



**UNDERGRADUATE SEMESTER SCHEME**

# **BOTANY**

**SYLLABUS**

**2014-15**

**onwards**

**BOTANY**  
**SYLLABUS FOR I SEMESTER**  
**PAPER - I**

**(MICROBIAL DIVERSITY AND PHYCOLOGY )**

**THEORY: 60 + 10 Marks**  
**3 hours per week**

**42 Hours**

**Unit I:** Introduction and a brief account of **microbiology**. Microbes of soil, air & Water  
**4 Hours**

**Unit II: Virology** - History and discovery, status of viruses in microbiology (Living & non-living characteristics), Structure and multiplication of TMV and Bacteriophage [T4], Virioids, Prions, Tobacco mosaic disease, Yellow mosaic of Bean, Transmission of viruses.  
**7 Hours**

**Unit III: Mycoplasma** - History, discovery and characteristics.  
Symptoms and management of Sandal spike disease. **2Hours**

**Unit IV: Bacteria:** History, discovery and Occurrence. Classification of Bacteria based on morphology, flagellation and nutrition. Ultra structure, reproduction - Vegetative by Fission, Budding & Endospore formation. Sexual by genetic recombination - conjugation, transformation and transduction.

**Role of bacteria in human welfare**-As Natures' scavengers, Bio-fertilizers, Industrial curing of tea, tobacco, tanning of leather, Retting of fibres, production of Alcohols and acids.  
A mention of bacterial diseases in Plants, Animals and Humans **10Hours**

**Unit V: Cyanobacteria:** A general account of occurrence, structure, reproduction and economic importance. Type study: *Spirulina* and *Nostoc*.  
Cyanobacteria -as food, bio-fertilizers, pioneers in plant succession, biological indicators and water blooms. **4 Hours**

**Unit VI: Phycology:** A general account, habitat, thallus, reproduction, economic importance  
And a brief account of classification.  
Type study: *Chlorella*, *Oedogonium*, *Caulerpa*, *Sargassum* and *Polysiphonia*  
**15 Hours**

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**I SEMESTER PRACTICALS**  
**PRACTICAL- I**  
**MICROBIAL DIVERSITY AND PHYCOLOGY**

**One practical of 3 hours per week**

**14 Practicals**

- Practical **I** : Study of Microscope (Dissecting and Compound)- Use ,care and mounting techniques.
- Practical **II** : Microbial instruments - Inoculation loop, Hot air oven, Incubator, Pressure cooker, Haemocytometer
- Practical **III,IV** : Sterilization techniques, (Preparation of Media-NA / PDA ) study of microbes in air by Petri plate exposure method
- Practical **V** : Study of TMV, YMBV, Sandal spike, Citrus canker
- Practical **VI** : Simple staining of bacteria -crystal violet/ Safranin
- Type study :-**
- Practical **VII** : Spirulina , Nostoc
- Practical **VIII** : Scytonema / Oscillatoria and Chlorella
- Practical **IX** : Oedogonium, Hydrodictyon
- Practical **X** : Caulerpa , Diatoms
- Practical **XI** : Sargassum
- Practical **XII** : Polysiphonia / Batrachospermum

**SCHEME OF BOTANY PRACTICAL EXAMINATION**  
**FOR I SEMESTER—PRACTICAL I**  
**(MODEL QUESTION PAPER)**  
**MICROBIAL DIVERSITY AND PHYCOLOGY**

**Time: 3 Hours**

**Max. Marks: 20**

- I.** identify the specimens **A & B** with reasons and labeled sketches.  
(one form of Cyanobacteria and one form Phycology) **2X2=4 marks**  
(Identification with reasons-01, Labelled sketches-01)
- II.** Prepare a temporary stained slide of the material **C** . **3 marks**  
Sketch, label identify with reasons .Leave the preparation for evaluation.  
(Staining and mounting - 2marks, Sketch label reasons -1 marks )  
( Protophyta /Algae )
- III.** Write critical note on **D , E & F** **2X3=6 marks**  
(one from Protophyta i.e., bacterial/viral disease, one from microbiological instrument and one from Phycology))
- IV.** Perform Bacterial Staining of given sample **G** & leave the preparation for evaluation ( Preparation-2 marks, Procedure – 1 mark ) **3 marks**
- V.** Identify the Microslides **H & I** With reasons.  
( one from Protophyta and one from Phycology) ) **2X2= 4marks**  
( Labelled sketch –01, Identification with reasons –01)

**Note: The candidates shall produce the records which shall be signed by the examiners**

**SYLLABUS FOR II SEMESTER**  
**THEORY PAPER – II**  
**MYCOLOGY, PLANT PATHOLOGY, LICHENS AND BRYOPHYTES**

**THEORY: 60 + 10 Marks**  
**3 hours per week**

**42 Hours**

**Unit I: MYCOLOGY:** General Characters, occurrence, Thallus organization, Nutrition, Reproduction, Ainsworth's classification and Economic importance of fungi

**Type study:** 1) Albugo  
2) Rhizopus  
3) Penicillium  
4) Lycoperdon

**12 Hours**

**Unit II:** Cultivation of **Mushrooms**, Spawn production, Cultivation methods of *Pleurotus* on Paddy straw by polythene bag method, Nutritional values of Mushrooms

**2 Hours**

**Unit III: PLANT PATHOLOGY** – Introduction and classification of plant diseases, Symptoms, causal organisms and management of :-

1. Downy Mildew of sorghum
2. Grain smut of sorghum
3. Tikka disease of groundnut
4. Late blight of potato
5. Koleroga of arecanut
6. Coffee rust.
7. Blast of Paddy
8. Wheat rust - *Puccinia graminis*
9. White rust

A brief account of **Biopesticides**: Neem, Trichoderma, Bacillus thuringiensis in pest and disease control.

**12 Hours**

**Unit IV: LICHENS:** Distribution, types, structure, reproduction and economic importance

**4 Hours**

**Unit V: BRYOPHYTES:** General characters and classification of bryophytes. Structure, Reproduction & Alternation of generations in:-

**Study of :** 1. Marchantia  
2. Anthoceros  
3. Funaria  
4. Economic Importance of Bryophytes

**12 Hours**

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## II SEMESTER PRACTICALS

### PRACTICALS - II

#### MYCOLOGY, PLANT PATHOLOGY, LICHENS AND BRYOPHYTES

One practical of three hours per week

14 Practicals

**Practical I** :Methods of staining and mounting fungi using cotton blue and Lactophenol

**Practical II** :Study of Albugo and Rhizopus

**Practical III** : Study of Penicillium and Lycoperdon

**Practical IV** : Demonstration of Mushroom cultivation.( Two practicals )

**Practical V** : Study of **fungal diseases**: Tikka disease of groundnut, Late blight of potato, Koleroga of arecanut, White rust, Blast of paddy

**Practical VI** : Downy mildew of sorghum, Grain smut of sorghum, wheat rust, coffee rust

**Practical VII** : Study of Biopesticides: Neem, Trichoderma and Bacillus thuringiensis

**Practical VIII**: Study of lichens

**Practical IX & X** : Preparation of PDA, Sterilization, pouring, inoculation and culturing of Fungi (Demonstration)

**Practical XI** : Study of morphology, Internal structure and reproduction in Marchantia

**Practical XII** : Study of morphology, Internal structure and reproduction in Anthoceros

**Practical XIII**: Study of morphology, Internal structure and reproduction in Funaria.

### SCHEME OF PRACTICAL EXAMINATION—PRACTICAL II

(MODEL QUESTION PAPER)

#### MYCOLOGY, PLANT PATHOLOGY, LICHENS AND BRYOPHYTES

Time --3 Hours

Max. marks: 20

- I. Identify the specimens **A** and **B** with reasons and labelled sketches **4 marks**  
(One from fungi/pathology and one from Bryophyta)  
Labelled sketch-01 Identification with reasons-01
- II. Prepare a temporary stained slide of the material **C**. Sketch, label and identify with reasons. Leave the preparation for evaluation. **4 marks**  
(Staining and mounting-02, Identification, labelled sketch, reasons-02)
- III. Write critical notes on **D** and **E** **4 marks**  
(One from fungi/pathology/lichen and one from Bryophyta)
- IV. Identify the Microslides **F, G, H and I** with reasons and labelled sketches **8 marks**  
(Identification with reason-01, Labelled sketch-01)  
  
(Two from fungi/pathology and two from lichen/ Bryophyta)

**Note: The candidates shall produce the records which shall be signed by the examiners**

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**SYLLABUS FOR III SEMESTER**  
**THEORY PAPER - III**

**PTERIDOPHYTA, GYMNOSPERMS, ANATOMY & PALEOBOTANY**

**THEORY: 60 + 10 Marks**  
**3 hours per week**

**42 HOURS**

**Unit I-- PTERIDOPHYTA :- Introduction, general characters, classification**

**2 Hours**

External and internal structure and reproduction of the following forms:  
(Developmental details not required)

1. Psilotum 2. Selaginella 3. Equisetum 4. Ophioglossum 5. Marsilea

A brief account of **Heterospory** and **seed habit** and **Stelar evolution** among Pteridophytes

**15 Hours**

**Unit II-- GYMNOSPERMS :- Introduction, general characters and classification.**

**2 Hours**

External and internal structure and reproduction of the following forms:

1. **Cycas** - Anatomy of Coralloid root, Young stem and leaf-let.  
Reproductive organs.

2. **Pinus** - Stem anatomy (Young and old), Anatomy of Needle.  
Reproductive organs.

3. **Gnetum** - Stem anatomy (Young), Eccentric secondary growth in stem, leaf anatomy. Reproductive organs.

4. A brief account of economic importance of Gymnosperms

**10 Hours**

**Unit III--ANATOMY of Angiosperms**

**Tissues** - Classification. Theories of apical meristem.

A brief account of Simple and complex tissues

**4 Hours**

**Anatomy-** Study of anatomy of **Dicot** and **Monocot** -Roots, Stems and Leaves  
Secondary growth in Dicot stem. Anomalous secondary growth in Monocot stem  
(Ex.: Dracaena)

A brief account of Trichomes, Stomata and Laticifers

**6 Hours**

**Unit IV--PALEOBOTANY**

A brief account of the study of Geological time-scale, Fossil types.  
Type study of **Rhynia, Cycadeoidea**

**3 Hours**

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### III SEMESTER PRACTICALS

#### PRACTICALS - III

#### PTERIDOPHYTA, GYMNOSPERMS, ANATOMY & PALEOBOTANY

One practical of three hours per week

14 Practicals

**Practical 1: Sectioning and staining** method. Slide preparation. The material for slide preparation may be chosen from any Angiosperm- Roots, Stems and Leaves.

**Practical 2.** Study of **Tissue systems**: Parenchyma, Collenchyma, Sclerenchyma, Xylem and Phloem.

**Practical 3.** Anatomy of Dicot and Monocot-- **Stems**  
(Materials may be chosen from Tridax/Zinnia, Grass/ Sorghum)

**Practical 4:** Anatomy of Dicot and Monocot--**Roots**  
(Materials may be chosen from Cicer, Grass/ Sorghum)

**Practical 5:** Anatomy of Dicot and Monocot-- **Leaves**  
(Materials may be chosen from Tridax/Zinnia, Grass/ Sorghum/Maize)

**Practical 6:** Study of morphology, anatomy and reproductive organs of **Psilotum**

**Practical 7:** Study of morphology, anatomy and reproductive organs of **Selaginella**.

**Practical 8:** Study of morphology, anatomy and reproductive organs of **Equisetum**.

**Practical 9:** Study of morphology, anatomy and reproductive organs of **Ophioglossum**

**Practical 10:** Study of morphology, anatomy and reproductive organs of **Marsilea**

**Practical 10:** Study of morphology, anatomy and reproductive organs of **Cycas**

**Practical 11:** Study of morphology, anatomy and reproductive organs of **Pinus**

**Practical 12:** Study of morphology, anatomy and reproductive organs of **Gnetum**

**Practical 13:** Study of morphology, anatomy and reproductive organs of **Fossil forms**—with slides and Photographs

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## **SCHEME OF PRACTICAL EXAMINATION—PRACTICAL III**

**(MODEL QUESTION PAPER)**

### **PTERIDOPHYTA, GYMNOSPERMS, ANATOMY & PALEOBOTANY**

**Time: 3 HOURS**

**Max. marks: 20**

- I.** Identify the specimens **A** and **B**, giving reasons **4 Marks**  
( One from Pteridophytes and one from Gymnosperms)
  
- II.** Prepare a temporary stained transverse section of the given material **C**. Sketch, Label and Identify giving reasons. Leave the preparation for evaluation **4 marks**  
( Preparation- 2 marks, Identification with diagram-1 mark and reason-1 mark)
  
- III.** Write critical notes on **D** and **E** **4 marks**  
( One from Pteridophytes and one from Gymnosperms)
  
- IV.** Identify the microslides- **F,G, H** and **I** with labelled sketches, giving reasons **8 marks.**  
( One from Pteridophytes, one from Gymnosperms, one from Anatomy and one from Paleobotany)

**NOTE: In Paleobotany :** Photograph or Slide may be kept

**The candidates shall produce the records which shall be signed by the examiners**

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# SYLLABUS FOR IV SEMESTER

## THEORY PAPER - IV

### MORPHOLOGY OF ANGIOSPERMS, REPRODUCTIVE BIOLOGY AND ECOLOGY

THEORY: 60 + 10 Marks  
3 hours per week

42 HOURS

#### Unit I: MORPHOLOGY OF ANGIOSPERMS

- 1. Parts of a flowering plant** : Monocot and Dicot plant  
**Root System** : Tap and Fibrous root system
  - 2. Root modifications** : Fusiform, Napiform, Conical, Fasciculated, Tuberous, Prop, Stilt, Climbing, Respiratory, Parasitic and Epiphytic
- Shoot system:-**
- 3. Stem modifications** : Rhizome, Tuber, Corm, Bulb, Runner, Stolon, Offset, Sucker, Phylloclade (*Opuntia*, *Euphorbia tirucalli*), Cladode (*Ruscus*, *Asparagus*)
  - 4. Leaf** : Parts, Phyllotaxy, Simple and Compound leaves ( Pinnate and Palmate)  
**Leaf modifications** : Tendril, Spine, Phyllode, Pitcher,
  - 5. Inflorescence** : Racemose types, Cymose types and Special types (Cyathium, Thyrsus, Verticillaster, Hypanthodium)
  - 6. An account of floral morphology**
  - 7. Fruits** : Classification- **Simple** ( Dry dehiscent, dry indehiscent, Schizocarpic and Fleshy types), **Aggregate** and **Composite** types
  - 8. Structure of seed** : Dicot
  - 9. Structure of Grain** : Monocot

10 Hours

#### Unit II - REPRODUCTIVE BIOLOGY ( Embryology )

- 1. Structure of Anther**, T.S. of anther, Microsporogenesis, Development of male gametophyte, Role of tapetum. A brief account of Palynology
- 2. Structure of Ovule**, types of Ovule, Megasporogenesis, Development of female gametophyte ( Polygonum type)
- 3. Pollination Biology** : Types, Contrivances and significance of cross pollination
- 4. Fertilization** : A general account.
- 5. Endosperm** : Types and development- a brief account
- 6. Embryo** : Dicot type with development- Crucifer type
- 7. Experimental embryology**, Apomixis, Polyembryony
- 8. Scope of Reproductive biology**

12 hours

#### Unit III- ECOLOGY

- 1. Ecosystem** : Classification, Concepts and components of ecosystem
- 2. Ecological factors** : a brief account
- 3. Study of Forest** (dry deciduous), **Fresh** (Pond) and **Marine** water ecosystems
- 4. Energy flow and Ecological pyramids**
- 5. Biogeochemical cycles** : Nitrogen Cycle and Hydrological cycle
- 6. Ecological adaptations** : Hydrophytes, Xerophytes, Halophytes, Parasites, Epiphytes
- 7. Plant succession** : Definition, Steps of succession and types ( Xerosere, Hydrosere)
- 8. Phytogeography** : Definition, Vegetational types of Karnataka

20 Hours

## IV SEMESTER PRACTICALS PRACTICALS IV

One practical of 3 hours per week

14 practicals

- Practical 1:** Study of parts of the Dicot ( *Mustard*) and Monocot(*Maize/Sorghum*) plants and Modifications of Root ( 2 practicals )
- Practical 2:** Modifications of Stem
- Practical 3:** Modifications of Leaf
- Practical 4:** Study of Inflorescences : Racemose types
- Practical 5:** Study of Inflorescences : Cymose and Special types
- Practical 6:** Study of Floral parts: *Tribulus* flower. Cohesion and adhesion of stamens, modifications of stamens and carpels. Examples- Rose, *Canna*, *Hibiscus*, *Calotropis*-Gynostegium and Pollinia.
- Practical 7:** Study of Fruits—Simple, Aggregate and Composite type
- Practical 8:** Study of Anther (T.S.) and Ovule of different types (L.S.)
- Practical 9:** Mounting of different pollen grains in Lactophenol  
*Hibiscus*, *Catharanthus*, *Solanum*, *Lycopersicum*, Honey-sample
- Practical 10:** Mounting of Endosperm ( *Cucumis*) Mounting of Embryo ( *Crotalaria*)
- Practical 11: Morphological characters of :-**  
**Hydrophytes:** *Eichhornia*, *Elodea*. **Halophytes:** Vivipary and Pneumatophores.  
**Xerophytes:** *Casuarina*, *Euphorbia tirucalli*, *Opuntia*. **Epiphytes:** Orchids.  
**Parasites:** *Cuscuta*, *Loranthus/Viscum*
- Practical 12: Anatomical characters ( Slides only):** *Eichhornia*, *Elodea*, *casuarina stem*, *Nerium* leaf, Orchid root T.S., *Cuscuta*-T.S. of host stem with parasite
- Practical 13: Study of Ecological Instruments:** Hygrometer, Anemometer, Rain Gauge, Altimeter
- Note: An Ecological field study shall be conducted for 1-2 days.**

### SCHEME OF PRACTICAL EXAMINATION- PRACTICAL IV

(MODEL QUESTION PAPER)

#### MORPHOLOGY OF ANGIOSPERMS, REPRODUCTIVE BIOLOGY AND ECOLOGY

Time : 3 Hours

Max. Marks : 20

- I. Identify the specimens **A** and **B**, mentioning the type of modification, giving suitable reason (Select two specimens out of root, stem, leaf) 4 marks
- II. Write critical notes on **C** and **D** 4 marks  
(Select one from Inflorescences and one from Fruits)
- III. Write Ecological features of **E** and **F** 4 marks  
(Select two specimens out of Hydrophytes, Xerophytes, Epiphytes, Halophytes, Parasitic flowering plants)
- IV. Identify the slides **G** and **H** 4 marks  
( Select one from Ecological Anatomy and one from Embryology)
- V. Prepare a temporary stained mount of **I** 2 marks  
( Select from Pollen grains, embryo / endosperm)
- VI. Write a note on the given Ecological Instrument **J** 2 marks

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## SYLLABUS FOR V SEMESTER THEORY PAPER -V

**TAXONOMY OF ANGIOSPERMS, ECONOMIC BOTANY AND ETHNOBOTANY**  
**THEORY: 80 + 20 Marks. 3 hrs/week** **42 HOURS**

### UNIT I--TAXONOMY

Principles of Taxonomy, A brief account of Classical and modern Taxonomy  
Systems of classification: Broad outline of **Bentham and Hooker's** and  
**Engler and Prantl's**-Classifications with merits and demerits.  
**Plant Nomenclature**- Binomial system, ICBN Principles and aims.  
Recent trends- Chemotaxonomy, Cytotaxonomy **04 Hours**

**UNIT II** --Field and Herbarium Techniques, Herbaria, Botanical gardens, Floras  
and their importance, Botanical Survey of India and its functions. **03 Hours**

**UNIT III.** Study of following Families according to Bentham and Hooker's system of  
Classification

**DICOTS:** 1. Magnoliaceae 2. Ranunculaceae 3. Brassicaceae 4. Rosaceae  
5. Malvaceae 6. Rutaceae, 7. Fabaceae, 8. Myrtaceae, 9. Cucurbitaceae,  
10. Apiaceae, 11. Asteraceae 12. Rubiaceae 13. Apocynaceae  
14. Asclepiadaceae, 15. Solanaceae, 16. Verbenaceae 17. Acanthaceae,  
18. Lamiaceae, 19. Amaranthaceae, 20 .Euphorbiaceae.  
21. Dipterocarpaceae

**MONOCOTS:** 1. Orchidaceae 2. Musaceae, 3. Liliaceae, 4. Arecaceae, 5. Poaceae,

**25 Hours**

**UNIT IV. ECONOMIC BOTANY** (Cultivation aspects not required)

**Food plants:** Rice, Wheat, Maize, Potato

**Pulses:** Pigeon Pea, Bengal gram, Black gram, Green gram

**Fibres and Fibre plants:** Cotton, Jute, Coir

**Oil and oil yielding plants:** Ground nut, Coconut, Safflower, Sunflower

**Firewood, Timber and Bamboos:** Rose wood, Teak, Honne, Acacia, Bamboo

**Spices:** Cardamom, Clove, Cinnamon, Pepper

**Beverages:** Coffee and Tea

**Narcotic Plants:** 1. Opium, 2. Cannabis, 3. Tobacco

**Medicinal plants:** A general account -Plants of medicinal importance studied in  
Monocot and Dicot families under Taxonomy

**UNIT V –ETHNOBOTANY**

Introduction and significance :- Examples under Ethnobotany:

1. *Phyllanthus*. , 2. *Hemidesmus indicus* 3. *Terminalia chebula*. 4. *Strychnos*  
*nux-vomica* 5. *Aloe vera* 6. *Boerhaavia diffusa*. 7. *Withania somnifera*

**Importance of sacred groves and their conservation:**

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**10 Hours**

**V SEMESTER PRACTICALS  
PRACTICALS -V**

**One Practical of 3 Hours/ Week**

- I. Technical description of the plants
- II. Construction of floral diagrams with floral formulae. Herbarium technique
- III. Study of the plants belonging to the Families prescribed in the theory  
**(One or Two plant representatives per Family)**
- IV. **Field Visits:** Field trips to the local areas to study, identify and record the Flora. Field visit report has to be submitted along with the Tour report at the time of practical examination.
- V. Study of plants of economic importance (Economic Botany)
- VI. Study of medicinal plants- *Acorus, Adhatoda,, Azadirachta, Eclipta, Costus, Cyanodon, Centella, Turmeric, Asparagus, Garlic, Ocimum, Tinospora, Cymbopogon, Piper longa, Rauwolfia* (Live or dry plants/ herbarium specimens/ photographs of above plants)
- VII. Ethnobotany
- VIII. Preparation of **Five Herbarium** sheets and submitting the same at the time of examination  
(Mostly of un cultivated plants)
- IX. As a part of the curriculum, a compulsory Botanical trip/ tour of about three days is to be conducted to study the different types of vegetation, medicinal plants and to collect herbarium specimen. A visit to herbal gardens/ Ayurvedic college.

**SCHEME OF PRACTICAL EXAMINATION. PRACTICAL- V  
(MODEL QUESTION PAPER)**

**Taxonomy of Angiosperms, Economic Botany, Ethno-botany.**

**Time 3 Hours**

**Max. marks 40**

- I Assign the plants **A, B** and **C** to their respective Families, giving reasons- **12 marks**  
(One from Polypetalae, one from Gamopetalae and one from Monochlamydeae / Monocot,)  
Family name and classification-1 mark, Characters with important diagrams -3 marks
- II. Describe the plant **D** in technical terms. **4 marks**
- III. Draw the floral diagram with floral formula of **E** **4 marks**  
(floral diagram - 3 marks, floral formula-1 mark)
- IV. Comment on **F, G, H** and **I** (Economic Botany) **2X 4= 8 marks**  
( Botanical name and family-1 mark, Part used, uses-1 mark)
- V. Identify and write the medicinal uses of **J, K** and **L** **2X 3= 6 marks**  
( Botanical name and family-1 mark, Part used, uses-1 mark)
- VI. Comment on **M** and **N** (Ethnobotany) **3X 2= 6 marks**  
( Local and Botanical name-1 mark, family and Part used-1 mark, Ethnomedicinal uses-1 marks)

**Note: Valued record, Tour report and Herbarium sheets shall be signed by the Examiners**

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# SYLLABUS FOR V SEMESTER

## THEORY PAPER –VI

### CELL BIOLOGY, MOLECULAR BIOLOGY AND EVOLUTION

**THEORY: 80 + 20 Marks**  
**3 Hours/ Week**

**42 HOURS**

#### CELL BIOLOGY

##### UNIT -I

Principles and uses of Light, Phase- contrast, Fluorescent and Electron Microscopes

Ultra structure of Prokaryotic and Eukaryotic cells. Cell-organelles—Cell wall, Cell membrane, Endoplasmic reticulum, Golgi apparatus, Nucleus, Chloroplast, Mitochondria, Lysosomes and Ribosomes.

Chromosome- Structure and number, Karyotype and Idiogram, nucleosome concept

**10 Hours**

##### UNIT – II. Cell cycle- Mitosis, Meiosis and their significance

Numerical variation in chromosomes, Euploidy and Aneuploidy (Detailed account)

Structural changes in Chromosomes: Deletion, duplication, Inversion and Translocation

**9 Hours**

#### MOLECULAR BIOLOGY

##### UNIT III. Nucleic acids as genetic material-Avery et.al's experiment, Fraenkel Conrat's experiment

**DNA-** Chemistry, structure, types and function

**RNA-** Chemistry, structure, types and function

**DNA-replication-** mechanism of replication in Prokaryotes and Eukaryotes

**Gene Concept-** Gene structure, action, One gene-one enzyme concept and One gene-one polypeptide concept

**10 Hours**

##### UNIT IV. Central dogma of Molecular Biology, Genetic code, Protein Synthesis- Transcription, RNA splicing and Translation, Gene regulation in prokaryotes ( Operon concept) and Eukaryotes(Gene battery).

Molecular basis of genetic disorders- Sickle cell Anemia and Thalassemia

**8 Hours**

#### EVOLUTION

##### UNIT V. A brief account of the origin of Life and concept of evolution

**Theories of Organic Evolution-** Lamarckism, Darwinism, Weismanism, DeVries theory, **Neo Darwinism** - Isolation, Mutation, Genetic Drift and Speciation

**5 Hours**

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## PRACTICALS FOR V SEMESTER—PRACTICAL - VI

One Practical of 3 Hours/ Week

14 Practical

1. Preparation of Fixatives and Stains
2. Study of Mitosis-Onion root tip
3. Study of Meiosis- *Onion/ Chlorophytum* flower buds
4. Micrometry
5. Karyotype Study
6. Isolation of DNA from Coconut endosperm
8. **Photographs and Charts- from Evolution, Molecular biology and Cell Biology:-**
  1. Cell organelles, 2. Electron Microscope, 3. Phase Contrast Microscope ,
  4. DNA replication 5. Lac operon 6. H.G.Khorana 7. Miller's experiment
  8. Genetic disorder- Sickle cell anaemia 9. Lamarck 10. Darwin. 11. Weismann

### SCHEME OF PRACTICAL EXAMINATION. PRACTICAL -VI

(MODEL QUESTION PAPER)

#### Cell biology, Molecular biology and Evolution.

Time 3 Hours

Max. marks 40

- I. Make a temporary squash preparation of the given material **A**, identify, sketch and label with reasons. Leave the preparation or evaluation **6 marks**  
(Preparation-3 mks, Identification of stage-1 mk, Labelled sketch-1 mk, Reasons-1 mk)
- II. Make a temporary squash preparation of the given material **B**, identify, sketch and label with reasons. Leave the preparation or evaluation -Meiosis. Squash preparation **6 marks**  
(reparation-3 marks, Identification of stage-1 mk, Labeled sketch-1 mk, Reasons-1 mk)
- III. Identify the given stages **C** and **D** **3X 2= 6 marks**  
(C- Mitotic stage, D- Meiotic stage (Both slides)  
(Identification 1 mark, labelled sketch 1 mark, reasons 1 mark)
- IV. Comment on **E** and **F** **2X2= 4 marks**  
(E- Stain, F- Fixative)
- V. Micrometry **G**- Calibrate the ocular micrometer using stage micrometer and measure the given material **6 marks**  
(Procedure-2 marks, Calibration-2 marks, Measurement-2 marks)
- VI. Critically comment on Karyotype- **H** **3 marks**
- VII. Comment on **I, J** and **K** **3X3 =9 marks**  
(Photographs- I -Cell Biology Cell organelles and Microscope charts, J-Mol. Biology,  
K - Evolution)

# SYLLABUS FOR VI SEMESTER

## THEORY PAPER VII (PLANT PHYSIOLOGY AND PLANT PROPAGATION)

THEORY: 80 + 20 Marks. 3 Hours / Week

42 HOURS

### PLANT PHYSIOLOGY

**UNIT I – Plant and Water Relations**-Diffusion. Imbibition, Osmosis, Cell as an Osmotic system, Concept of water Potential

**Short Distance Transport** - Active and Passive absorption of water. Absorption of minerals- Donnan's Equilibrium, Carrier Concept.

**Long Distance Transport**- Ascent of Sap, Root pressure Theory, TCT Theory, Phloem Transport- Munch's Hypothesis

**Transpiration**- Definition, Types, Mechanism of Stomatal movement- Starch-Sugar Inter conversion Hypothesis, Action of potassium ion transport, Antitranspirants, Guttation.

A brief account of **mineral nutrition**, Role of P, Mg, K, Mn, Bo, Cu,

12 hrs

**UNIT II – Growth** – Definition, Phases of growth, Sigmoid curve

**Growth Hormones**-chemical nature, biosynthesis and application of auxins, gibberellins, cytokinins, ethylene, and ABA.

**Growth and Movements**- Tropisms: Photo, Thigmo, Geo and Hydrotropisms.

**Photoperiodism and Vernalisation.**

8 hrs

**UNIT III – Enzymes**- classification, properties, and mode of action.

**Photosynthesis**- Introduction, significance, photosynthetic apparatus and Pigments, mechanism- light and dark reactions- C<sub>3</sub>, C<sub>4</sub>, and Photorespiration

**Respiration**- Introduction, significance, types, **Aerobic** - mechanism, Glycolysis, Krebs' cycle, Terminal Oxidation, ATP Synthesis - Chemiosmotic theory,

**Anerobic respiration**- alcoholic and lactic acid fermentation.

14 hrs.

**UNIT IV – Nitrogen metabolism**,- nitrogen fixation, mechanism- biological nitrogen fixation, nitrate reduction, **Aminoacids and their synthesis**,

3 hrs.

**UNIT V – Plant propagation** - methods of vegetative propagation- stem cutting, grafting, trenching, layering, suckers, stolons, tubers, corms. Basic nursery methods and green house techniques, Advantages of plant propagation.

5 hrs.

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## VI SEMESTER PRACTICALS. PRACTICAL- VII

One Practical of 3 Hours/ Week

14 Practicals

### Major Experiments:

- Determination of Osmotic potential by plasmolytic method. *Tradescantia*, or *Rhoeo*/ Onion peel/ Spirogyra
- Experiment on the relationship between transpiration and absorption.
- Experiment on Oxygen evolution during photosynthesis. Effect of 1)-light intensity 2) quality of light.(Red, Blue, Green)
- Separation of chloroplast pigments by paper chromatography.
- Demonstration of Starch in the leaf.
- Suction force due to Transpiration.
- Determination of stomatal index, Area of stomatal aperture and stomatal frequency
- Standardization of pH meter using buffer tablet. Determination of pH of the given solution (Extract of Tamarind leaf and Betel leaf or any locally available specimen )

### Minor Experiments:

- Streaming of cytoplasm ( Staminal hairs, Hydrilla leaf)
- Determination of transpiration by Ganong's Potometer.
- Experiment to demonstrate fermentation ( Kuhne's vessel )
- Measurement of growth by using Auxanometer.
- Experiment to demonstrate Geotropism, Phototropism and Hydrotropism
- Root pressure experiment
- Ganong's Respirometer
- Determination of unequal transpiration by using cobalt chloride paper.

### Biochemical tests for carbohydrates, fats and proteins.

**Propagation:** Demonstration of grafting, bud-grafting, wedge-grafting, cuttings and layering.

## SCHEME OF PRACTICAL EXAMINATION.

### VI SEMESTER. PRACTICAL- VII

### PLANT PHYSIOLOGY AND PLANT PROPAGATION

Time: 3 hours

Max. Marks: 40

I. Perform the major experiment **A**. Write the procedure, results, inference and leave the setup for evaluation.

**10 Marks**

(Ident- 2 marks, Procedure-2 marks, Setting/conducting- 3marks, Results/calculation/ interpretation- 3 marks)

II. Comment on **B, C & D** ( Minor expt.)

**5X3 =15 marks**

III. Perform the Biochemical test of **E** by elimination method  
(Procedure-5 marks, Result -2 marks)

**7 marks**

IV. Perform Plant propagation method of **F & G** .

**2X4= 8 marks**

( **F**)Air layering ( Gootee ), trench layering.(**G**)grafting (approach, Bud, wedge)

(Procedure significance & labeled diagram-2 marks, conducting/skill - 2marks)

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# SYLLABUS FOR VI SEMESTER

## THEORY PAPER -VIII

GENETICS, GENETIC ENGINEERING, PLANT BIOTECHNOLOGY, AND PLANT BREEDING

THEORY: 80 + 20 Marks  
3 Hours/ Week

42 HOURS

## GENETICS

**UNIT I - Introduction-** Mendel's law of inheritance, Test cross, Backcross, Incomplete dominance.

### Interaction of genes:-

**Complementary gene action-** flower color in sweet pea

**Supplementary interaction** - Anthocyanin pigmentation in Snapdragon

**Epistasis** - fruit color in summer squashes

**Multiple factor inheritance** - Ear size in maize

**Linkage and crossing over** - linkage in maize. Gene mapping by 2 and 3 point test cross, interference and coincidence.

15 hrs

**UNIT II- Cytoplasmic inheritance** - Plastid inheritance in *Mirabilis jalapa* and Cytoplasmic male sterility in *Maize*.

**Mutation** - spontaneous and induced, Transposable genetic elements

4 hrs

## PLANT BREEDING

**UNIT III-** A brief history – Aims and objectives of plant breeding

Techniques in plant breeding – hybridization( intergeneric and interspecific), Hybrid vigour and Hybrid seed production.

Germplasm maintenance, pollen banks, and quarantine measures. Plant breeding work done in India- paddy and cotton.

6 hrs

## GENETIC ENGINEERING

**UNIT IV-** A concise account of recombinant DNA Technology, Restriction enzymes, Ligases, Cloning vectors, Construction of genomics DNA and C-DNA libraries. A brief account of Genomics and its applications. A brief account of hazards and safe guards in Recombinant DNA Technology.

7 hrs

## PLANT BIOTECHNOLOGY

**UNIT V – Introduction – Scope of Biotechnology**

Tissue culture- Techniques, differentiation, toipotency, Organogenesis, Somatic hybridization, Somatic embryos and synthetic seeds. Anther culture - haploid production and its significance. Gene transfer methods- Agro bacterium mediated gene transfer, Electroporation and shot gun method.

**Applications of Biotechnology-** Transgenic plants in crop improvement, use of microbes in Industry and Agriculture. Production of Pencillin, Alcohol, Single Cell Proteins, Enzymes.

10 hrs

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## VI SEMESTER PRACTICALS. PAPER- VIII

**One Practical of 3 Hours/ Week**

**14 Practicals**

- A. Synthetic seed preparation
- B. Mounting of *Rhizobium/Anabaena* from root nodules/*Azolla*
- C. Solving the genetic problems related to theory portion. ( Monohybrid/ Dihybrid crosses /Interaction of genes)
- D. Construction of linkage maps- two point test cross
- E. Hybridization techniques- emasculation and bagging.
- F. Experiment on pollen germination-( Hanging drop method).
- G. Study of biotechnology products- Antibiotics, Rhizobium, Single Cell Protein.
- H. Photos of Transgenic plants, callus, multiple shoots, Tissue culture Equipments .
- I. Identification of photos and charts pertaining to theory portion.-Genetic engineering
- J. Tissue culture- Sterilization of glass wares, Preparation of M S medium, Inoculation of explants (2 classes)

### **Genetic problems:**

#### **PROBLEMS ON MONOHYBRID CROSS :-**

- 1) In Tomatoes Red fruit color (R ) is dominant over yellow (r). A pure red fruited plant is crossed to a yellow fruited one. What will be the appearance of F<sub>1</sub>? The F<sub>1</sub> are interbred and produce 320 offsprings in the F<sub>2</sub>. How many of them will be red and how many yellow? What will be the genotypes of F<sub>2</sub> and in what numbers ?
- 2) In man, brown eye (B) is dominant over blue eye (b). A man and his wife both brown eyed, beget a blue eyed child. What are the genotypes of the parents ?
- 3) In pea plant, Tallness (T) is dominant over dwarfness (t). A tall pea crossed with dwarf produces offerings of which 50% are tall and 50% are dwarf. What are the genotypes of the parents ?
- 4) In Drosophila, grey (G) is dominant to black (g). Two grey bodied flies when crossed produce 150 grey and 49 black. Give the genotypes of the parents and genotypes of the progeny

#### **PROBLEMS ON DI- HYBRID CROSS**

- 1) In garden pea, yellow seed color (Y) is dominant over green (y) and round seed shape (R) is dominant over wrinkled (r). The character pair segregate separately. A pure yellow wrinkled variety is crossed to a pure green round. Give the phenotypes and genotypes of F<sub>1</sub> and phenotypic ratio of F<sub>2</sub> generation.

- 2) A Man has brown eyes and red hair. He married a woman with blue eyes and dark hair. Give the genotype of the parents and children  
Note : Dark hair (D) is dominant over red (d) and brown eyes (B) is dominant over blue (b)
- 3) In garden pea, tall (T) is dominant over dwarf (t) and red flower color (R) is dominant over white (r). A tall red plant is crossed to a dwarf white plant . Give the genotypes of P<sub>1</sub> and F<sub>1</sub> generations. Give the phenotypic ratio of F<sub>2</sub>.
- 4) A tall red when crossed with dwarf red produces a dwarf white. Give the genotypes of the parents.

**PROBLEMS ON INTERACTIN OF FACTORS :**

1. In maize, the aleurone color (seed color ) is expressed due to the effect between two different gene pairs. A maize variety with purple colored corn (AACC) is crossed to colorless corn (aacc). Give the phenotype and genotype of F<sub>1</sub> and F<sub>2</sub> generations. What will be the phenotypic ratio in F<sub>2</sub> generation?
2. Two white flowered strains of the sweet pea ( *Lathyrus odoratus*) were crossed, producing an F<sub>1</sub> with only purple flowers. Random crossing among the F<sub>1</sub> produced 96 progeny plants, 53 exhibiting purple flowers and 43 with white flowers.
  - a) What phenotypic ratio is approximated by the F<sub>2</sub> ?
  - b) What type of interaction is involved ?
  - c) What were the probable genotype of the parental strains.

**PROBLEMS ON 2 POINT TEST CROSSES**

1. In tomato, red fruit (R) is dominant over yellow fruit (r) and yellow flowers (W) are dominant over white flowers (w). A cross is made between true breeding plants with red fruit and yellow flowers and plants with yellow fruit and white flowers. The F<sub>1</sub> generation plants are then test crossed to plants with yellow fruits and white flowers. The following results are obtained.
  - 333 red fruits/ yellow flowers
  - 64 red fruits/ white flowers
  - 58 yellow fruits/ yellow flowers
  - 350 yellow fruits/ white flowers

Calculate the map distance between the two genes.

2. Two different traits affecting pod characteristics in garden pea plants are enclosed by genes found on chromosome 5. Narrow pod is recessive to normal pod, yellow pod recessive to green pod. A true breeding plant with narrow, green pods was crossed to a true breeding plant with normal yellow pods. The F<sub>1</sub> were then test crossed to plants with narrow, yellow pods. The following results were obtained.
  - 144 normal green pods
  - 150 narrow yellow pods
  - 11 normal yellow pods
  - 9 narrow green pods

How far apart are these two genes?

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**SCHEME OF PRACTICAL EXAMINATION  
VI SEMESTER—PRACTICAL VIII**

**Time: 3 Hrs**

**Max. marks: 40**

1. **A-** Prepare synthetic seeds/ Perform inoculation of explant  
( Procedure-2 marks, conducting - 2marks) **4 marks**
2. **B-** Perform Emasculation and bagging experiment  
(Demonstration- 2 marks, Procedure & diagram-1 mk, Significance-1mk) **4 marks**
3. **C-** Mount the given microbe ( Rhizobium/Anabaena)  
(Mounting- 1.5 marks, Importance of the organism-1.5 marks) **3 Marks**
4. Solve the genetic problems **D, E and F** **4X3= 12 marks**  
(D- Monohybrid cross, E- Dihybrid cross, F- Interaction of factor/two point test crosses)
5. Comment on **G, H, I and J.** **3x4=12 marks**  
**G** - Biotechnology products, **H**- Tissue culture photo, **I**- Tissue culture equipment/photograph, **J**- Photographs from Genetic Engineering,  
(Identification 1 mark, Critical notes – 2 marks)
6. Perform pollen germination expt.of **K** **5marks**  
( Requirements-1 mk, Preparation- 2 mks, Procedure and significance-2 mks)

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**B.Sc., BOTANY SEMESTER SCHEME (I SEM TO IV SEM)  
THEORY QUESTION PAPER PATTERN**

**Time: 3 Hrs.**

**Max Marks: 60**

- Q I. Explain/Define 5 out of 7 questions. 5X2=10  
 Q II. Write notes on any 4 of the following 6 Questions 4X5=20  
 QIII. Give a detailed account of any 5 of the following 7 Questions 5X6=30

(While selecting major questions all the units concerned should be taken into consideration)

**B.Sc., BOTANY SEMESTER SCHEME (V and VI SEM)  
THEORY QUESTION PAPER PATTERN**

**Time: 3 Hrs.**

**Max Marks: 80**

- Q I. Explain/Define 10 out of 12 of the following. 10X2=20  
 Q II. Write notes on any 6 of the following 8 Questions 06X4=24  
 QIII. Give a comprehensive and detailed account of any 6 the following 8 Questions 06X6=36

(While selecting major questions all the units concerned should be taken into consideration)

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P.D. Sharma	Microbiology	Rastogi Publications; Shivaji road Meerat; 250002; India
P. D. Sharma	Microbiology and Plant pathology	Rastogi Publications; Shivaji road Meerat; 250002; India
H. C. Dube	Text book of fungi, Bacteria & Virus	Vani Educational books , Vikas house 20/4, Industrial area, Sahidabad, 201010, Ghaziabad, UP.
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William. C. Frazier and Dennis C. West hoff. 3 <sup>rd</sup> Edn <b>ALGAE</b> K.N. Bhatia	Food Microbiology A Treatise on Algae	Tata McGraw Hill Publishing company. R. Chand & company, Publishers, N.Delhi.
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Pandey. B.P.	Bryophyta	S. Chand and Company, New Delhi.
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<b>ANATOMY</b>		
Eames A.J. and Mac Daniels, L. H	Introduction to Plant Anatomy	MC Graw Hill, New York.
Katherien Esau	Anatomy of seed plants	Wiley Eastern, New Delhi.
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Tayal M. S.	Plant anatomy	Rastogi publications, Meerat.
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