

PATNA UNIVERSITY

Courses of Study for

**B.Sc. (Honours) and Subsidiary Examinations in Botany**

**Three Year Degree Course**

**2015-2018**

## B.Sc. Botany (Honours)

### Three Year Degree Course

Three shall be *two* theoretical and *one* practical paper each in the I year and II year examinations carrying 75 marks in each theory paper and 50 marks in each practical paper. In the III year, there shall be *three* theory and *one* practical paper carrying 100 marks each.

#### B.Sc. (H) Part-I

|            |   |                 |
|------------|---|-----------------|
| Paper I:   | General Biology, Microbiology, Mycology and Plant Pathology | 3Hrs. 75 marks  |
| Paper II : | Plant Diversity   | 3Hrs. 75 marks  |
|            | Practical based on Paper I and III                          | 4 Hrs. 50 marks |

#### B.Sc. (H) Part-II

|             |   |                 |
|-------------|---|-----------------|
| Paper III : | Angiosperms and Economic Botany               | 3 Hrs 75 marks  |
| Paper IV :  | Cell Biology, Cytogenetics and Plant Breeding | 3 Hrs. 75 marks |
|             | Practical based on Paper III & IV             | 4 Hrs. 75 marks |

#### B.Sc. (H) Part- III

|              |   |                  |
|--------------|---|------------------|
| Paper V :    | Molecular Biology and Biotechnology     | 3 Hrs. 100 marks |
| Paper VI :   | Plant Physiology and Biochemistry       | 3 Hrs. 100 marks |
| Paper VII:   | Biodiversity and Environmental Biology  | 3 Hrs. 100 marks |
| Paper VIII : | Practical based on Papers V, VI and VII | 4 Hrs. 100 marks |

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Adhyak

### B.Sc. Part-I Botany Honours

#### Paper I: General Biology, Microbiology, Mycology and Plant Pathology

Time : 3 Hours

Full Marks: 75

Ten questions are to be set, *three* each from group A and group B and *four* from group C. *Five* questions are to be answered, selecting at least one question from each group.

(i) General Biology

1. An elementary study of origin of life. Evolution. Natural Selection. Darwinism and Neo Darwinism.
2. A comparative account of two kingdom. Five kingdom and three domain classification systems.

(ii) Microbiology

1. Conceptual history of Microbiology
2. Techniques of isolation micro-organisms and culture media preparation.
3. Structure, growth and reproduction of Bacteria.
4. Structure and reproduction of TMV and bacteriaophages.
5. Industrial importance of Bacteria.
6. Role of microbes in nitrogen fixation.
7. Structure, reproduction and economic importance of Cyanobacteria.
8. Transmission of Plant viruses and control measures.

Group B: Mycology

1. A general study of the structure reproduction and classification of fungi.
2. Structure and life history of following genera: *Synchytrium*, *Albugo*, *Erysiphe*, *Peziza*, *Ustilago*, *Puccinia* and *Alternaria*

Group C: Plant Pathology

1. Role of Toxins and Enzymes in Plant disease.
2. Etiology, Symptoms and control of the following plant disease:
  - (a) Late blight of Potato
  - (b) Wart disease of Potato
  - (c) White rust of crucifers
  - (d) Loose Smut of Wheat
  - (e) Powdery mildews
  - (f) Brown Leaf Spot of Rice
  - (g) Rust of Wheat and Linseed
  - (h) Red rot of Sugarcane
  - (i) Wilt of Pigeon Pea
  - (j) Citrus Canker
  - (k) Tobacco Mosaic disease
  - (l) Little Leaf of Brinjal

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*Aditya*

## Paper II: Plant Diversity

Full Marks 75

Ten questions are to be set, five from group A and five from group B. Five questions are to be answered, selecting at least two questions from each group.

## Group A

## (a) Algae:

1. A general study of the structure reproduction and classification of algae.
2. Structure, life history and evolutionary significance of following genera.  
*Nostoc, Rivularia, Chlamydomonas, Volvox, Oedogonium, Chara, Vaucheria, Ectocarpus, Fucus, Batrachospermum and Polysiphonia*

## (b) Lichens: A general account

## (c) Bryophytes:

1. General characteristics and classification of Bryophytes.
2. A comparative study of the structures and life history of the following genera with particular reference to gametophytes and sporophytes.  
*Marchantia, Pellia, Anthoceros, Sphagnum and Pogonatum*

## Group B

## (a) Pteridophytes:

1. General characteristics and classification
2. Stellar evolution
3. Structures and life history of the following:  
*Psilotum, Lycopodium, Selaginella, Equisetum, Marsilea, Ophioglossum and Azolla*
4. **Fossils :- *Rhynia, Lepidodendron and Calamites.***

## (b) Gymnosperms: A comparative and evolutionary study of the morphological, anatomical and embryological features of gymnosperms with special reference to the following taxa:

Living: *Cycas, Pinus, Taxus and Gnetum*Fossils: *Lygenopteris and Cycadaeoidea*P. P. P.S. S. S.W. W. W.J. J. J.

**B.Sc. Part I Botany (Honours)**

**Practical**

Time : 4 Hours

Full Marks:50

**Microbiology, Mycology, Plant Pathology and Plant Diversity**

- |   |      |
|---|------|
| 1. Any one of the following   | 7.5  |
| Study of bacterial and viral diseases   |      |
| OR  |      |
| Gram's staining   |      |
| OR  |      |
| Preparation of a solid culture medium   |      |
| OR  |      |
| Isolation and inoculation of saprophytic fungi  |      |
| 2. Study of local fungal diseases.  | 7.5  |
| 3. Preparation of temporary stained microscopic slide of the forms prescribed in the syllabus and their identification. | 15   |
| Algae   | - 03 |
| Lichen  | - 02 |
| Bryophyte/Pteridophytes   | - 05 |
| Gymnosperms   | - 05 |
| 4. Comment upon the spots 1-5   | 05   |
| 5. Class record   | 10   |
| 6. Viva voce  | 05   |

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*Practical*     *Slide*     *On*     *work*     *of*     *specimens*

*Practical*

### B.Sc. Botany Subsidiary Course

#### Three Year Degree Course

Each year there shall be one paper of theory carrying of 75 marks and one paper of practical carrying 25 marks. Each of three hours duration.

|   |                 |
|---|-----------------|
| 1 <sup>st</sup> year Paper I: Section A: Microbiology                       | 3 Hrs. 75 marks |
| Section B: Cryptogams   |                 |
| Section C: Phanerogams  |                 |
| Practical based on Paper-I  | 3 Hrs. 25 marks |
| 2 <sup>nd</sup> Year Paper II: Section A: Plant Physiology and Biochemistry | 3 Hrs. 75 marks |
| Section B: Environmental Biology  |                 |
| Section C: Cell Biology, Cytogenetics and Plant Breeding                    |                 |
| Practical based on Paper-II   | 3 Hrs. 25 marks |

### B.Sc. Botany Subsidiary Course

#### Paper- I

Time : 3 Hours

Full Marks 75

In all ten questions are to be set, *two* from section A, *three* from section B and *five* from section C. Five question are to be answered selecting at least *one* from each section.

#### Section-A: Microbiology

1. Viruses – A General account
2. Bacteria- Structure, growth and reproduction
3. Economic importance of viruses and bacteria

#### Section-B: Cryptogams

Structure, life history, diagnostic features and economic importance of algae, fungi, bryophytes and pteridophytes based on the types wherever mentioned.

1. Algae: *Nostoc, Oedogonium, Chara, Vaucheria, Ectocarpus* and *Batrachospermum*
2. Fungi: *Albugo, Peziza* and *Puccinia*
3. Lichens: A general account
4. Bryophytes: *Marchantia, Anthoceros* and *Sphagnum*
5. Pteridophyta : *Selaginella, Equisetum* and *Marsilea*

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## Section- C: Phanerogams

1. Gymnosperms: Morphology, Anatomy and Reproduction of *Cycas* and *Pinus*.
2. Angiosperms:
  - (i) Taxonomy:
    - (a) Classification of Angiosperms with reference to the systems of classification of Bentham and J.D. Hooker; Adolf Engler and Karl Prantl and John Hutchinson
    - (b) Important rules of plant nomenclature

Study of the diagnostic features and evolutionary relationship of the following families of Angiosperms:

    - (a) Ranunculaceae (b) Euphorbiaceae (c) Cucurbitaceae (d) Apocynaceae (e) Acanthaceae (f) Lamiaceae (g) Amaranthaceae (h) Cyperaceae and (i) Poaceae.
  - (ii) Anatomy :
    - (a) Meristem
    - (b) Initiation, activity and function of cambium
    - (c) Anomalous secondary growth in *Boerhaavia*, *Tinospora* and *Dracaena*
    - (d) Root- stem- transition
  - (iii) Embryology :
    - (a) Structure and development of anther pollen, grain, embryo sac, endosperm and
    - (b) A general account of the process of fertilization.
    - (c) An elementary study of Experimental Embryology.

## B.Sc. Part- I Botany Subsidiary Course

## Practical

## Cryptogams and Phanerogams

Time : 3 Hours

Full Marks 25

1. Study of structural details of algae, fungi, bryophytes, pteridophytes and gymnosperms included in the syllabus with the help of temporary slide preparation. 8 marks
2. Description of an angiospermic plant belonging to a family prescribed in the syllabus and identification to family level. 4 marks
3. Study of the primary and secondary (both normal and abnormal) structure of roots and stems of flowers plants. 3 marks
4. Spots 1-5 5 marks
5. Practical records 5 marks

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**B.Sc. Part- II Botany Honours**

**Theory Papers**

**Paper III: Angiosperms and Economic Botany**

Time : 3 Hours

Full Marks :75

In all *ten* questions are to be set at least *three* from Group A and *two* each from Group B and *three* from Group D. Five questions are to be answered, selecting at least *one* question from each Group.

**Group A : Taxonomy**

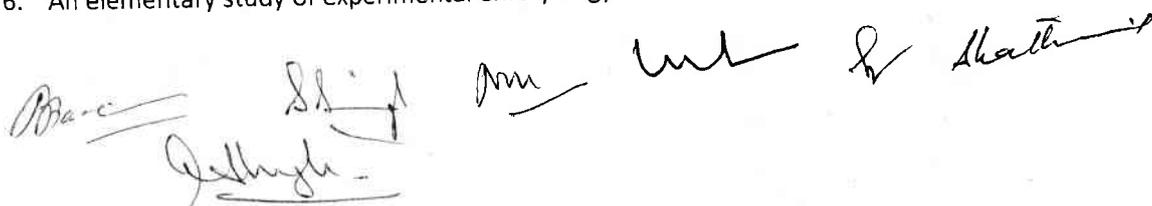
1. INTRODUCTION: Systematics, Taxonomy, Nomenclature, classification and Phylogeny Phenetics, Phyletics and Cladistic.
2. An elementary study of international code of Botanical Nomenclature with particular reference following.  
Naming of taxa, nomenclatural types (Holotype, Isotype, Paratype, syntype, lectotype and neotype) and Rule of priority.
3. A comparative study of the classification systems of Carolus, Linnaeus, G. Benthem & J.D.Hooker, Adolf Engler & Karl Prantl and John Hutchinson.
4. A study of the diagnostic features and relationship of *Ranunculaceae*, *Annonaceae*, *Magnoliaceae*, *Cryophyllaceae*, *Tiliaceae*, *Euphorbiaceae*, *Cucurbitaceae*, *Rubiaceae*, *Apcoynaceae*, *Boraginaceae*, *Scrophulariaceae*, *Acanthaceae*, *Laminaceae*, *Amaranthaceae* *Commelinaceae*, *Cyperaceae* and *Poaceae*.

**Group : B: Anatomy**

1. Mechanical tissues and their structure, distribution and function
2. Organization of tissue in relation to environment
3. Anomalous secondary growth
4. Periderm- structure, origin and function
5. Metristems- sturcture and function, various theories regarding organization of special meristem

**Group C: Embryology**

1. Microsporogenesis and male gametophyte
2. Megasporogenesis and female gametophyte
3. Fertilization
4. Embrygeny
5. Endosperm
6. An elementary study of experimental embryology



Group D: Economic Botany

- 1. Cereals
- 2. Pulses
- 3. Oil seeds
- 4. Sugar and starch yielding plants
- 5. Fruits and vegetables
- 6. Spices and condiments
- 7. Beverages gums , resins and rubber
- 8. Essential oil
- 9. Fibre yielding plants
- 10. Timber yielding plants
- 11. Medicinal plants

Panicum

Sorghum

Arachis

Urtica L. Struthium

Jatropha

**Paper IV: Cell Biology, Cytogenetics and Plant Breeding**

Time : 3 Hours

Full Marks 75

In all ten questions are to be set, *five* from section A and *five* from section B. *Five* questions are to be answered selecting at least two from each selection.

**Section A: Cell Biology**

1. Conceptual history, cell theory, a comparative account of pro- and eukaryotic cells, characteristics of archaebacteria and mycoplasma.
2. Structure and function of cell organelles.
3. Cell wall and Cell membrane
4. Ultrastructure of chromosomes
5. Cell division and its regulation
6. Techniques in cell biology
  - (a) Principles of light, phase contrast, fluorescence and Electron microscopy; autoradiography and their application.
  - (b) Staining Techniques: Acetocarmine and Fielgen

**Section B: Cytogenetics and Plant Breeding**

1. Structure of the nucleus and chromosomes including Lampbrush chromosomes, B-chromosomes, polytene chromosomes.
2. Cell cycle, mitosis and meiosis
3. Physical and chemical basis of heredity
4. Mendelian inheritance
5. Interaction of genes
6. Polyploidy
7. Chromosomal aberrations
8. Linkage and crossing over
9. Structure, replication and expression of DNA, Genetic code
10. Mutation: Induction and biochemical basis
11. One gene-one polypeptide chain hypothesis
12. Extra-nuclear inheritance
13. Chromosomal and genetic sex determination mechanisms and sex linked inheritance
14. Human genetics
15. Genetics of bacteria and their viruses with special reference to conjugation, transduction and transformation.
16. Cytogenetics in crop improvement
17. General principles of breeding for crop improvement
18. Centres of origin of cultivated plants

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*Adhye*

**B.Sc. Part-II Botany Hons.****Practical****Based on paper III and Paper IV**

Time : 4 Hours

Full Marks 50

1. Study of various stages of mitosis and meiosis using appropriate plant material 6 marks
2. General problem based on interaction of genes 6 marks
3. Systematic study of a flowering plant identification upto the rank of family 8 marks
4. Anatomical study of anomalous secondary growth 6 marks
5. Study of economics botany 4 marks
6. Spots 1-5 5 marks
7. Viva- voce 5 marks
8. Class records. 10 marks

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*Prabhakar*

## B.Sc. Part-II Botany Subsidiary course

## Theory

## Paper-II

Time: 3 Hours

Full Marks:75

In all *ten* questions are to be set *three* each from section A and section B and *four* from section *five* questions are to be answered selecting at least from each section.

## Section A: Plant Physiology and Biochemistry

1. Water and mineral absorption
2. Transpiration stomatal movement
3. Mineral nutrition and the role of macronutrients
4. Photosynthesis: mechanism in  $C_3$  &  $C_4$  plants and factors
5. Respiration: Aerobic and anaerobic, Glycolysis, Krebs's Cycle and Electron transport
6. Nitrogen cycle, Symbiotic and symbiotic nitrogen fixation
7. Hormones- a general account
8. Growth- Role of light, temperature and humidity
9. Movements Phototropic and Geotropic movements

## Section B: Environmental Biology

1. Plant communities and ecosystem
2. Succession (Hydroserc and Xerosere)
3. Environmental factors affecting vegetation
4. Pollution : Types, causes, prevention and control

## Group C: Cell Biology, Cytogenetics and Plant Breeding

1. Ultra structure of cell
2. Cell division: Mitosis and meiosis
3. Mendel's Laws of inheritance
4. Linkage and Crossing
5. Structure and replication of DNA
6. An elementary study of Polyploidy, Chromosomal aberrations and Mutation.
7. An elementary study of Biotechnology
8. Idea of plant breeding ~~plant breeding~~

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*Shakti*

## B.Sc. Part-II Botany Subsidiary course

## Practical

Time:- 3 Hours

Full Marks:25

- |   |         |
|---|---------|
| 1. Plant physiology experiment to be performed                              | 7 marks |
| 2. Ecology adaptations in Hydrophytes, Mesophytes, Xerophytes and Epiphytes | 5 marks |
| 3. Performance of Biochemical tests   | 3 marks |
| 4. Spotting 1-5   | 5 marks |
| 5. Practical records  | 5 marks |

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*Jadhav*

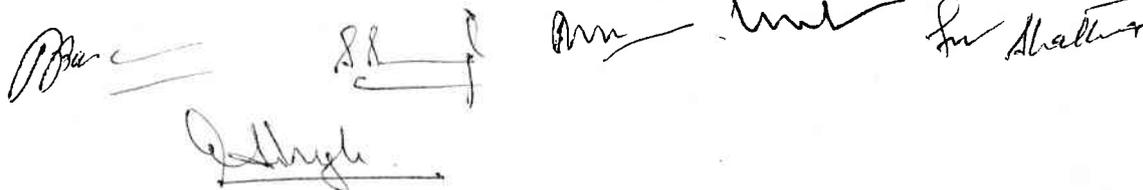
**B.Sc. Part-III Botany Honours****Theory Papers****Paper V: Molecular Biology and Biotechnology**

Time:- 3 Hours

Full Marks:100

In all *ten* questions are to be set. *Five* questions are to answered

1. DNA replication and repair: General principles, mechanism of prokaryotic and eukaryotic replication, DNA damage and repair (mismatch repair, nucleotide excision repair, base excision repair).
2. Transcription and Translation: General principles and mechanism of transcription and translation in prokaryotes and eukaryotes.
3. Gene regulation: Prokaryotic gene regulation (Operon concept); Inducible and repressible systems. An elementary study of eukaryotic gene regulation.
4. Genetic Engineering: Tools and technique of genetic engineering; restriction enzymes and ligase; Reverse transcriptase; Cloning Vectors: Plasmid and Phages.
5. Isolation and synthesis of foreign DNA: cDNA synthesis, Organochemical synthesis of gene; genomic library & cDNA library.
6. Strategy for creation of recombinant DNA and its transfer in host.
7. PCR and DNA fingerprinting.
8. Role of genetic engineering in human welfare.
9. Plant Biotechnology: An introduction to tissue culture: Definition, principle and significance of tissue culture; Requirements for growth and differentiation of cultured cells and tissues.
10. Explant culture and protoplast culture.
11. Application of plant tissue culture: Commercial application of plant tissue culture; Mass propagation; Transgenic plants.
12. Bioinformatics : An elementary study.

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## B.Sc. Part-III Botany Honours

## Paper VI: Plant Physiology and Biochemistry

Time:- 3 Hours

Full Marks:100

In all *ten* questions are to be set. *Five* questions are to be answered at least *one* question from each section.

**Section A: Plant Physiology**

1. Imbibition, diffusion and osmosis
2. Active and passive transport of water and solutes
3. Conduction of water
4. Phloem transport
5. Mechanism of stomatal movement and factors controlling it.
6. Photosynthesis: pigment system, photophosphorylation, Calvin cycle and Hatch & Slack cycle.
7. Respiration: Glycolysis, Krebs's cycle, oxidative phosphorylation.
8. Phytohormones: General account and roles of Auxins, Giberellins and Cytokinins.
9. Physiology of flowering: Photoperiodism role of pigment and hormones.
10. Vernalisation
11. Growth and differentiation
12. Plant movement
13. Biological nitrogen fixation and its mechanism
14. Micro and macro nutrients and their role in plant nutrition
15. Fat synthesis

**Section B: Biochemistry**

1. Biochemical components of the cell: Carbohydrate, proteins, fat and nucleic acid.
2. Enzymes: Classification, nomenclature, physico-chemical properties cofactors and coenzymes, isoenzymes, kinetics of enzyme action, significance, factors affecting enzyme activity.
3. Secondary plant metabolites and their roles.
4. Protein synthesis
5. Regulation of protein synthesis in prokaryotes and eukaryotes

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**Paper VII: Biodiversity and Environmental Biology**

Time:- 3 Hours

Full Marks:100

In all ten questions are to be set. Five questions are to be answered.

1. An introduction to the concept of Biological Diversity/ Biodiversity, Loss of biodiversity and conservation.
2. An elementary study of the causes and consequences of loss of biodiversity and conservation strategies.
3. Concept of Environment, Ecology, Environmental Science, Environmental Biology, Biosphere, Biome, Ecosystem, habitat, niche, community and population.
4. Concept of autoecology and synecology. Methods of studying autecology and Syecology.
5. Structure and function of Ecosystem. A general study of grass land, fresh water and forest ecosystem.
6. Ecological energetic: Energy environment; Fixation of energy by autotrophs; Energy flow beyond producers and concept of productivity, food chains and food webs; energy flow models; Energy pyramids and biomass.
7. Biogeochemical Cycles: Hydrological cycle and water harvesting; Gaseous and sedimentary nutrient cycles.
8. Community Ecology: Structure and organization; individualistic and organismic nature of communities; functional aspects of communities. Methods of studying plant communities with the help analytical and synthetic characters. Ecological succession; Seral and climax communities; succession in terrestrial and aquatic ecosystems.
9. Population Ecology: An elementary study of population growth, structure and population regulation.
10. Ecological factors: Isolation, precipitation and climate, edaphic factors; biotic factors.
11. Environmental Pollution and Public Health: Environmental pollutants; Air and water pollution; Radioactive and Noise pollution; pollution control measures.
12. Major vegetational belts of India.
13. An elementary study of Aerobiology.
14. An introduction to MAB programme, Resource Ecology, Conservation, Forestry, Wild Life Management and Aquaculture.

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*Jalghate*

**Paper VIII****Practical**

Time:- 6 Hours

Full Marks:100

Molecular Biology and Biotechnology, Physiology and Biochemistry and Environmental Biology.

- |  |    |
|--|----|
| 1. A major experiment in plant physiology/ biochemistry  | 20 |
| 2. A minor experiment in plant physiology/biochemistry   | 10 |
| 3. A major experiment in Molecular Biology/Biotechnology | 12 |
| 4. A minor experiment in Molecular Biology/Biotechnology | 08 |
| 5. Field study of community structure                    | 10 |
| 6. Laboratory experiment on                              |    |
| (a) Plant ecology  | 05 |
| (b) Aerobiology  | 05 |
| 7. Spotting  | 10 |
| 8. Class records   | 10 |
| 9. Viva- Voce  | 10 |

*Barc*      *Shyl*      *Muc*      *And*      *for Shalini*  
*Aditya*

