
Conservation Biology: Principles of conservation In situ - Protected areas, National parks, Wildlife sanctuaries, Biosphere reserves and Project tiger. Ex situ - Botanical gardens, Zoological parks and cryopreservation.

COURSE OUTCOMES:-

By understanding the concepts of ecological principles and environmental issues, the student will be able to develop attitude, value system and ethics towards environment related issues.

Lab-I Discipline Specific Elective-1

PRACTICAL :-

1. To study different sterilization technique.
2. To study preparations of culture media.(MS)
3. To study sterilization of seeds.
4. Enplant preparations.
5. Study of different techniques in plant hybridization.
6. Preparation of synthetic seeds.

PRACTICAL:-

- To study the physical characteristics (temperature, colour and texture) of soil.
- To determine water holding capacity of soils collected from different locations.
- To determine pH and conductivity of soils collected from different locations.
- Chemical testing of soil for phosphorus, potassium and nitrate.
- To determine percentage organic carbon and organic matter in the soils of crop land, grassland and forest.
- To determine the pH and conductivity of water samples collected from different locations.
- To estimate the dissolved oxygen content in eutrophic and oligotrophic water samples.
- To record the a biotic components i.e. pH, temperature, turbidity and light intensity of water in a pond ecosystem.
- To determine the minimum size of the quadrat by species- area curve.
- To study the community by Quadrat method by determining frequency, density and abundance of different species present in the community.
- Determination of species diversity index and importance value index of local vegetation.
- To compare protected and unprotected grasslands using community coefficients (similarity index).
- To study the species composition of an area for analyzing biological spectrum and comparison
- With Raunkiaer's normal biological spectrum.
- To survey and study the ecological adaptations of locally available hydrophytes and xerophytes.
- Field visit of any protected area and to discuss causes and impacts of biodiversity loss.

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Discipline Specific Elective-II Plants & Society

COURSE OBJECTIVES:-

1. Students will gain an appreciation for the plants in their world.
2. Students will develop an understanding of how plants grow.
3. Students will gain an understanding of how plants are used by people.
4. Students will be able to identify and label the basic parts of a plant, including: root, stem, leaves, flower, and petals, by creating their own flower and explaining it to the teacher or their classmates.
4. Introduce children to the concept that plants have various parts.
5. Help students to understand the basic functions of each of these structures.
6. Children will learn about plants and the elements (food, water, and sun) necessary for plant growth.

Syllabus:

- UNIT – I** History of plants and development of society, Role of plants in tracing human history, green revolution:- benefits and adverse consequences. Innovations for meeting world food demands. Early domestication centers of major cultivated plants, Plants in Mythology, folklores Role of Ethno botany in relation to development of society.
- UNIT – II** Plants & Human Health, Usage of plants in different systems of medicine allopathic, Homeopathic Aurvedic, Herbal Medicine, and concept of Herbal Cosmetic. Plants as health hazards. Food spoilage. Viral, Bacterial and fungal diseases of human beings.
- UNIT – III** Plants in Enterprenural Areas-A: Techniques of cultivation and marketing of few Chlorophytum, Guggul, Commiphera wightii, Rauwolfia serpentina. Plants and other uses : Agriculture & Horticulture.
- UNIT – IV** Plants in Enterprenural Areas - B: Use of plants in earning livelihood - Such as Bamboos, Rattans, Raw Materials of papermakings, Gums tannins, dyes, resins and fruits. Techniques of cultivation and marketing of - Aromatic Plants - Lemon grass, plasma Rosa, Floriculture - rose and gladioli.
- UNIT – V** Plants in Enterprenural Areas - C: Techniques of cultivation and marketing of - Mushroom Cultivation, Nursery management, Vermiculture & Vermicompost. Mass cultivation of few plants using tissue culture techniques. Bonsii Techniques.

COURSE OUTCOMES:-

- a. Plants are *like* other organisms in regard to: basic metabolism, sexual reproduction, clonal reproduction, hormonally regulated development, ability to respond to the environment, diversity and evolution.
- b. Plants are *unique* organisms in: their varied life histories - especially a sporic one with alternation of generations; their role as primary producers in food webs, serving as the interface organisms between the organic and inorganic worlds *via* mineral assimilation and photosynthesis; and the oxygenation of the atmosphere.
- c. Plants serve as an important source of products: food, fiber, flavorings, feed, fuel, pharmaceuticals, etc.

Lab-II Discipline Specific Elective-II

Practical –II

1. To study the parts of flower.
2. To cut the T.S. of anther, pollen and ovule.
3. To cut the T.S. of Dicot and monocot embryo.
4. To study the modes of reproduction in plant.
5. To study of endosperm.
6. To study of different types of ovule.

Practical -II

1. Identification of economically important plant products- their binomials, families and morphology of the parts used.
2. Submission of digital photographs with description of 5 wild medicinal plants and 5 wild edible plants.
3. Usage of plants in different systems of medicine
 - a. allopathic, Homeopathic, Ayurvedic, Herbal Medicine
4. Techniques of cultivation and marketing of - Mushroom Cultivation.
5. Techniques of cultivation and marketing of - Aromatic Plants

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Discipline Specific Elective-III

Tools and Techniques

COURSE OBJECTIVES:-

- 1.Utilize safety measures and equipment
- 2.Use a bright field microscope to view and interpret slides
- 3.Properly prepare slides for biological examination
- 4.Properly use aseptic techniques for the transfer and handling of microorganisms and instruments
- 5.Use appropriate biological media and test systems
- 6.Use standard biology laboratory equipment correctly

Syllabus:

UNIT – I Microscopy: Principles and applications of light, phase contrast, fluorescence microscopes, scanning and transmission electron microscopes.
Fixation and staining; cytophotometry and flow cytometry.

UNIT – II Chromatography: Principles and applications of gel filtration, ion-exchange, affinity, thin layer, gas chromatography and high pressure liquid chromatography (HPLC).
Electrophoresis and centrifugation: Principles and applications of agarose and polyacrylamide gel electrophoresis; ultracentrifugation (velocity and buoyant density).

UNIT – III Molecular biology techniques: Sequencing of proteins and nucleic acids; southern, northern and western blotting techniques, polymerase chain reaction (PCR), ELISA, MALDITOF.
Methods for measuring nucleic acid and protein interactions; DNA fingerprinting;
Molecular markers (RFLP, AFLP, RAPD).

UNIT – IV Spectroscopy: Fluorescence, UV, visible, NMR and ESR spectroscopy; X-ray diffraction.
Tracer Biology: Principles and applications of tracer techniques in biology; radioactive isotopes and half-life of isotopes; autoradiography.

UNIT – V Centrifuge: Principles and applications, methods of centrifuge.
Types of centrifuge. Soxhlet and extraction of plant.

COURSE OUTCOMES:-

- Students will be able to acquire, articulate, retain and apply specialized language and knowledge relevant to biology.
- Students will acquire and demonstrate competency in laboratory safety and in routine and specialized biological laboratory skills applicable to biological research or clinical methods, including accurately reporting observations and analysis.
- Students will communicate scientific concepts, experimental results and analytical arguments clearly and concisely, both verbally and in writing.
- Students will demonstrate engagement in the biology discipline through involvement in research or internship activities, the biology Student Association club (MSA) and outreach or mentoring activities specific to biology.

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Discipline Specific Elective-III

Evolutionary and Economic Botany

COURSE OBJECTIVES:-

- Describe the theory of natural selection.
- Explain how new species arise.
- Construct a phylogenetic tree.
- Explain the mechanisms which underlie evolution at the molecular level.
- to identify the following crops: Sorghum, Maize, Rice, and Wheat
- to know the origin, distribution, spread and taxonomy of the above listed crops
- to be able to describe morphological feature
- to know the economic importance of the listed crops.

Syllabus:

UNIT – I Evolutionary Biology: Origin of life (including aspects of prebiotic environment and molecular evolution); Concept of evolution; Theories of organic evolution; Mechanisms of speciation.

Hardyweineberg genetic equilibrium, genetic polymorphism and selection; origin and evolution of economically important microbes and plants.

UNIT – II Origin of agriculture: World centers of primary diversity of domesticated plants; Plant introduction; Secondary centers of origin.

Plant as a source of renewable energy; Innovations for meeting world food demands.

UNIT – III Botany, cultivation and uses of –

- a. Food, forage and fodder crops (cereals, pulses, vegetables and fruits)
- b. Fiber yielding plants
- c. Botany, cultivation and uses of Medicinal plants
- d. Aromatic plants
- e. Oil yielding plants

UNIT – IV Important fire-wood, timber-yielding plants and Non-wood forest products (NWFPs) such as- Bamboos, rattans, raw materials for paper-making, gums, tannins, dyes and resins.

Plants used as avenue trees for shade, pollution control and aesthetics.

UNIT – V Farming of medicinal plant, cryopreservation, seed bank, methods of crop rotation.

COURSE OUTCOMES:-

- Acknowledge the economic uses of plants in modern society.
- Acquire an increased awareness and appreciation of plants & plant products encountered in everyday life.
- Develop scientific insights into the development of many plant products that have shaped our society.
- Appreciate the diversity of plants and the plant products in human use;
- Understand the biological reasons why certain plant resources are important;
- Explain the geographical, historical, and cultural contributions of economically important plants on the development of human culture.
- Understand the conditions & consequences of natural selection: & describe different modes

Discipline Specific Elective-IV

Methods in Biology Applied Biology Instrument, Biostatistics and Computer

COURSE OBJECTIVES:-

- Describe the roles biostatistics serves in the discipline of public health.
- Describe basic concepts of probability, random variation and commonly used statistical probability distributions.
- Describe preferred methodological alternatives to commonly used statistical methods when assumptions are not met.
- Distinguish among the different measurement scales and the implications for selection of statistical methods to be used based on these distinctions.
- Apply descriptive techniques commonly used to summarize public health data.
- Apply common statistical methods for inference.
- Apply descriptive and inferential methodologies according to the type of study design for answering a particular research question.
- Apply basic informatics techniques with vital statistics and public health records in the description of public health characteristics and in public health research and evaluation.
- Interpret results of statistical analyses found in public health studies.
- Develop written and oral presentations based on statistical analyses for both public health professionals and educated lay audiences.
- Capability to build statistical model over real health data.
- Estimate and compare efficiency of models.
- Use statistical software to analyze health –related data.
- Be able to explain the advantages of a Bayesian data analysis.
- Perform univariate data analysis for continuous and categorical variables.
- Interpret inferential findings within Bayesian thinking (e.g. credible intervals, hypothesis testing). Conduct inference via posterior simulation and simulations tool.

Syllabus:

UNIT – I

- Microscopy, TEM, SEM, ELISA,
- Western and southern blotting,
- staining spectrophotometer,
- Electrophoresis colorimeter,
- x-ray differentiation, pH meter,
- centrifugation,
- chromatography,
- microtome
- Laminar air flow.

UNIT - II

- Biostatistics: mean, median, mode,
- Probability,
- Distribution normal and binomial,
- Histogram,
- Standard deviation,
- Standard errors,
- Correlation and regression,
- Significance based on small and large sample (t,z,f-test and chi square test,).

UNIT – III

- Microbial fermentation transgenic plants (bioremediation) biosensors, application of different techniques in biology,
- Culture of Algae, and fungi,
- Tissue culture technique.

UNIT – IV

- Introduction to computer; fundamentals, Permanent storage of number, system,,
- MS, DOS,
- MS WORD,
- MS EXCEL,
- Application of computer biostatistics problems,
- computer in biology:, sequence data bases,
- analysis of protein and nucleic acid,
- structure prediction,
- simple molecular modeling,
- Sample graph plotting.

UNIT – V

- Networking of computer, need and application.
- Detail study of internet,
- Use of e-mail and internet,
- Modern strategies of literature search,
- Record and presentation of data and scope.

COURSE OUTCOMES:-

- Draw conclusions or make predictions based on data summaries or statistical analyses.
- Design research studies in collaboration with physicians, life scientists, or other professionals.
- Analyze clinical or survey data using statistical approaches such as longitudinal analysis, mixed effect
- logistic regression analyses, and model building techniques.
- Provide Biostatistician consultation to clients or colleague

Discipline Specific Elective-IV Ethno Botany

COURSE OBJECTIVES:-

To enable the students:

1. To proper documentation and presentation of traditional knowledge about plants.
2. To use important plants by the tribal communities for various purposes.
3. Conservation natural growing plants and socioeconomic impacts.
4. Ethno botany solve human problem of nutrition health care and life support system.

Syllabus:

- UNIT - I** Ethno-Medicine Introduction, concept, scope and objective; Aboriginal uses and management of ethno-botanical species in India. Carefully analyzed, verified and proper preparation of medicines by local healers. Exploration of some ethno-medicinal plants used by tribals. Medico-Ethno-botanical sources in India. Ailments for cure diseases.
- UNIT - II** Ethno-botany (concept and studies) Introduction, definition, Classification, method of study ethno-botany, phytosociological studies, Significance and ethno-botanical practices, role of ethnic groups, Traditional systems of medicine, Conservation and protection of ethno-biodiversity, ethno- botany as tool to protract ethnic groups. Role of ethno-botany in modern, high tech science.
- UNIT - III** Ethno-botany and Legal aspect Ethno botany as an interdisciplinary science. Paleo-ethnobotany. Aims and object of legal aspect. Biopiracy, Intellectual property rights, endegerd species Vulnerable and extinct ethno-species . Application of natural habitat and propagation of ethno-botanical species. Propagation through cutting, layering, grafting, and budding. Enforcement of existing Acts. Policy framework.
- UNIT - IV** Herbal Medicines and Folk medicines History ,Scope, Definition, Aims and Objects about folk and herbal medicines. Selection of herbal planting material for Cultivation, Harvesting, Storage and Marketing of herbal medicines. Systematic position of herbal medicinal plants. Nursery, Forming, use of green houses for nursery. Development of agro- technology and promotion of rural bio-technology.
- UNIT - V** Phormacognosy and Economic ethno-botany Active principals and method of screening, testing of secondary metabolites-Alkaloids, Flavonoids, Steroids, Tannins, Terpenoids, Phenolic compounds. Anti-microbial, Anti-oxidant, Anti-inflammatory, Drug adulteration-types, methods of drug evaluation. Biological testing of herbal medicines. Future aspect of phormacognosy. Tribal economic realization through different sources for their livelihood. Ethnic policy for commercialization.

COURSE OUTCOMES:-

On completion of this course, the students will be able to:

1. To express the historical development of ethno botany. Recognize and identify important plant species.
2. Explain ethno botanically uses of plants. Detail their native habitats and cultivated lands.

LAB- I

- 1.Principles , applications and methods of centrifuge.
- 2.Study of Soxhlet and extraction of plant.
- 3.Molecular biology techniques.
4. Study of polyacrylamide gel electrophoresis.
5. Chromatography: Principles and applications of gel filtration, ion-exchange, affinity, thin layer, gas chromatography and high pressure liquid chromatography (HPLC).
6. Fixation and staining; cytophotometry and flow cytometry.
7. Microscopy: Principles and applications of light, phase contrast, fluorescence microscopes,
8. Spectroscopy: Fluorescence, UV, visible, NMR and ESR spectroscopy; X-ray diffraction.

- Representation of Statistical data by a) Histograms b) Pie diagrams
- Determination of Statistical averages/ central tendencies. a) Arithmetic mean b) Median c) Mode
- Determination of measures of Dispersion a) Mean deviation b) Standard deviation and coefficient of variation c) Quartile deviation
- Tests of Significance-Application of following a) Chi- Square test b) t- test c) Standard error
- Computer operations-getting acquainted with different parts of Computers. [DOS] and basics of operating a computer.
- Creating files, folders and directories.
- Applications of computers in biology using MS-Office. A] MS-Word B] Excel C] Power Point
- Creating an e-mail account, sending and receiving mails.
- An introduction to INTERNET, search engines, websites, browsing and Downloading.

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LAB-II

- Study of timber –Yielding plants
- Study of aromatic plant
- Study of cultivation and uses of medicinal plants
- Study of oil yielding plants
- Study of fiber yielding plants
- Study of Food, forage and fodder crops (cereals, pulses vegetables and fruits)
- Study of Ethnomedicinel plant.
- Study of archaeoethnobotany
- Study of Plants used in various systems of medicines.
- Study of plant used in Ayurvedic, Unani and Homoeopathic system .
- Study of plant in Allopathic systems.
- Plants used by villagers and tribal people.

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