- **Department of Botany**
- **Course Outcomes:**
- **F Y B Sc.**

- **Semester -1**

BOT.111: BACTERIA, VIRUSES AND ALGAE	• Understand the diversity among Bacteria, Viruses and Algae. • Know the systematic, morphology and structure, of Bacteria, Viruses and Algae. • Understand the life cycle pattern of Bacteria, Viruses and Algae. • Understand the useful and harmful activities of Bacteria, Viruses and Algae.
BOT. 112: PLANTS FOR HUMAN WELFARE	• Understand the Biodiversity of Fungi. • Know the Economic Importance of Fungi. • Understand the features of Lichens. • Know the terminologies in plant pathology. • Understand the scope and importance of Plant Pathology. • Know the control measures of plant diseases.
BOT:103 PRACTICAL COURSE	Students should understand: • Gram staining of Bacteria • Study of Bacterial Disease w.r.t. Causal organism, Symptoms and control measures. • Study of viral diseases w. r .t. Causal organism and Symptoms. • Study of Algal diversity w.r.t Systematic position and morphology. • Study of Life cycle f Spirogyra and Sargassum. • Know botanical source/s, characteristics and utilities of Plants/ plant products.

- **Semester -2**

BOT.121: FUNGI, LICHENS AND PLANT PATHOLOGY	• Understand the Biodiversity of Fungi. • Know the Economic Importance of Fungi. • Understand the features of Lichens. • Know the terminologies in plant pathology. • Understand the scope and importance of Plant Pathology. • Know the control measures of plant diseases.
BOT.122: INDUSTRIAL BOTANY	• Gain thorough knowledge about various plant groups from primitive to highly evolved plants. • Become aware of applications of different plants in various industries. • To highlight the potential of these studies to become an entrepreneur. • To equip the students with skills related to laboratory as well as industries based studies. • To make the students aware about conservation and sustainable use of plants. • To address the socio-economic challenges related to plant sciences.

BOT:103: PRACTICAL COURSE	Students should understand • Study of fungal diversity w.r.t Systematic position and morphology. • Study of life cycle of *Rhizopus* and *Agaricus*. • Study of Lichens and its types. • Study of plant diseases w.r.t. causal organisms, symptoms and control measure. • Cultivation ofMass culture of B.G.A. and Pleurotus. • Identify the botanical source, plant part used and uses of rubber. • Preparation of bio pesticide Azadirectin, Squash and Ketchup.

- **S Y B Sc.**

- **Semester -1**

BOT 231: BRYOPHYTES AND PTERIDOPHYTES	• Understand the morphological diversity of Bryophytes and Pteridophytes. • Understand the economic importance of the Bryophytes and Pteridophytes. • Know the evolution of Bryophytes and Pteridophytes.
BOT.232: MORPHOLOGY OF ANGIOSPERMS	• Understand the habit of the angiosperm plant body. • Know the vegetative characteristics of the plant. • Learn about the reproductive characteristics of the plant. • Understand the plant morphology.
BOT. 233: PRACTICAL COURSE	Students should understand, • Study of diversity of Bryophytes and Pteridophytes w.r.t systematic position and morphology. • Study of life cycle of *Riccia, Funaria, Selaginella and Adiantum.* • Morphology of root and stem with its modification. • Morphology of Leaf and its modification. • Study of Flower morphology , Inflorescence and its types of Inflorescence. • Study fruit Morphology and types.

- **Semester -2**

BOT. 241: PLANT PHYSIOLOGY	• Know importance and scope of plant physiology. • To understand the plants and plant cells in relation to water. • Understand the process of photosynthesis in higher plants with particular emphasis on light and dark reactions, C3 and C4 pathways. • Understand the respiration in higher plants with particular emphasis on aerobic and anaerobic respiration. • Learn about the movement of sap and absorption of water in plant body. • Understand the plant movements.
BOT.242: TAXONOMY OF ANGIOSPERMS	• Understand the diversity of angiosperms. • Understand the comparative account among the families of angiosperms. • Know the economic importance of the angiosperm plants. • Understand the distinguishing features of angiosperm families.

BOT.-243: PRACTICAL COURSE	Students should understand, • Determine the DPD by using the potato tuber • To determine the rate of photosynthesis • Determination of RQ using Ganong'srespirometer • Osmosis by curling experiment,Imbibition pressure, Thistle funnel, Ringing experiment, Relative transpiration, CO2 Necessary for photosynthesis, Kuhen's Tube experiment, Cyclosis in Hydrilla • Study of Plant families w.r.t Systematic position, Morphological characters, floral formula and floral diagram. • Preparation of artificial key.

- **T Y B Sc.**
  - **Semester -1**

BOT. 351, PAPER – I CRYPTOGAMS	• Know the salient features of Cryptogams plants. • Become aware of the status of cryptogams as a group in plant kingdom. • Understand the life cycles of selected genera. • Learn about the economic and ecological importance of Cryptogams plants.
BOT.352 - ANGIOSPERM TAXONOMY	• Understand the status of angiosperms in plant kingdom. • Realize the origin of Angiosperms with respect to time, place, origin and probable ancestors. • Know the Pre-Darwinian and Post- Darwinian systems of Classification. • Understand various angiosperm families emphasizing their morphology, distinctive features and biology. • Know the role of cytology and Phytochemistry in Taxonomy..
BOT. 353 - III GENETICS AND MOLECULAR BIOLOGY	• Gain knowledge about “Cell Science. • Understand Cell wall Plasma membrane, Cell organelles and cell division. • Learn the scope and importance of molecular biology. • Understand the biochemical nature of nucleic acids, their role in living systems, experimental evidences to prove DNA as a genetic material. • Understand the process of synthesis of proteins and role of genetic code in polypeptide formation.
BOT. 354 - PAPER-IV ADVANCED PLANT PHYSIOLOGY	• Learn and understand about mineral nutrition in plants. • Understand the growth and developmental processes in plants. • Know about movement in plants. • Understand the process of translocation of solutes in plants. • Know the nitrogen metabolism and its importance.
BOT.355 - PLANT ECOLOGY AND PHYTOGEOGRAPHY	• Know the scope and importance of the discipline. • Understand plant communities and ecological adaptations in plants. • Learn about conservation of biodiversity, Non-conventional Energy and Pollution. • Discover botanical regions of India and vegetation types of Maharashtra.

	• Understand Bioremediation, Global warming and climate change.
BOT.356.3 GARDENING	• To know the concept of garden. • To study the special types of gardens. • To study different features of garden. • To study the different ornamental garden plants. • To understand technique of pot culture, Bonsai, Topiary & Lawn.
BOT. 357:PRACTICAL PAPER I	Students should understand, • The range of thallus structure in algae. • The life cycle of *Chara, Uncinula, Marchantia and Marselia.* • The types of stele in Pteridophytes. • Preparation of fixative and stains • The Mitosis and Meiosis techniques. • Study of polytene chromosome from Chironomus larvae. • Isolation of DNA from any plant material. • Mitochondrial staining by Janus green stain.
BOT. 358: PRACTICAL PAPER II	Student should understand, • Study of plant families representing different groups of angiosperms w.r.t systematic position, morphological characters, floral formula and floral diagram. • Usinglocal, regional, state and national flora. • Principle working and uses of laminar air flow hood, autoclave, hot air oven, electrophoresis and centrifuge. • MS media preparation.
BOT. 359: PRACTICAL PAPER III	Students should understand, • Qualitative assessment of microelements in plant ash • Effect of hormone on germinating seeds. • To determine the minimum size of the quadrate by 'species area curve method'. • Soil texture, water holding capacity, pH, and test for carbonate, nitrate, and sulphate. • Demonstration, working and uses of ecological instruments. • Study of morphological and anatomical adaptation in locally available hydrophyte and Xerophyte. • Measurement of water quality based on – hardness, Dissolved oxygen, free CO2, Chloride, Total alkalinity.
• **Semester -2**	
BOT. 361 - GYMNOSPERMS &	• Understand Gymnosperms with respect to

PALEOBOTANY	distinguishing characters, comparison with Angiosperms, economic importance and classification. • Understand the life cycles of Pinus and Gnetum. • Know the scope of Paleobotany, types of fossils and geological time scale • Understand the various fossil genera representing different fossil groups.
BOT. 362 - ANATOMY AND EMBRYOLOGY	• Understand the scope & importance of Anatomy and Embryology. • Know various tissue systems. • Understand the normal and anomalous secondary growth in plants and their causes. • Perform the techniques in anatomy.. • Understand structure and development in microsporangium and megasporangium. • Understand microsporogenesis and megasporogenesis. • Understand male and female gametophytes. • Know fertilization, endosperm and embryogeny.
BOT : 363 GENETICS, PLANT BREEDING AND EVOLUTION	• Understand the "Science of Heredity". • Realize the role of genes in evolution of species. • To understand linkage, segregation and mutation of genes during evolution. • Understand the science of plant breeding. • To introduce the student with branch of plant breeding for the survival of human being from starvation. • To study the techniques of production of new superior crop verities. • To study the evolution in living organisms.
BOT- 364 PLANT BIOCHEMISTRY	• Understand the current status of Biochemistry. • Recognize the impact of Biochemistry on socioeconomic aspects of life. • Realize the industrial application of Biochemistry • Understand the importance of Bio-molecules.
BOT 365 -APPLIED BOTANY	• Understand the importance and scope of botanical science in the industries. • Understand the role of microbial plants in fermentations process. • Know the process of cultivation of cash crops. • Understand some plants which are used as herbal cosmetics. • Understand technique of plant tissue culture and its application. • Realize the role plants in forensic science.

BOT 366.3 : HORTICULTURE	• To understand scope , importance & disciplines of horticulture. • To familiar with horticultural zone of Maharashtra & India. • To understand different horticultural practices & methods. • To study role played by green & playhouses in horticulture. • To understand production technology, harvesting technics. • To understand methods of preservation & preparation of preserve product.
BOT- 367: PRACTICAL PAPER-I	Students should understand, • Study of *Pinus &Gnetum.* • Study of different types of fossils. • Solving of problems on monohybrid and dihybrid cross. • Isolation of DNA from suitable plant material. • Study of factors promoting self-pollination & cross pollination. • Techniques of Hybridization in Self Pollinated and Cross Pollinated Crops. • Methods of estimation of Heterosis
BOT- 368: PRACTICAL PAPER-II	Students should understand, • Study of epidermal tissue system and mechanical tissue system • Study of normal secondary growth in stem and root of woody dicots. • Study of anomalous secondary growth in the stem of the Plants. • Maceration of vascular tissue. • Study of Garden tools and Equipments. • Study of Phenology of fruits, vegetables or flowering crops. • Preparation of different types of fruit products & Food products.
BOT- 369: PRACTICAL PAPER-III	Students should understand, • To study the effect of temperature on activity of enzyme amylase. • To study the principle and working and uses of spectrophotometer, calorimeter, centrifuge, Autoclave, Laminar air flow, Hot air oven, Incubator etc. • Isolation and estimation of lipids from oil seeds by using Soxhlet apparatus. • To study the lipase activity by using germinating oily seeds. • Detection of adulteration in plant products using

	suitable tests. • Preparation of Aloe verajel&Jaswandjel. • Botanical name and uses of plant material in forensic science

M. Sc. I

- **Semester -1**

BOT. 1.1 ANGIOSPERMTAXONOMY	• Know the conceptual development of taxonomy & systematics. • Understand the general range of variations in the group of angiosperms. • Trace the history of development of systems of classification emphasizing angiospermic taxa. • Learn about the characters of biologically important families of angiosperms. • Know the floral variations in angiospermic families, their phylogeny and evolution. • Understand various rules, principles and recommendations of plant nomenclature. • Know modern trends in taxonomy. • Understand major evolutionary trends in various parts of angiospermic plants.
BOT. 1.2 ENVIRONMENTALBOTANY AND BIOSTATISTICS	• Understand the environmental botany. • Know the nature and its co-relation with human society. • Realize the impact of human activities on environment. • Understand global issues concerned with environment. • Know the sustainable development and care of environment. • Understand the connection between material wealth & resources exploitation. • Worth the relationship between economic growth and environmental degradation. •
BOT 1.3 CYTOGENETICSANDMOLECULARBIOLOGY	• Understand structural organization and variation in chromosome as well as karyotype analysis. • Learn about the extra-chromosomal inheritance in plant system. • Know the molecular biology in relation to genetic material, its inheritance, modification, replication and repair. • Understand transcription, translation post translation modification of protein. Know gene regulation in prokaryotes and

	eukaryotes.
BOT.104 PRACTICAL –I	Students should understand, • Study of the families with respect to morphological characters using botanical terms, floral formula, floral diagram and classification giving. • Identification of genus and species with the help of flora of the plant materials. • Preparation of artificial, bracketed/indented dichotomous keys based on vegetative and reproductive characters. • Study of Morphological and biological peculiarities of plants.
BOT.105 PRACTICAL –II	Students should understand, • Estimation of Biomass. • Instruments used for collection of meteorological data. • Estimation of Phosphatic fertilizers from agricultural soil using colorimeter /Spectrophotometer. • Preparation of Cytological fixative and stains. • Study Mitosis and Meiosis. • Determination of Mitotic index and Metaphase frequency in plant material. • Estimation of RNA by Orcinol Method. • Isolation and estimation of DNA from suitable pl ant material. • Study of chromosomal aberrations in plant.
Semester -2	
BOT 2.1 DIVERSITY OF LOWER CRYPTOGAMS	• Understand the salient features of Algae and Fung. • Learn about diversity of lower Cryptogrammic plants in nature. • Understand the life cycle patterns in lower cryptogams. • They will understand the role of algae and fungi for human welfare.
BOT.2.2 DIVERSITY OF HIGHER CRYPTOGAMS	• Become aware of the status of higher cryptogams as a group in plant kingdom. • Understand the habit and habitat of the higher cryptogams in the field. • Understand the distinguishing features, interrelationships, phylogeny and evolutionary tendencies of selected orders with their affinities. • Realize the economic importance of higher cryptogams plants.

BOT.2.3 PLANT PHYSIOLOGYAND BIOCHEMISTRY	• Understand plant structures in the context of physiological functions of plants. • They will learn about the growth and development of plants and its regulations • Understand the physiological details of photosynthesis and respiration • Understand lipid metabolism in plants • Understand the stress of plants and its adaptations. • They will learn about the metabolites synthesized by plants. • They will be able to understand the red-ox systems of plants.
BOT 204 Practical-I	Students should understand, • Morphological observations, description and classification according to Fritsch with reason oftaxa belonging to at least two examples from each order of algae • Preparation of temporary and permanent algal slides. • Preparation of cotton blue, Lactophenol and culture medium – PDA. • Study fungi with respect to vegetative,reproductive structures and classification with reasons. •
BOT 2.5 PRACTICAL II	Students should understand, • Studies of Morphological, Anatomical and Reproductive character of Bryophyta. • Studies of Morphological,Anatomical and Reproductive character of pteridophyta. • Determine diaurnal fluctuations in titrable acid number (TAN) values ofCAMsucculents. • Determine the absorption spectrumof chlorophyll pigments and estimate theamount of Chl-a, Chl-b and total Chlorophylls by spectrophotometermethod. • Extraction and separation of free amino acid of germinating seed bycircular paper chromatography. • Extraction and Detection of secondary plant metabolites from suitableplant material. • To study the activity of enzyme lipase in germinating seeds.
M. Sc. II (Organic Chemistry)	
• **Semester -1**	
BOT 3.1 GYMNOSPERMS AND	• Understand the diversity of Gymnosperms in

PALEOBOTANY	India. • Know the evolutionary trends and affinities of living gymnosperms with respect to external and internal features. • Understand the important fossil types in different groups of plants and Indian fossil records. • Realize the applied aspects of Paleobotany.
BOT 3.2: PLANT BIOTECHNOLOGY AND BIOINFORMATICS	• Understand the fundamentals of totipotency plant tissue culture techniques. • Know the transgenic technology for the improvement of quality and quantity of plant and thereby product. • Understand the advantages of in vitro propagation in various areas. • Realize the application and importance of plant tissue culture and transgenic plants.
BOT 3..31: ALGAE SPECIAL PAPER-I	• To Understand Algology. • To Know Diversity of various algal groups. • To provide a clear & sound background knowledge in respect to morphology. • To understand deferent systems of classification of algae.
BOT.3.4 PRACTICAL-I	Students should understand, • Study of External morphology, anatomy of rachis and pinnae, morphologyof microsporangiate and megasporangiatestrobilii of Cycas. • Study of External morphology, wood anatomical features by doublestained preparations. • Study the External morphology, anatomy and morphology of reproductiveorgans of Ephedra and Ginkgo. • Study of various instruments used for plant biotechnology. • Preparation of stock solutions of MS medium and plant growth regulator stocks. • Preparation of explants and inoculation on nutrient media for callus induction, Sub-culture of callus and regeneration of plants from callus. • Hardening techniques of tissue culture plantlets. • DNA separation with the help of gel electrophoresis. • Study of NCBI - BLAST.
BOT.3.5 PRACTICAL-II	Students should understand, • study on Morphology, Taxonomy of Thallus organization,Reproduction, Life Cycle, Phylogeny and interrelationships of algae belonging to the classes of algae.

	• Artificial key of the genera based on morphology and reproduction characters of algae. • Study on algal habitat.
	Semester -2
BOT.4.1: DEVELOPMENTAL BOTANY	• Understand the vascular tissues, structure of woods and anomalous secondary growth. • Detect adulterations and understand forensic botany. • Know historical development of embryology. • Understand structure and development of microsporangium, megasporangium, embryo and endosperm. • Know the methods of pollination and fertilization. • Understand the applications of embryology in plant tissue culture. • Learn about the structure and development of pollen grains. • Realize the applications of palynology in human welfare.
BOT 4.21: ALGAE SPECIAL PAPER-II	• To understand cellular details of prokaryotic & eukaryotic cell. • To Commercial development of algal culture. • To aware about commercial utilization of algae. • To understand diversity of morphological & biochemical. • To know role of algae in industries.
BOT 4.31: ALGAE SPECIAL PAPER-III	• To know ecological classification of algae. • To understand those environmental factors which control their survival growth, distribution & causal mechanisms. • To understand bio-monitoring the water bodies & pollution control. • To know phycological techniques in algae from water supplies. • To study the role of algae in sewage disposal.
BOT.4.4 PRACTICAL-I	Students should understand, • Study of types stomata and Trichomes . • Isolation and study of wood elements by acid maceration method. • Study of the development of microsporangium, microsporogenesismicrospores, male gametophyte of angiosperms. • Study of endosperms types. • Study of pollen development, tetrad types, pollen units: monad, dyad,tetrad, polyad, pollinia.

	• Pollen analysis from honey samples using acetolysis.
BOT.4.5 PRACTICAL-II	Students should understand, • Preparation of culture media for algae. • Isolation of algae by dilution and streak culture technique. • Mass culture of blue green algae as bio-fertilizer. • Extraction and separation of amino acids and carbohydrates of algae bychromatography methods. • Extraction and Estimation of algal proteins from polluted and unpollutedwaters.
BOT.4.6 PROJECT WORK	Students should understand, • To select the topic. • Literature survey for the topic of the project. • Skill in practical work, experiments, use of biological tool and techniques. • Handle instruments for analysis and discuss their experimental results. • Used ICT tools to prepare project reports and present it using Power point presentation. • Work within a small team to achieve a common research goal.

Program Outcomes:

- **UG & PG**

	• To provide thorough knowledge about various plant groups from primitive to highlyevolved. • To make the students aware of applications of different plants invarious industries. • To highlight the potential of these studies to become an entrepreneur • To equip the students with skills related to laboratory as well as field based studies. • To make the students aware about conservation and sustainable use of plants. • To create foundation for further studies in Botany. • To address the socio-economical challenges related to plant sciences. • To facilitate students for taking up and shaping a successful career in Botany. • Discipline specific competitive exams conducted by service commission.