Syllabus for Botany Bachelor's

Section 1: Subject Knowledge

Please Note: A Total of 40 Questions will be asked, combining the following topics, with the difficulty level commensurate to a Bachelor's Candidate.

Unit I: Phycology and Microbiology

Algal Biology: Classification and evolution of algal groups (Cyanophyta, Chlorophyta, Phaeophyta, Rhodophyta), morphology, reproduction, physiology, and ecological roles. Applications in biofuels, bioremediation, and biotechnology. Cultivation techniques and growth optimization.

Microbial Biology: Classification and taxonomy of bacteria, archaea, and viruses. Microbial physiology, genetics, and pathogenesis. Environmental roles in biogeochemical cycles and applications in industry (fermentation, antibiotics, waste treatment).

Unit II: Biomolecules and Cell Biology

Biomolecules (carbohydrates, lipids, proteins, nucleic acids), membrane structure and transport, cytoskeleton, and cell motility. Cell signaling, cell cycle, organelle functions, gene expression, and regulation. Apoptosis, stress responses, and cellular techniques .

Unit III: Mycology and Phytopathology

Fungal diversity, structure, reproduction, and physiology. Genetics, ecology, and biotechnology applications. Plant-fungal interactions, plant pathology, and disease resistance. Major fungal pathogens in agriculture, emerging diseases, and mycotoxins in food safety.

Unit IV: Archegoniate

Evolution and characteristics of land plants. Detailed study of Bryophytes (liverworts, mosses, hornworts), Pteridophytes (ferns, lycophytes), and Gymnosperms (conifers, cycads) covering morphology, reproduction, life cycles, and ecological significance.

Unit V: Anatomy and Angiosperms

Tissue types, cell differentiation, and meristematic tissues. Primary and secondary growth, vascular and epidermal tissue systems. Reproductive anatomy, flower and seed development, and anomalous secondary growth. Angiosperm diversity, pollination, fertilization, and wood anatomy.

Unit VI: Economic Botany

Overview of the importance of plants in human life, history, and the evolution of plant usage for food, medicine, and materials. Plant Domestication and Evolution, Study of the domestication of plants, centers of origin, and the impact of agriculture on plant evolution.

Unit VII: Genetics

Mendelian genetics, complex inheritance, and quantitative traits. Gene structure and function (DNA replication, transcription, translation, regulation), epigenetics, population genetics, genomics, and CRISPR genetic engineering techniques.

Unit VIII: Molecular Biology

Media preparation, E. coli culturing, gene cloning, and functional analysis. PCR optimization, DNA ligation, and recombinant selection. Practical exercises: DNA amplification, purification, restriction digestion, and E. coli transformation.

Unit IX: Plant Ecology and Phytogeography

Principles of plant ecology, abiotic and biotic factors, and plant population dynamics. Community and ecosystem ecology, plant adaptations, biomes, and vegetation types. Phytogeography, endemism, biodiversity hotspots, climate change impact, conservation strategies, ecological succession, and effects of invasive species on ecosystems.

Unit X: Plant Semantics

Role of VOCs and hormones in plant-plant and plant-environment interactions. Plant signals (colors, scents) for pollinator attraction, and chemical communication in symbiotic and pathogenic interactions. Key signaling pathways (auxins, gibberellins) and their functions.

Unit XI: Reproductive Biology of Angiosperms

Sexual and asexual reproduction. Flower structure, pollination mechanisms, and co-evolution with pollinators. Fertilization (double fertilization, pollen tube growth), self-incompatibility, and embryo and seed development, including dormancy stages.

Unit XII: Plant Physiology

Water's role in plant metabolism, water absorption, and transpiration. Mineral nutrition and nutrient uptake. Photosynthesis (C3, C4, CAM) and respiration pathways. Plant growth regulators and their agricultural use. Growth parameters in crop productivity. Secondary metabolites and their roles in plant defense.

Unit XIII: Plant Metabolism

Structure and function of PSI and PSII, light reactions, Calvin cycle, C3 & C4 cycles, and photorespiration. Glycolysis, TCA cycle, glyoxalate cycle, and alternative oxidative pathways. Nitrogen metabolism: biological nitrogen fixation, nitrate assimilation, and ammonia assimilation (GS-GOGAT pathway). Seed storage proteins and plant secondary metabolites and their biological roles.

Unit XIV: Plant Biotechnology

Callus culture, organogenesis, somatic embryogenesis, and micropropagation for plant regeneration. Gene transfer methods (Agrobacterium, direct DNA transfer, CRISPR) for genetic modification. Molecular markers (RFLP, AFLP, SSR, SNP) in plant breeding and trait selection.

Section 2: Fundamental Skills

Please Note: A Total of 28 Questions will be asked, combining the following topics, with the difficulty level commensurate to a Bachelor's Candidate.

Unit I: Data Analysis Unit II: Math and Statistics Unit III: Lab skills Unit IV: Reading and Writing

Section 3: Specific Skill Proficiency

This section has more than 30 skills. You can select the ones you are proficient in from the enrollment form. You can choose a maximum of 2 skills. Each skill contains 10 questions.