

# **Revised Syllabus and Structure**

For

B. Sc. (Program) with Botany  
(Approved by Board of Studies in Botany, OU)

Submitted

To

**NIZAM COLLEGE (AUTONOMOUS)**  
**Osmania University, Hyderabad-500001**

Under

Choice Based Credit System (CBCS)  
(From the academic year 2015-2016)

## Details of Courses

### Core Courses –Botany

1. Microbial Diversity (Microbes, Algae, Fungi and Archegoniate)
2. Plant Diversity
3. Plant Anatomy, Embryology, Biodiversity, Pharmacognosy, Phytochemistry
4. Plant Physiology and Metabolism

### Discipline Specific course

5. Cell and Molecular Biology

### Discipline specific electives

6. A) Economic Botany and Biotechnology  
B) Forensic Palynology and Pollen Biotechnology

### Discipline specific Course

7. Genetics and Plant Breeding

### Discipline specific electives

8. A) Analytical Techniques in Plant Sciences  
B) Clinical Palynology

## SYLLABUS PATTERN

| Semester     | Paper                       | Title  | Units | Credits |            |
|--------------|-----------------------------|--|-------|---------|------------|
|              |                             |  |       | Theory  | Practicals |
| Semester-I   | Paper-I                     | Microbial Diversity  | 4     | 4       | 1          |
| Semester-II  | Paper-II                    | Plant diversity  | 4     | 4       | 1          |
| Semester-III | Paper-III                   | Plant Anatomy, Embryology, Biodiversity, Pharmacognosy, Phytochemistry | 4     | 4       | 1          |
| Semester-IV  | Paper-IV                    | Plant physiology and metabolism  | 4     | 4       | 1          |
| Semester-V   | Paper-V                     | Cell and molecular biology   | 3     | 3       | 1          |
|              | Paper-VI-A<br>Elective-I    | Economic Botany and Biotechnology                                      | 3     | 3       | 1          |
|              | Paper-VI-B<br>Elective-II   | Forensic Palynology and Pollen Biotechnology                           | 3     | 3       | 1          |
| Semester-VI  | Paper-VII                   | Genetics and Plant breeding  | 3     | 3       | 1          |
|              | Paper-VIII-A<br>Elective –I | Analytical techniques in Plant sciences                                | 3     | 3       | 1          |
|              | Paper-VIII-B<br>Elective-II | Clinical Palynology  | 3     | 3       | 1          |

## EXAM PATTERN

| Semester     | Paper                       | Title   | Units | Internal | External | Total | Practical |
|--------------|-----------------------------|---|-------|----------|----------|-------|-----------|
| Semester-I   | Paper-I                     | Microbial Diversity   | 4     | 10       | 40       | 50    | 25        |
| Semester-II  | Paper-II                    | Plant diversity   | 4     | 10       | 40       | 50    | 25        |
| Semester-III | Paper-III                   | Plant Anatomy,<br>Embryology, Biodiversity,<br>Pharmacognosy,<br>Phytochemistry | 4     | 10       | 40       | 50    | 25        |
| Semester-IV  | Paper-IV                    | Plant physiology and<br>metabolism  | 4     | 10       | 40       | 50    | 25        |
| Semester-V   | Paper-V                     | Cell and molecular biology  | 3     | 10       | 40       | 50    | 25        |
|              | Paper-VI-A<br>Elective-I    | Economic Botany and<br>Biotechnology  | 3     | 10       | 40       | 50    | 25        |
|              | Paper-VI-B<br>Elective-II   | Forensic Palynology and<br>Pollen Biotechnology                                 | 3     | 10       | 40       | 50    | 25        |
| Semester-VI  | Paper-VII                   | Genetics and Plant breeding   | 3     | 10       | 40       | 50    | 25        |
|              | Paper-VIII-A<br>Elective –I | Analytical techniques in<br>Plant sciences                                      | 3     | 10       | 40       | 50    | 25        |
|              | Paper-VIII-B<br>Elective-II | Clinical Palynology   | 3     | 10       | 40       | 50    | 25        |

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**B.Sc. I Year, Botany CBCS Theory Syllabus**

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**Core Course-Semester I –Paper-I, Lectures-60**

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**Microbial diversity (Viruses, Bacteria, Algae and Fungi )**  
**(Credits: Theory-4, Practicals-1)**

**OBJECTIVES:**

**After going through this course students will be able to**

1. Explain the importance of microbial diversity
2. Describe the distribution and occurrence of microbes
3. Discuss about the classification of microbes
4. Analyze the differences between various microbes
5. Know the economic importance of the microbes in day to day life.

**Unit 1: Viruses:**

**(15 Lectures)**

Origin and evolution of life with reference to microbes-an outline. Viruses – general structure of TMV and bacteriophages, replication and transmission. Purification of plant viral particles. An outline of important plant diseases caused by viruses and their control. Brief account of Archebacteria, Actinomycetes and Mycoplasma.

**Unit 2: Bacteria:**

General characteristics, structure and reproduction – vegetative, asexual and recombination (conjugation, transformation and transduction). An outline of important plant diseases caused by bacteria and its control. Economic importance of bacteria. Cyanobacterial structure life history of Nostoc and Oscillatoria.

**Unit 3: Algae:**

**(15 Lectures)**

General characters, Ecology and distribution, Range of thallus organization and reproduction, Classification of algae, Morphology and life-cycles of the following: *Chlamydomonas*, *Spirulina*, *Oedogonium*, *Vaucheria*, *Fucus*, *Polysiphonia*. Economic importance of algae.

**Unit 4: Fungi:**

**(15 Lectures)**

Introduction- General characteristics, reproduction and classification, True Fungi- General characters, life cycle of *Rhizopus* (Zygomycota), *Alternaria* (Ascomycota), *Agaricus* (Basidiomycota). Mycorrhiza: Ectomycorrhiza and Endomycorrhiza and its significance.

## Practicals

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. *Rhizopus* and *Penicillium*: 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. Lichens: Study of growth forms of lichens (crustose, foliose and fruticose)
10. Mycorrhiza: ecto mycorrhiza and endo mycorrhiza (Photographs)

## Suggested Readings

1. Kumar, H.D. (1999). Introductory Phycology. Affiliated East-West. Press Pvt. Ltd. Delhi. 2<sup>nd</sup> edition.
2. Tortora, G.J., Funke, B.R., Case, C.L. (2010). Microbiology: An Introduction, Pearson Benjamin Cummings, U.S.A. 10<sup>th</sup> 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. 4<sup>th</sup> edition.
5. Raven, P.H., Johnson, G.B., Losos, J.B., Singer, S.R., (2005). Biology. Tata McGraw Hill, Delhi, India.
6. Sharma, P.D (1991). The Fungi. Rastogi & Company, Meerut, India.
7. Vashista, B.R(1996). Fungi. Chand & Company, New Delhi.
8. Mehrotra, R.S.(1998). Plant pathology.

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**Core Course-Semester II –Paper-II, Lectures-60**

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**Plant Diversity**  
**(Bryophytes, Pteridophytes, Gymnosperms, and Angiosperm Taxonomy)**  
**(Credits: Theory-4, Practicals-1)**

**OBJECTIVES:**

**After going through this course students will be able to**

1. Explain the importance of Taxonomy
2. Describe the distribution and occurrence of Bryophytes, Pteridophytes and Gymnosperms.
3. Discuss about the classification of angiosperms
4. Analyze the differences between various plant families
5. Know the economic importance of the Gymnosperms and Angiosperms.

**Unit 1: Bryophytes: (15 Lectures)**

General characteristics, adaptations to land habit, Classification, Range of thallus organization. Classification (up to family), morphology, anatomy and reproduction of *Marchantia*, *Anthoceros* and *Funaria*. (Developmental details not to be included). Evolution of sporophyte in bryophytes. Economic importance of bryophytes with special reference to *Sphagnum*.

**Unit 2: Pteridophytes: (15 Lectures)**

General characteristics, classification (up to family), morphology, anatomy and reproduction of Rhynia, *Lycopodium*, *Equisetum* and *Marsilea*. (Developmental details not to be included). Stellar evolution, heterospory and seed habit in pteridophytes.

**Unit 3: Gymnosperms: (15 Lectures)**

General characteristics, distribution, classification (up to family), morphology, anatomy and reproduction of *Pinus* and *Gnetum*. (Developmental details not to be included). Fossils and importance of fossil Gymnosperms. Geological time scale. Bennettitales-general account. Economic importance of Gymnosperms.

**Unit 4: Angiosperm Taxonomy: (15 Lectures)**

Introduction, Taxonomy and its significance, Opportunities, Basic principles, International Code of Nomenclature (ICN for plants), Binominal system,

Typification, History of classification, Types of classifications –Artificial (Linnaeus system), Natural (Bentham & Hooker system) and Phylogenetic (Engler & Prantl system) and APG system. Herbarium techniques. DNA barcoding. Web resources – BHL, IPNI, Species 2000, Tropicos and The Plant List.

### Practicals

1. **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).
2. **Funaria**- morphology, w.m. leaf, rhizoids, operculum, peristome, annulus, spores (temporary slides); permanent slides showing antheridial and archegonial heads, l.s. capsule and protonema.
3. **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).
4. **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).
5. **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).
6. Quantitative analysis of herbaceous vegetation in the college campus for frequency and comparison with Raunkiaer's frequency distribution law
7. Study of locally available flowering plant families (vegetative & floral characters, l.s. of flower, flower dissection, t.s. of ovary, floral diagram/s, floral formula/e and classification): (a) Capparaceae- *Cleome*, (b) Leguminosae- *Tephrosia*, *Cassia/Senna*, *Acacia*, *Prosopis*. (c) Asteraceae- *Vernonia*, *Tridax*. (d) Asclepiadaceae/Apocynaceae- *Calotropis*, *Catharanthus*. (e) Lamiaceae – *Leucas*, *Ocimum*, *Vitex*. (f) Euphorbiaceae – *Euphorbia*. (g) Cyperaceae – *Cyperus*. (h) Poaceae – *Brachiaria*, *Chloris*, *Cymbopogon*.
8. Herbarium preparation of locally available (wild) plant species (to be submitted along with the record book).
9. Local fieldtrips- National Parks & Wild Life Sanctuaries

## Suggested Readings

1. Parihar, N.S. (1991). An introduction to Embryophyta. Vol. I. Bryophyta. Central Book Depot, Allahabad.
2. Vashishta, P.C., Sinha, A.K., Kumar, A., (2010). Pteridophyta, S. Chand. Delhi, India.
3. Bhatnagar, S.P. and Moitra, A. (1996). Gymnosperms. New Age International (P) Ltd Publishers, New Delhi, India.
4. Simpson, M.G. (2006). *Plant Systematics*. Elsevier Academic Press, San Diego, CA, U.S.A.
6. Lawrence, George H. M. (1967). *Taxonomy of Vascular Plants*. Oxford & IBH co Pvt. Ltd., New Delhi.
7. Naik, V.N. (1995). *Taxonomy of Angiosperms*. Tata McGraw-Hill co Pvt. Ltd., New Delhi.
8. Verma B.K. (2010). *Introduction to Taxonomy of Angiosperms*. Prentice-Hall of India Pvt.Ltd. New Delhi

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**Core Course-Semester III –Paper-III, Lectures-60**

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**Plant Anatomy, Embryology, Biodiversity, Pharmacognosy and phytochemistry**  
**(Credits: Theory-4, Practicals-1)**

**OBJECTIVES:**

**After going through this course students will be able to**

1. Explain the importance of Plant Anatomy
2. Describe the distribution and occurrence of Biodiversity
3. Discuss about the value addition of Biodiversity
4. Know about conservation of biodiversity
5. List out and describe the various pollinators useful for pollination.
6. **List out the** endangered plant species and their importance
7. Describe medicinal importance of various drugs used as medicine.

**Unit 1: Meristematic and permanent tissues: (15 Lectures)**

Root and shoot apical meristems, Simple and complex tissues. **Organs:** Structure of dicot and monocot root stem and leaf. **Secondary Growth:** Vascular cambium – structure and function, seasonal activity. Secondary growth in root and stem. Wood (heartwood and sapwood). Epidermis, cuticle, stomata. General account of adaptations in xerophytes and hydrophytes. **Structural organization of flower:** Structure of anther and pollen, Structure and types of ovules, Types of embryo sacs.

**Unit 2: Pollination and fertilization: (15 Lectures)**

Organization and ultrastructure of mature embryo sac. Pollination mechanisms and adaptations, Double fertilization, Seed-structure appendages and dispersal mechanisms. Endosperm types, structure and functions, Dicot and monocot embryo, Embryo-endosperm relationship. **Apomixis and polyembryony:** Definition, types and practical applications.

**Unit 3: Biodiversity: (15 Lectures)**

Concepts, Convention on Biodiversity-Earth Summit, Types and Levels of Biodiversity, Hotspots of Biodiversity in India, Endemism, Threats and Value of Biodiversity, Conservation- Ex situ and In situ conservation, Red data book, IUCN Red List Categories and Criteria, Threatened & Endangered Plants of India, Role of organizations/programs in the conservation of Biodiversity: BSI, IUCN, UNEP, UNCED, LACONES, NBPGR, NBRI, WWF. Protected Area network in state of Telangana-National Parks, Wildlife sanctuaries & Tiger reserves.

#### Unit 4: Pharmacognosy and phytochemistry:

(15 Lectures)

Introduction and Scope, Systematic position medicinal uses of the following herbs in curing various ailments; Tulsi, Ginger, Fenugreek, Indian Goose berry and Ashoka. Phytochemistry - active principles and methods of their testing - identification and utilization of the medicinal herbs: *Catharanthus roseus* (anticancer), *Centella asiatica* (memory booster), *Gymnema sylvestre* (antidiabetic), *Rauvolfia serpentina* (high blood pressure), *Withania somnifera* (drugs acting on nervous

#### Practicals

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.
14. Village Biodiversity Documentation and study visits to places – Botanical Gardens, National Parks, Wild Life Sanctuaries, Medicinal Plant Gardens and locally available scientific organizations.
15. Detailed morphological and anatomical study of locally available medicinal plants used in traditional medicine.

### **Suggested Readings**

1. Bhojwani, S.S. & Bhatnagar, S.P. (2011). Embryology of Angiosperms. Vikas Publication House Pvt. Ltd. New Delhi. 5<sup>th</sup> edition.
2. Mauseth, J.D. (1988). Plant Anatomy. The Benjamin/Cummings Publisher, USA.
3. Kokate, C. and Gokhale (2008). Pharmacognacy. Nirali Prakashan, New Delhi.
4. Krishnamurthy, KV (2003). Text Book of Biodiversity. Science Publishers.
5. Krishnamurthy, KV (2008). An Advanced Textbook on Biodiversity: Principles and Practice. Oxford and IBH publishing Company PVT. Ltd. New Delhi.

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**Core Course-Semester IV –Paper-IV, Lectures-60**

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**Plant Physiology and Metabolism**  
**(Credits: Theory-4, Practicals-1)**

**Unit 1: Plant-water and mineral relations** **(15 Lectures)**

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

**Unit 2: Translocation in phloem** **(15 Lectures)**

Composition of phloem sap, girdling experiment; Pressure flow model; Phloem loading and unloading. **Photosynthesis:** Photosynthetic Pigments (Chl. a, b, xanthophylls, carotene); Photosystem I and II, reaction center, antenna molecules; Electron transport and mechanism of ATP synthesis; C<sub>3</sub>, C<sub>4</sub> and CAM pathways of carbon fixation; Photorespiration.

**Unit 3: Respiration** **(15 Lectures)**

Glycolysis, anaerobic respiration, TCA cycle; Oxidative phosphorylation, Glyoxylate, Oxidative Pentose Phosphate Pathway. **Enzymes:** Structure and properties; Mechanism of enzyme catalysis and enzyme inhibition.

**Unit 4: Nitrogen metabolism** **(15 Lectures)**

Biological nitrogen fixation; Nitrate and ammonia assimilation.

**Plant growth regulators:** Discovery and physiological roles of auxins, gibberellins, cytokinins, ABA, ethylene. **Plant response to light and temperature:** Photoperiodism (SDP, LDP, Day neutral plants); Phytochrome (discovery and structure), red and far red light responses on photomorphogenesis; Vernalization.

### **Practicals**

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 O<sub>2</sub> 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. 5<sup>th</sup> Edition.
2. Hopkins, W.G., Huner, N.P., (2009). Introduction to Plant Physiology. John Wiley & Sons, U.S.A. 4<sup>th</sup> Edition.
3. Bajracharya, D., (1999). Experiments in Plant Physiology- A Laboratory Manual. Narosa Publishing House, New Delhi.
4. Pandey, SN & Sinha, BK ( 2006). Plant Physiology. Vikas Publishing House. 4<sup>th</sup> edition.

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**Discipline Specific Course-Semester V –Paper-V, Lectures-45**

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**Cell and Molecular Biology**  
**(Credits: Theory-3, Practicals-1)**

**Unit 1: Techniques in Biology** **(15 Lectures)**

Principles of microscopy; Light Microscopy; Phase contrast microscopy; Fluorescence microscopy; Confocal microscopy; Sample Preparation for light microscopy; Electron microscopy (EM)- Scanning EM and Scanning Transmission EM (STEM); Sample Preparation for electron microscopy; X-ray diffraction analysis.

**Unit 2: Cell Organelles** **(15 Lectures)**

Mitochondria: Structure, marker enzymes, composition; Proteins synthesized within mitochondria; mitochondrial DNA. Chloroplast Structure, composition; chloroplast DNA. ER, Golgi body & Lysosomes: Nuclear Envelope- structure of nuclear pore complex; chromatin; molecular organization, DNA packaging in eukaryotes, euchromatin and heterochromatin, nucleolus and ribosome structure (brief).

**Unit 3: Cell membrane and Genetic material** **(15 Lectures)**

The functions of membranes; Models of membrane structure; The fluidity of membranes; Membrane proteins and their functions; Carbohydrates in the membrane; Faces of the membranes; Mitosis and Meiosis; Transcription (Prokaryotes and Eukaryotes). Translation (Prokaryotes and eukaryotes), genetic code. Regulation of gene expression. Prokaryotes: Lac operon and Tryptophan operon ; and in Eukaryotes.

## Practicals

1. To study prokaryotic cells (bacteria), viruses, eukaryotic cells with the help of light and electron micrographs.
2. Study of the photomicrographs of cell organelles
3. To study the structure of plant cell through temporary mounts.
4. To study the structure of animal cells by temporary mounts-squamous epithelial cell and nerve cell.
5. Preparation of temporary mounts of striated muscle fiber
6. To prepare temporary stained preparation of mitochondria from striated muscle cells /cheek epithelial cells using vital stain Janus green.
7. Study of mitosis and meiosis (temporary mounts and permanent slides).
8. Study the effect of temperature, organic solvent on semi permeable membrane.
9. Demonstration of dialysis of starch and simple sugar.
10. Study of plasmolysis and deplasmolysis on *Rhoeo* leaf.
11. Measure the cell size (either length or breadth/diameter) by micrometry.
12. Study the structure of nuclear pore complex by photograph (from Gerald Karp) Study of special chromosomes (polytene & lampbrush) either by slides or photographs.
13. Study DNA packaging by micrographs.
14. Preparation of the karyotype and ideogram from given photograph of somatic metaphase chromosome.

## Suggested Readings

1. Karp, G. 2010. Cell and Molecular Biology: Concepts and Experiments. 6th Edition. John Wiley & Sons. Inc.
2. De Robertis, E.D.P. and De Robertis, E.M.F. 2006. Cell and Molecular Biology. 8th edition. Lippincott Williams and Wilkins, Philadelphia.
3. Cooper, G.M. and Hausman, R.E. 2009. The Cell: A Molecular Approach. 5th edition. ASM Press & Sunderland, Washington, D.C.; Sinauer Associates, MA.
4. Becker, W.M., Kleinsmith, L.J., Hardin. J. and Bertoni, G. P. 2009. The World of the Cell. 7th edition. Pearson Benjamin Cummings Publishing, San Francisco.
5. Arumgam, N (2014). Cell Biology. Saras Publication. Tamilnadu.

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**Discipline Specific Elective-I-Semester-V Paper-VI-A, Lectures-45**

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**Economic Botany and Biotechnology**  
**(Credits: Theory-3, Practicals-1)**

**Unit 1: Origin of Cultivated Plants** **(15 Lectures)**

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

**Legumes:** General account with special reference to Gram and soybean. **Cereals:** Wheat -Origin, morphology, uses. **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 2: Oils and fibers** **(15 Lectures)**

**Oils and Fats:** General description with special reference to groundnut.

**Fiber Yielding Plants:** General description with special reference to Cotton (Botanical name, family, part used, morphology and uses). Micropropagation; haploid production through androgenesis and gynogenesis; brief account of embryo & endosperm culture with their applications

**Unit 3: Recombinant DNA Techniques** **(15 Lectures)**

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.



## **Practicals**

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. 4<sup>th</sup> 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.
4. Sambamurthy, AVSS & Subrahmanyam, NS (2000). Economic Botany of Crop Plants. Asiatech Publishers. New Delhi.

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**Discipline Specific Elective-II-Semester-V Paper-VI-B, Lectures-45**

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**Forensic Palynology and Pollen Biotechnology**  
**(Credits: Theory-3, Practicals-1)**

**Unit-I-Forensic Palynology** **(15 Lectures)**

Palynology: Definition, scope and importance, Pollen productivity, Pollen dispersal, Pollen morphology: Pollen units, Polarity, Symmetry, Shape, Size, Apertural patterns, and Sporoderm (Exine) stratification, NPC system of apertural classification.

Methodology in forensic study: potential pollen/spore forensic sample collections, Laboratory techniques in forensic Palynology, Forensic Palynology as an aid to Criminology case studies/evidences from sediments, cloths, hair and illegal drugs.

**Unit – II-Pollen Biotechnology** **(15 Lectures)**

Pollen viability, pollen preservation and controlling factors, Various factors involved in Invitro germination of pollen grains, Pollen banks and their role in agriculture and plant breeding, Pollen-expressed and pollen specific genes.

**Unit-III-Pollen Biotechnology** **(15 Lectures)**

Induction of haploids from pollen grains: developmental pathways of embryogenesis, and importance of haploids, Use of cytoplasmic male sterility (CMS) and Genic male sterility (GMS), Use of pollen sterility induced through recombinant DNA (r-DNA) technology, Use of pollen for genetic transformation.

**Practicals:**

1. Recovery of pollen from clay or mud samples.
2. Recovery of pollen from clothes, honey samples and spider webs.
3. Identification of some geographically important pollen and spores.
4. Pollen viability test by using Acetocarmine and Evans blue.
5. In-vitro germination of pollen grains.
6. Study of pollen tube on stigmatic surface.
7. Acetolysis technique

## References:

1. Faegri and Iversen 1989. Text book of pollen analysis. John wiley and sons. New York.
2. Mildenhall DC. 1992. Forensic socus 11: 1-4
3. Bryant VM. 1989. Pollen: natures fingerprints.
4. Erdtman G. 1969. Handbook of Palynology hafner publishing Co., New yark.
5. Havinga AJ. 1984. Pollen et spores, 26:541-558.
6. Stanley EA. 1991. Forensic aspects of trace evidence.
7. Maheshwari P. 1950. An introduction to the embryology of Angiosperms.
8. Bojwani and Bhatnagar. 1995. The embryology of Angiosperms.

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**B.Sc. III Year, Botany CBCS Theory Syllabus**

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**Discipline Specific Course--Semester-VI Paper-VI-, Lectures-45**

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**Genetics and Plant Breeding**  
**(Credits: Theory-3, Practicals-1)**

**Unit 1: Heredity**

**(15 Lectures)**

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: Linkage and Crossing over**

**(15 Lectures)**

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. Types of mutations, effects of physical & chemical mutagens. Numerical chromosomal changes: Euploidy, Polyploidy and Aneuploidy ; Structural chromosomal changes: Deletions, Duplications, Inversions & Translocations.

**Unit 3: Plant Breeding**

**(15 lectures)**

Introduction and objectives. Breeding systems: modes of reproduction in crop plants. Important achievements and undesirable consequences of plant breeding. 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.

## Practicals

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, Laggards 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. 5<sup>th</sup> 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. 10<sup>th</sup> 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. 7<sup>th</sup> edition.
7. Chaudhari, H.K. (1984). Elementary Principles of Plant Breeding. Oxford – IBH. 2<sup>nd</sup> edition.
8. Acquaah, G. (2007). Principles of Plant Genetics & Breeding. Blackwell Publishing.

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**Discipline Specific Electives-I--Semester-VI Paper-VIII-A-, Lectures-45**

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**Analytical Techniques in Plant Sciences**  
**(Credits: Theory-3, Practicals-1)**

**Unit 1: Imaging and related techniques** **(15 Lectures)**

Principles of microscopy; Light microscopy; Fluorescence microscopy; Confocal microscopy; Use of fluorochromes: (a) Flow cytometry (FACS); (b) Applications of fluorescence microscopy: Chromosome banding, FISH, chromosome painting; Transmission and Scanning electron microscopy – sample preparation for electron microscopy, cryofixation, negative staining, shadow casting, freeze fracture, freeze etching.

**Unit 2: Cell fractionation** **(15 Lectures)**

**Spectrophotometry:** Principle and its application in biological research.  
**Chromatography:** Principle; Paper chromatography; Column chromatography, TLC, GLC, HPLC, Ion-exchange chromatography; Molecular sieve chromatography; Affinity chromatography. Mass spectrometry; X-ray diffraction; X-ray crystallography; Characterization of proteins and nucleic acids; Electrophoresis: AGE, PAGE, SDS-PAGE.

**Unit 3: Biostatistics** **(15 Lectures)**

Statistics, data, population, samples, parameters; Representation of Data: Tabular, Graphical; Measures of central tendency: Arithmetic mean, mode, median; Measures of dispersion: Range, mean deviation, variation, standard deviation; Chi-square test for goodness of fit.

## **Practicals or Project work (Optional)**

### **Practicals**

1. Study of Blotting techniques: Southern, Northern and Western, DNA fingerprinting, DNA sequencing, PCR through photographs.
2. Biostatistical practice
3. To separate nitrogenous bases by paper chromatography.
4. To separate sugars by thin layer chromatography.
5. Isolation of chloroplasts by differential centrifugation.
6. To separate chloroplast pigments by column chromatography.
7. To estimate protein concentration through Lowry's methods.
8. To separate proteins using PAGE.
9. To separate DNA (marker) using AGE.
10. Study of different microscopic techniques using photographs/micrographs (freeze fracture, freeze etching, negative staining, positive staining, fluorescence and FISH).
11. Preparation of permanent slides (double staining).

### **Suggested Readings**

1. Plummer, D.T. (1996). An Introduction to Practical Biochemistry. Tata McGraw-Hill Publishing Co. Ltd. New Delhi. 3<sup>rd</sup> edition.
2. Ruzin, S.E. (1999). Plant Microtechnique and Microscopy, Oxford University Press, New York. U.S.A.
3. Ausubel, F., Brent, R., Kingston, R. E., Moore, D.D., Seidman, J.G., Smith, J.A., Struhl, K. (1995). Short Protocols in Molecular Biology. John Wiley & Sons. 3<sup>rd</sup> edition.
4. Zar, J.H. (2012). Biostatistical Analysis. Pearson Publication. U.S.A. 4<sup>th</sup> edition.

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**Discipline Specific Electives-II--Semester-VI Paper-VIII-B-, Lectures-45**

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**Clinical Palynology**  
**(Credits: Theory-3, Practicals-1)**

**Unit-I-Pollen/spore sampling** **(15 Lectures)**

Sampling methods for airborne pollen and spores-Gravity sedimentation methods and Inertial methods, Some common samplers conventionally used for trapping pollen and spores-Rotorod sampler, Burkard volumetric sampler, Anderson sampler, Tilak air sampler, Lakhanpal and Nair sampler. Pollen calendars of Hyderabad and Secunderabad.

**Unit-II-Pollen/spore Allergy symptoms** **(15 Lectures)**

Pollen expressed proteins that act as human allergens, Symptoms of pollen allergy in human beings: Pollenosis, Rhinitis, Asthma, Conjunctivitis.  
Mould spores provoking allergy- Systemic mycosis, Aspergilosis, Blastomycosis, Candidiasis, Cryptococcosis, Zygomycosis/Mucomycosis.

**Unit-III-Diagnosis and Treatment** **(15 Lectures)**

Immune system and basic structure of immunoglobulins, Types of allergic (hypersensitivity) reactions, Mechanism of allergic reactions, Diagnosis of pollen or spore allergy: Prick test, Intracutaneous test, Radio Immune Assay (RIA), ELISA, RAST, PRIST, ECP-Immunoassay, Treatment of pollen allergy



### **Practicals/Project work (Optional)**

1. Study of Aeroscopes Rotorod, Lakhanpal & Nair and Tilak's air sampler
2. Qualitative and quantitative study of airborne pollen
3. Prick test for confirmation of pollen allergy
4. Study of Pollen calendar of Hyderabad
5. Morphological study of some important allergenic pollen grains
6. Morphological study of some important allergenic spores
7. Study of Phenogram of some herbaceous allergenic plants

### **References:**

1. S.T.Tilak. 1989 Air borne pollen and fungal spores. Vaijayanti Prakasam, Aurangabad.
2. S.T.Tilak 1987 Air monitoring. Vaijayanti Prakasam, Aurangabad.
3. S.T.Tilak. 1982 Aerobiology. Vaijayanti Prakasam, Aurangabad.
4. Hjemoors M. 1992. Aerobiologia. 8: 231-236.
5. Gell PGH 1963. Clinical aspects of immunology. 1963. Oxford.
6. Shripad N. Agashe, 2006. Palynology and its applications
7. Kashinath Bhattacharya, 2006., A Text book of palynology

**The End**

**Nizam College (Autonomous)**  
**Model Question Paper for Semester Exams**  
**Faculty of Science (B.Sc)**  
**Semester I- IV**

**Time: 2 Hours**

**Marks: 40**

**Section – A--- (4 x 3 = 12)**  
**Short Answer Questions**

1. UNIT –I
2. UNIT –II
3. UNIT –III
4. UNIT –IV

**Section – B----- (4 x 7 = 28)**  
**(Essay Questions)**

5. (a) UNIT –I  
OR  
5 (b)
6. (a) UNIT –II  
OR  
6 (b)
7. (a) UNIT –III  
OR  
7 (b)
8. (a) UNIT –IV  
OR  
8 (b)

**Nizam College (Autonomous)**  
**Model Question Paper for Semester Exams**  
**Faculty of Science (B.Sc)**  
**Semester V-VI**

**Time: 2 Hours**

**Marks: 40**

**Section – A--- (4 x 3 = 12)**  
**Short Answer Questions**

1. UNIT –I
2. UNIT –II
3. UNIT –III
4. UNIT –IV OR Questions from Unit – I to Unit III

**Section – B-----(4 x 7 = 28)**  
**(Essay Questions)**

5. (a) UNIT –I  
OR  
5 (b)
6. (a) UNIT –II  
OR  
6 (b)
7. (a) UNIT –III  
OR  
7 (b)
8. (a) UNIT –IV OR Questions from Unit – I to Unit III  
OR  
8 (b)

**Nizam College (Autonomous)**  
**Model Question Paper for Internal Exams**  
**(BA/B.Com/B.Sc)**

**Time: 30 Min**

**Marks: 10**

**I. Fill in the blanks ( 5X ½ = 2 ½ )**

- 1.
- 2.
- 3.
- 4.
- 5.

**II. Multiple Choice Questions ( 5X ½ = 2 ½ )**

- 1.
- 2.
- 3.
- 4.
- 5.

**III. Short Answer Questions ( 5 X 1 = 5)**

- 1.
- 2.
- 3.
- 4.
- 5.

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