

BOTANY

SYLLABUS

(Effective from session 2016-17)



FOR
3 YEAR DEGREE COURSE
B.Sc

Department of Botany
Udaipur Pratap(Autonomous)College
Varanasi

SYLLABUS
BOTANY
(3 Year Degree Course)

B.Sc. PART –I EXAMINATION

PAPER I	: Algae and Fungi	50 MARKS
PAPER II	: Bryophytes, Pteridophytes, Gymnosperms and Palaeobotany	50 MARKS
PAPER III	: Diversity of Angiosperms: Systematics, Development, Reproduction & Economic Importance	50 MARKS
PRACTICAL EXAMINATION		50 MARKS
TOTAL		200 MARKS

B.Sc. PART –II EXAMINATION

PAPER I	: Plant Physiology	50 MARKS
PAPER II	: Plant Ecology	50 MARKS
PAPER III	: Cytogenetics	50 MARKS
PRACTICAL EXAMINATION		50 MARKS
TOTAL		200 MARKS

B.Sc. PART –III EXAMINATION

PAPER I	: Microbiology and Plant Pathology	55 MARKS
PAPER II	: Biochemistry and Molecular Biology	55 MARKS
PAPER III	: Environmental Biology:(Pollution, Conservation and Forestry)	55 MARKS
PAPER IV	: Plant Biotechnology	55 MARKS
PRACTICAL EXAMINATION		80 MARKS
TOTAL		300 MARKS

NOTE :

Each theory paper shall be of three hours duration. The practical examination shall be of five hours duration in Part-I and Part -II and of six hours duration in Part-III

Question No.1 in each theory paper is compulsory and will comprise of only objective/ short-answer questions based on the entire syllabus of the concerned theory paper .

B.Sc.- I
BOTANY : PAPER-I
ALGAE AND FUNGI

Maximum marks- 50

Duration - 3 hrs.

UNIT—I :

Smith(1955)classification of algae upto the rank of classes; economic importance of algae; classification of fungi upto classes as proposed by Alexopoulos and Mims(1979);fungi as our friends and foes.

UNIT—II :

Habit and habitat; thallus organization especially in algal forms studied;ultra structure of a blue green and a green algal cell; life history of *Ectocarpus*, *Sargassum*, *Batrachospermum*, *Oscillatoria*,and *Scytonema*.

UNIT-III:

Life history of *Chlamydomonas*, *Volvox*,*Oedogonium*, *Chara* and *Vaucheria*; reproductive diversity in algae.

UNIT—IV:

Fungi and their significant characters;thallus organization; modes and mechanism of nutrition; life history of *Saprolegnia*, *Albugo* and *Peziza*.

UNIT—V:

Reproduction in fungi;life history of *Ustilago tritici*.*Agaricus*,*Cercospora* and *Alternaria*.

PRACTICALS

ALGAE: *Volvox*, *Oedogonium*, *Vaucheria*, *Chara*, *Ectocarpus*, *Batrachospermum*, *Oscillatoria*, *Scytonema*.

FUNGI: *Saprolegnia**,*Albugo*, *Peziza*, *Agaricus*, *Ustilago tritici**,*Alternaria*, *Cercospora*

*Only for specimen/ slide demonstration

SUGGESTED READINGS:

1. A Textbook of Botany – Singh, Pandey and Jain
2. Botany-B.P. Pandey
3. A Textbook of Algae – B.R. Vashishtha
4. Introductory Mycology- Alexopoulos and Mims
5. The Fungi-H.C. Dube

B.Sc. -I
BOTANY : PAPER -II
(Bryophytes, Pteridophytes, Gymnosperms and Palaeobotany)

Maximum marks- 50

Duration - 3 hrs.

UNIT -1

General classification of **Bryophytes** as Proposed by ICBN.

Classification of **Pteridophytes** upto the rank of classes as proposed by Reimers(1954).

Classification of **Gymnosperms** upto the rank of classes as proposed by Pant (1957).

UNIT-II (Bryophytes)

Salient features in the life history of *Riccia* , *Marchantia*, *Pellia*, *Anthoceros* and *Sphagnum*(Developmental details not required).

UNIT -III (Pteridophytes)

Salient features in the life history of *Selaginella*, *Equisetum* and *Marsilea*. (Developmental details not required).

UNIT - IV (Gymnosperms)

Salient features in the life history of *Pinus* and *Ephedra*.

UNIT -V (Palaeobotany)

Process of Fossilization, Types of Fossils.

Morphology of *Rhynia*.

PRACTICALS

Bryophytes : *Riccia*, *Marchantia*, *Anthoceros*, *Sphagnum*.

Pteridophytes : *Selaginella*, *Equisetum* , *Marsilea*.

Gymnosperms : *Pinus*, *Ephedra*.

SUGGESTED READINGS:

1. A Textbook of Botany by Singh , Pandey and Jain
2. A Textbook Of Botany Vol. II by Pandey, Mishra and Trivedi
3. An Introduction to Embryophyta Vol. I Bryophyta by N.S. Parihar
4. An Introduction to Embryophyta Vol. II Pteridophytes by N.S. Parihar .
5. Cryptogamic Botany Vol II by G.M. Smith.
6. Gymnosperms by O.P. Sharma .

B.Sc.-I
BOTANY : PAPER-III
Diversity of Angiosperms: Systematics, Development, Reproduction & Economic Importance

Maximum marks- 50

Duration - 3 hrs.

Unit-I

Outline of Bentham & Hooker system of classification. General idea of herbarium techniques.

Unit-II

Distinguishing features of following families:

Nymphaeaceae, Ranunculaceae, Rutaceae, Cucurbitaceae, Asteraceae, Apocynaceae, Acanthaceae, Eupobiaceae, Palmae and Poaceae

Unit-III

Apical meristem and tissue differentiation in shoot. Anatomy of roots, stems and leaves. Abnormal behaviour of cambium and anatomical abnormalities in *Bignonia*, *Achyranthes* and *Dracaena* stems.

Unit-IV

Structure and development of male and female gametophytes-microsporogenesis; male gametophyte, and megasporogenesis; female gametophyte, fertilization, endosperm and embryo- types.

Unit-V

Economic importance of following plants:

Fibres: Cotton, Jute and Coir

Oils: Mustard, Castor and Coconut

Sugar: Sugarcane and Sugarbeet

Medicinal Plants: Rauwolfia and Opium

Beverages: Tea and Coffee

PRACTICALS

1. Taxonomic study of plants belonging to the families listed in theory papers.
2. Preparation of 20 herbarium of wild angiosperms.
3. Anatomical study of plants listed in theory paper.
4. Study of permanent slides of Embryology.
5. Study of economically important plants/plant products listed in theory paper.
6. Study of path of pollen tube.
7. Study of endosperm haustoria in *Cucumis*.
8. Study of anther wall and male gametophyte.

SUGGESTED READINGS:

1. Angiosperm-G.L. Chopra
2. Plant Taxonomy-O.P. Sharma
3. Taxonomy of Angiosperms- A.V.V.S. Sambamurty
4. Economic Botany- A.V.V.S. Sambamurty
5. Embryology of Angiosperms- Bhojwani and Bhatnagar
6. Plant Embryology- H.P. Sharma
7. Plant Anatomy-M.S.Tayal

B.Sc.–II
BOTANY : PAPER-I
PLANT PHYSIOLOGY

M.M :-50

Duration - 3 hrs.

UNIT- I

1. Processes : Permeability, Imbibition , Diffusion , Osmosis , Plasmolysis and Guttation –their importance in plants
2. Water potential : Components and importance in plants
3. Mineral elements : Essential and non-essential elements, macro and micro nutrients, specific role and deficiency symptoms of essential elements
4. Mechanism of mineral uptake

UNIT –II

1. Absorption of water, water absorbing organs of plants , mechanism of water absorption , factors affecting water absorption.
2. Ascent of sap and its mechanism.
3. Transpiration : Types, significance and factors affecting transpiration.
4. Stomatal distribution and mechanism of stomatal movement.

UNIT –III

1. Photosynthesis : Photosynthetic organ & pigments.
2. Mechanism of photosynthesis : light reaction, photophosphorylation, dark reaction C_3 , C_4 and CAM pathways.
3. Limiting factor and factors affecting photosynthesis .
4. Translocation of photoassimilates from source to sink cells

UNIT-IV

1. Photorespiration : Mechanism and significance.
2. Respiration : Fermentation, aerobic and anaerobic respiration.
3. Mechanism of respiration: Glycolysis, Krebs's cycle, electron transport system and oxidative phosphorylation.
4. Respiratory quotient, factors affecting respiration.

UNIT-V

1. Growth and its measurement.
2. Growth hormones : Discovery, physiological effects of auxin and kinetins.
3. Photoperiodism : long day, short day and day neutral plants role in flowering, vernalizations.
4. Plant movements

PRACTICALS

A. FOR DEMONSTRATION:

1. To demonstrate osmosis using – (a) egg membrane (b) Raisins.
2. To demonstrate the phenomenon of end- osmosis and ex-osmosis using potato pieces.
3. To demonstrate the path of conduction of water in plants.
4. To demonstrate that O_2 is given out during photosynthesis.
5. To demonstrate that CO_2 , light and chlorophyll are necessary for photosynthesis.
6. To demonstrate that energy is liberated during aerobic respiration.
7. To demonstrate alcoholic fermentation by Yeast Cells.

B. TO BE PERFORMED

1. To study the phenomenon of imbibitions of water by dry gram / pea seed .
2. To study the phenomenon of plasmolysis and deplasmolysis in peeling of leaves of Rhoeo discolor/ Tradescantia.
3. To compare between cuticular and stomatal transpiration using cobalt chloride paper method.
4. To measure the rate of transpiration by simple photometer.
5. To study the effect of various environmental factors on the rate of transpiration by photometer method.
6. To study the effect of quality and intensity of light on photosynthesis.

SUGGESTED READINGS:

1. Hopkins, W.G. and Hunter P.A. 2008 Introduction to Plant Physiology . John Wiley and Sons.
2. Nelsons, D.L. , Cox, M.M. 2004 Lehninger Principles of Biochemistry, 4th edition, W.H. Freeman and Company, New York ,USA.
3. Salisbury, F.B. and Ross C.W. 1991 Plant Physiology, Wadsworth Publishing Co. Ltd.
4. Taiz, L. and Zeiger, E. 2006 Plant Physiology , 4th edition, Sinauer associates Inc. MA, USA.

B.Sc.-II
BOTANY : PAPER-II
PLANT ECOLOGY

M.M. -50

Duration - 3 hrs.

Unit I:

Ecology : Definition, basic concepts, branches & scope; Climatic factors :light, temperature, wind, precipitation and atmospheric humidity; Topographic factor.

Unit II :

Biotic factors: mutualism , proto cooperation , commensalism , amensalism, parasitism and predation; Edaptic factors: soil component and their effect on vegetation ;Soilgenesis:weathering and pedogenesis (soil profile, residual and transported soil).

Unit III:

Epiphytes and Halophytes ; Plant community: attributes and characteristics (frequency, density, abundance , dominance, IVI and life forms);Ecological secession: types, mechanism, trends and kinds of successions (hydrosere and xerosere).

Unit IV:

Ecosystem : kinds, structure (components, trophic level, food chain, food web and ecological pyramid) and function(energy flow and biogeochemical cycle).

Unit V :

Soil erosion and conservation ;plant indicators (soil moisture and mineral indicator).

PRACTICALS

1. To determine minimum requisite size of a quadrat by "Species-Area Curve" method to study herbaceous community.
2. To determine minimum number of quadrat to study herbaceous community.
3. To study herbaceous community by quadrat method by determine frequency of different species.
4. To study herbaceous community by quadrat method to determine density and abundance of different species.
5. To study life form of given area by physiogramic method.
6. To study morphological and anatomical adaptation of hydrophytes ,xerophytes and epiphytes.
7. To determine relative humidity of different microclimate by psychrometer.
8. To study microclimate variables of different habitat.
9. To collect and identify local xeric and hydrophytic species of your locality.
10. To collect and identify local area species of crop land ecosystem in different seasons.

SUGGESTED READINGS:

1. A Treatise in Plant Ecology – K.N. Bhatia
2. Textbook of Ecology – Ambasth & – Ambasth
3. Ecology & Environment – P.D. Sharma
4. Textbook of Ecology – Subrahmaniyam
5. Ecology & Soil Science – Shukla & Chandel

B. Sc.-II
BOTANY : PAPER-III
CYTOGENETICS

M.M – 50

Duration - 3 hrs.

Unit-I :

1. Cell -cycle, Mitosis, Meiosis and its significance.
2. Mendel and his experiments, Principles of segregation and assortment, Test cross and Back cross

Unit -II:

1. Interaction of genes and modified dihybrid ratios.
2. Linkage and crossing- over.

Unit- III:

1. Structural changes in chromosomes : deletions, duplications, inversions, translocations and their evolutionary significance.
2. Preliminary idea of numerical changes in chromosomes.

Unit- IV:

1. Cytoplasmic inheritance.
2. Mutation : mutation at molecular level , types of mutagens.
3. Elementary knowledge of modern concept of gene, cistron , recon, muton , split gene , overlapping gene , transposons.

Unit -V:

1. Cytology and genetics in human welfare.
2. Measures of central tendency : mean , median and mode .
3. Measures of dispersion :- standard deviation and variance.

PRACTICALS

1. Mitosis
2. Demonstration of meiotic cells and different gene interaction

SUGGESTED READINGS:

1. Genetics by Gardener, Snustad and Simmons
2. Genetics : Classical to Modern by P.K. Gupta
3. Genetics by B.D. Singh
4. Genetics by Kavita Ahloowalia.

B.Sc. – III
BOTANY : PAPER – I
MICROBIOLOGY AND PLANT PATHOLOGY

Maximum marks: 55

Duration: 3 hrs.

UNIT – I: History and scope of microbiology; Ultrastructure of a typical bacterial cell; General characteristics of viruses; Virus vector relationship; Structure and reproduction of TMV and a typical bacteriophage.

UNIT – II: Gram staining technique; Genetic recombination in bacteria; Elementary idea about culture and sterilization; Isolation and pure culturing of microorganisms; Microbial nutrition; Milk-pasteurization; Microbiology of drinking water.

UNIT – III: Plant diseases and disease-cycle (chain of events leading to disease development); Symptoms of plant diseases; Koch's postulates; Epiphytology (epidemiology); Principles of plant disease management.

UNIT – IV : Occurrence, symptoms, disease cycle and control measures of Late blight of potato, White rust of crucifers, Stem gall of coriander, Powdery mildew of pea, Loose smut of wheat, Leaf spot of crucifers; Red rot of sugarcane; Leaf curl of papaya; Little leaf of brinjal and Citrus canker.

UNIT – V : Important landmarks in the history of plant pathology; Terminologies used in plant pathology; Classification of plant diseases; Significance of plant diseases; Viroids, virusoids, prions and phytoplasmas(=MLOs); Introduction to bio-fuel cells.

PRACTICALS

Microbiology—Studying a typical bacterial cell using ethylene blue; Gram-staining of different bacterial species; Microscopic examination of various water samples.

Plant pathology—To calibrate the microscope and measure size of spores of some fungal pathogens; Camera lucida drawing of spores of fungal pathogens; Study of plant diseases mentioned in unit-iv.

SUGGESTED READINGS:

Microbiology by Prescott; Microbiology by Pelczar, Chang and Reid; Microbiology by R.P.Singh; Plant Pathology by G.N.Agrios; Plant Diseases by R.S.Singh; Plant Pathology by R.P.Singh.

B. Sc.-III
BOTANY : PAPER -II
BIOCHEMISTRY AND MOLECULAR BIOLOGY

Maximum marks - 55

Duration - 3hrs.

Unit-I:

Introduction: Relevance of Biochemistry in the study of life processes; **Carbohydrates:** Classification, Structure and function with special reference to glucose, Fructose, Sucrose, Starch and Cellulose. **Proteins:** Structure and properties of Amino Acids; Primary, secondary, tertiary and quaternary structure of proteins; Protein denaturation and Protein folding; Biological significance of proteins; Classification based on solubility, shape and function.

UNIT- II :

Enzymes: Structure, Classification and general properties; Active sites and mechanism of enzyme action, Kinetics of enzyme catalyzed reaction; enzyme inhibition. **Coenzymes:** Introduction, Classification based on function; Mechanism of action with special reference to NAD⁺.

UNIT-III :

Fats: Structure and properties of Triglycerides and fatty acids; Oxidation of triglycerides and saturated fatty acids; Biological significance of fats. **Biological Nitrogen Fixation:** Enzymatic Mechanism of biological nitrogen fixation, Nitrogenase sensitivity to O₂.

UNIT-IV

Nucleic Acids: a) DNA as a genetic material; Chemical composition and structure of DNA; Elementary idea of forms of DNA; Replication of DNA; Biological significance. **b)** RNA as genetic material; Structure of RNA; Types of RNA; Synthesis of RNA (Transcription); TATA box and Pribnow box; RNA Processing and Heterogenous RNA.

UNIT-V

Gene Expression: Genetic code; Translation (Protein Synthesis). **Regulation of Gene Expression:** Operon Model with special reference to 'lac operon' and 'trp operon'.

Knowledge of split genes, Overlapping genes and Transposons

PRACTICALS

1. To separate plant pigments from a green leaf by paper chromatography.
2. To extract amino acids from germinating pea seeds and test their presence by ninhydrin.
3. To test the presence of starch in green leaves by Iodine test.
4. To test the presence of oil drops in germinating castor oil seeds by Sudan.
5. To test the presence of protein in germinating seeds by biuret test.
6. To test the presence of reducing sugars in germinating seeds by Benedict's reagent.
7. To study the activity of the enzyme amylase extracted from the germinating barley seeds.
8. To study the activity of the enzyme catalase extracted from potato or cabbage.
9. Separation, isolation and identification of plant proteins.
10. Separation and isolation of DNA from plant samples.
11. Molecular genetics Practical (Work based on theory course).

SUGGESTED READINGS:

1. Lehninger Principles of Biochemistry- D.L. Nelson and M.M. Cox(2008).
2. Elements of Biochemistry- H.S. Srivastava(2000).
3. Plant Biochemistry- J.B. Harborne(1998).
4. Biochemistry of Molecular Biology of Plants-B.Buchnan, Grissemann and Jones(2010)

B.Sc.-III
BOTANY : PAPER-III
Environmental Biology : (Pollution, Conservation and Forestry)

M.M. -55

Duration - 3 hrs.

Unit I: Environment and its components(atmosphere, hydrosphere lithosphere and biosphere) ; Particulate air pollution : Sources and effect; Gaseous air pollution: (oxides of carbon, sulphur and nitrogen) sources and effect ; Air pollution control devices.

Unit II : Water pollution by sewage ,agricultural runoff and industrial effluents: sources and effect ; Eutrophication ; Water pollution control devices ;Ganga action plan (GAP).

Unit III : Soil pollution: Metals and wastes; Global warming and its consequences; Ozone depletion : causes and effect ; Acid rain and photochemical smog.

Unit IV : Biodiversity : Definition, magnitude, levels, threat, categories of depleted taxa ; Conservation of biodiversity;Hot spots and hottest hot spots.

Unit V : Forest types of India : Characteristics of wet tropical , dry tropical and himalayan temperate forest; Social forestry : Components , objectives and practices in India ; Shifting cultivation and Taungya system of cultivation .

PRACTICALS

1. To perform qualitative test of carbonate and nitrate in given soil sample.
2. To determine pH of soil and water samples.
3. To determine total alkalinity of different water samples
4. To determine salinity of different water samples.
5. To determine DO (dissolved oxygen) of different water samples.
6. To Determine BOD(Biological oxygen demand) of different water samples.
7. To estimate various air pollution using air pollution measuring kit.
8. To determine TDS in water .
9. To determine electrical conductivity in various water samples.
10. To determine total organic carbon content of different soil.

SUGGESTED READINGS:

1. Environmental Pollution – R.S. Ambast
2. Environmental Chemistry – A.K. Dey
3. Environmental Biology – Maury
4. Environmental Pollution – Krishna Kanan
5. Environment– Asthana & Asthana

B.Sc. – III
BOTANY : PAPER – IV
PLANT BIOTECHNOLOGY

Maximum marks – 55

Duration – 3 hrs.

UNIT-I: Historical perspectives; Present status of biotechnology in India; Outline of Genetic engineering: knowledge of cloning vectors; Gene manipulative enzymes (restriction enzymes, DNA ligases).

UNIT-II : Gene transfer strategies in prokaryotes and eukaryotes(higher plants);Recombinant DNA;Complementary(c)DNA;Genome libraries; Screening of recombinants.

UNIT-III: Application of genetic engineering in medicine and pharmaceuticals, agriculture and environmental control; Blotting techniques;PCR;RFLP;RAPDs;Gene sequencing.

UNIT-IV : History of plant cell and tissue culture; Composition and sterilization of a typical culture medium; Somatic embryogenesis; Techniques of tissue culture; Isolation of single cell and its culture techniques; Anther culture and production of haploids; Application of cell and tissue culture; Protoplast isolation, fusion and its application.

UNIT-V: Elementary knowledge about non-conventional energy sources (biogas, fuel alcohol, microbial conservation of solar energy); Cryopreservation; Biofertilizers; Single cell protein; Antibiotics.

PRACTICALS

1. Preparation of nutrient media for shoot multiplication
2. Introduction of callus from various explants of plants
3. Restriction digestion of DNA
4. Ligation of DNA fragments
5. Bacterial antibiotic sensitivity test
6. Biomass cultivation of Cyanobacteria
7. IAA Production by cyanobacteria

SUGGESTED READINGS:

1. Basic Biotechnology- Rattedge and Kristianson
2. Molecular Biotechnology: Principles and Application of Recombinant DNA- Glick & Pasternak
3. Principles of Gene Manipulation- Genomics : Primrose & Twyman
4. Plant Tissue Culture : An Introductory Text- Bhojwani & Dantu
5. Gene Cloning : T.A. Brown.