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**GONDWANA UNIVERSITYGADCHIROLISYLLABUS**

**For**

**B. Sc.**

**BOTANY**

**SEMESTER III & IV**

**Under**

**Choice Based Credit System**

**(CBCS)**

(With effect from: 2018-19)

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**SEMESTER – III:**

<b>Papers</b>	<b>Title of the Paper</b>	<b>Th/Pr</b>	<b>Internal Assessment</b>	<b>Total Marks</b>
Paper – I	Reproductive Biology of Angiosperms, Plant Growth and Development	50 Marks	10 Marks	60 Marks
Paper – II	Plant Biochemistry and Physiology	50 Marks	10 Marks	60 Marks
Practical – I	Based on Theory Paper –I & II of Semester – III	30 Marks	--	30 Marks
<b>Internal Assessment:</b> Based on Assignment, Seminar, Unit Test & overall attendance and performance of the student				

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## B.Sc. SEMESTER – III

### Paper – I

(48 Periods)

## Reproductive Biology of Angiosperms, Plant Growth and Development

### UNIT – I: (12 Periods)

1. Structure of Stamen, Microsporogenesis and Male gametophyte.
2. Structure of Pistil, Megasporogenesis and Female gametophyte (*Polygonum* type).
3. Types of Embryo sac (Mono, bi and tetrasporic).
4. Structure and types of Ovules.
5. Pollination: Types, Contrivances of self and cross pollinations, Attractions and Rewards.

### UNIT – II: (12 Periods)

1. **Double fertilization and Triple fusion**
2. **Seed:**Endosperm and its types, Embryo and its types, Development of Dicot embryo (Onagrad type).
3. **Significance of seed:** Ecological adaptations  
Seed dormancy: Suspended animation, causes and role of dormancy, methods to break seed dormancy.  
Seed dispersal strategies.

### UNIT – III (12 Periods)

1. **Growth and Development:**Definition, phases of growth and development.
2. **Plant Growth Regulators:** Introduction and Role of Auxin, Cytokinin, Gibberelin, Abscisic acid and Ethylene
3. **Plant Movements:** Tropic and Nastic Movements.

### UNIT – IV: (12 Periods)

1. **Photoperiodism:** Concept, Short-day plants, Long-day plants, Day-neutral plants.
2. **Physiology of flowering:** Concept of florigen, Vernalization.
3. **Phytochromes:** Pr and Pfr forms, Circadian rhythm (Biological clock) Process and significance.
4. **Senescence and Abscission:** Definition and general account.

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**B.Sc. SEMESTER – III**  
**Paper – II**  
**(48 Periods)**  
**Plant Biochemistry and Physiology**

**UNIT – I:** **(12 Periods)**

1. Carbohydrates: Definition, properties and role, Aldoses and Ketoses; Structure of monosaccharides (glucose), disaccharides (sucrose), polysaccharides (cellulose and starch).
2. Lipid: Definition, properties and role; structure and uses of fatty acids, oils and waxes, phospholipids, sphingolipids, sterols.
3. Proteins: Structure and classification of amino acids, peptide bond and primary structure of protein.

**UNIT – II:** **(12 Periods)**

1. **Basics of Enzymology:** Nomenclature (IUB system), Characteristics and properties of enzymes, Holoenzyme, Apo-enzyme, Co-enzyme and Co-factors, Regulation of Enzyme Activity (Enzyme-Substrate Complex Theory), Mechanism of Action (Lock and Key Model, Induced Fit Model).
2. Nitrogen Metabolism: Sources of Nitrogen to plants, Biological Nitrogen Fixation (Mechanism of Root Nodule formation), Importance of Nitrate Reductase.
3. Mineral Nutrition: Role and deficiency symptoms of macro (N, P, K, S, Ca, Mg) and micro (Cu, Fe, Zn, Mn, Mo) –nutrients.

**UNIT – III:** **(12 Periods)**

1. **Plant Water Relations:** Properties of water, diffusion, osmosis and plasmolysis, water potential.
2. **Ascent of sap:** Water conduction through xylem, Root pressure theory, Cohesion-Adhesion theory.
3. **Transpiration:** Definition, types, Stomatal opening and closing mechanisms(K and malate theory), significance, guttation.
4. **Phloem transport:** Bulk flow theory (Munch hypothesis).
5. Theories of absorption of solute in plants:Active absorption (Carrier concept), Passive absorption (Ion exchange theory and Donnan Equilibrium theory).

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**UNIT – IV:**

**(12 Periods)**

- 1. Photosynthesis:** Photosynthetic pigments, Action spectra, Red drop and Emerson enhancement effect, Cyclic and Non-cyclic photophosphorylation, C<sub>3</sub>, C<sub>4</sub> and CAM pathway, factors affecting photosynthesis.
- 2. Respiration:** Structure of ATP, aerobic and anaerobic respiration, respiratory substrates and respiratory quotient (R. Q.), glycolysis, citric acid cycle, ETS, oxidative phosphorylation, factors affecting respiration.

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## **B.Sc. Botany Practicals**

### **SEMESTER – III**

#### **Laboratory Exercises:**

Make use of the permanent micro-preparation, temporary mounts, transparencies, photographs, charts, preserved or fresh specimens etc.

#### **Reproductive Biology of Angiosperms: (Any three)**

1. To study Structure of anther, microsporogenesis and pollen grain.
2. To calculate pollen germination percentage in the given specimen e.g. *Catharanthus roseus*, *Datura stramonium*.
3. To study structure and types of ovule and embryo-sac.
4. To study dicot (non-endospermic) and monocot (endospermic) seeds.
5. To study floral adaptations for different types of pollinations based on pollinating agents (*Vallisneria*, *Calotropis*, *Salvia*, *Kigelia*, *Agave*, *Lantana*, *Butea*, *Bombax*)

#### **Plant Growth and Development: (Any three)**

1. To demonstrate seed viability test by T.T.C. (Triphenyl-Tetrazolium-chloride).
2. To demonstrate the phenomenon of nastic movement in *Mimosa pudica*/*Biophytum sensitivum* plants.
3. To demonstrate the measurement of growth of germinating pea seeds.
4. To demonstrate the phenomenon of gravitropism (geotropism), phototropism and hydrotropism.
5. To demonstrate effect of auxin, cytokinin, GA, ABA and ethylene using appropriate plant materials.
6. To study the various methods of breaking seed dormancy.

#### **Plant Biochemistry Experiments: (Any three).**

1. To study the enzyme activity of *Catalase* in suitable plant material as influenced by temperature.
2. To study the enzyme activity of *Peroxidase* in suitable plant material as influenced by temperature.
3. To study activity of Enzyme *Amylase* from germination Barley/ Wheat grains.

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4. Colorimetric/ Spectrophotometric estimation of sugars and starch (Carbohydrates in suitable plant materials).
  5. To prepare the standard curve of protein and determine the protein content in plant samples.

**Plant Physiology Experiments: (Any Six).**

1. To demonstrate the phenomenon of dispersion.
2. To demonstrate the phenomenon of adsorption.
3. To demonstrate the phenomenon of imbibitions.
4. To demonstrate the root pressure.
5. To demonstrate that the amount of water absorbed and the amount of water transpired is approximately equal.
6. To study the permeability of plasma membrane using different concentration of organic solvents.
7. To determine the osmotic potential of vacuolar sap by plasmolytic method.
8. To compare the rate of transpiration from two surfaces of a leaf – By bell jar method.
9. To compare the rate of transpiration from two surfaces of a leaf – Cobalt chloride method.
10. To determine the path of water (ascent of sap).
11. To separate amino acids from plant material by paper chromatography and their identification by comparison with standards.
12. To demonstrate that the light is necessary for photosynthesis (Ganong's light screen).
13. To demonstrate that the light, chlorophyll and CO<sub>2</sub> is necessary for photosynthesis (By Moll's half leaf experiment).
14. To demonstrate fermentation by Kuhne's tube.
15. To demonstrate aerobic respiration.
16. To demonstrate the evolution of CO<sub>2</sub> in respiration.
17. To demonstrate the part of energy is released in the form of heat during respiration.
18. To separate chloroplast pigments by solvent method and preparation of their absorption spectra.
19. To separate chloroplast pigments by paper chromatography.
20. To measure rate of photosynthesis by Wilmott's bubbler/Simple bubbler under variable conditions of light, temperature and CO<sub>2</sub> concentrations.
21. To determine RQ of different respiratory substrates.

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**B.Sc. BOTANY  
SEMESTER – III  
PRACTICAL**

Based on Theory Paper - I & II of Semester – III

**[Time 5 Hours]**

**[Max. Marks – 30]**

- Que. 1: One experiment [A] from **Reproductive Biology of Angiosperms** **05 Marks**
- Que. 2: One experiment [B] from **Plant Growth and Development** **05 Marks**
- Que. 3: One experiment [C] from **Plant Biochemistry** **05 Marks**
- Que. 4: One experiment [D] from **Plant Physiology** **05 Marks**
- Que. 5: Identify and comment on given spots: **04 Marks**

**SPOT-E: (Reproductive Biology of Angiosperms)**

**SPOT-F: (Plant Growth and Development)**

**SPOT-G: (Plant Biochemistry)**

**SPOT-H: (Plant Physiology)**

- Que. 6: Practical Record (2 Marks) Excursion Report (2 Marks) Viva-voce (2 Marks) **06 Marks**

**NOTE:** Well labeled diagrams are expected wherever necessary.



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**SEMESTER – IV:**

<b>Papers</b>	<b>Title of the Paper</b>	<b>Th/Pr</b>	<b>Internal Assessment</b>	<b>Total Marks</b>
Paper – I	Cell Biology, Genetics and Biotechnolgy	50 Marks	10 Marks	60 Marks
Paper – II	Plant Ecology	50 Marks	10 Marks	60 Marks
Practical – III	Based on Theory Paper –I & II of Semester – III	30 Marks	--	30 Marks
<b>Internal Assessment:</b> Based on Assignment, Seminar, Unit Test & overall attendance and performance of the student				

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**B.Sc. SEMESTER – IV**  
**Paper – I**  
**Cell Biology, Genetics and Biotechnology**  
**(48 Periods)**

**UNIT – I:** **(12 Periods)**

- 1. Ultrastructure and function of typical plant cell:**  
Cell wall, Plasma Membrane; General structure of Nucleus, Mitochondria, Plastids, Endoplasmic Reticulum, Golgi Complex, Vacuole, Lysosome, Peroxisome, Glyoxisome.
- 2. Cell Division:** Mitosis, Meiosis with respect to plant cells.
- 3. DNA:** Structure and replication of DNA.
- 4. Plant Tissue culture:** Concept of totipotency, Steps of plant tissue culture from explant to whole plant regeneration.

**UNIT – II:** **(12 Periods)**

- 1. Mendelism:** Laws of inheritance (Dominance, Segregation and Independent Assortment), back cross and test cross.
- 2. Interaction of genes:** with reference to plants.  
a) Allelic interaction - Incomplete Dominance (1:2:1) b) Non-allelic interaction Complementary genes (9:7), Supplementary genes (9:3:4).
- 3. Extra nuclear genome:** Structure and functions of Mitochondrial and Plastid DNA.

**UNIT – III:** **(12 Periods)**

- 1. Linkage:** Definition, Gene theory of Morgan, types of linkage- Complete and Incomplete, significance.
- 2. Crossing over:** Definition, theories (Breakage and Reunion, Copy Choice), significance.
- 3. Variation in Chromosome number:** Polyploidy (Auto- and Allo-), Aneuploidy (Nullisomy, Monosomy, Trisomy and Tetrasomy), Significance.
- 4. Structural changes in chromosome:** Deletion and Deficiency, Duplication, Inversion and Translocation.

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5. **Mutation:** Definition, Types-Spontaneous and Induced; Substitution and Frame-shift, Mutagens-Physical and Chemical, application of Induced Mutation in Crop Improvement.

#### UNIT – IV

(12 Periods)

1. **Genetic Engineering:** Tools and techniques of Recombinant DNA technology (RDT)-
  - a) Cloning vectors (Plasmids – PBR 322, Bacteriophages-T4 phage, lambda Phage and *Agrobacterium*)
  - b) Restriction enzymes and Ligases
  - c) Genomic and complementary DNA (c-DNA) libraries
2. **Protein synthesis-transcription and translation**
3. **Jumping genes (Transposons):** Ac/Ds elements in Maize.
4. **Regulation of gene action in Prokaryotes:** Lac-Operon concept.

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**SEMESTER – IV**  
**Paper – II**  
**Plant Ecology**  
**(48 Periods)**

**UNIT – I:** **(12 Periods)**

1. **Ecology:** Plant and Environment, branches of ecology and significance.
2. **Climatic Factors:** Atmosphere, Light, Temperature.
3. **Edaphic Factors:** Pedogenesis (process), Soil profile and properties (Physical and Chemical).
4. **Biotic Factors:** Interactions between plants and animals, interaction between plants growing in a community, interactions between plants and soil microorganisms.

**UNIT – II:** **(12 Periods)**

1. **Ecosystem:** Structure, Biotic and Abiotic components, Food chains, Food web, Ecological pyramid.
2. **Biogeochemical Cycles:** Water, Carbon, Nitrogen.
3. **Environmental Pollution:** Air, Water and its control.

**UNIT – III:** **(12 Periods)**

1. **Autecology:** Definition, parameters and importance, growth curve, interaction among population, ecad, ecotype- characteristics and importance.
2. **Synecology:** Life forms, Community dynamics, study of community (analytical and synthetic characters).

**UNIT – IV:** **(12 Periods)**

1. **Plant Succession:** Definition, causes of succession, Climax concept; Hydrosere, Xerosere.

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2. **Phytogeography:** Botanical zones or Phytogeographic regions of India (Name, distribution area, typical vegetation). Concept of continental drift
  3. Phytogeographical studies of Chandrapur and Gadchiroli districts.
  4. Western Himalaya, Eastern Himalaya, Indus plane, Gangatic plane, Central India, Western coast, Deccan, Assam.

### **Botany Practicals**

#### **SEMESTER – IV**

#### **Laboratory Exercises:**

Make use of the permanent micro-preparation, temporary mounts, transparencies, photographs, charts etc.

Cell Biology, Genetics and Biotechnology Experiments: (Any five)

1. Examination of various stages of mitosis and meiosis using appropriate plant material(i.e. Onion root tips and flower buds respectively).
2. Study of cytoplasmic organelles.
3. Working out of Laws of inheritance using dry seeds / plastic beads by applying Chisquare( $\chi^2$ ) test.
4. To get acquainted with the Laboratory organization.
5. To get acquainted with tools of genetic engineering, laboratory equipments, apparatus and instruments in biotechnology laboratory.
6. To study the different methods of sterilization.
7. Media preparation required for culture.
8. To study the structure of following vectors on the basis of photographs and diagrams: Plasmid, Bacteriophage and *Agrobacterium*.
9. To demonstrate the technique of micropropagation by using different explants e.g., axillary bud and shoot meristem.
10. To demonstrate the technique of anther culture.
11. To isolate protoplast from different tissues using commercially available enzymes.

**(NOTE:1.** Frequent Industrial/ Laboratory visits are necessary. **2.** Submit Industrial/ Laboratory visit report duly signed by HOD).

**Ecology Experiments : (Note: Any Ten experiments; Experiment No. 01 is compulsory)**

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1. To study the ecological characters (morphological and anatomical) of the following plant (Use permanent micro-preparations /transparencies/specimens/natural habitats for the study).

**Hydrophytes:** *Hydrilla, Vallisneria, Nymphaea, Potamogeton, Eichhornia, and Trapa*(Any four).

**Xerophytes:** *Acacia auriculiformis, Parkinsonia, Muehlenbeckia, Ruscus, Asparagus, Kalanchoe, Euphorbia nerifolia, Opuntia, Nerium, Casuarina* (Any four).

**Halophyte :***Rhizophora*

**Epiphyte :***Orchid (Vanda)*

**Parasite :***Cuscuta*

2. To determining the minimum size and number of quadrats required for reliable estimate of biomass in vegetation.
3. To study the frequency of herbaceous species in grassland and to compare the frequency distribution with Raunkiaer's Standard Frequency Diagram.
4. To estimate Importance Value Index for vegetation on the basis of relative frequency, relative density, and relative biomass.
5. To measure the vegetation cover through point-frame method.
6. To measure the above-ground plant biomass in a vegetation.
7. To determine the Kemp's constant for dicot and monocot leaves and to estimate leaf-area-index of a community.
8. To estimate bulk density and porosity of different soil samples.
9. To determine moisture content and water holding capacity of different soil samples.
10. To study the vegetation structure through profile diagram.
11. To estimate transparency, pH and temperature of different water bodies.
12. To measure dissolved oxygen content in polluted and unpolluted water samples.
13. To estimate salinity of different water samples
14. To determine the percent leaf-area-injury of different leaf samples collected around polluted and non-polluted sites.
15. To estimate dust-holding capacity of the leaves of different plant species

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B.Sc. BOTANY  
SEMESTER – IV  
**PRACTICAL**  
Based on Theory Paper - I & II of Semester – IV

**[Time 5 Hours]**

**[Max. Marks – 30]**

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|--|-----------------|
| Que. 1: One experiment [A] from <b>Cell Biology mitosis/meiosis</b>              | <b>04 Marks</b> |
| Que. 2: One experiment [B] from <b>Genetics</b>                                  | <b>04 Marks</b> |
| Que. 3: One experiment [C] from <b>Plant Biotechnology</b>                       | <b>04 Marks</b> |
| Que. 4: One experiment [D] from <b>Plant Ecology</b> <b>Exp-I</b>                | <b>04 Marks</b> |
| Que. 5: One experiment [E] from <b>Plant Ecology (other ecology experiments)</b> | <b>04 Marks</b> |
| Que. 5: Identify and comment on given spots:                                     | <b>04 Marks</b> |

**SPOT-F: (Cell Biology)– Cell organelles**

**SPOT-G: (Genetics or Biotechnology)**

**SPOT-H: (Plant Ecology)- Morphology**

**SPOT-I: (Plant Ecology) - Anatomy**

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Que. 6: Practical Record (2 Marks) Excursion Report (2 Marks) Viva-voce (2 Marks) **06**

**MarksNOTE:** Well labeled diagrams are expected wherever necessary.



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**GONDWANA UNIVERSITY, GADCHIROLI**  
**CBCS Theory Question Paper Pattern**  
**For**  
**B.Sc. BOTANY**  
**SEMESTER – III and IV**  
**Theory**  
**All questions are compulsory and carry equal marks**  
**Draw well labeled diagram where ever necessary**  
**[Time 3 Hours] [Max. Marks – 50]**

**Question 1.** Based on Unit – I **:05 x 2 = 10**

a. Unit - I

b. Unit - I

**OR**

**: 02<sup>1/2</sup> X4 = 10**

c. Unit - I

d. Unit - I

e. Unit - I

f. Unit - I

**Question 2.** Based on Unit – II:**05 x 2 = 10**

a. Unit II

b. Unit II

**OR**

**: 02<sup>1/2</sup> X4 = 10**

c. Unit II

d. Unit II

e. Unit II

f. Unit II

**Question 3.** Based on Unit – III :**05 x 2 = 10**

a. Unit III

b. Unit III

**OR**

**: 02<sup>1/2</sup> X4 = 10**

a. Unit III

b. Unit III

c. Unit III

d. Unit III

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**Question 4.** Based on Unit - IV :  $05 \times 2 = 10$

- a. Unit IV
- b. Unit IV

**OR**

$$: 02^{1/2} \times 4 = 10$$

- c. Unit IV
- d. Unit IV
- e. Unit IV
- f. Unit IV

**Question 5.** Write any ten questions in one or two lines only :  $1 \times 10 = 10$   
(Diagrams are NOT necessary)

- a. Unit I
- b. Unit I
- c. Unit I
- d. Unit II
- e. Unit II
- f. Unit II
- g. Unit III
- h. Unit III
- i. Unit III
- j. Unit IV
- k. Unit IV
- l. Unit IV