

**BOTANY (HONOURS)**  
**SEMESTER-I**  
**PROGRAMME SPECIFIC OUTCOMES OF CORE - 1**  
**MICROBIOLOGY & PHYCOLOGY**

After completion of this course, students will be eligible to understand following:

1. Diversity of Microorganisms e.g. Bacteria, Virus, Algae present in our surroundings.
2. To Know the systematic position, the morphology and life cycle of Bacteria, Virus and Algae.
3. To know the harmful and useful aspect of these microorganisms in daily life and in food, diary, medicines and biotech industries.

**Practical's outcome:**

4. After hand on practical knowledge, on sterilization technique, isolation of microbes, pure culture technique makes the student confident for a job of Laboratory Technician.

**COURSE OUTCOME OF CORE -1 MICROBIOLOGY & PHYCOLOGY**

On completion of the course the students are expected to know

**Course Outcome 1:**

- a) About microbial world, their nutrition and metabolism.

**Course Outcome 2:**

- a) Reproduction of Bacteria and genetic recombination in Bacteria.
- b) Economic Importance of Bacteria in Agriculture and Industry.

**Course Outcome 3:**

- a) Structure of thallus in Algae
- b) Reproduction in Algae.
- c) Economic importance of Algae in Agriculture, Biotechnology and Industry.

**Course Outcome 4:**

- a) Structure of thallus, reproduction, heterocyst, economic importance of cyanobacteria (*Nostoc*)
- b) General characters, thallus structure, reproduction and life cycle of *Clamydomonas*, *Volvox*, *Oedogonium*, *Coleochete* etc.

**Course Outcome 5:**

- a) General characters, thallus structure, reproduction and life cycle of *Chara*, *Voucheria*, *Phaeophyta*, *Fucus*, *Ectocarpus* and *Polysiphonia*.

**PROGRAMME SPECIFIC OUTCOMES OF CORE - 2**  
**BIOMOLECULES & CELL BIOLOGY**

After completion of this course, students will be eligible to understand following:

1. Gain knowledge on cell Structure, Plasma membrane, different organelles and their functions.
2. The sequences of cell division and growth of organisms.
3. Learn scope and importance of bio-molecules in molecular biology.
4. To know the biochemical nature of nucleic acids, their role in Living systems, experimental evidence of DNA as genetic material.
5. To understand the process of Protein synthesis and role of Genetic code in polypeptide formation.

**Practical's outcome :**

6. Students will be able to know the Presence of carbohydrate, Protein & fat in different food stuffs.
7. Study cell structure, measure cell size by Micrometry, counting cells numbers by Haemocytometre , cytoplasmic movement etc.
8. Study the division of vegetative cells and reproductive cells (Mitosis & meiosis)

## COURSE OUTCOME OF CORE -2 BIOMOLECULES & CELL BIOLOGY

On completion of the course the students are conversant:

### Course Outcome 1:

- About types and significance of chemical bonds.
- Structure and properties of different types of Carbohydrates (Monosaccharide, disaccharides and polysaccharides).
- Lipids, Fatty Acids and triglycerides
- Proteins, Amino Acids and Nucleic Acids

### Course Outcome 2:

- Bioenergetics, Laws of thermodynamics, free energy concepts, chemical reactions, ATP structures and their roles.
- Structure, Classification, mechanism of action of enzymes and factors affecting enzyme activity.

### Course Outcome 3:

- Cell structure of Prokaryotes and Eukaryotes, Endosymbiotic theory.
- Models of Cell Wall and Plasma Membrane and their function

### Course Outcome 4:

- Electron micrograph structure of Cell, nucleus chromatin structure and function,
- Semi-autonomous nature of Mitochondria and Chloroplast
- Structure of Endoplasmic Reticulum, Golgi Apparatus and Lysosome.

### Course Outcome 5:

- Cell Cycle in Eukaryotes
- Types of Cell Division and regulation of Cell Cycle.

## SEMESTER- II

### PROGRAMME SPECIFIC OUTCOMES OF CORE 3

#### MYCOLOGY & PLANT PATHOLOGY

On completion of the programme the students will be able to:

- Have a definite idea about the characteristic features of Fungi, identify its different divisions, know about their structure, life cycle economic and ecological importance.
- Understand the role of bacterial, viral and fungal pathogens and control measures used for disease management.

### COURSE OUTCOMES OF CORE -3-( MYCOLOGY & PLANT PATHOLOGY)

On completion of the course the students are expected to

#### Course Outcome 1:

- Know about general features, diversity and classification of Fungi, affinities with other groups.
- General Characters of Chytridomycetes, Zygomycota and Ascomycota
- Structure, life cycle, economic importance of some genera like *Rhizopus*, *Saccharomyces*, *Aspergillus*, *Penicillium*, *Alternaria*, *Neurospora* and *Peziza*.

#### Course Outcome 2:

- Understand the general Characters of Basidiomycota and Oomycota and slime molds
- Study the ecology structure, life cycle, economic importance of important genera like *Puccinia*, *Agaricus*, *Phytophthora* and *Albugo*.

#### Course Outcome 3:

- Develop a working knowledge on lichen biology and characterize the different forms of lichen and know about their range of thallus organization.
- Understand the nature of symbiotic association of fungi with other plant groups as in case of Lichens and Mycorrhizae and their significance.

**Course Outcome 4:**

- Understand the importance of Fungi in nature and in the practical activities of man. Know about the role of fungi in biotechnology, food industry, fermentation, production of enzymes, mycoproteins and secondary metabolites.
- Learn about the application of fungi in agriculture, pharmaceutical industry and biological control of pests.

**Course Outcome 5:**

- Know about principles of plant pathology, diseases that affect plants, microbiology and host parasite interactions.
- Gain knowledge of select diseases caused by bacteria, viruses and fungi and their control measures.

**PROGRAMME SPECIFIC OUTCOMES OF CORE - 4 (ARCHEGONIATES)**

On completion of the programme the students will be able to:

- Understand the general characters and classification of three plant groups under Archegoniates i.e. Bryophyta, Pteridophyta and Gymnosperms.
- Know about the structure and life cycle of important genera as well as their ecological and economic importance

**COURSE OUTCOME OF CORE 4- Archegoniates****Course Outcome 1:**

- Describe the basic concepts of archegoniates and unifying characters of Bryophyta, Pteridophyta and Gymnosperms.
- Know about the evolutionary history regarding transition to land habit.

**Course Outcome 2:**

- Know about the general characteristics of Bryophytes and their classification.
- Describe the range of thallus organization.
- Understand about the structure, reproduction and evolutionary trends *Riccia*, *Marchantia*, *Pellia*, *Porella*, *Anthoceros* and *Funaria*.
- Gain knowledge about their economic and ecological importance.

**Course Outcome 3:**

- Know about the general characteristics of Pteridophytes and their classification.
- Describe morphology, anatomy and reproduction of *Psilotum*, *Selaginella*, *Equisetum* & *Pteris*.
- Describe the phenomena of Apogamy and apospory, heterospory and seed habit.
- Develop understanding about basic concept of telome theory.
- Describe the different types of stele and its evolution.
- Gain knowledge about the ecological and economic importance of Pteridophytes.

**Course Outcome 4:**

- Know about the general characteristics of Gymnosperms and their classification.
- Describe morphology, anatomy and reproduction of *Cycas*, *Pinus*, *Ginkgo*, *Gnetum* & *Pteris*.
- Gain knowledge about the ecological and economic importance of Gymnosperms.

**Course Outcome 5:**

- Develop an understanding of the Geological Time Scale sequence in which different plant groups developed through time and the changes in their anatomy and complexity.
- Describe the different types of fossils and the process of fossilization.
- Describe the anatomy and affinities of fossil plants like *Rhynia*, *Calamites*, *Lepidodendron*, *Lyginopteris* and *Cycadeoidea*.

**Practical's outcome:-** Students were encouraged to conduct several practicals related to the topics.

### **SEMESTER- III**

#### **PROGRAMME SPECIFIC OUTCOMES OF CORE- 5 (Anatomy of Angiosperms)**

On completion of the course, students are able to understand:

- (i) The characteristic features of different types of tissues and their organization.
- (ii) The anatomical structure of stem, root, leaf and able to identify them.
- (iii) Understand the structure and function of vascular cambium, xylem, phloem and periderm.
- (iv) Understand the structure and importance of epidermal tissue system and secretory tissue system.

**Practical:-** With Practical knowhow of the structure of wood, students can apply them in future to choose the career in wood technology, furniture manufacturing, Dendro-chronology etc.

#### **COURSE OUTCOME OF CORE- 5(Anatomy of Angiosperms)**

##### **Course Outcome 1:**

On completion of the course students will be able know:

- a) Different types of tissues and their organizations in Plants.
- b) About Secondary growth, epidermal and Secretory tissue system.

##### **Course Outcome 2:**

On completion of this course students learn:

- a) Different theories to explain the organization of root and shoot apical meristem.
- b) Internal structure of dicot and monocot stem, leaf and roots and types of vascular bundles..

##### **Course Outcome 3:**

Completion of this course gives idea on:

- a) Structure and function of vascular cambium.
- b) Normal and abnormal secondary growth in stems and roots.
- c) Stellar and extra stellar Secondary growth, Periderm and dendrochronology..

##### **Course Outcome 4:**

On completion of this course students learn:

- a) Epidermal tissues, cuticle, trichome and stomata.
- b) Anatomical adaptation of xerophytes and hydrophytes.

##### **Course Outcome 5:**

On completion of this course students gain knowledge on:

- a) Different types of Secretory tissues.
- b) Function of hydathodes, lithocysts and laticifers.

#### **PROGRAMME SPECIFIC OUTCOMES OF CORE- 6 (Economic Botany)**

Students are able to:

- (i) Learn about the concept of origin of species, plant domestication, reasons for loss of genetic diversity and importance of genetic diversity.
- (ii) Know about origin, morphology, processing and uses of wheat, rice, legumes, millets & potato with special emphasis on the uses of byproducts of sugarcane.
- (iii ) know the morphology and economic importance of fennel, saffron, clove, black pepper, tea, coffee, *Cinchona* and different drug yielding plants.
- (iv) Learn about morphology, extraction method and uses of groundnut coconut, mustard and a brief account about essential oil.
- (v) Know the tapping, processing, uses of rubber, morphology, uses of teak, pine and morphology, extraction and uses of fibres.

**Practical's outcome:-** Students with practical knowledge on economic use of cereals, legumes, spices, condiments, edible oil and essential oil, alkaloid, fibers, timbers, medicinal drug yielding plants.

### **COURSE OUTCOME OF CORE OF CORE- 6 (Economic Botany)**

#### **Course Outcome 1:**

On completion of the course students will be able know:

- a) About the concept of origin of different crops and plant domestication.
- b) About reasons for loss and importance of genetic diversity.

#### **Course Outcome 2:**

On completion of this course students learn:

- a) About origin, morphology, processing and uses of wheat, rice, legumes, millets and potatoes.
- b) Morphology and processing of Sugarcane and uses of their byproducts.

#### **Course Outcome 3:**

Completion of this course gives idea on:

- a) Morphology and economic importance of fennel, saffron, clove, black pepper, tea and coffee.
- b) Structure and therapeutic value, use and health hazards of *Cinchona*, *Digitalis*, *Papaver*, *Cannabis*, *Tobacco* etc.

#### **Course Outcome 4:**

On completion of this course students learn:

- a) About morphology, extraction of oil and use of Groundnut, Coconut, Linseed, Mustard.
- b) About essential oils, their extraction and uses..

#### **Course Outcome 5:**

On completion of this course students gain knowledge on:

- a) Tapping processing and uses of Rubber.
- b) Timber yielding plants e.g. Teak, Pines etc.
- c) Morphology and extraction in process of Cotton and Jute.

### **SEMESTER –III**

### **PROGRAMME SPECIFIC OUTCOMES OF CORE-7 (GENETICS)**

On completion of the course, students are able to gain Knowledge on:

- (i) Mendelian genetics and its extension, role of autosomes and sex chromosomes.
- (ii) Extra-chromosomal inheritance of Chloroplast & Mitochondrial Mutations.
- (iii) The Cytoplasmic Inheritance pattern of shell coiling in snails and Kappa Particles in *Paramecium*.
- (iv) Linkage, crossing over and chromosomes mapping and variation in chromosome number and structure and their effect.
- (vi) The physical/ chemical mutagens and role of transposons in mutation and mechanism of DNA repair.

**Practical's outcome:-**

Study of meiosis through squashing technique, Chromosome mapping using test cross data. Analysis of pedigree for dominant and recessive autosomal and sex linked traits with charts.

### **COURSE OUTCOME OF CORE OF CORE- 7 (GENETICS)**

#### **Course Outcome 1:**

- Understand Mendelism and its deviation,

- Study of incomplete and co-dominance, multiple alleles, Lethal alleles, epistasis, pleiotropy, polygenic inheritance.

#### **Course Outcome 2:**

- Understand extra chromosomal inheritance Chloroplast mutation, variegation in four 'o' clock plant. Mitochondrial mutation in Yeast.
- Maternal effect in Shell coiling in Snail and Kappa particle in *Paramecium*.

#### **Course Outcome 3:**

- Understand linkage and crossing over, chromosome mapping, recombination frequencies, two and three point crosses.
- Know about interference and coincidence, solve numerical based on gene mapping.

#### **Course Outcome 4:**

- Understand the effect of variation in chromosome number and structure i.e. deletion, duplication, inversion, translocation, position effect, Euploidy and Aneuploidy.
- Gene mutation, types of mutation
- Physical and chemical mutagens, detection of mutagens- CIB method
- Role of transposons and DNA repair mechanism.

#### **Course Outcome 5:**

- Understand fine structure of gene, classical vs molecular concepts of gene.
- Structure of phage T4, rII Locus.
- Allele frequencies, genotype frequencies, Hardy-Weinberg Law, Role of natural selection, genetic drift, variation and speciation.

### **PROGRAMME SPECIFIC OUTCOMES OF CORE- 8 (Molecular Biology)**

On completion of the course, students are able to understand:

- (i) DNA as the carrier of genetic information.
- (ii) The detailed molecular structure of DNA and its replication mechanism.
- (iii) The process of transcription and translation in prokaryotes and Eukaryotes.
- (iv) Regulation of gene Expression in prokaryotes and Eukaryotes.

#### **Practical's outcome -**

Students were encouraged to conduct practicals related to the topic  
Prepare DNA model, preparation of LB medium and raise *E. coli*,  
Isolation of DNA by Orcinol method, DNA replication through photographs

### **COURSE OUTCOME OF CORE OF CORE - 8 (Molecular Biology)**

#### **Course Outcome 1:**

- Understand DNA as genetic material.
- Griffith, Avery, Hershey-Chase experiment.

#### **Course Outcome 2:**

- Understand the detailed molecular structure of DNA and RNA.
- Mechanism of DNA replication.

#### **Course Outcome 3:**

- Understand the central dogma and mechanism of transcription in prokaryotes.
- Split gene and RNA editing.

#### **Course Outcome 4:**

- Understand translation in prokaryotes.
- Post translational changes.

#### **Course Outcome 5:**

- Regulation of transcription in Prokaryotes and Eukaryotes
- Gene silencing.

**SEMESTER -IV**  
**PROGRAMME SPECIFIC OUTCOMES- CORE-9**  
**(PLANT ECOLOGY & PHYTOGEOGRAPHY)**

On completion of the course, students are able to understand following:

- (i) Introduction and types of ecology, components of ecology.
- (ii) soil and role of climate in soil development.
- (iii) factors of ecosystem and adaptation of plants.
- (iv) biotic interactions and population ecology.
- (v) plant communities and about succession process.

**Practical's outcome:-**

After getting practical knowledge, students are able to study about

- (i) Functional aspects of ecosystem and about different ecological cycles.
- (ii) To study about different terrestrial biomes, about phytogeographical division of India, knowledge about continental drift, theory of tolerance.

**COURSE OUTCOMES OF CORE- 9**  
**(PLANT ECOLOGY & PHYTOGEOGRAPHY)**

On completion of the course the students are expected to understand:-

**Course Outcome -1:**

- (i) Concept of ecology, types of ecology, components of ecology.
- (ii) Concepts of hydrosphere and lithosphere.

**Course Outcome -2:**

- (i) Definition, origin, formation, composition of soil.
- (ii) Role of climate in development.
- (iii) Importance of water, water cycle.
- (iv) Factors of ecosystem, adaptations of plants to their variation.

**Course Outcome -3:**

- (i) Study about biotic interactions, population ecology & Ecological specification,
- (ii) About plant communities.
- (iii) About succession processes.

**Course Outcome -4:**

- (i) Functional aspects of ecosystem.
- (ii) Biogeochemical cycles.

**Course Outcome -5:**

- (i) Different terrestrial biomass.
- (ii) Phytogeographical division of India.
- (iii) Continental drift, theory of tolerance.

**PROGRAMME SPECIFIC OUTCOMES- CORE-10 (PLANT SYSTEMATICS)**

After completion of this course, students will be eligible to understand following:-

- (i) Plant systematic, various aspects of herbarium, Botanical gardens, Journals & Keys.
- (ii) Taxonomic hierarchy, ICBN, typication, principles of priority.
- (iii) Evidences of systematic s & system of classification.
- (iv) Numerical taxonomy, OTUS, Cluster analysis. Phenograms, cladograms.

(v) Phylogeny of angiosperms & evolution of angiosperms.

**Practical's outcome:** After getting practical knowledge, students are able to :-

(i) To study about different families of monocots & dicots.

(ii) To know about the preparation of herbarium.

### **COURSE OUTCOMES OF CORE-10 (PLANT SYSTEMATICS)**

On completion of the course the students are expected to understand:

**Course Outcome - 1:**

(i) Plant systematic, different aspects of herbarium.

(ii) About botanical gardens, journals & keys.

**Course Outcome - 2:**

(i) About taxonomic hierarchy, ICBN, typification, & principles of priority.

**Course Outcome - 3:**

(i) About evidences of systematic.

(ii) About systems of classification.

**Course Outcome - 4:**

(i) Regarding numerical taxonomy.

(ii) Regarding cluster analysis, phenograms, cladograms.

**Course Outcome -5:**

(i) Regarding phylogeny of angiosperms, origin & evolution of angiosperms.

### **SEMESTER - V**

### **PROGRAMME SPECIFIC OUTCOMES OF CORE-11 (REPRODUCTIVE BIOLOGY OF ANGIOSPERMS)**

On completion of the programme the students will be able to:

- Know about the Historical development and scope and applications of embryology
- Understand the structure of anther, process of microsporogenesis and megasporogenesis, development of male and female gametophytes, embryo and endosperm.
- Possess definite idea on pollination and fertilization, seed and its dispersal and concept of self incompatibility.

### **COURSE OUTCOMES OF CORE 11- (REPRODUCTIVE BIOLOGY OF ANGIOSPERMS)**

On completion of the course the students are expected to

**Course Outcome 1:**

- Know about the historical background, scope and applications of embryology.

**Course Outcome 2:**

- Understand the structure of anther, the process of microsporogenesis, microgametogenesis, pollen biology, palynology and its scope.
- Know about the abnormal features in pollen.

**Course Outcome 3:**

- Have a clear concept on structure of ovule, process of megasporogenesis and megagametogenesis, development of female gametophyte.
- Develop good understanding on organization of embryo sac, structure and development of endosperm, embryology and development of embryo in monocots and dicots.

**Course Outcome 4:**

- Understand the concepts of pollination and process of fertilization.
- Have good idea on the basic concepts of self incompatibility, in-vitro fertilization.

**Course Outcome 5:**



- Know about the structure and dispersal mechanisms of seed.
- Understand the concept and applications of polyembryony and polyembryony, types of germline transformation.

### **PROGRAMME SPECIFIC OUTCOMES OF CORE-12 (PLANT PHYSIOLOGY)**

On completion of the programme the students will be able to:

- Have a clear idea on the general concepts of plant water relationships, absorption of water, ascent of sap, transpiration, mineral nutrition and deficiency symptoms, phloem translocation.
- Understand the growth regulators, their roles and physiology of flowering.

### **COURSE OUTCOMES OF CORE - 12 (PLANT PHYSIOLOGY)**

On completion of the course the students are expected to

#### **Course Outcome 1:**

- Understand the plants and plant cells in relation to water, mechanism of absorption of water and movement of sap in the plant body.
- Have clear concept on the process of transpiration and mechanism of translocation in phloem.

#### **Course Outcome 2:**

- Understand the concept of mineral nutrition in plants
- Know the essential elements, macro and micro nutrients, their roles and deficiency symptoms.

#### **Course Outcome 3:**

- Develop understanding on nutrient uptake in plants.
- Have definite idea on the mechanism of active and passive transport of ions across cell membrane.

#### **Course Outcome 4:**

- Know the different types of phytohormones and understand growth and development processes in plant.
- Understand their basic structure, bioassay and physiological roles.

#### **Course Outcome 5:**

- Have a clear idea on the physiology of flowering.
- Understand the process of photoperiodism, vernalization and seed dormancy.
- Know about phytochrome and florigen concept..

## **SEMESTER – VI**

### **PROGRAMME SPECIFIC OUTCOMES OF CORE- 13 (PLANT METABOLISM)**

After completion of this course, students will be eligible to understand following:

1. The concepts of Plant Metabolism and role of enzymes.
2. The catabolic processes of sucrose and starch in plant.
3. The role of lipid during seed germination.
4. The physiology and biochemistry of nitrogen fixation.

**Practical's outcome:** After getting practical knowledge, students are able to

1. Separate different types of pigments by using chromatography technique.
2. Know the effect of light intensity, carbon dioxide concentration on the rate of photosynthesis by Wilmott's bubbler.

### **COURSE OUTCOMES OF CORE- 13 (Core- 13: PLANT METABOLISM)**

On completion of the course students are expected to understand

**Course Outcome 1:**

1. Different metabolic pathways and their regulation.
2. Role of regulatory enzymes like allosteric, isozymes etc.
3. Synthesis and catabolism of carbohydrates.

**Course Outcome 2:**

1. Details about photosynthesis, photosynthetic pigments and their role, photochemical reactions etc.
2. Photosynthetic electron transport, photorespiration and C<sub>4</sub> pathways.
3. Factors affecting CO<sub>2</sub> reduction.

**Course Outcome 3:**

1. Carbon oxidation, TCA cycle, mitochondrial electron transport.
2. Oxidative photophosphorylation and ATP synthesis.

**Course Outcome 4:**

1. Lipid metabolism and role of mobilisation of lipids during seed germination.
2. What is oxidation.

**Course Outcome 5:**

1. Nitrogen Metabolism
2. Mechanism of signal transduction.

**PROGRAMME SPECIFIC OUTCOMES OF CORE -14 (PLANT BIOTECHNOLOGY)**

After completion of this course, students will be eligible to understand following:

1. Various techniques regarding plant tissue culture.
2. Molecular Biotechnology and its applications.
3. Role of recombinant DNA technology in genetic engineering.

**Practical's outcome:** After getting practical knowledge, students are able to

1. know the methods of gel electrophoresis.
2. get knowledge of genetic engineering.
3. prepare NS media.
4. construct a map of DNA.

**COURSE OUTCOMES OF CORE- 14**  
**(Core- 14: PLANT BIOTECHNOLOGY)**

On completion of the course students are expected to understand:

**Course Outcome 1:**

1. Different media composition, culture techniques.
2. Role of vitamins and hormones.

**Course Outcome 2:**

1. Tissue culture applications like haploid production, cryopreservation, secondary metabolite production etc.
2. protoplast isolation and culture.

**Course Outcome 3:**

1. Restriction Mapping, types of cloning vectors.
2. Biological role and application of Restriction Endonucleases.
3. Gene cloning and PCR techniques.

**Course Outcome 4:**

1. Construction of genetic and DNA libraries.
2. Different methods of gene transfer.

3. Uses of selectable marker and reporter gene.

**Course Outcome 5:**

1. Applications of Biotechnology. How it is useful for pest resistant, herbicide resistant, Industrial enzyme etc?

2. Role of transgenics in bioremediation.