

# SITANANDA COLLEGE, NANDIGRAM

## Department of Botany

The CBCS course curriculum is well designed and very promising where the course would help to enrich the subject knowledge of the students and generic electives make integration among various interdisciplinary courses. The introduction of Skill Enhancement Course (SEC) and Discipline Specific Course (DSE) would help to gain more powerful knowledge not only in their Subject but also interrelated multidisciplinary subject and also helps them to become familiar and expert in handling different Botany based Exams after completing the course. In brief the student graduated with this type of curriculum would be able to accumulate the subject knowledge along with the necessary skills to suffice their capabilities for academia entrepreneurship and industry. It will help them to understand the importance of nature, the relationship between plants and Human and most importantly the importance of many medicinal plants and their uses in our life.

### COURSE OUTCOME

#### BOTANY GENERAL DSC

#### UNDER CBCS

Semester	Course Code	Course Outcomes
	DSC1A-: ( Biodiversity (Microbes, Algae, Fungi and Archegoniate))	
SEM 1	DSC-1A-T Unit-1 Microbs	CO-1: Learn about classification, characteristics, ultra structure of Prokaryotic and Eukaryotic microbes  CO-2: Know about organisms and causal factor responsible for plant diseases & methods of studying plant diseases  CO-3: Familiarize with some common plant diseases of India  CO-4: Gain knowledge on Host parasite interaction process
	DSC-1A-T Unit-2 Algae	CO-1: Learn about the structure, pigmentation, food reserves and methods of reproduction of Algae  CO-2: Know about the Economic importance of algae
	DSC-1A-T Unit-3 Fungi	CO-1: Learn about the structure, pigmentation, food reserves and methods of reproduction of Fungi .  CO-2: Know about the Economic importance of Fungi and

		lichen, mycorriza. CO-3: Studied some plant diseases with special reference to the causative agents, symptoms, etiology and control measures.
	DSC-1A-T Unit-4 Introduction of Archegoniate	CO-: Learn about Alternation of generation
	DSC-1A-T Unit-5 Bryophytes	CO-1: Understand the morphological diversity of Bryophytes  CO-2: Understand the economic importance of the Bryophytes.  CO-3: Know the taxonomic position, occurrence, thallus structure, reproduction of Bryophytes.
	DSC-1A-T Unit-6 Pteridophytes	CO-1: Learn about the general characters and classification, stellar evolution in Pteridophytes, heterospory and origin of seed habit
	DSC-1A-T Unit-7 Gymnosperm	CO-1: Know about the structure, life history and Economic importance of Gymnosperms.
	DSC-1A -P Biodiversity (Microbes, Algae, Fungi and Archegoniate(Practical))	CO-: Microscopic observation and identification of algae, fungi, bryophytes, pteridophytes and gymnosperm
SEM 2	DSC-1B: (Plant Ecology and Taxonomy)	
	DSC-1B-T Unit- 1 Introduction	CO-: Know about Plant Ecology and Taxonomy
	DSC-1B-T Unit-2 Ecological factors	CO-1: Learn about Soil formation, composition, soil profile.  CO-2: Understand the States of water in the environment, precipitation types  CO-3: Gain knowledge on Adaptation of hydrophytes and xerophytes.
	DSC-1B-T Unit-3 Plant communities	CO-1: Understand Ecotone and edge effect,  CO-2: Know about Plant succession- Hydrosere and Xerosere
	DSC-1B-T Unit-4	CO-: Explain various Ecosystem & relationship between

	Ecosystem	organisms and environment
	DSC-1B-T Unit-5 Phytogeography	CO-1: Discuss Phytogeography, the major plant communities of the world and different vegetational belts of the earth with characteristic climatic conditions of the area.  CO-2: Know about Endemism.
	DSC-1B-T Unit-6 Introduction to plant taxonomy	CO-1: Know about Classification & Nomenclature.  CO-2: Learn the types of classifications- artificial, Natural and phylogenetic.
	DSC-1B-T Unit-7 Identification	CO-1: Gain knowledge about important herbaria and botanical gardens of the world and India, Botanical Survey of India (BSI).  CO-2: Briefly studied on herbarium techniques
	DSC-1B-T Unit-8 Taxonomic evidences from palynology, cytology, phytochemistry and molecular data	CO-: evidences Learn the taxonomic from molecular, numerical and chemicals
	DSC-1B-T Unit-9 Taxonomic hierarchy	CO-: Learn about ranks, categories and taxonomic groups
	DSC-1B-T Unit-10 Botanical nomenclature	CO-: Brief studied the economic products with special reference to the Botanical name, family, morphology of useful part and the uses
	DSC-1B-T Unit-11 Classification	CO-: Understand types of classification-artificial, natural and phylogenetic. Bentham and Hooker , Engler and Prantl
	DSC-1B-T Unit-12 Biometrics, numerical taxonomy and cladistics	CO-: Gain knowledge about OTUs, character weighting and coding; cluster analysis; phenograms, cladograms.
	DSC-1B-P Plant Ecology and Taxonomy(Practical)	CO-1: Accurate interpretation of collected information and use taxonomic information to evaluate and formulate a position of a plant in taxonomy.  CO-2: Students will be able to apply the scientific method to questions in botany by formulating testable hypotheses

SEM -3	DSC-1C : (Plant Anatomy and Embryology)	
	DSC-1C-T Unit- 1 Meristematic and permanent tissues	CO-1: Understand the basic knowledge about Meristematic and Permanent tissues. CO-2: Learn about Simple and complex tissues
	DSC-1C-T Unit-2: Organs	CO-: Brief studied about Structure of dicot and monocot root stem and leaf.
	DSC-1C-T Unit-3: Secondary Growth	CO-1: Know about Vascular cambium – structure and function, seasonal activity. CO-2: Understand Secondary growth in root and stem, Wood (heartwood and sapwood)
	DSC-1C-T Unit-4: Adaptive and protective systems	CO-1: Learn about Epidermis, cuticle, stomata. CO-2: General account of adaptations in xerophytes and hydrophytes
	DSC-1C-T Unit-5: Structural organization of flower	CO-1: Understand the Structure of anther and pollen. CO-2: Learn about Structure and types of ovules. CO-3: Know the types of embryo sacs, organization and ultrastructure of mature embryo sac.
	DSC-1C-T Unit-6: Pollination and fertilization	CO-1: Brief knowledge about pollination mechanisms and adaptations CO-2: Learn about double fertilization and their significance CO-3: Understand Seed-structure appendages and dispersal mechanisms.
	DSC-1C-T Unit-7: Embryo and endosperm	CO-: Know about the Structure and development of dicot and monocot embryos
	DSC-1C-T Unit-8: Apomixis and polyembryony	CO-: Learn about Apomixis and polyembryony.

	DSC-1C-P Plant Anatomy and Embryology(Practical)	CO-1: Study of meristems through permanent slides and photographs. CO-2: Able to undersand Tissues (parenchyma, collenchyma and sclerenchyma); Macerated xylary elements, Phloem (Permanent slides, photographs) CO-3: Dissect out the Stem & root : Monocot: Zea mays; Dicot: Helianthus; Secondary: Helianthus (only Permanent slides) CO-4: Adaptive anatomy: Xerophyte (Nerium leaf); Hydrophyte (Hydrilla stem) CO-5: Dissection of embryo/endosperm from developing seeds
	Skill Enhancement Course(SEC) SEC1T: Bio-fertilizers	
	SEC1T Unit -1	CO-: Know about the microbes used as biofertilizer.
	SEC1T Unit – 2	CO-: Learn the characteristics, identification, cultural methods and maintenance of Azospirillum, Azotobacter.
	SEC1T Unit – 3	CO-: Gain knowledge about Azolla and Anabaena, blue green algae and Azolla in rice cultivation
	SEC1T Unit- 4	CO-: Know about Mycorrhiza – VAM association, types, occurrence, collection, isolation and inoculum production.
	SEC1T Unit -5	CO-: Studied the method of large scale production of biofertilizer& Organic farming
SEM 4	DSC1DT : Plant Physiology and Metabolism	
	DSC1DT Unit-1 Plant-water relations	CO-1: Understand Importance of water, water potential and its components CO-2: Learn about Transpiration and its significance; Root pressure and guttation.
	DSC1DT Unit- 2 Mineral nutrition	CO-: Know about the requirement of mineral nutrition for plant growth
	DSC1DT Unit-3 Translocation in phloem	CO-: Learn about Phloem loading and unloading.
	DSC1DT Unit-4 Photosynthesis	CO-: Understand the process of Photosynthesis
	DSC1DT Unit-5 Respiration	CO-: Learn the process of Respiration and it's importance

	DSC1DT Unit-6 Enzymes	CO-: Learn the properties, Enzyme catalysis and activation energy ,Mechanism of enzyme
	DSC1DT Unit-7 Nitrogen metabolism	CO-: Gain knowledge about Nitrogen metabolism
	DSC1DT Unit-8 Plant growth regulators	CO-: Know about the Plant Growth hormones (Auxins, Gibberellins, Cytokinins, Ethylene)
	DSC1DT Unit-9 Plant response to light and temperature	CO-: Brief study about Photoperiodism ; Phytochrome , red and far red light responses on photomorphogenesis; Vernalization
	DSC1DP- Plant Physiology and Metabolism (Practical)	CO-1: Determination of osmotic potential of plant cell sap by plasmolytic method. CO-2: To study the effect of two environmental factors (light and wind) on transpiration by excised twig. CO-3: Calculation of stomatal index and stomatal frequency of a mesophyte and a xerophyte. CO-4: Demonstration of Hill reaction. CO-5: Demonstrate the activity of catalase and study the effect of pH and enzyme concentration. CO- 6: To study the effect of light intensity and bicarbonate concentration on O <sub>2</sub> evolution in photosynthesis. CO-7: Comparison of the rate of respiration in any two parts of a plant.
	SEC-2: Mushroom Culture Technology	
	SEC2T Unit -1	CO-: Know about history of Mushroom, Nutritional and medicinal value of edible mushrooms; Poisonous mushrooms.
	SEC2T Unit -2	CO-: Learn about Mushroom bed preparation.
	SEC2T Unit -3	CO-: Understand about Storage and nutrition of mushroom
	SEC2T Unit -4	CO-: Gain knowledge about Types of foods prepared from mushroom; Marketing in India and abroad, Export Value.
SEM -5	DSE-1: Cell and Molecular Biology	

DSE-1T Unit- 1 Techniques in Biology	CO-: Understand about Principles of microscope
DSE-1T Unit- 2 Cell as a unit of Life	CO-: Learn about The Cell Theory; CO-: Difference between Prokaryotic and eukaryotic cells;
DSE-1T Unit-3 Cell Organelles	CO-: Brief knowledge about cell organelles i.e. Mitochondria, Chloroplast, ER, Golgi body & Lysosomes, Nucleus.
DSE-1T Unit-4 Cell Membrane and Cell Wall	CO-: Learn about The functions of membranes; Models of membrane & cell wall structure
DSE-1T Unit-5 Cell Cycle	CO-: Brief knowledge about Cell cycle, Mitosis and Meiosis; Molecular controls.
DSE-1T Unit-6 Genetic material	CO-: Experiment of genetic material, DNA structure, types of DNA, types of genetic material. Replication of DNA.
DSE-1T Unit-7 Transcription (Prokaryotes and Eukaryotes)	CO-: Know about Types of RNA, Translation (Prokaryotes and eukaryotes), genetic code.
DSE-1T Unit-8 Regulation of gene expression	CO-: Gain concept on Lac operon and Tryptophan operon.
DSE1P Cell and Molecular Biology ( Practical)	CO-1: To study prokaryotic cells (bacteria), viruses, eukaryotic cells with the help of light and electron micrographs. CO-2: Study of the photomicrographs of cell organelles CO-3. To study the structure of plant cell through temporary mount. CO-3: Cheek epithelial cells using vital stain Janus green. CO-4: Study of mitosis and meiosis (temporary mounts and permanent slides).
OR	
DSE-1 : Economic Botany and Biotechnology	
DSE1T Unit-1 Origin of Cultivated	CO-: Gain Concept of centres of origin, their importance.

Plants	
DSE1T Unit-2 Cereals	CO-: Learn about Origin, morphology & uses of Wheat.
DSE1T Unit-3 Legumes	CO-: Brief studied the importance of Gram and soybean.
DSE1T Unit-4 Spices	CO-: Know about Botanical name, family, part used, morphology and uses of clove and black pepper.
DSE1T Unit-5 Beverages	CO-: Gain knowledge about morphology, processing, uses of Tea.
DSE1T Unit-6 Oils and Fats	CO-: learn about general description and importance of groundnut.
DSE1T Unit-7 Fibre Yielding Plants	CO-: Gain Concept about part used, morphology and uses of Cotton.
DSE1T Unit-8 Introduction to biotechnology	CO-1: Understand about biotechnology CO-2: Applications of Biotechnology in Plant, Animal and Human welfare
DSE1T Unit-9 Plant tissue culture	CO-1: Understand the basic knowledge about tissue culture tools, medium, sterilization and techniques of tissue culture. CO-2: Learn about the production of Synthetic seeds & significance. CO-3: Study about the role of tissue culture in crop improvement.
DSE1T Unit-10 Recombinant DNA Techniques	CO-1: Learn about Blotting techniques. CO-2: Understand DNA Fingerprinting; Molecular DNA markers; DNA sequencing, PCR and Reverse Transcriptase-PCR. CO-3: Gain knowledge about Hybridoma and monoclonal antibodies, ELISA and Immunodetection. Molecular diagnosis of human disease, Human gene Therapy.
DSE1P- Economic Botany and Biotechnology(Practical)	CO-1: Students will be able to sections and microchemical tests through specimens. CO-2: Familiarization with basic equipment's in tissue



	<p>culture.</p> <p>CO-3: Study through photographs: Anther culture, somatic embryogenesis, endosperm and embryo culture; micropropagation.</p>
SEC3T Floriculture	
SEC3T Unit-1: Introduction	CO-: Know about History of gardening; Importance and scope.
SEC3T Unit-2: Nursery Management and Routine Garden Operations	CO-: Brief knowledge about Soil sterilization; Seed sowing; Pricking; Planting and transplanting; Shading; Stopping or pinching; Mulching; Topiary; Role of plant growth regulators.
SEC3T Unit-3: Ornamental Plants	CO-: Awareness of basics of Ornamental Plants.
SEC3T Unit-4: Principles of Garden Designs	CO-: Learn about the Principles of Garden Designs (English, Italian, French, Persian, Mughal and Japanese gardens).
SEC3T Unit-5:	CO-: Understand about Landscaping Places of Public Importance.
SEC3T Unit-6: Commercial Floriculture	CO-: Complete knowledge about scope and importance of commercial floriculture in India.
SEC3T Unit-7 Diseases and Pests of Ornamental Plants.	CO-: Aware with the mechanism of pest and disease of ornamental plants.
OR	
Ethnobotany	
SEC3T Unit-1 Ethnobotany	CO-: Know about history of ethnobotany and Plants used by the tribals.
SEC3T Unit-2 Methodology of Ethnobotanical studies	CO-: Learn the plant name both scientific and local, temples and sacred places.
SEC3T Unit-3 Role of ethnobotany in modern Medicine	CO-: Gain knowledge about herbal drugs in Indian system of medicine.
SEC3T Unit-4 Ethnobotany and legal aspects	CO-: Awareness of Ethnobotany as a tool to protect interests of ethnic groups, biopiracy.

SEM-6	DSE-2: Genetics and Plant Breeding	
	DSE2T Unit- 1 Heredity	CO-1: Brief knowledge about life history of Mendel. CO-2: Learn about Laws of Inheritance. CO-3: Gain Concept of Modified Mandelian Ratios: 2:1-lethal Genes; 1:2:1- Co - dominance, incomplete dominance; - 9:7; 9:4:3; 13:3; 12:3:1.; ChiSquare; Pedigree Analysis. CO-4: Know about Multiple allelism; Pleiotropism; Chromosome theory of Inheritance.
	DSE2T Unit-2 Sex-determination and Sex-linked Inheritance	CO-: Understand about Sex-determination and Sex-linked Inheritance.
	DSE2T Unit-3 Linkage and Crossing over	CO-: Learn about Linkage, complete & incomplete linkage; concept and significance of Crossing over.
	DSE2T Unit- 4 Mutations and Chromosomal Aberrations	CO-1: Concept about Mutation, Types of mutations. CO-2: Numerical chromosomal changes: Euploidy, Polyploidy and Aneuploidy; Structural chromosomal changes: Deletions, Duplications, Inversions & Translocations.
	DSE2T Unit-5 Plant Breeding	CO-: Gain knowledge on Plant breeding techniques
	DSE2T Unit-6 Methods of crop improvement	CO-: Aware about Hybridization: For self, cross and vegetatively propagated plants – Procedure, advantages and limitations.
	DSE2T Unit-7 Quantitative inheritance	CO-: Concept about Monogenic vs polygenic Inheritance.
	DSE2T Unit-8 Inbreeding depression and heterosis	CO-: Learn about History, genetic basis of inbreeding depression and heterosis; Applications.
	DSE2T Unit-9 Crop improvement and breeding	CO-: Gain knowledge Role of mutations; Polyploidy; Distant hybridization and role of biotechnology in crop improvement.
DSE2P Genetics and Plant	CO-1: Mendel's laws through seed ratios. Laboratory exercises in probability and chisquare.	

	Breeding(Practical)	CO-2: Chromosome mapping using point test cross data. CO-3: Incomplete dominance and gene interaction through seed ratios (9:7, 9:6:1, 13:3, 15:1, 12:3:1, 9:3:4). CO-4: Study of aneuploidy: Down's, Klinefelter's and Turner's syndromes through photographs. CO-5: Hybridization techniques - Emasculation, Bagging (For demonstration only). CO-6: Induction of polyploidy conditions in plants (For demonstration only).
	SEC-4: Medicinal Botany	
	SEC4T Unit-1	CO-: Know about History, Scope and Importance of Medicinal Plants
	SEC4T Unit-2	CO-: Gain knowledge about Conservation of endangered and endemic medicinal plants.
	SEC4T Unit-3	CO-: Study about Ethnobotany and Folk medicines; Ethnobotany in India.

## **PROGRAM OUTCOMES**

### Knowledge and understanding of:

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

### Intellectual skills able to:

1. Think logically and organize tasks into a structured form.
2. Assimilate knowledge and ideas based on wide reading and through the internet.
3. Transfer of appropriate knowledge and methods from one topic to another within the subject.

4. Understand the evolving state of knowledge in a rapidly developing field.
5. Construct and test hypotheses.
6. Plan, conduct and write a report on an independent term project.

### Practical skills:

Students learn to carry out practical work, in the field and in the laboratory, with minimal risk. They gain introductory experience in applying each of the following skills and gain greater proficiency in a selection of them depending on their choice of optional modules.

1. Interpreting plant morphology and anatomy.
2. Plant identification.
3. Vegetation analysis techniques.
4. A range of physicochemical analyses of plant materials in the context of plant physiology and biochemistry.
5. Analyze data using appropriate statistical methods and computer packages.
6. Plant pathology to be added for sharing of field and lab data obtained.

### Scientific Knowledge:

Apply the knowledge of basic science, life sciences and fundamental process of plants to study and analyse any plant form

### Design/development of solutions:

Design solutions from medicinal plants for health problems, disorders and disease of human beings and estimate the phytochemical content of plants which meet the specified needs to appropriate consideration for the public health.

### Modern tool usage:

Create, select, and apply appropriate techniques, resources, and modern instruments and equipment for Biochemical estimation, Molecular Biology, Biotechnology, Plant Tissue culture experiments, cellular and physiological activities of plants with an understanding of the application and limitations.

### The Botanist and society:

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

Environment and sustainability:

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

Ethics:

Apply ethical principles and commit to environmental ethics and responsibilities and norms of the biodiversity conservation.