

Department of Botany
P. O. of B.Sc. Medical + C.O of Botany

B.Sc. MEDICAL

PROGRAMME OUTCOME

Bachelor of Science (B.Sc.) in Medical is a three years undergraduate programme with Science subjects i.e., Botany, Zoology and Chemistry. Students seeking admission in this programme must have Physics, Chemistry and Biology subject in their Senior Secondary School are eligible to opt for this programme. This programme is beneficial for students having interest in Biological Sciences i.e., Plant Science and Animal Sciences. The programme structure is designed by skilled and efficient subject experts keeping in view the carrier prospects of students. A students acquiring B.Sc. (Medical) degree will be skilled in the following fields:

- Plant Taxonomy and Identification: Student will be able to identify and classify major group of plants with their characteristic features.
- Practical Implementation and Theoretical Knowledge: Student will learn to carry out practicals in the field and Laboratory with minimal risk.
- Communication Skills: Students are given exposures through various events organized by Botany department to enhance their communication skills like Seminars, Power point presentations, Project Reports and Viva-voce.
- Conservation of Botanical Gardens: Through field work in the Botanical Gardens, students are able to learn Integrated Conservation Approaches for plants. Students will also be able to learn Plant Propagation Techniques.
- Environment Sustainability: Students shall be able understand the impact of plants in Societal and Environmental contexts and demonstrate the knowledge of and need for sustainable development.
- Scientific Ethics: Students will be able to understand and commit to scientific and environmental ethics like honesty in reporting and analysis of results, responsibilities and norms of the biodiversity conservation, proper crediting of sources of information, data and ideas.
- Modern Tool Usage: Apply appropriate techniques, resources and modern instructions and equipments for Biochemical, Physiological, Molecular, Plant Tissue Culture of Plants.
- Ethno botany: Able to understand and learn Importance and Utilization of Economically Important Plant

Having B.Sc Medical degree opens doors to Science as a Profession like

- Pharmaceutical, Horticulture, Floriculture, Vermiculture, Pisciculture, Sericulture, Silviculture, Medical Hospitals, Veterinary, Aquaculture, Biotechnology, Microbiology, Beverage Industries, Sugar Mill, Pathological Laboratory
- Student can work in Government sectors related to Agriculture department, Forest department, Food and Beverage Industries
- Student can choose teaching like Educational Institutes like Schools and Colleges or can be a Scientist.
- Further studies like M.Sc. Botany, Zoology, Microbiology, Biotechnology, Biochemistry, Genetics and Chemistry, B.Ed., Diploma in Lab technician
- Microbusiness like Nurseyman, Vermiculture, Organic farming, Coaching Institutes
- Student can further prepare for competitive exams like IFS, UPSC, SSC, CGL

PROGRAMME SPECIFIC OUTCOME

Botany is abroad discipline having various branches involved with the study of plants and deals with phylogenetic systematic of plants covering higher plants, lower plants, aquatic plants, nature/field study, functional aspects of various cellular processer of plants, molecular genetics and modern tools i.e. tissue culture, genetic engineering and computational studies.

- Department of Botany always tried to create environment awareness along its students.
- Studying Botany in B.Sc. Medical involves broad range of Scientific disciplines concerned with the study of Microbes (Bacteria, Fungi, Algae), and Plants (Bryophytes, Pteridophytes, Gymnosperms and Angiosperms)
- Students will learn Morphology, Anatomy, Development, Reproduction, Metabolism, Physiology of various Plants.
- They will be able to explain various plant process, metabolism, concepts of gene, genome, experimental teachings and methods of their area of specialization in botany.
- Perform Laboratory experiments related to Cell Biology, Genetics, Plant Physiology, Anatomy, Embryology, Taxonomy, Biochemistry and Biotechnology.

- They gain introductory experience in applying each of the following skills and gain greater proficiency in selection of them.
 - Interpreting plant morphology and anatomy
 - Plant identification
 - Vegetative analyses skills
 - Plant pathology to be added for sharing of field and lab data obtained
- We organize various excursions and field visits at natural habitats as per the curriculum so that students can have a closer look at their environment.
- Students visit industries and prepare reports on sources, types and control of air and water pollution as a part of their curriculum requirement. Field exposures are given for better understanding of plant distribution and collection.
- Field reports are maintained for Algae, Fungi, Bacteria, Bryophytes, Pteridophytes, Gymnosperms and Angiosperms.
- Apply appropriate techniques, resources and modern instruments for practical performance.
- Understand the application of Biological Sciences in carrier fields.
- Understand the relationship among microbes and plants.
- Understand the interactions between plants, environment and human beings and our role in environment conservation.
- Various topics related to global change like greenhouse effect and greenhouse gases; impacts of global warming; carbon trading are also taught as a part of the curriculum.
- Different activities to save the environment such as celebration of World Environment Day, Ozone Day, Earth Day, Van Mahotsav and Wild Life Week in association with the Zoology department are organized by the department.
- Various events like slogan and poster competitions, bouquet formation, invited talks and flower exhibitions are organized to create awareness about nature, biodiversity, environment and sustainability. Such activities enable the students to learn about the ecosystem and other environmental factors.
- They also learn measures to protect the environment and are made aware of global warming and other related issues. Drawing posters and essay competitions are held regarding environment issues to cheer up the students.

BSc. Medical student having Botany as a subject is able to acquire knowledge regarding- Diversity of Microbes, Cell Biology, Seed Plants Diversity, Plant Anatomy, Plant embryology, Plant physiology, Plant biotechnology, Biochemistry, Ecology and Economic Botany.

COURSE OUTCOMES OF THE COURSE : BOTANY

Course Outcomes of the course "Diversity of Microbes"

CO1

1. Student can describe Structure, nutrition, reproduction and economic importance of Bacteria. Can briefly explain general account of cyanobacteria (with reference to *Nostoc*).
2. Student can describe general characters, classification (upto classes) and economic importance, important features and life-history of *Volvox*, *Oedogonium*, *Vaucheria*, *Ectocarpus* and *Polysiphonia*. and can write down the General account of Viruses including structure of TMV and Bacteriophages.
3. Students can explain general characters, classification (upto classes) and economic importance; important features and life-history of *Phytophthora* (Mastigomycotina), *Mucor* (Zygomycotina), *Penicillium* (Ascomycotina), *Puccinia*, *Agaricus* (Basidiomycotina), *Colletotrichum* (Deuteromycotina) Write down the general account of Lichens.

Course Outcomes of the course "Cell Biology"

CO2

1. Students will be able to write down the structure and functions of Cell Wall and Plasma Membrane.
2. They can explain the Ultrastructure and function of nucleus, Golgi Apparatus, Endoplasmic Reticulum, Chloroplast, Mitochondria, Lysosomes, Peroxisomes and Vacuoles.
3. Students can explain Mitosis and Meiosis. Describe Morphology, organization, ultrastructure of Centromere and Telomere. They can explain Chromosomal alterations- deletions, duplications, translocations, inversions.
4. Students can describe variations in chromosome number- aneuploidy, polyploidy, sex chromosomes and sex determination

Course Outcomes of the course "Diversity OF Archegoniates "

CO3

1. Students can give General characters, classification (upto classes), alternation of generations, structure and reproduction(excluding development) of *Marchantia* (Hepaticopsida), *Anthoceros*(Anthocerotopsida), *Funaria* (Bryopsida)
2. They can explain general characters, classification (upto classes), alternation of generations, structure and reproduction (excluding development) of *Rhynia* (Psilopsida), *Selaginella*(Lycopsida), *Equisetum* (Sphenopsida) and *Pteris* (Pteropsida)

Course Outcomes of the course "Genetics"

CO 4

1. Students can give an account on DNA the genetic material, DNA structure and replication, DNA-Protein interaction, the Nucleosome Model, Genetic Code, Satellite and Repetitive DNA. Students can briefly explain Laws of segregation and Independent Assortment; Linkage Analysis; Allelic and non-allelic interactions.
2. They can describe mutations- spontaneous and induced; transposable genetic elements; DNA damage and repair
3. Students can explain the modern concept of gene; RNA; Ribosomes; transfer of genetic information- transcription and translation (Protein Synthesis); regulation of gene expression in prokaryotes and eukaryotes; 1-D, 2-D and 3-D structure of Proteins.
4. They can describe Extra Nuclear Inheritance: Presence and function of Mitochondrial and Plastid DNA; Plasmids

Course Outcomes of the course “Biology and Diversity of Seed Plants-I”

CO05

1. Students can explain General characters and diversity of Gymnosperms (seed plants without fruits). They can classify Pilger and Melchior's (1954) system of classification. Students can describe Geological Time Table and Evolution of Seed Habit.
2. They can describe Fossils and the process of Fossilization, types of Fossils and Importance of Fossils. They will be able to understand the reconstruction of the following fossil plants *Lyginopteris*, *Williamsonia*, *Cycadeoidea* (= *Bennettites*).
3. Students can briefly explain morphology and anatomy of root, stem, leaf/leaflet and reproductive parts including mode of reproduction, life-cycle and economic importance of : *Cycas*, *Pinus*, *Ephedra*. They can write down the general characters of Angiosperms including primitive angiosperms (Amentiferae, Ranales, Magnoliales).

Course Outcomes of the course “Plant Anatomy”

CO6

1. Students can give account on diversity in plant forms – annuals, biennials and perennials. They can briefly explain tissues- meristematic and permanent (simple and complex). They can describe the Shoot system- shoot apical meristem and its histological organizations (monocot and dicot stem). Students can write an account on Cambium-structure and functions.
2. Students can explain Secondary growth in dicot stem, characteristics of growth rings, sap wood, heart wood and periderm.
3. Students can explain anomalous secondary growth in *Dracaena*, *Boerhaavia* and *Achyranthes*. Students can give an account on types of leaves (simple and compound) and phyllotaxy.. They can write down on uniseriate and multiseriate Epidermis, epidermal appendages and their morphological types. Students can explain anatomy of typical Monocot and Dicot leaf and cell inclusions in leaves, leaf abscission, stomatal apparatus and their morphological types.
4. Students can describe the root apical meristem and the histological organization (monocot and dicot root, secondary growth in dicot root).

5. Students can describe structural modifications in roots-storage (*Beta*), Respiratory (Rhizophora), Epiphytic (*Vanda*)

Course Outcomes of the course “Biology and Diversity of Seed Plants-II”

1. CO 7
2. Students can briefly explain Taxonomy and Systematics, fundamental components of taxonomy (identification, classification, description, nomenclature and phylogeny). What is the role of chemotaxonomy, cytotaxonomy and taxometrics in relation to taxonomy?
3. They can explain botanical Nomenclature, principle of priority, principles and rules. They can explain type concept and taxonomic ranks keys to identification of plants
4. Students will be able to describe flower and types of Inflorescence. They can explain salient features of the systems of classification of angiosperms proposed by Bentham & Hooker and Engler & Plant.
5. They will be able to explain the diagnostic features and economic importance of the following families: Ranunculaceae, Brassicaceae, Malvaceae, Euphorbiaceae, Rutaceae, Leguminosae, Apiaceae, Asclepiadaceae, Lamiaceae, Solanaceae, Asteraceae, Liliaceae and Poaceae

Course Outcomes of the course “Plant Embryology”

CO8

1. Students can explain flower as a modified shoot, functions of various floral parts microsporangium, its wall and explain the mechanism of dehiscence. They can describe microsporogenesis, pollen grains and its structure (pollen wall), pollen-pistil interaction and self incompatibility.
2. Students can describe pollination, its types and agencies, pollen germination (microgametogenesis), development of male gametophyte.
3. A learner can give an account on the structure of megasporangium (ovule), its curvatures, megasporogenesis and megagametogenesis, structure of female gametophyte (mono-bi and tetrasporic)

4. Students can describe double fertilization, endosperm, its types and its biological importance, embryogenesis in dicot and monocot, polyembryony. They can explain structure of dicot and monocot seed fruit types and dispersal mechanisms in fruits and seeds

Course Outcomes of the course "Plant Physiology"

CO9

1. Students can give an account on importance of water to plant life, its physical properties and define Imbibition, Diffusion, Osmosis and Plasmolysis. They can explain absorption and transport of water. They can describe transpiration and its types the physiology of stomata, factors affecting transpiration and importance of transpiration.
2. They will be able to explain essential macro and micro elements and their role, can explain deficiency symptoms
3. Students can describe mineral uptake. They can explain the mechanism of phloem transport and account on source-sink relationship and factors affecting translocation
4. They can explain on photosynthetic pigments, action spectra and enhancement effect, concept of two photosystems, Z-scheme and photo-phosphorylation. Calvin cycle, C4 pathway, CAM plants and photorespiration, ATP—the biological energy currency.
5. Students can explain aerobic and anaerobic respiration, Krebs cycle, electron transport mechanism (chemi-osmotic theory) redox –potential, oxidative phosphorylation, pentose phosphate pathway. Students can give an account of seed dormancy, plant movement, photoperiodism and physiology of flowering. They can describe florigen concept, physiology of senescence and fruit ripening

Course Outcomes of the course "Ecology"

CO10

1. Students can explain scope and importance of Ecology, levels of organization. They can explain environmental factors- climatic (water, humidity, wind, light, temperature), edaphic (soil profile, physico-chemical properties), topographic and biotic factors (species interaction).
2. Students will be able to explain adaptations of plants to water stress and salinity (morphological and anatomical features) of hydrophytes, xerophytes and halophytes

3. Students will be able to describe population ecology, its characteristics, biotic potential, growth curves, ecotypes and ecads.
4. They can explain community ecology, its characteristics (qualitative and quantitative analytical and synthetic), methods of analysis of community ecology, ecological succession
5. Students can describe the structure (components) and functions of trophic levels, food chains, food webs, ecological pyramids and energy flow
6. Students can describe carbon, nitrogen and hydrological (water) cycle.
7. They can briefly explain phyto-geographical regions of India, vegetation types of India (forests)
8. They can describe sources, types and control of air and water pollution
9. They can write briefly on Greenhouse effect, greenhouse gases, impacts of global warming and carbon trading

Course Outcomes of the course “Biochemistry & Plant Biotechnology”

CO 11

1. Students can describe discovery, nomenclature and characteristics of enzymes, holoenzyme, apoenzyme, coenzyme and co-factors, regulation of enzyme activity and mechanism of action
2. Students can describe growth and development and its phases, plant hormone, history of discovery and mechanism of action of Auxins, Gibberellins, Cytokinins, Abscissic acid and Ethylene
3. They can explain discovery, physiological role and mechanism of action of photo morphogenesis and phytochromes.
4. Students can explain structure and functions of lipids, saturated and unsaturated fatty acids, storage and mobilization of fatty acids, fatty acid biosynthesis, α and β -oxidation
5. They can describe the biology of nitrogen fixation, importance of nitrate reductase and its regulation. ammonium assimilation.
6. Students can describe tools and techniques of recombinant DNA technology, cloning vectors, genomic and cDNA library, agrobacterium, vectors for gene delivery and marker genes.
7. Students can explain transposable elements. Explain the aspects of plant tissue culture, cellular totipotency, differentiation and morphogenesis

Course Outcomes of the course “Economic Botany”

CO12

1. Students can write briefly on origin, distribution, and botanical description, brief idea of cultivation and uses of cereals(Rice, Wheat and Maize)
2. Students can explain origin, distribution, botanical description, brief idea of cultivation and uses of the pulses(Gram, Arhar and Pea)
3. They can explain origin, distribution, botanical description, cultivation and uses of the vegetables(Potato, Tomato and Onion)
4. They can describe the origin, distribution, botanical description, brief idea of cultivation and uses of the fibers (Cotton, Jute and Flax)
5. Students can describe origin, distribution, botanical description, cultivation and uses of the Groundnut, Mustard and Coconut
6. They will be able to describe the morphology of plant part used, cultivation and uses of the spices (Coriander, Ferula, Ginger, Turmeric and Cloves)
7. Students can describe the medicinal plants *Cinchona*, *Rauwolfia*, *Atropa*, *Opium*, *Cannabis*, Neem
8. They can explain botanical description and processing of Beverages- Tea and Coffee
9. Students can write briefly on botanical description and processing of rubber (*Hevea*) and Sugar(Sugarcane)
10. Students can describe the sources of timber; energy plantations and bio-fuels