

Department of Botany & Microbiology
Gurukul Kangri University, Haridwar

TDC B.Sc. Botany Syllabus
(w.e.f. Session 2008-09)

B.Sc. I		Max Marks
Paper I	Algae and Bryophyta	33
Paper II	Fungi and Lichens	33
Paper III	Pteridophyta, Gymnosperm and Palaeobotany	34
<i>Practical</i>		50
Total Marks		150
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B.Sc. II		
Paper I	Taxonomy, Anatomy and Embryology	33
Paper II	Plant Ecology and Environment	33
Paper III	Plant Physiology and Biochemistry	34
<i>Practical</i>		50
Total Marks		150
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B.Sc. III		
Paper I	Cytology, Genetics, Evolution and Plant Breeding	33
Paper II	Applied Botany	33
Paper III	General and Applied Microbiology	34
<i>Practical</i>		50
Total Marks		150
GRAND TOTAL		450

Note: A total of 10 questions are to be set by the examiners, 02 questions from EACH UNIT. The students are required to attempt 05 Questions in all, selecting 01 Question from each Unit. All questions will carry equal marks.

B.Sc. Part-I (Botany)
Paper-I: Algae and Bryophyta

Unit-I: A brief history of phycology, essential features of algae, classification; General characters of important algal groups, range in structures of chloroplast, methods of reproduction, life cycles, range of thallus organization in algae, utilization in sewage disposal, methods of algal culture and economic importance of algae.

Unit-II: Classification, distribution, structure and reproduction of *Nostoc*, *Oscillatoria*, *Chlamydomonas*, *Chlorella*, *Volvox*, *Oedogonium*.

Unit-III: Classification, distribution and reproduction of *Chara*, *Vaucheria*, *Batrachospermum*, *Ectocarpus*, *Sargassum* and *Polysiphonia*.

Unit-IV: General characters and outline of classification of Bryophyta and their distribution in the Himalaya. Methods of vegetative propagation, Alternation of generation, phylogeny and evolution of the sporophytes.

Unit-V: Structure and reproduction of *Riccia*, *Marchantia*, *Anthoceros* and *Sphagnum*, Economic importance; role of bryophytes in ecological succession.

B.Sc. Part-I (Botany)
Paper-II: Fungi and Lichens

Unit-I: A brief history of mycology, outline of classification of fungi, salient features, general characters of important classes, methods of reproduction; Economic importance of fungi.

Unit-II: Disease symptoms, structure, reproduction, life cycle and control of *Synchytrium*, *Phytophthora*, *Albugo*.

Unit-III: Disease symptoms, structure, reproduction, life cycle and control of *Ustilago*, *Puccinia* and *Alternaria*.

Unit-IV: Distribution morphological structure and economic importance of Yeast, *Mucor*, *Aspergillus*, *Penicillium*, and *Morchella*.

Unit-V: Lichens- Distribution of lichen in India, Types of lichens, Classification and general features of lichens, economic importance of lichens.

B.Sc. Part-I (Botany)
Paper-III: Pteridophyta, Gymnosperms and Palaeobotany

Unit-I: General characters and outlines of classification of Pteridophyta, Stealer system in ferns, heterospory and seed habit.

Unit-II: Distribution, morphology, anatomy and life cycle of *Lycopodium*, *Selaginella* and *Equisetum*.

Unit-III: Distribution, morphology, anatomy and life cycle of *Marsilea* and *Adiantum*.

Unit-IV: General character and classification of gymnosperms, Morphology, life history and economic importance of Cycus, Pinus. Comparative analysis of the distribution of gymnosperms in the Eastern and Western Himalayas; Evolutionary trends in gymnosperms.

Unit-V: Knowledge of methods of fossil study; Types of fossils; structure of *Rhynia*, *Medullosa*, *Pentoxylon*; Importance of fossil studies; Contribution of Prof. Birbal Sahini.

Scheme of Practical Examination

MM = 50

1. Two specimens from each group Algae, Fungi and Bryophyta for suitable preparation, morphological study and proper identification.
2. One specimen from Pteridophyta and Gymnosperms for detailed anatomical study with double staining and identification.
3. Comments and identification of 10 spots.
4. Viva-voce.
5. Practical records, charts etc.

B.Sc. Part-II (Botany)

Paper-I: Taxonomy, Anatomy and Embryology

Unit-I: Characters of classification, different systems of classification, general principles of classification, nomenclature of plants, cytotaxonomy and chemotaxonomy.

Unit-II: Study of the following families with special reference to local representatives and plants of economic importance.

Caryophyllaceae, Ranunculaceae, Capparidaceae, Fabaceae, Malvaceae, Rosaceae, Rutaceae, Solanaceae and Acanthaceae,

Unit-III: Study of the following families with special reference to local representatives and plants of economic importance.

Cucurbitaceae, Rubiaceae, Asteraceae, Poaceae, Brassicaceae, Liliaceae, Euphorbiaceae and Orchidaceae.

Unit-IV: Anatomy of root, stem and leaf, primary and secondary structure of root and stem, anomalous secondary growth in dicots and monocots.

Unit-V: Embryology of angiosperm; works done on embryology in India. Microsporogenesis and megasporogenesis, development of male and female gametophytes, sex organs, fertilization and development of embryo with seed development in angiosperms, significance of double fertilization.

B.Sc. Part-II (Botany)

Paper-II: Plant Ecology and Environment

Unit-I: Introduction- History of Ecology; Concept of habitat and niche; Ecological subgroups; Environmental factors, climate (temperature and its effects); light, water, Soil (soil formation, soil profile, soil composition and other properties).

Unit-II: Ecosystem-structural components of ecosystem (both biotic and abiotics), Producers, consumers and decomposers, ecological pyramids.

Unit-III: Population and community- Aut and synecology, Concept of population ecology, characterization of population, Concept and characterization of community, Ecological succession, Types and process of succession.

Unit-IV: Pollution- Introduction to soil, water and air pollution; causes of pollution; Bioremediation of pollution, Bio-indication of pollution, Vedic technology for air purification.

Unit-V: Biogeochemical cycles: Introduction, Nitrogen cycle, Carbon cycle, Phosphate cycle, Sulphur cycle.

B.Sc. Part-II (Botany)

Paper-III: Plant Physiology and Biochemistry

Unit-I: Osmosis and osmotic pressure, turgor pressure, Imbibition, permeability. Physiology of stomata and moisture stress, Anti-transpirants; An introduction to water uptake and translocation of solutes. Active and passive absorption; Transport of organic substances, Soil-plant-water relationship. Inorganic nutrition- Essential major and micronutrients, deficiency symptoms due to N, P, K and micronutrients- B, Zn and Mo.

Unit-II: Photosynthesis- conversion of light energy into chemical energy, factors affecting carbon assimilation, law of limiting factors, path of carbon in photosynthetic fixation of carbon di-oxide, two photo-systems, Hatch and slack path way, C3 and C4 plants.

Unit-III: Nitrogen metabolism- sources of nitrogen, fixation of nitrogen, biological nitrogen fixation, nitrate reduction, amino acid biosynthesis, protein synthesis.

Unit-IV: Respiration- Aerobic and anaerobic respiration, mechanism of respiration, factors affecting respiration and respiratory quotient; Enzyme- chemical structure, properties, nomenclature, mechanism of action.

Unit-V: Seed germination, Juvenility, Flower physiology-photo periodism, vernalization and senescence; Plant growth hormones structure, function and properties- Auxins, Gibberellines and Cytokinins.

Scheme of Practical Examination

MM = 50

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| 1. Description of two plants for systematic study (One major and one minor) | 6+4 = 10 marks |
| 2. Stem T.S (from anatomy) | 05 |
| 3. Ecology (plant description e.g. habitat, adaptation, plant characters, etc.) | 05 |
| 4. Demonstration and comments on Physiology Experiment | 05 |
| 5. One experiment from Biochemistry | 05 |
| 6. Comments and identification of 10 spots | 10 |
| 7. Viva-voce | 05 |
| 8. Practical records, charts etc. | 05 |

B.Sc. Part-III (Botany)

Paper-I: Cytology, Genetics, Evolution and Plant Breeding

Unit-I: Ultra structure of plant cell, nuclear membrane, nucleolus, cell division, significance of cell division, types of cell division, mitosis and meiosis, structure of gene, transfer of genetic information, transcription, protein synthesis.

Unit-II: Morphological types and ultra-structure of chromosomes, special type of chromosomes, DNA and RNA structure and model proposed by Watson and Cricks's, DNA replication, Gene concept.

Unit-III: Mendelism, Mendel's laws of inheritance, Linkage and crossing over, Evolution- theories of organic evolution, Darwinisms, Lamarckism, Neolamarckism.

Unit-IV: Chromosomal aberration, structural and variation in chromosomes (duplication, deletion, translocation, inversion); Numerical variation, aneuploidy (monosomic, nullisomic and trisomic); euploidy, haploidy, polyploidy and their significance in improvement of agriculture.

Unit-V: Plant Breeding: Historical account during vedic period, selection, hybridization (methods and techniques of hybridization, give some examples of crop plants); Heterosis of hybrid vigour, Mutation, breeding, Breeding work done in India and production of crops; crop improvements through genetic engineering; role of biotechnology in crop improvement.

B.Sc. Part-III (Botany)

Paper-II: Applied Botany

Unit-I: Plants in relation to human welfare mentioned in Vedas; cereals, Wheat, Rice, Maize, legume, Gram, Mung and Arhar and oil yielding plants (sunflower, Groundnut, *Brassica*).

Unit-II: Fibers-Cotton, jute, coil, Timber-Teak, Sal and Seshame.

Unit-III: Drug Plants-Pipali, Brahmi, Sargandhs, Harad, Gokhru, Jatamanshi, Datura, Shankpushpi, Dioscorea and Digitalis.

Unit-IV: Energy Plant- Sugarcane, sugar beet and *Euphorbia* sp., Fruits and vegetable, plants in abatement of environmental degradation.

Unit-V: Plant cell, tissue and organ culture; culturing methods, scope and application in conservation of endangered plant species, embryo rescue, somaclonal variation, molecular pharming, cell suspension culture, methods of cell suspension, micropropagation of drug plants, somatic seeds, cybridization and cybrid production; cryopreservation.

B.Sc. Part-III (Botany)

Paper-III: General and Applied Microbiology

Unit-I: Emergence of Microbiology, History and developments of microbiology, golden era of microbiology, development of microbiology in India; Control of microorganisms, Microbial diversity- archaeobacteria, cyanobacteria, mycoplasmas, fungi, actinomycetes, rickettsia and Chlamydia.

Unit-II: Bacteria, morphological types: Cocci, bacilli (rods), spiral, vibrio, spirochaetes, pleomorphic, stalked and prothecate- bacteria; Arrangement of bacterial cells, flagellation, structure of flagella and pili. Structure of bacterial cell envelope, Gram positive and Gram negative cell wall, membranes invagination and intracellular membrane systems, ribosomes, cytoplasmic inclusions, genome

(nucleoid) and plasmids; Nutritional types of bacteria, phototrophs, autotrophs, heterotrophs, isolation, purification (pure culture), preservation and maintenance of cultures.

Unit-III: Viruses: Discovery of viruses, classification and techniques of viruses, structure of plant viruses (TMV, Potato virus X (PVX)), Potato virus Y (PVY), tulip break, potato mosaic, bacteriophages, viroids and PSTV; Mode of transmission, Poliovirus, HIV (AIDS).

Unit-IV: Identification and differentiation of bacteria, staining characteristics, gram stain, acid fast stain, metachromatic granule stain, spore stain, flagellar stain, cultural characteristics, physiological (biochemical and serological characteristics), chemotaxonomy and genetic characterization, pathogenicity and methods of identification of Dermatophytes.

Unit-V: Application of microbiology; biofertilizer, mycorrhiza, history and development of fermentation industry; Production of edible fungi and penicillin; Potential application of Archeobacteria (Methanogens & Thermophiles), Immunology- historical account of immunology, structure of antigen and antibody, serology.

Scheme of Practical Examination

MM = 50

Practical examination shall cover the courses of theory papers taught in that year.

1. Chromatographic separation of pigments amino acids (TLC/Paper chromatography).
2. Comments upon the experiments set up.
3. Devise an experiment to demonstrate/determine
4. Comments and identification of 06 spots (one specimen from each group) from paper II for description and comments; three spot from paper I (Electron micrograph showing virus) plant mycoplasma infection in plants, one disease specimen, bacterial type stain available. TWO minute time shall be given for each spot.
5. Staining of bacteria
6. Viva-voce.
7. Practical records, charts etc.