

Department of Botany

Bachelor of Science

BOTANY

(Three Year Course- Semester System)

Under CBCS

SYLLABUS

Details of Courses

Core Courses –Botany (4 credits of theory & 2 credits of Practical)

C-1 . Biodiversity (Microbes, Algae, Fungi and Archegoniate)

C-2 . Plant Ecology and Taxonomy

C-3 . Plant Anatomy and Embryology

C-4 . Plant Physiology and Metabolism

Discipline Specific Electives-Botany (Any 02, one in Vth & one in VIth Semester 04 credits (theory) & 02 credits (Pract.))

DSE-1 . Economic Botany and Biotechnology

DSE-2 . Cell and Molecular Biology

DSE-3 . Genetics and Plant Breeding

DSE-4 . Analytical Techniques in Plant Sciences

DSE-5 . Bioinformatics

DSE-6 . Research Methodology

DSE-7 . Dissertation

Ability Enhancement Compulsory Courses 02 credits

AEC-1 . Environmental Science

AEC-2 . English/MIL Communication

Skill Enhancement Courses Botany (Any one of the following may be opted in Semester IIIrd, or IV or Vth & one more course may be opted in VIth Semester) 02 credits

SEC-1 . Biofertilizers

SEC-2 . Herbal Technology

SEC-3 . Nursery and Gardening

SEC-4 . Floriculture

SEC-5 . Medicinal Botany

SEC-6 . Plant Diversity and Human Welfare

SEC-7 . Ethnobotany

SEC-8 . Mushroom Culture Technology

SEC-9 . Intellectual Property Right

Total credits (Summary)

Core courses (Th +Pr.) $6 \times 4 = 24 \times 03$ (Three Subjects in BSc) =72

DSE (Th+Pr.) $6 \times 2 = 12 \times 03$ (Three Subjects in BSc) = 36

AEC $2 \times 2 = 04$ (Commen in all the three subjects) =04

SEC $2 \times 4 = 08$ (one courses each from 03 subjects + one course from any of the 03 subjects)=08

Total 120 credits to be earned in B.Sc.

Core Course: Botany I

C-1 Biodiversity (Microbes, Algae, Fungi and Archegoniate)

(Credits: Theory-4, Practicals-2)

THEORY

Lectures: 60

Unit 1:Microbes (10 Lectures)

Viruses – Discovery, general structure, replication (general account), DNA virus (T-phage); Lytic and lysogenic cycle, RNA virus (TMV); Economic importance; Bacteria – Discovery, General characteristics and cell structure; Reproduction – vegetative, asexual and recombination (conjugation, transformation and transduction); Economic importance.

Unit 2:Algae (12 Lectures)

General characteristics; Ecology and distribution; Range of thallus organization and reproduction; Classification of algae; Morphology and life-cycles of the following: *Nostoc*, *Chlamydomonas*, *Volvox*, *Oedogonium*, *Vaucheria*, *Sargassum*, *Diatom* and *Polysiphonia*. Economic importance of algae.

Unit 3:Fungi (12 Lectures)

Introduction- General characteristics, ecology and significance, range of thallus organization, cell wall composition , nutrition, reproduction and classification; True Fungi- General characteristics, ecology and significance, life cycle of *Synchytrium*, *Rhizopus* (Zygomycota) *Alternaria* (Ascomycota), *Puccinia*, *Agaricus* (Basidiomycota) *Colletorichum* (Deuteromycota); Symbiotic Associations-Lichens: General account, reproduction and significance; Mycorrhiza: ectomycorrhiza and endomycorrhiza and their significance.

Unit 4:Introduction to Archegoniate (2 Lectures)

Unifying features of archegoniate, Transition to land habit, Alternation of generations.

Bryophytes (10 Lectures)

General characteristics, adaptations to land habit, Classification, Range of thallus organization. Classification (up to family), morphology, anatomy and reproduction of *Riccia*, *Marchantia*, *Anthoceros* and *Funaria*. (Developmental details not to be included). Ecology and economic importance of bryophytes.

Unit 5:Pteridophytes (8 Lectures)

General characteristics, classification, Early land plants (*Cooksonia* and *Rhynia*). Classification (up to family), morphology, anatomy and reproduction of *Selaginella*, *Equisetum* and *Adiantum*.

(Developmental details not to be included). Heterospory and seed habit, stelar evolution. Ecological and economical importance of Pteridophytes.

Gymnosperms (6 Lectures)

General characteristics, classification. Classification (up to family), morphology, anatomy and reproduction of *Cycas*, *Pinus* and *Ephedra*. (Developmental details not to be included). Ecological and economical importance.

Practical

1. EMs/Models of viruses – T-Phage and TMV, Line drawing/Photograph of Lytic and Lysogenic Cycle.
2. Types of Bacteria from temporary/permanent slides/photographs; EM bacterium; Binary Fission; Conjugation; Structure of root nodule.
3. Gram staining.
4. Study of vegetative and reproductive structures of *Nostoc*, *Chlamydomonas* (electron micrographs), *Oedogonium*, *Vaucheria*, *Fucus** and *Polysiphonia* through temporary preparations and permanent slides. (* *Fucus* - Specimen and permanent slides)
5. *Synchytrium* and *Rhizopus*: Asexual stage from temporary mounts and sexual structures through permanent slides.
6. *Alternaria*: Specimens/photographs and tease mounts.
7. *Puccinia*: Herbarium specimens of Black Stem Rust of Wheat and infected Barberry leaves; section/tease mounts of spores on Wheat and permanent slides of both the hosts.
8. *Agaricus*: Specimens of button stage and full grown mushroom; Sectioning of gills of *Agaricus*.
9. *Colletotrichum*: Specimens/photographs and tease mounts.
10. Lichens: Study of growth forms of lichens (crustose, foliose and fruticose)
11. Mycorrhiza: ecto mycorrhiza and endo mycorrhiza (Photographs).
12. *Riccia*: Morphology of thallus, w.m. rhizoids and scales, v.s./t.s. thallus, (all temporary slides), v.s. antherida, archegonia, l.s. sporophyte (all permanent slides).
13. *Marchantia*- morphology of thallus, w.m. rhizoids and scales, v.s. thallus through

gemma cup, w.m. gemmae (all temporary slides), v.s. antheridiophore, archegoniophore, l.s. sporophyte (all permanent slides).

14. *Antoceros*: Morphology of thallus, w.m. rhizoids and scales, v.s./t.s. thallus, (all temporary slides), v.s. antherida, archegonia, l.s. sporophyte (all permanent slides).

15. *Funaria*- morphology, w.m. leaf, rhizoids, operculum, peristome, annulus, spores (temporary slides); permanent slides showing antheridial and archegonial heads, l.s. capsule and protonema.

16. *Selaginella*- morphology, w.m. leaf with ligule, t.s. stem, w.m. strobilus, w.m. microsporophyll and megasporophyll (temporary slides), l.s. strobilus (permanent slide).

17. *Equisetum*- morphology, t.s. internode, l.s. strobilus, t.s. strobilus, w.m. sporangiophore, w.m. spores (wet and dry)(temporary slides); t.s. rhizome (permanent slide).

18. *Adiantum* - morphology, v.s. pinnule through sori, w.m. spores (temporary slides), t.s. rhizome, w.m. prothallus with sex organs and young sporophyte (permanent slide).

19. *Cycas*- morphology (coralloid roots, bulbil, leaf), t.s. coralloid root, t.s. rachis, v.s. leaflet, v.s. microsporophyll, w.m. spores (temporary slides), l.s. ovule, t.s. root (permanent slide).

20. *Pinus*- morphology (long and dwarf shoots, w.m. dwarf shoot, male and female), w.m. dwarf shoot, t.s. needle, t.s. stem, , l.s./t.s. male cone, w.m. microsporophyll, w.m. microspores (temporary slides), l.s. female cone, t.l.s. & r.l.s. stem (permanent slide).

Suggested Readings

1. Kumar, H.D. (1999). Introductory Phycology. Affiliated East-West. Press Pvt. Ltd. Delhi.

2nd edition.

2. Tortora, G.J., Funke, B.R., Case, C.L. (2010). Microbiology: An Introduction, Pearson Benjamin Cummings, U.S.A. 10th edition.

3. Sethi, I.K. and Walia, S.K. (2011). Text book of Fungi & Their Allies, MacMillan Publishers Pvt. Ltd., Delhi.

4. Alexopoulos, C.J., Mims, C.W., Blackwell, M. (1996). Introductory Mycology, John Wiley and Sons (Asia), Singapore. 4th edition.

5. Raven, P.H., Johnson, G.B., Losos, J.B., Singer, S.R., (2005). Biology. Tata McGraw Hill, Delhi, India.
6. Vashishta, P.C., Sinha, A.K., Kumar, A., (2010). Pteridophyta, S. Chand. Delhi, India.
7. Bhatnagar, S.P. and Moitra, A. (1996). Gymnosperms. New Age International (P) Ltd Publishers, New Delhi, India.
8. Parihar, N.S. (1991). An introduction to Embryophyta. Vol. I. Bryophyta. Central Book Depot, Allahabad.

B.Sc Semester I Practical

Biodiversity (Microbes, Algae, Fungi, and Archigoniate)

The practical examination will covers of study as enumerated in practical of Semester I and will be of three hours duration for B.Sc. I Semester. Following would be the scheme and marks distribution for the practical examination.

Time: 3 Hours MM 70

Q.1. Working out materials, making suitable preparations, drawing diagrams and their description leading to identification of one each Microbes, Algae, Fungi and Archigoniate (Bryophytes, Pteridophytes and Gymnosperms). 40

Q.2. Ten spots for identification and comments. 20

Q.3. Viva Voce 05

Q.4. Sessional Records, submission of specimen, poster/chart/collection of plant species in Herbarium sheets. 05

Semester II

Core Course Botany –II

C-2 Plant Ecology and Taxonomy

(Credits: Theory-4, Practicals-2)

THEORY

Lectures: 60

Unit 1:

Introduction (2 Lectures)

Ecological factors (10 Lectures)

Soil: Origin, formation, composition, soil profile. Water: States of water in the environment, precipitation types. Light and temperature: Variation Optimal and limiting factors; Shelford law of tolerance. Adaptation of hydrophytes and xerophytes.

Plant communities (5 Lectures)

Characters; Ecotone and edge effect; Succession; Processes and types.

Unit 2:

Ecosystem (7 Lectures)

Structure; energy flow trophic organisation; Food chains and food webs, Ecological pyramids production and productivity; Biogeochemical cycling; Cycling of carbon, nitrogen and Phosphorous.

Phytogeography (3 Lectures)

Principle biogeographical zones; Endemism

Unit 3:

Introduction to plant taxonomy (2 Lectures)

Identification, Classification, Nomenclature.

Taxonomic hierarchy (1 Lectures)

Ranks, categories and taxonomic groups

Identification (4 Lectures)

Functions of Herbarium, important herbaria and botanical gardens of the world and India;

Documentation: Flora, Keys: single access and multi-access

Taxonomic evidences from palynology, cytology, phytochemistry and molecular data . (5 Lectures)

Unit 4:

Botanical nomenclature (4 Lectures)

Principles and rules (ICN); ranks and names; binominal system, typification, author citation, valid publication, rejection of names, principle of priority and its limitations.

Classification (4 Lectures)

Types of classification-artificial, natural and phylogenetic. Bentham and Hooker (upto series), Engler and Prantl (upto series).

Biometrics, numerical taxonomy and cladistics (3 Lectures)

Characters; variations; OTUs, character weighting and coding; cluster analysis; phenograms, cladograms (definitions and differences).

Unit 5:

Taxonomy, important distinguishing characters, classification, and economic importance of the following families: (10 Lectures)

Ranunculaceae, Papaveraceae, Caryophyllaceae, Malvaceae, Rutaceae, Fabaceae, Apiaceae, Solanaceae, Apocyanaceae, Asclepidiaceae, Acanthaceae, Lamiaceae, Euphorbiaceae, Orchidaceae, Poaceae.

Practical

1. Study of instruments used to measure microclimatic variables: Soil thermometer, maximum and minimum thermometer, anemometer, psychrometer/hygrometer, rain gauge and lux meter.
2. Determination of pH, and analysis of two soil samples for carbonates, chlorides, nitrates, sulphates, organic matter and base deficiency by rapid field test.
3. Comparison of bulk density, porosity and rate of infiltration of water in soil of three habitats.
4. (a) Study of morphological adaptations of hydrophytes and xerophytes (four each). (b) Study of biotic interactions of the following: Stem parasite (*Cuscuta*), Root parasite (*Orobanche*), Epiphytes, Predation (Insectivorous plants)
5. Determination of minimal quadrat size for the study of herbaceous vegetation in the college campus by species area curve method. (Species to be listed)

6. Quantitative analysis of herbaceous vegetation in the college campus for frequency and comparison with Raunkiaer's frequency distribution law
7. Study of vegetative and floral characters of the following families (Description, V.S. flower, section of ovary, floral diagram/s, floral formula/e and systematic position according to Bentham & Hooker's system of classification): Brassicaceae - Brassica, Alyssum / Iberis; Asteraceae - Sonchus/Launaea, Vernonia/Ageratum, Eclipta/Tridax; Solanaceae - Solanum nigrum, Withania; Lamiaceae - Salvia, Ocimum ; Liliaceae - Asphodelus / Lilium / Allium.
8. Mounting of a properly dried and pressed specimen of any wild plant with herbarium label (to be submitted in the record book).
9. Taxonomic treatment of plant species belonging to families mentioned in the syllabus.
10. Study of taxonomic terminology

Suggested Readings

1. Kormondy, E.J. (1996). Concepts of Ecology. Prentice Hall, U.S.A. 4th edition.
2. Sharma, P.D. (2010) Ecology and Environment. Rastogi Publications, Meerut, India. 8th edition.
3. Simpson, M.G. (2006). Plant Systematics. Elsevier Academic Press, San Diego, CA, U.S.A.
4. Singh, G. (2012). Plant Systematics: Theory and Practice. Oxford & IBH Pvt. Ltd., New Delhi. 3rd edition.

B.Sc Semester II Practical

Plant Ecology and Taxonomy

The practical examination will covers of study as enumerated in practical of Semester II and will

be of three hours duration for B.Sc. II Semester. Following would be the scheme and marks distribution for the practical examination.

Time: 3 Hours MM 70

Q.1. To undertake the ecological experiment/To solve the ecological problem. 20

Q.2. Using semi technical language description of the characteristics features of two plants, giving their floral formulae and floral diagrams and to assign them to any recognized system of classification. 20

Q.3. Ten spots for identification and comments. 20

Q.4. Viva Voce 05

Q.5. Sessional Records, submission of specimen, poster/chart/collection of plant species in Herbarium sheets. 05

Semester III

Core Course Botany –III

C-3 Plant Anatomy and Embryology

(Credits: Theory-4, Practicals-2)

THEORY

Lectures: 60

Unit 1:

Meristematic and permanent tissues (8 Lectures)

Root and shoot apical meristems; Simple and complex tissues.

Unit 2:

Organs (4 Lectures)

Structure of dicot and monocot root stem and leaf.

Secondary Growth (8 Lectures)

Vascular cambium – structure and function, seasonal activity. Secondary growth in root and stem, Wood (heartwood and sapwood).

Unit 3:

Adaptive and protective systems (8 Lectures)

Epidermis, cuticle, stomata; General account of adaptations in xerophytes and hydrophytes.

Unit 4:

Structural organization of flower (8 Lectures)

Structure of anther and pollen, introductory account of palynology, Structure and types of ovules; Types of embryo sacs, organization and ultrastructure of mature embryo sac.

Pollination and fertilization (8 Lectures)

Pollination mechanisms and adaptations; Double fertilization; Seed-structure appendages and dispersal mechanisms.

Unit 5:

Embryo and endosperm (8 Lectures)

Endosperm types, structure and functions; Dicot and monocot embryo; Embryoendosperm relationship.

Apomixis and polyembryony (8 Lectures)

Definition, types and practical applications.

Practical

1. Study of meristems through permanent slides and photographs.
2. Tissues (parenchyma, collenchyma and sclerenchyma); Macerated xylary elements, Phloem (Permanent slides, photographs)
3. Stem: Monocot: Zea mays; Dicot: Helianthus ; Secondary: Helianthus (only Permanent slides).
4. Root: Monocot: Zea mays ; Dicot: Helianthus ; Secondary: Helianthus (only Permanent slides).
5. Leaf: Dicot and Monocot leaf (only Permanent slides).

6. Adaptive anatomy: Xerophyte (Nerium leaf); Hydrophyte (Hydrilla stem).
7. Structure of anther (young and mature), tapetum (amoeboid and secretory)
(Permanent slides).
8. Types of ovules: anatropous, orthotropous, circinotropous, amphitropous/
campylotropous.
9. Female gametophyte: Polygonum (monosporic) type of Embryo sac Development
(Permanent slides/photographs).

10. Ultrastructure of mature egg apparatus cells through electron micrographs.
11. Pollination types and seed dispersal mechanisms (including appendages, aril,
caruncle) (Photographs and specimens).
12. Dissection of embryo/endosperm from developing seeds.
13. Calculation of percentage of germinated pollen in a given medium.

Suggested Readings

1. Bhojwani, S.S. & Bhatnagar, S.P. (2011). Embryology of Angiosperms. Vikas Publication House Pvt. Ltd. New Delhi. 5th edition.
2. Mauseth, J.D. (1988). Plant Anatomy. The Benjamin/Cummings Publisher, USA.

B.Sc. Semester III Practical

Plant Anatomy and Embryology

The practical examination will covers of study as enumerated in practical of Semester III and will be of three hours duration for B.Sc. III Semester. Following would be the scheme and marks distribution for the practical examination.

Time: 3 Hours MM 70

- Q.1. Study of morphology, section cutting and making stained preparation of the material and to comment upon the anatomical features. 20
- Q.2. Dissection and mounting of young embryo/endosperm from developing seeds. 05
- Q.3. Calculation of percentage of germinated pollen in a given medium. 15

Q.4. Ten spots for identification and comments. 20

Q.5. Viva Voce 05

Q.6. Sessional Records, submission of specimen, poster/chart/collection of plant species in Herbarium sheets. 05

Semester IV

Core Course Botany -IV

C-4: Plant Physiology and Metabolism

(Credits: Theory-4, Practicals-2)

THEORY

Lectures: 60

Unit 1:

Plant-water relations (8 Lectures)

Importance of water, water potential and its components; Transpiration and its significance; Factors affecting transpiration; Root pressure and guttation.

Unit 2:

Mineral nutrition (8 Lectures)

Essential elements, macro and micronutrients; Criteria of essentiality of elements; Role of essential elements; Transport of ions across cell membrane, active and passive transport, carriers, channels and pumps.

Translocation in phloem (6 Lectures)

Composition of phloem sap, girdling experiment; Pressure flow model; Phloem loading and unloading.

Unit 3:

Photosynthesis (12 Lectures)

Photosynthetic Pigments (Chl a, b, xanthophylls, carotene); Photosystem I and II, reaction center, antenna molecules; Electron transport and mechanism of ATP synthesis; C₃, C₄ and CAM pathways of carbon fixation; Photorespiration.

Unit 4:

Respiration (6 Lectures)

Glycolysis, anaerobic respiration, TCA cycle; Oxidative phosphorylation, Glyoxylate, Oxidative Pentose Phosphate Pathway.

Unit 5:

Enzymes (4 Lectures)

Structure and properties; Mechanism of enzyme catalysis and enzyme inhibition.

Nitrogen metabolism (4 Lectures)

Biological nitrogen fixation; Nitrate and ammonia assimilation.

Plant growth regulators (6 Lectures).

Discovery and physiological roles of auxins, gibberellins, cytokinins, ABA, ethylene.

Plant response to light and temperature (6 Lectures)

Photoperiodism (SDP, LDP, Day neutral plants); Phytochrome (discovery and structure), red and far red light responses on photomorphogenesis; Vernalization.

Practical

1. Determination of osmotic potential of plant cell sap by plasmolytic method.
 2. To study the effect of two environmental factors (light and wind) on transpiration by excised twig.
 3. Calculation of stomatal index and stomatal frequency of a mesophyte and a xerophyte.
 4. Demonstration of Hill reaction.
 5. Demonstrate the activity of catalase and study the effect of pH and enzyme concentration.
 6. To study the effect of light intensity and bicarbonate concentration on O₂ evolution in photosynthesis.
 7. Comparison of the rate of respiration in any two parts of a plant.
 8. Separation of amino acids by paper chromatography.
- Demonstration experiments (any four)
1. Bolting.
 2. Effect of auxins on rooting.
 3. Suction due to transpiration.
 4. R.Q.
 5. Respiration in roots.

Suggested Readings

1. Taiz, L., Zeiger, E., (2010). Plant Physiology. Sinauer Associates Inc., U.S.A. 5th Edition.
2. Hopkins, W.G., Huner, N.P., (2009). Introduction to Plant Physiology. John Wiley & Sons, U.S.A. 4th Edition.
3. Bajracharya, D., (1999). Experiments in Plant Physiology- A Laboratory Manual. Narosa Publishing House, New Delhi.

B.Sc. Semester IV Practical

Plant physiology and Metabolism

The practical examination will covers of study as enumerated in practical of Semester IV and will be of three hours duration for B.Sc. IV Semester. Following would be the scheme and marks distribution for the practical examination.

Time: 3 Hours MM 70

Q.1. To perform the physiological experiment and interpreting the results. 20

Q.2. Comment upon the physiological set up. 05

Q.3. To undertake micro tests and interpretation of the results. 15

Q.4. Ten spots for identification and comments. 20

Q.5. Viva Voce 05.

Skill Enhancement Course

(Student is required to select any one paper during semester III to V and may choose one paper again in VI semester from the list of following nine papers)

SEC-1 . Biofertilizers

SEC-2 . Herbal Technology

SEC-3 . Nursery and Gardening

SEC-4 . Floriculture

SEC-5 . Medicinal Botany

SEC-6 . Plant Diversity and Human Welfare

SEC-7 . Ethnobotany

SEC-8 . Mushroom Culture Technology

SEC-9 . Intellectual Property Right

SEC-1 Biofertilizers

Lectures: 30

(Credits 2)

Unit 1: (4 Lectures)

General account about the microbes used as biofertilizer – *Rhizobium* – isolation, identification, mass multiplication, carrier based inoculants, Actinorrhizal symbiosis.

Unit 2: (8 Lectures)

Azospirillum: isolation and mass multiplication – carrier based inoculant, associative

effect of different microorganisms. *Azotobacter* : classification, characteristics – crop response to *Azotobacter* inoculum, maintenance and mass multiplication.

Unit 3: (4 Lectures)

Cyanobacteria (blue green algae), *Azolla* and *Anabaena azollae* association, nitrogen fixation, factors affecting growth, blue green algae and *Azolla* in rice cultivation.

Unit 4: (8 Lectures)

Mycorrhizal association, types of mycorrhizal association, taxonomy, occurrence and distribution, phosphorus nutrition, growth and yield – colonization of VAM – isolation and inoculum production of VAM, and its influence on growth and yield of crop plants.

Unit 5: (6 Lectures)

Organic farming – Green manuring and organic fertilizers, Recycling of biodegradable municipal, agricultural and Industrial wastes – biocompost making methods, types and method of vermicomposting – field Application.

Suggested Readings

1. Dubey, R.C., 2005 A Text book of Biotechnology S.Chand & Co, New Delhi.
2. Kumaresan, V. 2005, Biotechnology, Saras Publications, New Delhi.
3. John Jothi Prakash, E. 2004. Outlines of Plant Biotechnology. Emkay _Publication, New Delhi.
4. Sathe, T.V. 2004 Vermiculture and Organic Farming. Daya publishers.
5. Subha Rao, N.S. 2000, Soil Microbiology, Oxford & IBH Publishers, New _Delhi.
6. Vayas,S.C, Vayas, S. and Modi, H.A. 1998 Bio-fertilizers and organic _Farming Akta Prakashan, Nadiad.

SEC-6 Plant Diversity and Human Welfare

Lectures: 30

(Credits 2)

Unit 1: (6 Lectures)

Plant diversity and its scope- Genetic diversity, Species diversity, Plant diversity at the ecosystem level, Agrobiodiversity and cultivated plant taxa, wild taxa. Values and uses of Biodiversity: Ethical and aesthetic values, Precautionary principle, Methodologies for valuation, Uses of plants, Uses of microbes.

Unit 2: (6 Lectures)

Loss of Biodiversity: Loss of genetic diversity, Loss of species diversity, Loss of ecosystem

diversity, Loss of agrobiodiversity, Projected scenario for biodiversity loss, Management of Plant Biodiversity: Organizations associated with biodiversity management-Methodology for execution-IUCN, UNEP, UNESCO, WWF, NBPGR; Biodiversity legislation and conservations, Biodiversity information management and communication.

Unit 3: (6 Lectures)

Conservation of Biodiversity: Conservation of genetic diversity, species diversity and ecosystem diversity, In situ and ex situ conservation, Social approaches to conservation, Biodiversity awareness programmes, Sustainable development.

Unit 4: (6 Lectures)

Role of plants in relation to Human Welfare; (a)

Cereals- Wheat, Rice

Pulses- A general account

Fruits- A general account

Alcoholic beverages.

Unit 5: (6 Lectures)

Role of plants in relation to Human Welfare ; (b)

Importance of forestry its utilization and commercial aspects, Wood, Ornamental plants of India.

Suggested Readings

1. Krishnamurthy, K.V. (2004). An Advanced Text Book of Biodiversity - Principles and Practices. Oxford and IBH Publications Co. Pvt. Ltd. New Delhi.

Discipline Specific Elective Courses

(Student will select one paper in semester V and one paper in semester VI)

DSE-1 . Economic Botany and Biotechnology

DSE-2 . Cell and Molecular Biology

DSE-3 . Genetics and Plant Breeding

DSE-4 . Analytical Techniques in Plant Sciences

DSE-5 . Bioinformatics

DSE-6 . Research Methodology

DSE-7 . Dissertation

DSE-1 Economic Botany and Biotechnology

(Credits: Theory-4, Practicals-2)

THEORY

Lectures: 60

Unit 1: (4 Lectures)

Origin of Cultivated Plants

Concept of centres of origin, their importance with reference to Vavilov's work

Unit 2: (10 Lectures)

Cereals

Wheat and Rice -Origin, morphology, uses

Legumes

General account with special reference to Gram and soybean

Unit 3: (10 Lectures)

Spices

General account with special reference to clove and black pepper (Botanical name, family, part used, morphology and uses)

Beverages

Tea (morphology, processing, uses)

Unit 4: (08 Lectures)

Oils and Fats

General description with special reference to groundnut

Fibre Yielding Plants

General description with special reference to Cotton (Botanical name, family, part used, morphology and uses)

Unit 5: (28 Lectures)

Introduction to biotechnology

Plant tissue culture

Micropropagation ; haploid production through androgenesis and gynogenesis; brief account of embryo & endosperm culture with their applications

Recombinant DNA Techniques

Blotting techniques: Northern, Southern and Western Blotting, DNA Fingerprinting;

Molecular DNA markers i.e. RAPD, RFLP, SNPs; DNA sequencing, PCR and Reverse

Transcriptase-PCR. Hybridoma and monoclonal antibodies, ELISA and Immunodetection.

Molecular diagnosis of human disease, Human gene Therapy.

Practical

1. Study of economically important plants : Wheat, Gram, Soybean, Black pepper, Clove Tea, Cotton, Groundnut through specimens, sections and microchemical tests
2. Familiarization with basic equipments in tissue culture.
3. Study through photographs: Anther culture, somatic embryogenesis, endosperm and embryo culture; micropropagation.
4. Study of molecular techniques: PCR, Blotting techniques, AGE and PAGE.

Suggested Readings

1. Kochhar, S.L. (2011). Economic Botany in the Tropics, MacMillan Publishers India Ltd., New Delhi. 4th edition.
2. Bhojwani, S.S. and Razdan, M.K., (1996). Plant Tissue Culture: Theory and Practice. Elsevier Science Amsterdam. The Netherlands.
3. Glick, B.R., Pasternak, J.J. (2003). Molecular Biotechnology- Principles and Applications of recombinant DNA. ASM Press, Washington.

B.Sc. Semester V Practical

DSW-1 Economic Botany and Biotechnology

The practical examination will covers of study as enumerated in practical of Semester V and will be of three hours duration for B.Sc. V Semester. Following would be the scheme and marks distribution for the practical examination.

Time: 3 Hours MM 70

- Q.1. To study the mixture and comment upon the products of economic importance. 15
- Q.2. Section cutting and micro chemical tests of the product of economic importance. 15
- Q.3. To study and comment upon the given molecular technique. 10
- Q.4. Ten spots for identification and comments. 20
- Q.5. Viva Voce 05
- Q.6. Sessional Records, submission of specimen, poster/chart/collection of plant species in Herbarium sheets.

DSE-3 Genetics and Plant Breeding

(Credits: Theory-4, Practical-2)

THEORY

Lectures: 60

Unit 1: (20 Lectures)

Heredity

1. Brief life history of Mendel
2. Terminologies
3. Laws of Inheritance
4. Modified Mendelian Ratios: 2:1- lethal Genes; 1:2:1- Co- dominance, incomplete dominance; 9:7; 9:4:3; 13:3; 12:3:1.
5. Chi Square
6. Pedigree Analysis
7. Cytoplasmic Inheritance: Shell Coiling in Snail, Kappa particles in Paramecium, leaf variegation in *Mirabilis jalapa*, Male sterility.
8. Multiple allelism
9. Pleiotropism
10. Chromosome theory of Inheritance.

Unit 2: (12 Lectures)

Sex-determination and Sex-linked Inheritance

Linkage and Crossing over

Linkage: concept & history, complete & incomplete linkage, bridges experiment, coupling & repulsion, recombination frequency, linkage maps based on two and three factor crosses.

Crossing over: concept and significance, cytological proof of crossing over.

Unit 3: (4 Lectures)

Mutations and Chromosomal Aberrations Types of mutations, effects of physical & chemical mutagens. Numerical chromosomal

changes: Euploidy, Polyploidy and Aneuploidy ; Structural chromosomal changes:

Deletions, Duplications, Inversions & Translocations.

Unit 4: (16 Lectures)

Plant Breeding

Introduction and objectives. Breeding systems: modes of reproduction in crop plants.

Important achievements and undesirable consequences of plant breeding.

Methods of crop improvement

Introduction: Centres of origin and domestication of crop plants, plant genetic resources;

Acclimatization; Selection methods: For self pollinated, cross pollinated and vegetatively propagated plants; Hybridization: For self, cross and vegetatively propagated plants –

Procedure, advantages and limitations.

Quantitative inheritance

Concept, mechanism, examples. Monogenic vs polygenic Inheritance.

Unit 5: (8 Lectures)

Inbreeding depression and heterosis

History, genetic basis of inbreeding depression and heterosis; Applications.

Crop improvement and breeding

Role of mutations; Polyploidy; Distant hybridization and role of biotechnology in crop improvement.

Practical

1. Mendel's laws through seed ratios. Laboratory exercises in probability and chi-square.
2. Chromosome mapping using point test cross data.
3. Pedigree analysis for dominant and recessive autosomal and sex linked traits.
4. Incomplete dominance and gene interaction through seed ratios (9:7, 9:6:1, 13:3, 15:1, 12:3:1, 9:3:4).
5. Study of aneuploidy: Down's, Klinefelter's and Turner's syndromes through photographs.
6. Photographs/Permanent Slides showing Translocation Ring, Laggard and Inversion Bridge.
7. Hybridization techniques - Emasculation, Bagging (For demonstration only).

8. Induction of polyploidy conditions in plants (For demonstration only).

Suggested Readings

1. Gardner EJ, Simmons MJ, Snustad DP (2008). Principles of Genetics. 8th Ed. Wiley- India.
2. Snustad, D.P. and Simmons, M.J. (2010). Principles of Genetics, John Wiley & Sons Inc., India. 5th edition.
3. Klug WS, Cummings MR, Spencer, C, Palladino, M (2011). Concepts of Genetics, 10th Ed., Benjamin Cummings
4. Griffiths, A.J.F., Wessler, S.R., Carroll, S.B., Doebley, J. (2010). Introduction to Genetic Analysis. W. H. Freeman and Co., U.S.A. 10th edition.
5. Pierce BA (2011) Genetics: A Conceptual Approach, 4th Ed., Macmillan Higher Education Learning
6. Singh, B.D. (2005). Plant Breeding: Principles and Methods. Kalyani Publishers. 7th edition.
7. Chaudhari, H.K. (1984). Elementary Principles of Plant Breeding. Oxford – IBH. 2nd edition.
8. Acquaah, G. (2007). Principles of Plant Genetics & Breeding. Blackwell Publishing.

DSE-3 Genetics and plant Breeding Practical

The practical examination will covers of study as enumerated in practical of Semester VI and will be of three hours duration for B.Sc. VI Semester. Following would be the scheme and marks distribution for the practical examination.

Time: 3 Hours MM 70

Q.1. Two problems based on Genetics(Gene interaction and Chromosome mapping) 20

Q.2. Problem on Plant Breeding (demonstration of hybridization techniques Emasculation,

Bagging, etc.) 10

Q.3. Floral Biology of any local crop, giving objectives for the improvement, floral characters and breeding programme) 10

Q.4. Ten spots for identification and comments. 20

Q.5. Viva Voce 05

Q.6. Sessional Records, submission of specimen, poster/chart/ etc. 05