Program Outcomes

After successful completion of three-year degree program in **Botany** a student should be able to

- It enhances skills in handling scientific instruments, planning and executing biological research.
- It provides Entrepreneurship skill development.
- It targets at providing an environment that encourages, promotes and stimulates the intellectual, professional and personal development of the student.
- Understood the basic concepts, fundamental principles, and the scientific theories related to various scientific phenomena and their relevancies in the day-to-day life.
- Acquired the skills in handling scientific instruments, planning and performing in laboratory experiments.
- Developed scientific outlook not only with respect to science subjects but also in all aspects related to life.
- Developed various communication skills such as reading, listening, speaking, etc., which we will help in expressing ideas and views clearly and effectively.
- Due to continuous field visits in the interior regions students interact with the social activities for their study.
- Being the botanist students they have to communicate with many people, they become more familiar as well as interactive.
- To make the students to develop awareness regarding applications of different plants in various industries.
- Environment and Sustainability: conservation practices are studied for sustainable development.
- To facilitate students for taking up and shaping a successful career in Botany.

Program Specific outcomes:

On completion of course, students will have basic knowledge of the

- Possess basic knowledge about Algae, Viruses, Fungi, Lichen, Bryophytes, Pteridophytes, Gymnosperms and Angiosperms.
- Understand the biodiversity, systematic, morphology, structure and life cycle of plant kingdom.
- Gain knowledge about the structure of Plants by studying its Anatomy and identification of various disease by studying Plant Pathology.
- Plant Embryology helps them understand the basics of cell division and development of embryos and endosperms.
- Possess adequate knowledge about Physiology and different types of interaction of Biomolecules in Plant Biochemistry.
- Understanding about the structure, functioning and biochemical nature of cell and Molecular Biology.

- Techniques involved in Plant Genetics and Breeding to produce high valued crops.
- Helps to understand and sustain the diversity of the planet by gaining importance of Plant Ecology in human welfare.
- Phytogeography helps them to learn the types of vegetation around the different parts of the country.
- The effective usage of plants as a source of food, medicine and folklore of tribal people in their day to day life.
- Use of statistics to understand the biological data in a scientific manner.
- Production of large number of quality planting material in short span of time using Plant Tissue culture.
- Understanding the evolution by studying Paleo botany specimen.
- Role of microbiology in various industries and its application in food and drug industry.
- Producing desirable plants that are disease and stress tolerant using techniques of Plant Breeding.
- Role of Molecular biology and Plant Biotechnology in today's scenario.
- Environmental Biology and climate change to help sustain the earth for further generations.
- Horticulture, Gardening and Forestry for promoting self-employment techniques.

Course outcomes: (SEM: I)
Course BOT- 101 (Study of lower plants, Cytology, Genetics and Molecular biology, Environmental Biology and Climate change, Plant Biotechnology)

On completion of the course, students are able to:

- Study of lower plants like algae, fungi, bryophyte and pteridophytes will helps them identify their taxonomic position by knowing their structure, modes of reproduction.
- They gain understanding about the basic of plant cell, its ultrastructure and function of cell organelles.
- Fully acquire knowledge about DNA as the basics of genetics and molecular biology.
- They will have a concept of ecology and environment, which will help them study scope, structure and functioning of ecosystems, different biogeochemical cycles and basics of climate change and sustainable biodiversity.
- Know the latest technological developments in the field of Biotechnology and plant tissue culture.

Course BOT-102 (Practical's)
On completion of the course, students are able to:

- The students learn to observe the external and internal features of lower plants under the microscope using various staining methods.
- The primitive reproductive features of early world plants are observed.

- The structure of DNA, RNA and protein synthesis by using models and charts provides them a better understanding.
- They observe various interactions and relationships among the biotic factors of an ecosystem by watching live plants in the laboratory.
- It helps them get acquainted with the tools and instruments used in Plant tissue culture and other biotechnological applications.

Course outcomes: (SEM: II)

Course BOT 103 (Study of higher plants, Plant Morphology and Taxonomy, Plant Physiology/ Plant resource utilization, Horticulture and Gardening)

On completion of the course, students are able to:

- Students will gain detailed knowledge about higher plants like Gymnosperms and Angiosperms and diversity found within them.
- They learn Classifications system, occurrence, distribution, taxonomic position, morphology, reproduction and life history of these higher plants.
- Student 's learns about different plant parts and their morphological structure and their modifications that plants possess which were obtained during the course of evolution.
- Since plants are living entity, study about their physiology helps students understand the role of water in plants life, various processes like photosynthesis, respiration, flowering, transpiration etc.
- They learn about various plant resources that are being used for various purposes like food, medicine etc.
- They are made to understand the scope of horticulture and gardening, along with various operations, equipment's and techniques used.

Course BOT-104 (Practical's)

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

- The students observe morphological and anatomical features of higher plants under the microscope using various staining methods.
- To observe diversity of nature by learning morphology of leaf, stem, flowers etc
- The close character plants are classified into families and students learn their morphological characters to identify the plants.
- Different experiments are performed to have a better understanding of various physiological processes of plants.
- Students learn to understand the economically important plants, learn best fit plants for various utility, plants techniques used in horticulture industry, tools used in gardening etc.

Course outcomes: (SEM: III)

Course BOT 201 (Algae, Fungi, Lichens and Plant Pathology, Bryophytes and Economic Botany)

On completion of the course, students are able to

- The students learn to observe the external and internal features of lower plants, their classification system and reproductive features of early world plants.
- To have a close understanding of fungus, their benefits and harmfulness, association with other living organisms and different types of disease observed in plants.
- They learn classification system of bryophytes, their habit, habitat, life cycle and economic importance.
- Students learn diversity of plant usage for purpose of fiber, timber, firewood, oil etc.
- They are made to study medicinal importance, which includes the habit, cultivation, useful parts, chief chemical constituents and medicinal uses.

Course BOT- 202 (Plant Anatomy, Plant Ecology, Plant Embryology, Plant Cell Biology)

On completion of the course, students are able to

- In this course they learn about the various tissue systems that exist in plants such as meristematic, simple and complex tissues.
- Anatomical difference between the monocot and dicot plants in relation to internal structure of root and stem parts are studied.
- They study the types, properties and role of soil in ecology and its conservation aspect.
- The application of ecosystem management using remote sensing are studied.
- Ecological adaptation of plants based upon their habit are learnt.
- The basis of plant reproduction as to how the male and female reproductive organs develops and lead to fruit and seed formation in majority of plants are studied along with special modes of pollination in certain plants are studied.
- The ultrastructure details of cell and its organelles and their function are studied in detail.

Course BOT-203 (Practical's)

On completion of the course, students are able to:

- Students learn to observe and identify microscopic characters of various lower plants and their reproductive parts.
- Students are made to learn morphology and identification features of some economically important plants used for various commercial and medicinal purposes.
- To study mounting of shoot and root apex of plants under the microscope.
- Anatomical structure of plant parts is studied to identify the types of tissues and their specific role position and development in plants.

- Anatomical ecological adaptation in hydrophyte and xerophytes are studied.
- Reproduction in plants are studied by observing growth and development of plant reproductive structures.
- The ultrastructure of cell and cell organelles are studied using electron micrographs and coloured charts.
- The students are given minor project works during the semester based upon the theory to acquaint students about basic research methodology.

Course outcomes: (SEM: IV)

Course BOT 204 (Pteridophytes, Gymnosperms, Plant Morphology and Taxonomy, Plant Physiology)

On completion of the course, students are able to

- Study life history, morphology and anatomy of pteridophytes and have a basic understanding of how fossils of plants are formed.
- General characters of large woody gymnosperms are studied to understand their life cycle, morphology, anatomy and economic significance.
- The structure, types and development of fruits are studied that helps to classify the fruits into various categories.
- Various classification systems adopted time to time for studying plant systematics.
- Classification of plants and economic importance of some important families of plants.
- Various physiological processes of plants and theories associated with each functionality.
- They achieve knowledge about growth and development of plants and role of various micro and macro nutrients on plant growth.

Course BOT-205 (Plant Anatomy, Biophysics and Biochemistry, Genetics, Applied Botany)

On completion of the course, students are able to

- Understand the complex tissue system in plants that carries major function of transport within plants, in addition various abnormal growth observed in stem and root of some plants during the lifecycle of plants.
- Learn general account of pH and buffer solution in plant life.
- Role of biomolecule - enzymes, its nature, properties, mechanism of action and factor affecting its activity are understood.
- General account of secondary metabolites produced by plants, its biochemistry, pathway and usage for human welfare.
- The basics of mendelian genetics to acquaint students understand genetic interactions.
- Non mendelian genetics are various theories to determine sex in plants.

- The applied botany helps students understand cultivation and preservation of certain fruits.

Course BOT-206 (Practical's)
On completion of the course, students are able to perform

- The students observe morphology of the plants and mounting them on slides for better understanding the lower plants
- The morphology of different fruits by charts and preserved specimen have been studied.
- The family characters of plants are studied to help them classify them.
- Demonstration of physiological experiments helps them to learn how the water is transported from the soil to the tip of the plant.
- The complex tissue comprising of xylem and phloem elements are studied from various specimens.
- Normal and abnormal secondary growth are studied by taking sections and preparing permanent slides for the same.
- Various biochemical experiments help them understand the role of different parameters on the activity of the compound.
- The technique of creating and types of Bonsai have been demonstrated.

Course outcomes: (SEM: V)
Course BOT 301 (Algae, Fungi, Plant Pathology, Bryophytes)
On completion of the course, students are able to

- Understand the morphological structure and reproductive structure of different algae and their role in human welfare.
- Identify the fungi based upon its structure, reproductive parts and distribution. The basic technique of mushroom cultivation is also taught.
- Different tools and procedure are taught to recognize symptoms and pathogens in diseased plants.
- Helps students identify, classify and understand the morphology, reproduction and life cycle of bryophytes.

Course BOT 302 (Systematic Botany, Angiosperms, Plant Embryology, Plant Anatomy)
On completion of the course, students are able to

- Understand the basics of plant systematic regarding classification characters and methods of plant classification.
- They learn collection and preparation of Herbarium for studying and documenting plants.
- The role of herbaria and botanical gardens in study of botany.
- They understand the outline classification for plant families based upon various classification system adopted time to time for identifying plants.

- It helps them to give a baseline knowledge about the palynology and its application in various fields.
- Different mode of embryo development is studies that helps them learn the complexity of nature.
- They also learn certain abnormalities in embryo formation that occur in certain group of plants.
- They gain knowledge about various tissue system, their role, position and development in different plants during its lifecycle.
- Special anatomical structure developed to overcome natural challenges, growth and aging are also studied.

Course BOT 303 (Plant Physiology, Biochemistry, Cell Biology, Genetics)
On completion of the course, students are able to

- The special methods adopted by plants to overcome environmental factors are studied.
- The biochemistry of biomolecules, their types, structure, functioning, uses and their synthesis and breakdown are learnt.
- Ultra structure of Chromosomes in special macro-chromosomes provides better idea for understanding their structure and functioning.
- Different structures that helps cells to communicate with each other are gained.
- Methods to study cell organelles by cell fractionation study.
- Deviation from Mendelian genetics and its importance and examples are studied.
- Technique of chromosome mapping will help them map the genes.
- Different types of mutations and their effects that occur helps them to gain knowledge about gene functioning.

COURSE BOT-304 (Plant Ecology, Phytogeography, Economic Botany, Biostatistics)
On completion of the course, students are able to

- They learn the concept of succession, mechanism and their types with examples.
- Methods of studying different characters of plant community in a scientific approach.
- It helps students to know about the phytogeography of Gujarat and India in whole, as well as role of remote sensing and GIS for plant analysis.
- The botanical name, cultivation practices, climate and uses of high economic, medicinal, aromatic, spices etc. are studied.
- Statistical methods to analyze biological data are thought to help students evaluate and conclude the results.

COURSE BOT-305 (Plant Tissue Culture)
On completion of the course, students are able to

- Understand the basic of plant tissue culture, its past and present. They can setup a small tissue culture laboratory and operate the instruments used in tissue culture.
- They will be able to carry out different sterilization techniques, prepare media and could also inoculate and maintain the tissue culture laboratory.
- They will be acquainted with different techniques like seed culture, embryo culture, callus culture, organ culture, protoplast culture etc.

COURSE BOT-306 (Practical's)

On completion of the course, students are able to

- Prepare temporary and permanent mounting of plant samples using different staining methods.
- They will be able to mount the reproductive organs of the plant specimen and identify the different parts.
- They will be able to identify different plant diseases based upon the symptoms seen under the microscope and plant.
- They could identify and classify the plants up to their family by the help of different flower and plant characters.
- They could mount the embryo of seeds under the microscope and identify the stage of development.
- Using plant sections, they could identify the different tissues of the plants including mechanical, secretory and absorbing tissue system of plants.
- They could themselves carry out practical's to determine the water potential of a tissue, could perform paper chromatography, qualitative test for proteins, fats and could also detect seed viability.
- They get an overview about the anabolic and catabolic pathways for amino acids, proteins, lipids and carbohydrates.
- They can solve genetic problem about multiple alleles and can identify different mutations.
- They could carry out quadrate survey of a given area and determine the frequency, density and abundance of the plant species over there.
- The can predict the type of vegetation by comparing it with the normal biological spectrum.
- They have understanding about the vegetation of Gujarat and biogeographical regions of India.
- They can identify the economically important plants and will be able to cultivate them.
- They can perform statistical analysis of a given data and could conclude based upon the statistical analysis performed.

Course outcomes: (SEM: VI)

Course BOT 307 (Pteridophytes, Pteridophytes Fossils, Gymnosperms, Gymnosperms Fossils)

On completion of the course, students are able to

- Understand the morphological diversity of Pteridophytes and Gymnosperms.
- Understand the economic importance of the Pteridophytes and Gymnosperms.
- Know the evolution of Pteridophytes and Gymnosperms through fossils studies.
- Know the vegetative and reproductive characteristics of the plant.

Course BOT 308 (Angiosperms, Plant Anatomy, Advanced Biochemistry, Microbiology)

On completion of the course, students are able to

- Know the concept of methodology in taxonomy.
- Understand the chemical nature of biomolecules and their different types of interactions.
- Different types of biochemical metabolism of biomolecules are studied.
- They will be able to understand the anomalous secondary growth in different plant parts.
- The will be well versed with methods of preparing permanent slides and processes included in it.
- Basic knowledge about different viruses and their classification.
- Industrial application of bacteria in today's world.

Course BOT 309 (Advanced Plant Physiology, Plant Breeding, Molecular Biology, Biotechnology)

On completion of the course, students are able to

- The will learn different types of plant movements and physiology behind the processes involved.
- Role of different plant growth regulators and other physiological functions.
- Understand the science of plant breeding.
- To study the techniques of production of new superior crop verities.
- Get the detail knowledge about modern strategies applied in Plant Breeding for crop improvement i.e. Mass selection, Pure line Selection and Clonal selection.
- They will be familiar with techniques of gene mapping, DNA sequencing and Fingerprinting.
- Understand the fundamentals of Recombinant DNA Technology and approach of Genetic Engineering.
- Applications of biotechnology in health and agriculture, artificial seed, edible vaccines and cryopreservation and germplasm storage.

Course BOT 310 (Environmental Biology, Gardening, Ethnobotany, Forestry)

On completion of the course, students are able to

- They will learn about environmental impact assessment, man and biosphere program etc.
- Role and effect of greenhouse gases.
- Effect of climate change and its consequences.
- Basic principles of garden design, garden features, garden operations etc.
- Knowledge about history and development of ethnobotany, sacred groves.
- Methods of ethnobotanical research and plants used by tribes of Gujarat.
- Types of forest in India and benefits of forest and forest products.
- Provide them knowledge about wildlife and biosphere reserves.

Course BOT 311 (Horticulture and Gardening)

On completion of the course, students are able to

- Make them understand the fundamentals of horticulture, its scope, importance and branches.
- Effective use of garden tools and equipment's.
- They will learn about the physical and chemical composition of soil.
- Different methods of beds preparation, types and application of fertilizer in different plants.
- Various vegetative propagation methods, techniques of potting, transplanting, weeding, pruning etc.
- Besides this other special horticulture practices like greenhouse cultivation, floriculture, hydroponics and aeroponics etc.

COURSE BOT-312 (Practical's)

On completion of the course, students are able to

- They will be able to identify and classify different lower plants from fresh or preserved material.
- They could mount the reproductive structure of pteridophytes and gymnosperms.
- Know types of fossils, its role in global economy and geological time scale.
- Understand the various fossil genera representing different fossil groups.
- They will be familiar with identification of different family group of plants based upon the classification system provided by Bentham and Hooker.
- Knowledge of different types of stele through charts and permanent slides.
- They will be ab able to study abnormality in the secondary growth of different plant parts.
- Techniques of plant fixation, dehydration, infiltration, embedding and microtomy of plant materials for permanent slide preparation.
- They learn the technique of gram staining for bacterial identification.
- Technique to prepare herbarium sheets of plants of different families.
- Methods to study the rate of photosynthesis under various physiological conditions.

- Techniques of plant breeding which include emasculation, bagging and tagging.
- Producing plant by breeding through pedigree, bulk and back cross methods.
- In molecular biology they learn how to map a gene, carryout DNA sequencing and DNA fingerprinting.
- They will know about the genomic organization of mitochondria and chloroplast.
- Technique used in human insulin and vaccine production.
- Methods of gene transfer like microinjection, electroporation, particle gun and agrobacterium mediated gene transfer.