



**BANGALORE UNIVERSITY**  
**DEPARTMENT OF BOTANY**

# **SYLLABUS**

**B.Sc. BOTANY**  
**I – VI SEMESTER**

**2010**

## PROCEEDINGS OF THE MEETING OF BOS (UG) IN BOTANY

Venue : Department of Botany, Bangalore University, Jnana Bharathi Campus, Bangalore – 560 056.

Date : 16-02-2010

Time : 11.00 A.M.

Agenda : 1. Revision of the B.Sc. (Botany I to VI Semester)

### Members Present

### Signature

|                         |                            |      |
|-------------------------|----------------------------|------|
| Dr. S. R. Ambika        | - Chairperson              | Sd/- |
| Dr. N. Sathyananda      | - Member                   | Sd/- |
| Sri Muthe Gowda         | - Member                   | Sd/- |
| Dr. H. Gokul            | - Member                   | Sd/- |
| Mrs. Sujatha. N. S      | - Member                   | Sd/- |
| Dr. Ravindra. V. Reshme | - Member                   | Sd/- |
| Dr. P. Anitha           | - Member                   | Sd/- |
| Dr. K. R. Chandrashekar | - External Member          | Sd/- |
| Dr. H. Niranjanmurthy   | - External Member          | Sd/- |
| Dr. Jenifer Lolita. C   | - Co-opted internal Member | Sd/- |
| Sri T. K. Ghorl         | - Co-opted internal Member | Sd/- |

The Chairperson welcomed the members to the meeting and thereafter he agenda was taken up for discussion.

### **I. Syllabus revision objectives:**

1. To attract students towards basic Botany so as to inculcate in them the Botanical spirit as love and passion for plant life.
2. To provide training in various experimental methods and skills so as to stimulate interest in scientific research.
3. To expose the students to field studies and Botanical exploration so as to develop environmental awareness and social responsibility.
4. To enable them to take up competitive examinations.
5. To convert the syllabus to course credits to enable students to take up choice based course credits.

### **II. It was decided to make a frame work of the syllabus and to distribute it to different colleges to prepare and come up with a power point presentation before a workshop is conducted to discuss the same.**

|                     |                                         |
|---------------------|-----------------------------------------|
| <b>Semester I</b>   | : Dr. Najma Bhanu, Alameen College      |
| <b>Semester II</b>  | : Dr. P. Anitha, BMS College            |
| <b>Semester III</b> | : Dr. H. Gokul National College         |
| <b>Semester IV</b>  | : Sri T.K. Ghorl KLE College            |
| <b>Semester V</b>   | :                                       |
| <b>Paper V</b>      | : Dr. Muthe Gowda, V. V. Puram College. |
| <b>Paper VI</b>     | : Dr. Ravindra. V. Reshme, MES College  |
| <b>Semester IV</b>  | :                                       |
| <b>Paper VII</b>    | : Dr. Jenifer Lolita. C. MSCw           |
| <b>Paper VII</b>    | : Dr. N. Satyananda. Vijaya College     |

### **III. The venue of the workshop: It was decided to conduct the workshop on 5<sup>th</sup> and 6<sup>th</sup> March 2010 at KLE College, Rajajinagar, Bangalore.**

## Frame work

**Semester I :** Dr. Najma Bhanu, Alameen College

Microbiology

Bacteria

Cyanobacteria

Phycology

**Semester II :** Dr. P. Anitha, BMS College

Mycology

Plant pathology

Bryophytes

Plant Anatomy

**Semester III :** Dr. H. Gokul, National College

Pteridophytes

Paleobotany

Environmental biology

Phytogeography

**Semester IV :** Sri T.K. Ghor, KLE College

Gymnosperms

Embryology

**Semester :V**

**Paper V :** Dr. Muthe Gowda, V. V. Puram College.

**Taxonomy and Economic Botany**

Biodiversity and Conservation

**Paper VI :** Dr. Ravindra. V. Reshme, MES College

Cytology

Genetics and plant breeding

Evolution

**Semester IV :**

**Paper VII :** Dr. Jenifer Lolita. C MSCW, Molecular Biology and Plant Biotechnology, Plant Physiology

**Paper VII :** Dr. N. Satyananda, Vijaya College, Plant Biochemistry

**Resolution:**

1. The internal members are authorized to coopt the subject experts of their choice for their respective papers.

The chairperson is also authorized to finalize the syllabus after the workshop in consultation with the internal BOS members.

Proceedings of the meeting of syllabus committee held on 17-3-2010

at K.L.E Society's S. Nijalingappa College

The syllabus committee met at K.L.E Society's S. Nijalingappa College on 17-3-2010 and discussed the revision of B.Sc. syllabus for papers II, IV, V and VI for the respective semesters. Those absent are informed to communicate their respective revised syllabus to the chairperson before 20-3-2010. The following members were present

Dr.M.C.Gayathri, Dept of Botany. Bangalore University

*M.C. Gayathri* 17.3.10

Dr. Rose Maria NMKRV College

*Rose Maria*

Dr. Prathibha Jyothi Nivas College

*K. Prathibha* 17.3.10

Smt Prasanna Mount Carmel College

*M. Prasanna* 17/3/10

Prof.Gadag KLES Nijalingappa college

*Gadag*

Dr.Jenifer Lolita.C Maharani's Science college

*Jenifer Lolita C*

Smt. Sujatha. N.S. MLACW

*Sujatha* 17-3-10

Dr. P. Anitha BMS College

*Anitha* 17/3/10

Sri.T.K.Ghori KLES Nijalingappa college

*T.K. Ghori*

Smt. Manjula SJRC College (Deputy GFGC Hosakote)

*Manjula* 17.3.10

Dr.S.R. Ambika Chairperson Dept of Botany. Bangalore University

*S.R. Ambika* 17/3/10

**Proceedings of the meeting of BOS (U.G.) in Botany held on 05.04.2010 in the Department of Botany, Bangalore University, Bangalore – 560 056**

**Members Present:**

Dr. H. Gokul

Dr. Ravindra V. Reshme

Dr. Muthegowda

Dr. Sangameshwar

Dr. P. Anitha

Dr. Najma Banu

Dr. Jenifer Lolitha. C

Dr. S. R. Ambika

**Signature**

Sd/-

Sd/-

Sd/-

Sd/-

Sd/-

Sd/-

Sd/-

Sd/-

**Members absent:**

Dr. Satyananda

Dr. Niranjnathurthy. H

Dr. Chandrashekar

1. The Board discussed in length the B.Sc., Semester syllabus and finalized the syllabus for I & II semester.
2. Draft syllabi for I, II, III & IV semesters were prepared, read and ratified.
3. Connected practical papers were also prepared, read & ratified.
4. It was unanimously decided that **RTI Act** will be included in the syllabus of constitution of India paper of the II Semester B.Sc., (Refer Order No-KIC/8/ADM/2010 Dated: 17.02.2010).
5. The Chairperson, BoS is authorized to incorporate required addition & deletions in the B.Sc., Botany syllabus.

# PROFORMA FOR THE SCHEME OF STUDY AND EXAMINATION OF THE COURSE

Name of the Course : Bachelor's Degree in Botany

Duration of the Course : 3 year with 6 semesters

Scheme of study and examination : Semester I - VI

| Code of the Paper    | Subject                                                                                                                                    | Theory (Hrs/Week) | Practicals (Hrs/Week) | Total No of hours |            | Duration of Examination (Hrs) |           | Max. Marks for Examination |           | Internal assessment | Total Marks |
|----------------------|--------------------------------------------------------------------------------------------------------------------------------------------|-------------------|-----------------------|-------------------|------------|-------------------------------|-----------|----------------------------|-----------|---------------------|-------------|
|                      |                                                                                                                                            |                   |                       | Theory            | Practicals | Theory                        | Practical | Theory                     | Practical |                     |             |
| Botany Semester I    | Diversity of Non Vascular Plants Part - I<br>Introduction to Microbiology, Viruses, Immunology, Bacteria, Cyanobacteria and Phycology      | 4                 | 3                     | 60                | 45         | 3                             | 3         | 60                         | 30        | 10                  | 100         |
| Botany Semester II   | Diversity of Non Vascular Plants Part - II & Plant Anatomy<br>Mycology, Lichens, Mycorrhiza, Plant Pathology, Bryophytes and Plant Anatomy | 4                 | 3                     | 60                | 45         | 3                             | 3         | 60                         | 30        | 10                  | 100         |
| Botany Semester III  | Peridophytes, Palaeobotany, Environment Biology and Phylogeography                                                                         | 4                 | 3                     | 60                | 45         | 3                             | 3         | 60                         | 30        | 10                  | 100         |
| Botany Semester IV   | Gymnosperms and Embryology of Angiosperms                                                                                                  | 4                 | 3                     | 60                | 45         | 3                             | 3         | 60                         | 30        | 10                  | 100         |
| Botany Semester V    | Taxonomy and Economic Botany                                                                                                               | 3                 | 3                     | 45                | 36         | 3                             | 3         | 60                         | 30        | 10                  | 100         |
| Botany Semester VI   | Cytology, Genetics, Plant Breeding and Evolution                                                                                           | 3                 | 3                     | 45                | 36         | 3                             | 3         | 60                         | 30        | 10                  | 100         |
| Botany Semester VII  | Molecular Biology, Genetic Engineering, Biotechnology and Plant Physiology - I (Water relations)                                           | 3                 | 3                     | 45                | 36         | 3                             | 3         | 60                         | 30        | 10                  | 100         |
| Botany Semester VIII | Plant Physiology - II                                                                                                                      | 3                 | 3                     | 45                | 36         | 3                             | 3         | 60                         | 30        | 10                  | 100         |

\* 5 marks for attendance + 3 marks for test + 2 marks for seminars / assignments and field reports.

\*\* 5 Marks for attendance + 5 marks for practical test.

© Test for theory and practical should be conducted 15 days earlier to the last working day of each semester.

### QUESTION PAPER FOMRAT

The question papers of Theory examinations to follow the pattern specified below:

| Marks for each question | Number of question to be<br>Answered out of |    | Total<br>marks |
|-------------------------|---------------------------------------------|----|----------------|
| 1                       | 30                                          | 30 | 30             |
| 5                       | 6                                           | 8  | 30             |
|                         |                                             |    | -----          |
| Total                   |                                             |    | 60             |
|                         |                                             |    | -----          |

### BANGALORE UNIVERSITY B.Sc. Semester Examination

#### BOTANY

#### Paper

Time: 3 Hours

Max. Marks: 60

A. Answer all the following by **choosing** the correct choice

(30 x 1 = 30)

B. Write notes on any **FIVE** of the following

(6 x 5 = 30)

**I SEMESTER**  
**PAPER 1- DIVERSITY OF NON-VASCULAR PLANTS**  
**(INTRODUCTION TO MICROBIOLOGY, VIRUSES, BACTERIA CYANOBACTERIA AND PHYCOLOGY)**

|                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                  |
|-----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|
| <b>UNIT I:</b>  | <b>INTRODUCTION TO MICROBIOLOGY</b><br>Scope of Microbiology, Contributions of scientists to the field of Microbiology (Anton Von Leeuwenhoek, Louis Pasteur, Robert Koch, Alexander Flemming) Branches of Microbiology, Isolation of microbes from soil—Brief account of culture media, Serial dilution, Pour plate method and Colony characteristics of Bacteria and Fungi.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 60 hrs<br>10 hrs |
| <b>UNIT II:</b> | <b>STUDY OF VIRUSES</b><br>A brief history of Virology -- (Adolf Mayer, Iwanowsky, Beijerinck, W.M Stanley, F. W. Twort), Characteristics of viruses, General structure-shape, size, protein coat, envelope, nucleic acids and carbohydrates. Outline classification of viruses. Viral diseases: Tomato leaf curl disease. Structure, replication and significance of:<br>a) TMV<br>b) HIV<br>c) A brief account of Prions and Viroids                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 8 hrs            |
| <b>UNIT III</b> | <b>STUDY OF BACTERIA</b><br>Introduction, Occurrence, size and shape, Classification based on shape, arrangement of cells and flagella, Ultrastructure of bacterial cell.<br>Cell wall- structure, Chemical composition, Cytoplasm, Mesosome, Ribosomes, Flagella, Pili, Capsules, Nuclear material, and Endospores.<br>A brief account of Plasmids - Definition, properties, and types, Structure and importance of Ti plasmid. Bacterial nutrition- Phototrophs and Chemotrophs. Reproduction-Binary fission and Genetic Recombination.<br>Economic importance - Role of Bacteria in Agriculture, Medicine & Industry. Bacterial disease: Citrus canker disease<br>General account of Mycoplasmas Sandal spike disease.<br>Immunology - Brief account of immune systems, application of Immunotechniques in agriculture & industry, monoclonal anti bodies (ELISA, Hybridoma Techniques). | 15 hrs           |
| <b>UNIT IV:</b> | <b>STUDY OF CYANOBACTERIA</b><br>Introduction, General characters, Outlines of classification (Fritsch-1947), Thallus structure, Ultrastructure of cell, Photosynthesis, Reproduction, Economic importance of Cyanobacteria; SCP, Biofertilizers, role in water pollution.<br>Type study: <i>Gloeocapsa</i> , <i>Anabaena</i> , <i>Scytonema</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 7 hrs            |
| <b>UNIT V:</b>  | <b>STUDY OF ALGAE</b><br>Introduction, General characters, Outlines of classification (Fritsch-1947), Thallus structure, Pigmentation, Reproduction and Economic importance of algae in Industry, Agriculture and Medicine, Occurrence, Structure and Reproduction and Life cycles of <i>Chlamydomonas</i> , <i>Volvox</i> , <i>Oedogonium</i> , <i>Chara</i> , <i>Ectocarpus</i> and <i>Polysiphonia</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 20 hrs           |

## References

1. Aneja, K.R. (1993) **Experiments in Microbiology, Pathology and Tissue Culture**, Vishwa Prakashan, New Delhi.
2. Basu, A.N. (1993) **Essentials of plant viruses, vectors and Plant diseases**, new age International, New Delhi.
3. Chopra, G.L. (1984) **A text book of Algae**, Rastogi publications.
4. Desikachar, T.V.(1959) **Cyanophyta**, ICAR, New Delhi.
5. Fritch, R.E (1977) **Structure and reproduction of Algae**, Cambridge University press.
6. Pandey B.P, 1979, 2001, **College Botany Volume 1**, S. Chand & Company Ltd, New Delhi
7. Power, C. B. and Dagainwala, H.F(1982)
8. Pelzar (1963) **Microbiology**, Tata Mc Graw Hill, New Delhi.
9. Singh. V, Pande. P.C and Jain. D. K, 2008- 2009, Rastogi Publications, Meerut.
10. Smith GM(1978)&(1996) **Cryptogamic Botany Volume I**, Tata Mc Graw Hill, NewDelhi
11. Sundar Rajan,S.(1997)**College Botany Volume I** Himalaya Publications, Mumbai.
12. Singh, R.P.(2007), **Microbial taxonomy and culture techniques**. Kalyani publishers, New Delhi.
13. Vashishta, B. R. Sinha, A.K and Singh, V.P, (1991) **Algae**. S. Chand and Co. Ltd, New Delhi

## SEMESTER I - PRACTICAL PAPER-I INTRODUCTION TO MICROBIOLOGY, VIRUSES, BACTERIA CYANOBACTERIA AND PHYCOLOGY

**Total units: 15**

- |                                                                                                                                                                                                                 |                 |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| 1. Study of instruments: Autoclave, Inoculation chamber, Hot air oven, Incubator and Inoculation loop                                                                                                           |                 |
| 2. Sterilization of glass ware and media preparation (Nutrient Agar, Martin Rose Bengal Agar)                                                                                                                   |                 |
| 3. Isolation of Bacteria and Fungi from soil by pour plate method                                                                                                                                               | <b>04 units</b> |
| 4. Colony characteristics of Bacteria and Fungi to identify the Colonies obtained<br>( <i>Bacillus</i> , <i>Staphylococcus</i> <i>E. coli</i> , <i>Penicillium</i> , <i>Aspergillus</i> , <i>Cladosporium</i> ) | <b>02 units</b> |
| Study of Tomato leaf curl disease, Sandal spike disease & Citrus canker disease.                                                                                                                                |                 |
| 5. Gram's staining: a) <i>Rhizobium</i> from root nodules<br>b) <i>Lactobacillus</i> from curds                                                                                                                 |                 |
| 6. Measurement of cell concentration- Yeast cells / fungal spores using Hemocytometer,                                                                                                                          | <b>02 units</b> |
| 7. Type study of Cyanobacteria: <i>Gloeocapsa</i> , <i>Anabaena</i> , <i>Sytonema</i>                                                                                                                           | <b>07 units</b> |
| 8. Type study of Algae: <i>Chlamydomonas</i> , <i>Volvox</i> , <i>Oedogonium</i> , <i>Chara</i> , <i>Ectocarpus</i> , <i>Polysiphonia</i>                                                                       |                 |

**I - SEMESTER PRACTICAL QUESTION PAPER**  
**INTRODUCTION TO MICROBIOLOGY, VIRUSES, BACTERIA CYANOBACTERIA AND**  
**PHYCOLOGY**

**Time: 3 hrs.**

**Total marks 30**

- |   |                                                                                                                                            |            |
|---|--------------------------------------------------------------------------------------------------------------------------------------------|------------|
| 1 | Identify the given specimens <b>A, B &amp; C</b> with labelled diagrams and reasons. -----                                                 | 3x3=9marks |
| 2 | Describe the colony characteristics of the given colony <b>D</b> and tabulate your observations. -----                                     | 2marks     |
| 3 | Prepare temporary slide of <b>E</b> , sketch, label and identify with reasons Leave the preparation for evaluation. -----                  | 4marks     |
| 4 | Stain the given material <b>F</b> by Gram's staining. Write the procedure and identify with reasons .Leave the preparation for evaluation. |            |

**OR**

- |   |                                                                                                        |            |
|---|--------------------------------------------------------------------------------------------------------|------------|
| · | Calculate the population of fungal spores / Yeast cells in sample <b>F</b> using haemocytometer. ----- | 4marks     |
| 5 | Identify the slides <b>G</b> and <b>H</b> with labelled diagrams and with reasons -----                | 2x3=6marks |
| 6 | a) Record -----                                                                                        | 3marks     |
|   | b) Submission -----                                                                                    | 2marks     |

**SCHEME OF VALUATION**

1. Three specimens **A, B** and **C** – One from Algae, One from Cyanobacteria and One Specimen of diseases / Herbarium. (Identification-1 mark, labelled diagram with reasons-2 marks)
2. Colony characters of the given colony '**D**' - 2 marks.
3. Specimen from algae-mounting-2marks, Identification, sketch & reasons-2marks
4. Specimen **F**---Gram staining. (Staining-2 marks, Procedure & Result -2 mark)

**OR**

Calculation of fungal spores/ yeast using Haemo cytometer (Procedure-2marks, Calculations -2 marks)

- |       |                                                                               |         |
|-------|-------------------------------------------------------------------------------|---------|
| 5.    | Two permanent slides from Algae(Identification-1mark,sketch & reasons 2marks) |         |
| 6. a) | Record-----                                                                   | 3 marks |
|       | b)Submission of 2 algae / cyanobacteria materials-----                        | 2 marks |

### MODEL QUESTION PAPER

#### PAPER- I DIVERSITY OF NON - VASCULAR PLANTS – PART I

Time: 3 Hrs

Max marks : 60

I. Answer the following by choosing the correct choice:

1x30=30

1. Palmella stage in *Chlamydomonas* is helpful in
  - a) Protecting the alga against dessication
  - b) Bringing about gametic union
  - c) vegetative reproduction
  - d) accumulating mucilage
2. Who first isolated TMV in its crystalline form?
  - a) Adolf Mayer
  - b) Iwanowsky
  - c) Stanley W. M
  - d) Beijerinck
3. Heterocysts are not seen in
  - a) *Gloecapsa*
  - b) *Scytonema*
  - c) *Nostoc*
  - d) *Anabaena*
4. Cocci arranged in cubes with 8 or more cells
  - a) Tetrads
  - b) Diplococci
  - c) Streptococci
  - d) Sarcinae
5. The prokaryotic genetic system contains
  - a) Either DNA or histones
  - b) DNA and histones
  - c) Neither DNA nor histones
  - d) DNA but no histones
6. The cause of 'red snow' is
  - a) *Chlamydomonas nivalis*
  - b) *Volvox globator*
  - c) *Chlamydomonas coccifera*
  - d) *Nostoc muscarum*
7. One of the intresting features of the viruses is that they
  - a) Multiply only in the host cytoplasm
  - b) Occur only inside bacteria
  - c) Are Made up of proteins only
  - d) multiply only outside the host
8. The stoneworts belong to the order
  - a) Oedogoniales
  - b) Charales
  - c) Volvocales
  - d) Conjugales
9. The bacterial cell wall is composed of
  - a) Peptidoglycan
  - b) Suberin
  - c) Lignin
  - d) Cellulose
10. Agar-agar is obtained from
  - a) *Ectocarpus*
  - b) *Sargassum*
  - c) *Polysiphonia*
  - d) *Gelidium*
11. Root nodules with nitrogen fixing bacteria are present in
  - a) Cotton
  - b) Wheat
  - c) Mustard
  - d) Gram
12. The first bacteriologist
  - a) Pasteur
  - b) Jenner
  - c) Leuwenhock
  - d) Robert Koch

13. The seaweeds belong to
  - a) Chlorophyceae
  - b) Phaeophyceae
  - c) Bacillariophyceae
  - d) Rhodophyceae
14. The mycoplasma contains
  - a) Only DNA
  - b) Both DNA and RNA
  - c) Only RNA
  - d) Neither DNA nor RNA
15. CFU is
  - a) Cell Forming Unit
  - b) Cluster Forming Unit
  - c) Colony Forming Unit
  - d) Cytoplasm Forming Unit
16. Scytonema reproduces by the formation of
  - a) Hormogonia only
  - b) Heterocysts and endospores
  - c) Hormogonia and akinetes
  - d) Hormogonia and heterocysts
17. The cystocarp of *Polysiphonia* is
  - a) Haploid
  - b) Triploid
  - c) Diploid
  - d) Polyploid
18. Pour plate method is used
  - a) To isolate pure cultures
  - b) To preserve pure cultures
  - c) To isolate impure cultures
  - d) To discard mixed cultures
19. A virus that can reproduce without killing its host is called
  - a) Temperate virus
  - b) Retroactive virus
  - c) Lytic virus
  - d) Virion
20. The nanandria in *Oedogonium* gives rise to
  - a) Oogonia
  - b) Zoospores
  - c) Antheridia
  - d) Endospores
21. Most brown algae live in
  - a) Fresh water streams
  - b) Cool coastal waters of oceans
  - c) Fresh water lakes
  - d) Warm coastal waters of oceans
22. The Plakea stage of *Volvox* consists of
  - a) 2 cells
  - b) 8 cells
  - c) 4 cells
  - d) 16 cells
23. Solutions of crystal violet, iodine & alcohol are used in a staining procedure known as
  - a) Gram stain
  - b) Geisma stain
  - c) Acid fast stain
  - d) Wright's stain
24. The common method of reproduction in bacteria is
  - a) Budding
  - b) Fragmentation
  - c) Fission
  - d) Hormogone formation
25. The globule of *Chara* consists of
  - a) 4 shield cells
  - b) 16 shield cells
  - c) 8 shield cells
  - d) 24 shield cells

26. A cyanobacteria also known as single cell protein is  
 a) *Anabaena* c) *Spirulina*  
 b) *Gelidium* d) *Chara*
27. Transfer of genetic material from one bacterium to another by virus is called  
 a) Transformation c) Transduction  
 b) Conjugation d) Propagation
28. One of the following characters found in bacteria is a plant character  
 a) Presence of flagella c) Prokaryotic nucleus  
 b) Rigid cell wall d) Heterotrophic nutrition
29. False branching is found in  
 a) *Oscillatoria* c) *Nostoc*  
 b) *Anabaena* d) *Scytonema*
30. The non motile male gamete in Rhodophyceae is called  
 a) Monospore c) Carpospores  
 b) Spermatium d) Tetraspore

II. Answer any six of the following: -

6x5=30

1. Describe pour plate method of isolation of microorganisms.
2. Give an account of asexual reproduction in *Volvox*.
3. Describe the structure and multiplication of TMV.
4. Give an account of contribution of Louis Pasteur to the development of Microbiology.
5. What are plasmids? List the types and properties.
6. With labelled diagrams explain thallus structure and branching in *Scytonema*.
7. Compare cell walls of Gram positive and Gram negative bacteria.
8. Give an account of economic importance of brown algae.
9. Describe the structure of nucleole of *Chara*.

**II SEMESTER**  
**PAPER II – DIVERSITY OF NON – VASCULAR PLANTS**  
**(MYCOLOGY, LICHENS, MYCORRHIZA, PLANT PATHOLOGY, BRYOPHYTES AND**  
**PLANT ANATOMY)**

|                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |               |
|------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
|                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | <b>60 Hrs</b> |
| <b>UNIT I:</b>   | <p><b>Mycology : Introduction:</b> General characters, occurrence, thallus organization, reproduction &amp; classification. Structure, reproduction and life history of <i>Albugo</i>, <i>Penicillium</i>, <i>Puccinia</i> and <i>Alternaria</i> and economic importance : Role of fungi in medicine, agriculture and industry</p> <p><b>Lichens:</b> General account, Structure and reproduction. Ecological and economic importance.</p> <p><b>Mycorrhiza:</b> General account</p> <p><b>Saccharomyces</b> – A model genetic organism.</p>                                                       | <b>20 hrs</b> |
| <b>UNIT II:</b>  | <p><b>Plant Pathology:</b> General account of symptoms, pathogen, etiology, mode of infection and management of:</p> <p><b>Fungal diseases:</b> Koleroga, Ergot of Bajra, Coffee rust, Grain smut of Sorghum, Blast disease of Rice, Red rot of Sugarcane &amp; Tikka disease of Groundnut.</p> <p>A brief account of biopesticides: Neem, <i>Trichoderma</i> &amp; <i>Bacillus thuringiensis</i>.</p>                                                                                                                                                                                             | <b>10 hrs</b> |
| <b>UNIT III:</b> | <p><b>Bryophyta:</b> General characters, Type study of distribution, structure, reproduction, classification and alternation of generations in Bryophytes.</p> <p><i>Marchantia</i>, <i>Anthoceros</i> &amp; <i>Funaria</i>.</p>                                                                                                                                                                                                                                                                                                                                                                   | <b>15 hrs</b> |
| <b>UNIT IV:</b>  | <p><b>Plant anatomy: Meristematic tissues</b> – Structure, function, classification. Organization of Apical meristems : Tunica – Corpus theory and Histogen theory. <b>Secretory cells and Tissues:</b> Structure, classification and significance. <b>Vascular tissues</b> : A brief account</p> <p><b>Secondary growth</b> : Origin and activity of Vascular cambium in dicot stem.</p> <p><b>Wood anatomy:</b> A brief account and commercial application in paper and fibre industry etc. <u>Anomalous secondary growth</u> : A general account. (<i>Dracaena</i> &amp; <i>Boerhaavia</i>)</p> | <b>15 hrs</b> |

**Practical II**  
**DIVERSITY OF NON - VASCULAR PLANTS (MYCOLOGY, LICHENS, MYCORRHIZA,**  
**PLANT PATHOLOGY, BRYOPHYTES & PLANT ANATOMY)**

|      |                                                                                                                    |                                       |
|------|--------------------------------------------------------------------------------------------------------------------|---------------------------------------|
|      |                                                                                                                    | <b>Total units allotted: 15 Units</b> |
| I    | Identification and classification of fungal members included in the theory.                                        | <b>4 Units</b>                        |
| II   | Demonstration of mushroom cultivation                                                                              |                                       |
| III  | Study of Lichens                                                                                                   |                                       |
| IV   | Study of Mycorrhiza                                                                                                | <b>3 Units</b>                        |
| V    | Study of Plant diseases included in the theory                                                                     | <b>2 Units</b>                        |
| VI   | Study of forms of Bryophytes included in the theory                                                                | <b>3 Units</b>                        |
| VII  | Normal and anomalous secondary growth in stem Eg. <i>Tridax</i> , <i>Dracaena</i> stem and <i>Boerhaavia</i> stem. | <b>3 Units</b>                        |
| VIII | Field visit to study pathogen and host interaction.                                                                |                                       |
| IX   | Report of field visit + Project report of mushroom cultivation / Application of biofertilizers.                    |                                       |

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16. Singh, R.S. (1978) **Plant Diseases** 4<sup>th</sup> Ed. Oxford and IBH, New Delhi.
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## II Semester Practical Question Paper II (MYCOLOGY, LICHENS, MYCORRHIZA, PLANT PATHOLOGY, BRYOPHYTES AND PLANT ANATOMY)

**Time : 3 Hours**

**Max Marks : 30**

- |                                                                                                                                                        |       |
|--------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| 1 Identify the specimens <b>A, B &amp; C</b> With labeled diagrams and reasons.                                                                        | 3X3=9 |
| 2 Prepare a temporary Safranin stained T.S of the material ' <b>D</b> '. Sketch, Label and Identify with reason, leave the preparation for evaluation. | 1X5=5 |
| 3 Write critical notes on <b>E</b>                                                                                                                     | 1X2=2 |
| 4 Identify the slides <b>F,G &amp; H</b> with labeled diagrams and reasons                                                                             | 3X3=9 |
| 5 Class record and submissions                                                                                                                         | 3+2=5 |

### Scheme of Valuation

- 1) Two specimens from fungi and one from Bryophyta (Identification – 1 Mar, Labelled diagram with reasons – 2 Marks)
- 2) Any one of the following may be given - Stem of *Tridax*, *Dracaena* or *Boerhaavia* stem, (Staining and Mounting – 3 Marks, Sketch and Labeling – 1 Mark, Identification with reasons – 1 Mark)
- 3) One diseased palnt / Lichens / Mycorrhiza (Identification – 1 Mark & Critical points – 1 Mark)
- 4) One from Bryophytes, One from Fungi and One from Anatomy (Identification – 1 Mark, Labelled diagrams with reasons – 2 Marks)
- 5) Class records & Submissions: 3 herbarium sheets from Plant pathology (Marks: 2+3)=5

### Model Question Paper

#### Paper-II : Mycology, Lichens, Mycorrhiza, Plant Pathology, Bryophytes & Plant Anatomy

Time: 3 Hours

Max Marks= 60

I. Answer the following by choosing the correct choice

1x30=30

- 1) Facultative saprophyte is
  - a) Always parasite
  - b) Parasite but can be saprophyte
  - c) Saprophyte but acquires a parasitic mode
  - d) Always saprophyte
- 2) All heterotrophs require an environment which can provide
  - a) Organic compounds
  - b) Vitamin A
  - c) Ammonium salt
  - d) Nitrates in solution
- 3) Fungal hyphae penetrates hard cell walls of their hosts with the help of
  - a) Sugar exudates
  - b) Hormones
  - c) Enzymes
  - d) Sharp tips
- 4) Fungal hyphae get arranged in parallel manner to constitute
  - a) Trama
  - b) Hymenium
  - c) Fruiting body
  - d) Fructification
- 5) A dark brown compact mass of mycelium acting as a resting body is called
  - a) Sclerotium
  - b) Chlamydospore
  - c) Rhizomorph
  - d) Zoospore
- 6) When a portion of fungal mycelium is used in the formation of reproductive structures, the organism is called
  - a) Eucarpic
  - b) Acarpic
  - c) Holocarpic
  - d) Cystocarp
- 7) The mycelium is typically coenocytic in
  - a) Phycomycetes
  - b) Ascomycetes
  - c) Basidiomycetes
  - d) Deuteromycetes
- 8) White rust of crucifers is caused by
  - a) *Phytophthora*
  - b) *Albugo*
  - c) *Puccinia*
  - d) *Penicillium*
- 9) Hypertrophy of floral parts in a cruciferous plant is caused by
  - a) Conidia of *Cystopus*
  - b) Conidiophores of *Cystopus*
  - c) Accumulation of hyphae of *Cystopus* for sexual reproduction
  - d) Stunted growth
- 10) Yeast is an important source of
  - a) Protein
  - b) Riboflavin
  - c) Sugar
  - d) Ascorbic acid
- 11) Which of the following is commonly called as blue-green mould?
  - a) *Aspergillus*
  - b) *Penicillium*
  - c) *Alternaria*
  - d) *Puccinia*

- 12) In *Puccinia* diploidisation occurs in the  
 a) Teleutospores c) Uredospores  
 b) Aeciospores d) Pycniospores
- 13) Roots of *Pinus* seedling are associated with  
 a) Fungus c) Algae  
 b) Bacteria d) Microbes
- 14) Mycorrhizal association is found in  
 a) Fungi and tree root c) Algae and *Azolla*  
 b) Algae and Fungi d) Algae and tree root
- 15) A common phycobiont in lichens is  
 a) *Microcystis* c) *Euglena*  
 b) *Trebouxia* d) *Citraria*
- 16) Lichens are best indicators of  
 a) Air pollution b) Water pollution c) Soil pollution d) All pollution
- 17) Draw a neat labeled diagram of ventral surface of liver wort
- 18) Elaters and pseudoelaters are meant  
 a) For absorption of nutrition c) For spore dispersal  
 b) To provide mechanical strength d) For conduction of sap
- 19) Gemma are asexual reproductive bodies of  
 a) Horn worts c) Liver worts  
 b) Mosses d) Stone worts
- 20) Which of the following is true moss?  
 a) Club moss c) Irish moss  
 b) Reindeer moss d) Peat moss
- 21) Periblem gives rise to  
 a) Pericycle c) Medulla  
 b) Cortex d) Epidermis
- 22) Quiescent centre is present in  
 a) Root apex c) Shoot apex  
 b) Vegetative apex d) Reproductive apex
- 23) A nectar-secreting gland cell characteristically contains  
 a) Granular cytoplasm filling the cell and a small nucleus  
 b) Granular cytoplasm lining a central vacuole and a small nucleus  
 c) Granular cytoplasm filling the cell and a large conspicuous nucleus  
 d) Vacuolated cytoplasm but with a large nucleus
- 24) The amphivasal vascular bundles are seen in the old stem of  
 a) *Helianthus* c) *Zea*  
 b) *Cucurbita* d) *Dracaena*

25) Match the following:

- |                  |                         |
|------------------|-------------------------|
| a) Grain smut    | a) <i>Haemelia</i>      |
| b) Ergot         | b) <i>Claviceps</i>     |
| c) Red rust      | c) <i>Pyricularia</i>   |
| d) Blast disease | d) <i>Sphacelotheca</i> |
| e) Coffee rust   | e) <i>Puccinia</i>      |

II Answer any Six of the following :

6x5=30

1. Explain the life cycle of polymorphic fungus on the primary host.
2. Asexual reproduction in *Penicillium*.
3. Role of fungi as model genetic organisms.
4. Give an account of endomycorrhiza.
5. Describe the structure of archegoniophore in *Marchantia*.
6. Explain anomalous secondary growth in monocot stem.
7. What is Koleroga? Give the symptoms, casual organism and control measures.
8. Give an account of secretory tissues.
9. Explain the capsule of *Funaria*.

**III SEMESTER**  
**PAPER III - PTERIDOPHYTES, PALEOBOTANY, ENVIRONMENTAL BIOLOGY AND**  
**PHYTOGEOGRAPHY**

|                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                |
|------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|
| <b>UNIT I:</b>   | <b>Pteridophytes</b><br>Introduction and classification (as per K.R. Sporne)<br>Study of diversity in morphology, anatomy and reproduction of the following groups as studied in representative forms:<br>i) Psilotopsida – Eg: <i>Psilotum</i><br>ii) Lycopsidea – Eg: <i>Selaginella</i><br>iii) Sphenopsida – Eg: <i>Equisetum</i><br>iv) Filicopsida – Eg: <i>Marsilea</i><br>(Developmental stages not required).<br>A brief account of stelar evolution, heterosporous & seed habit.                                                                                     | <b>60 HRS</b><br><b>15 hrs</b> |
| <b>UNIT II:</b>  | <b>Paleobotany</b> : Contribution of Paleobotanist - Birbal Sahni.<br>Geological time scale, methods of studying fossils; Process of fossilization, types of fossils.<br>A brief account of <b>Rhynia</b> , <b>Calamites</b> (Stem), <b>Cycadeoidea</b>                                                                                                                                                                                                                                                                                                                        | <b>10 hrs</b>                  |
| <b>UNIT III:</b> | <b>Environmental Biology</b><br>Introduction and scope of environment biology<br>Ecological factors: Climatic, Edaphic and Biotic.<br>Ecosystem – Concept, components, study of marine, grassland and cropland ecosystems.<br>Ecological Succession – Hydrosere, Xerosere<br>Ecological adaptations – Hydrophytes, Xerophytes, Halophytes, Epiphytes and Parasites.                                                                                                                                                                                                            | <b>15 hrs</b>                  |
| <b>UNIT IV:</b>  | <b>Ecosystem management</b> – Soil reclamation, watershed management and remote sensing.<br><b>Biodiversity</b> : Genetic diversity and Ecological diversity. Need for integration of biodiversity with science and technology.<br><b>Conservation of natural resources</b> – Over exploitation of natural resources, Principle methods of soil conservation (Biological and Mechanical), Afforestation.<br>Social forestry, Agroforestry. Forest conservation.<br><b>Conservation of plant diversity</b> – (In situ & Ex situ), Role of seed bank, gene bank and pollen bank. | <b>15 hrs</b>                  |
| <b>UNIT V:</b>   | <b>Brief account of Continental drift</b><br><b>Phytogeography</b> – Phytogeographical regions of India, Vegetational types of Karnataka state.                                                                                                                                                                                                                                                                                                                                                                                                                                | <b>5 hrs</b>                   |

**III SEMESTER**  
**PAPER III - PTERIDOPHYTES, PALEOBOTANY, ENVIRONMENTAL BIOLOGY AND**  
**PHYTOGEOGRAPHY**

Total Units allotted = 15

|                  |                                                                                                                          |         |
|------------------|--------------------------------------------------------------------------------------------------------------------------|---------|
| <b>UNIT I:</b>   | Identification and classification of Pteridophytes (Examples studied in the theory)                                      | 4 units |
| <b>UNIT II:</b>  | Paleobotany – Study of specimens and slides (Fossil material / slide)                                                    | 2 units |
| <b>UNIT III:</b> | Study of one example for each adaptation (Specimens and slides) Estimation of Oxygen & chloride content in given samples | 4 units |
| <b>UNIT IV:</b>  | Marking of vegetation types on Karnataka map                                                                             | 1 unit  |
| <b>UNIT V:</b>   | Study of quadrat and line transect methods in ecology (Preferably to be conducted in the field)                          | 2 units |
| <b>UNIT VI:</b>  | Submission of 4 permanent free hand sections (Both Pteridophytes and ecological adaptations).                            | 2 units |

**References :**

01. Agashe, S.N. (1995) *Paleobotany. Plants of the past, their evolution, palaeoenvironment & application in exploration of fossil fuels.* Oxford I.B.H. New Delhi
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15. Wilson N. Stewart & Gar W. Rothwell (2010), *Paleobotany & the Evolution of Plants*

**III SEMESTER**  
**Practical Question Paper**  
**PAPER III - PTERIDOPHYTES, PALEOBOTANY, ENVIRONMENTAL BIOLOGY AND**  
**PHYTOGEOGRAPHY**

**Time: 3 Hours**

**Max Marks: 30**

- |   |                                                                             |               |
|---|-----------------------------------------------------------------------------|---------------|
| 1 | Identify and classify specimen <b>A and B</b> giving reasons.               | 3 x 2 = 6     |
| 2 | Identify the slides <b>C and D</b> with reasons and diagrams                | 3 x 2 = 6     |
| 3 | Comment on slide / specimen / photocopy/photograph of <b>E</b>              | 3 x 1 = 3     |
| 4 | Identify and comment on ecological adaptation of <b>F and G</b>             | 2 x 2 1/2 = 5 |
| 5 | Estimate the O <sub>2</sub> / Chloride content of the given sample <b>H</b> | 5             |
| 6 | Class record and slides                                                     | 3 + 2 = 5     |

**Scheme of Valuation**

- Pteridophytes  
(Identification & Classification – 1 mark; Reasons – 2 marks)
- Pteridophytes  
(Identification – 1 mark; Reasons – 1 mark, Diagram – 1 mark)
- Fossil material  
(Identification – 1 mark; Comment – 2 marks)
- Specimens / Slides  
(Identification – 1 mark; Comment – 1 1/2 marks)
- O<sub>2</sub> / Chloride content  
(Conducting the experiment – 2 marks; – 1, Principle and Procedure – 2 marks; Results – 1 mark)
- Submissions: 4 free hand permanent slides of Pteridophytes and Ecological specimens + Class records (Marks 2 + 3)

**MODEL QUESTION PAPER**

**PAPER III:PTERIDOPHYTES, PALEOBOTANY, ENVIRONMENTAL BIOLOGY AND PHYTOGEOGRAPHY**

**TIME: 3 hours**

**Max. Marks: 60**

**I. Answer the following by choosing the correct choice:**

**1 x 30 = 30**

1. Pteridophytes represent the:  
a) Amphibious plants      c) Flowering plants  
b) Vascular plants      d) Naked seed plants.
2. Pteridophytes commonly possess:  
a) Trachea   b) Cotyledons   c) Tracheids   d) Albuminous cells.
3. *Selaginella* is also called as:  
a) Moss   b) Horse Tails   c) Fern   d) Resurrection Plant
4. Identify the heterosporous fern:  
a) *Psilotum*   b) *Selaginella*   c) *Equisetum*   d) *Marsilea*
5. Polystelic condition is observed in:  
a) *Rhynia*   b) *Marsilea*   c) *Selaginella*   b) *Psilotum*
6. Trabaculæ are present in the stem of:  
a) *Selaginella*   b) *Marsilea*   c) Moss   d) Ferns
7. Trilobed sporangia in *Psilotum* are also called:  
a) Sporogonium   b) Strobilus   c) Synangia   d) Cone
8. The eminent Indian Paleobotanist is:  
a) Parihar   b) Balraj Sahni   c) M S Swaminathan   d) Birbal Sahni
9. The Jurassic period was predominated by:  
a) Thallophytes   b) Angiosperms   c) Tree Ferns   d) Lycopod
10. The age of fossils can be estimated by:  
a) Nitrogen fixation      b) Carbon assimilation  
c) Radioactive Phosphorus   d) Carbon dating
11. *Rhynia* was first observed in the soils of:  
a) India   b) Yellow stone   c) Germany   d) Gold Coast
12. Petrified part of the plant are usually:  
a) Pericarp   b) Leaf   c) Stem   d) Ovule
13. Petrology is the study of:  
a) Petrol   b) Fossils   c) Rocks   d) Soil
14. Pedology refers to the study of:  
a) Earth   b) Phylogeny   c) Soil   d) Pseudofossils
15. Ground water enrichment may be done through:  
a) Borewells   b) Tanks   c) Water Harvesting   d) Wet Irrigation.

16. The non living component of an ecosystem include:  
a) Biotic factors b) Edaphic factors c) Abiotic factors d) Decomposers
17. Floods can cause:  
a) Vegetation growth b) High transpiration c) Erosion d) Salt resistance
18. Soil reclamation is done by:  
a) Red Algae b) Moss c) Cyanobacteria d) Ferns
19. Plants growing in salt water marshes are called:  
a) Mesophytes b) Epiphytes c) Xerophytes d) Halophytes
20. Sandal wood tree is a:  
a) Total parasite b) Semi parasite c) Ectoparasite d) Endoparasite
21. Acid rain is due to increase of:  
a) CO<sub>2</sub> b) NO<sub>2</sub> c) SO<sub>2</sub> d) O<sub>2</sub>
22. The national agency for remote sensing is:  
a) ICAR b) CSIR c) UGC d) NRSA
23. 'Ozone holes' were reported to be prominent in:  
a) Arctic b) Antarctic c) African d) Australian region.
24. Western Ghats are recorded as:  
a) Zones of abundant wildlife b) Natural waterfall regions c) Arid zones d) Biodiversity Hotspot
25. The 'Chipko Movement' was initiated by:  
a) Amrita Devi b) Suresh Heblikar c) S.L. Bahuguna d) UNEP
26. Seed banks, pollen banks and gene banks facilitate:  
a) Easy propagation b) Mutations c) Food security d) Easy trading
27. An example of total parasite is:  
a) Vanda plant b) Sandal wood tree c) Ipomea d) Cuscuta
28. Parasites absorb nutrition through:  
a) Rhizoids b) Velamen c) Haustoria d) Rhizomes
29. Andaman and Nicobar islands possess:  
a) Deciduous forests c) Temperate forests b) Pine forests d) Mangrove forests
30. Kodagu district in Karnataka has:  
a) Pine forests b) Mangrove forests c) Dry deciduous forests d) Tropical evergreen forests

## II. ANSWER ANY SIX QUESTIONS:

6 X 5 = 30

1. With neat labeled diagrams explain the morphology and internal structure of the synangium in *Psilotum*.
2. Describe the strobilus, as seen in L.S. of *Selaginella* with the aid of a diagram.
3. Explain the structure and morphological nature of the sporocarp in *Marsilea*.
4. Describe the anatomy of the rhizome in *Marsilea*.
5. Describe the marine ecosystem.
6. Global warming and Green house effect' pose a serious threat, Discuss.
7. Explain the stages in the formation of Xerosere.
8. Elucidate the vegetation types of Karnataka.
9. Methods of Conservation

#### IV Semester

#### Paper IV- GYMNASPERMS AND EMBRYOLOGY OF ANGIOSPERMS

60 HRS

- UNIT I: GYMNASPERMS** - General account and classification, distribution, structure and reproduction of *Cycas*, *Pinus* and *Gnetum*. (Development stages not required), Economic importance of Gymnasperms. 15 hrs
- UNIT II: EMBRYOLOGY OF ANGIOSPERMS: Male Gametophyte: Anther** - 15 hrs  
Development and structure (detailed account of Anther wall layers inclusive of Tapetum)  
Tapetum - Types, Cytology or nuclear behaviour of tapetum.  
Microsporogenesis, development of Male Gametophyte (Microgametogenesis).  
Brief account of Pollen embryo sac (Nemec Phenomenon) Pollen Morphology (A brief account on pollen wall, apertures, shapes, size and architecture based on number, position and characterisation (NPC System) Palynology and its applications.
- UNIT III: Female Gametophyte: Ovules** - Types (Orthotropous, Anatropous, 15 hrs  
Campylotropous, Amphitropous & Circinotropous)  
Megasporengesis - study of types of embryo sac or female gametophyte development, Monosporic type (*Polygonum* type), Bisporic type (*Allium* type) (Difference between *Allium* and *Endymion* type)  
Tetrasporic type (*Fritillaria* type)  
Fertilization - General account  
(Germination of Pollen grain on stigma, Path of Pollen tube in style, Histology of style, entry into ovule - Porogamy, Mesogamy and Chalazogamy, Double fertilization - Pre- Mitotic, Post - Mitotic and intermediate).  
Post fertilization changes.  
Preferential fertilization and Polyspermy.
- UNIT IV: Endosperm** - Types (Free Nuclear - abinitio - Cellular and Helobial). 05 hrs  
Brief account on endosperm Haustoria (*Cucumis* and *Grevillea*) and Ruminant endosperm.  
Embryo - Classification (Schnarf 's system), Development of Dicot embryo - Crucifer type Ex- *Capsella bursa pastoris* and Monocot embryo (Grass)  
Polyembryony - A brief account on Parthenocarp
- UNIT V: Experimental Embryology** - Definition, Totipotency, Basic techniques in plant 10hrs  
cell & tissue culture methods, Nutrient media (MS & white's), Tissue and organ culture (anther, cell and protoplast culture), Practical applications, Embryology of Podostemaceae.  
Embryology in relation to Taxonomy - Ex: *Trapa* and *Exocarpus*  
Contributions of P. Maheshwari & B. G. L. Swamy.

**SEMESTER IV  
PRACTICAL IV  
[Gymnosperms & Embryology of Angiosperms]**

|   |                                                                                                                             | <b>Total Units – 15 Units</b> |
|---|-----------------------------------------------------------------------------------------------------------------------------|-------------------------------|
| 1 | Study of Materials and Permanent slides of Gymnosperms- <i>Cycas</i> , <i>Pinus</i> and <i>Gnetum</i> (Included in theory). | <b>5 units</b>                |
| 2 | Permanent slides of Microsporogenesis and male gametophyte.                                                                 | <b>1 unit</b>                 |
| 3 | Mounting of Pollen grains – Grass, <i>Mimosa</i> , Pollinia of <i>Calotropis</i> – Micropreparation (By students)           | <b>1 unit</b>                 |
| 4 | Hanging Drop Method – Eg: <i>Vinca</i> (By students)                                                                        | <b>1 unit</b>                 |
| 5 | Types of Ovules – permanent slides                                                                                          | <b>1 unit</b>                 |
| 6 | Types of Placentation – Sectioning of ovary (By students to observe Axile, Basal, Parietal and Marginal type.               | <b>2 units</b>                |
| 7 | Mounting of embryo – <i>Tridax</i> / Mustard.                                                                               | <b>2 units</b>                |
| 9 | Mounting of endosperm – <i>Cucumis</i> .                                                                                    | <b>2 units</b>                |

**References**

1. Bhatnagar, S.P. and Moitra, A. **Gymnosperms**. New Age Publications, New Delhi.
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**B.Sc. IV Semester – Practical Question**

**Model Question Paper**

**Time – 3 HRS**

**Max Marks:- 30**

- |                                                                  |          |
|------------------------------------------------------------------|----------|
| 01. Identify & Classify Specimens A, B & C Giving reasons        | 3 x 3 =9 |
| 02. Identify the slides D, E & F with reasons & labeled diagrams | 3 x 3 =9 |
| 03. Mount the endosperm/ embryo of specimen G & Comment.         | 5 x 1 =5 |
| 04. Comment on H                                                 | 2 x 1 =2 |
| 05. Class Record & permanent slides                              | 3 + 2=5  |

**Scheme of Valuation**

1. Gymnosperms [Cycas, Pinus & Gnetum] (Materials) [Identification & Classification – 1 Mark Reasons – 2 Marks ]
2. One Gymnosperm slide & Two embryology slides [Embryology slides may include T.S. of Young anther & mature anther, different stage of Embryo Sac developement i, e 2 nucleate, 4 nucleate & organized or mature embryo Sac, Types of ovules, Types of Placentation & embryo] [Identification – 1 Mark, Diagram – 1 Mark & Reasons – 1 Mark]
3. Endosperm / Embryo Mounting (Temporary Micropreparation) (mounting – 3 Marks Comment with diagram- 02 Marks)
4. Types of pollen grains (permanent slides) / Pollinia (permanent slide)  
Section of ovary to observe placentation – Axile, Basal, Marginal,  
Parietal – Temporary Micro Preparation.  
Diagram – ½ Mark  
Comment – 1 ½ Marks / Sectioning, slide preparation 1 ½ Marks,  
Identify the type of Placentation with diagram – ½ Marks
1. Submission – 4 Free hand permanent slides of Gymnosperms /  
Pollinia + class Record – (2+3) (Each slide – ½ Mark)

## Model Question Paper

### Semester IV

#### Paper IV [Gymnosperms and Embryology of Angiosperms]

Time:- 3 Hrs

Max Marks :- 60

I Answer the following by choosing the correct choice:

1 x 30 = 30

1. Coralloid roots are seen in  
a) *Hibiscus* c) *Cycas* b) Fungus d) Algae
2. Male cone in *Cycas* is made of  
a) Flowers c) Microsporophylls b) Ovules d) Megasporophylls
3. Pollen chamber is present in  
a) Algae b) Stamen c) Embryo Sac d) Ovule of *Cycas*
4. *Pinus* is a  
a) Cycad b) Conifer c) Angiosperm d) Pteridophyte
5. Ovuliferous scale is seen in  
a) Megasporophyll of c) Male cone of *Gnetum* *Pinus* female cone m  
b) Male cone of *Pinus* d) Female cone of *Gnetum*.
6. *Pinus* Shows  
a) Pocket of Pollen grains b) No Pollen grains c) Pollinia d) Winged Pollen grains
7. *Gnetum* leaf resembles with  
a) Dicot leaf b) Monocot leaf c) Fern leaf d) Moss leaf
8. Pavement Tissue is present in  
a) Ovule of *Gnetum* b) *Cycas* ovule c) *Pinus* Ovule d) Angiosperm ovule
9. Cupules are seen in  
a) Cone of *Cycas* b) Cone of *Pinus* c) Cone of *Gnetum* d) Angiosperm ovule
10. *Cycas* exhibits following fern character namely  
a) Soral organization b) Naked seededness c) Ovules d) Absence of Vasculture
11. Microsporogenesis is production of  
a) Microspores b) Megaspores c) Ovules d) Stamens
12. Endothelium of Anther wall in Angiosperms is  
a) Multi layered b) A Nutritive Tissue c) Hygroscopic in nature d) Spore producing Tissue
13. Ubisch bodies are produced in  
a) Archosporium b) Glandular or Secretary type c) Megaspore Mothercell d) Pollen grain of Tapetum
14. Nemec Phenomenon is about  
a) Types of ovules b) Pollen Embryo sac c) Types of Pollen grains d) Types of Placentations
15. NPC System is  
a) Number, Position & Characterization c) Types of Megaspores of Pollen grain  
b) Types of endosperm d) Types of Embryo Sac
16.  $180^\circ$  Curvature is seen in  
a) Anatroous Ovule b) Orthotropous ovule c) Amphitropous ovule d) Circinotropous ovule

17. Megasporogenesis is production of  
a) Endospores b) Conidiospores c) Microspores d) Megaspores
18. *Polygonum* type of Embryo Sac Comes under  
a) Bisporic type b) Monosporic type c) Tetrasporic type d) Pentasporic type
19. Entry of the pollen tube in to the ovule through Micropyle is  
a) Mesogamy b) Porogamy c) Chalazogamy d) Triple Fusion
20. Double Fertilization is  
a) Syngamy only b) Triple Fusion only c) Somatic in nature d) Syngamy + Triple Fusion
21. Triple Fusion results in  
a) Primary endosperm nucleus b) Zygote c) Embryo d) Embryosac
22. Free Nuclear is a type of  
a) Embryo b) Endosperm c) Embryo Sac d) Type of Ovule
23. Mature Embryo is  
a) Globular b) Horse – Shoe Shaped c) Cordate d) Torpedo Shaped
24. When Zygote cleaves and produces many embryos, it is  
a) Cleavage Polyembryony b) Adventive Polyembryony c) Apomixis d) Polyspermy
25. In tissue culture, amorphous mass of cells is called  
a) Totipotency b) Callus c) Callose d) Plantlet
26. Fusion of protoplast is  
a) Somatic Hybridization b) Protomixis c) Somatic embryogenesis d) Somatogamy
27. On the basis of embryological differences, it can be easily justified that *Trapa* can be removed from  
a) Santalaceae b) Euphorbiaceae c) Hydrocharitaceae d) Onagraceae
28. In Podostemaceae  
a) Embryo Sac is absent b) Embryo is absent c) Endosperm is absent d) Pollen absent
29. Anther culture is useful in raising  
a) Haploid plants from microspores b) Parthenocarpic fruits c) Plants from Megaspores or pollen grains d) Polyploid fruits
30. Shoot formation in tissue culture refers to  
a) Calllogenesis b) Caullogenesis c) Organogenesis d) Rhizogenesis

**II Answer any six of the following :-**

**5 X 6=30**

1. With neat, labeled diagram, describe the L.S of mature ovule of *Cycas*
2. Describe the T.S of stem in *Pinus* with the help of neat, labelled diagram.
3. Give a comparative account of male & female cones in *Gnetum* with diagrams.
4. With the help of neat, labelled diagram, describe the Anther wall in Angiosperms.
5. Explain the development & structure of *Polygonum* type of embryo Sac in Angiosperms with the help of neat, labelled diagram.
6. Describe Double fertilization in angiosperms
7. Explain the Free Nuclear type of Endosperm in Angiosperms & add a note on Endosperm Haustorium.
8. What is Polyembryony? Describe the Adventive polyembryony in angiosperms.
9. Give a brief account on Nutrient Media in Tissue culture & add a note on MS Media.

## V SEMESTER

### PAPER V: TAXONOMY AND ECONOMIC BOTANY.

- UNIT I: CLASSICAL TAXONOMY :** Aim and Scope of taxonomy      Relevance      45 hrs  
of taxonomy to conservation, sustainable utilization of bio-resources, plant exploration and introduction of exotic species.
- Brief History of taxonomy, broad outline of classification proposed by Bentham and Hooker, Engler and Prantl and their relative merits and demerits. Species concept: Taxonomic hierarchy, species, genus and family
- UNIT II: BIOSYSTEMATICS:** Plant nomenclature, Binomial system, rules for nomenclature. Salient features of the International code of Botanical nomenclature.      10 hrs
- Brief account of Taxonomic evidence: Morphology, anatomy, palynology, cytology and phytochemistry Taxonomic Tools: Herbarium and its techniques, floras and their importance. Botanical survey of India and its functions, Green House and its importance. Botanical gardens and their importance, (one state level, one National level & one International level).
- (State: Lalbagh, National: Indian Botanical garden-Sibpur, Calcutta International: Royal Botanical Garden, Kew, England).
- Numerical taxonomy, bio-systematic applications of Computer.
- UNIT III: MONOCOTYLEDONOUS FAMILIES:** Study of the following families according to Engler and Prantl system of classification and plants with their economic importance, Commelinaceae, Arecaceae, Orchidaceae, Poaceae & Musaceae.      4 hrs
- UNIT IV: DICOTYLEDONOUS FAMILIES:** Study of the following families according to Engler & Prantl system of classification and plants with economic importance:- **Archichlamydeae:** Magnoliaceae, Annonaceae Brassicaceae, Capparidaceae, Rutaceae, Leguminosae (Papilionaceae, Caesalpiniaceae and Mimoseae) Apiaceae, Euphorbiaceae and Moraceae **Metachlamydeae:** Cucurbitaceae, Rubiaceae, Asteraceae, Asclepiadaceae, Convolvulaceae, Acanthaceae & Lamiaceae.      16 hrs
- UNIT V: ECONOMIC BOTANY:** Study of the following plants with Botanical names, family, part used and economic uses.      7 hrs

#### FOOD

|                     |                                                             |
|---------------------|-------------------------------------------------------------|
| Cereals and millets | Wheat, Rice, Jowar and Ragi                                 |
| Pulses              | Pigeonpea, Blackgram & Bengal gram                          |
| Edible oils         | Groundnut, Coconut & Sesamum                                |
| Sugar and starch    | Sugarcane, Beetroot, Potato and Tapioca.                    |
| Fibres              | Cotton, Jute, and Coir                                      |
| Paper and pulp      | Bamboo, Eucalyptus                                          |
| Beverages           | Coffee, Tea, and Cocoa                                      |
| Spices              | Cardamom, Clove and Cinnamon                                |
| Timber              | Teak, Rose wood                                             |
| Medicinal           | Phyllanthus, Ocimum, Catharanthus, Azadirachta & Aloe vera. |

**V SEMESTER**  
**Paper V - PRACTICALS**  
**TAXONOMY AND ECONOMIC BOTANY.**

|                                                                                                                                       |                       |
|---------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| 1. Modification of root, stem, and leaf.                                                                                              | <b>Total Units 12</b> |
| 2. Morphology: - Inflorescence, Racemose, Cymose, Mixed and Special types.                                                            | <b>01 Unit</b>        |
| 3. Fruits: Simple, fleshy, dry dehiscent and dry indehiscent, aggregate & multiple fruits.                                            | <b>01 Unit</b>        |
| 4. Methods of identification of Plants with Technical terms.                                                                          | <b>01 Unit</b>        |
| 5. Study of taxonomic characters of families included in theory (minimum one Genus from each family)                                  | <b>07Units</b>        |
| 6. Study of economically important plants covered in theory to identify with Botanical names, families, parts used and Economic uses. |                       |
| 7. Herbarium Techniques.                                                                                                              | <b>01 Unit</b>        |
| 8. Study of local flora by arranging local collection trips.                                                                          |                       |
| 9. Submission of field report along with records                                                                                      |                       |
| 10. Submission of Ten Herbarium of Plants included in theory.                                                                         |                       |

**V SEMESTER**  
**PAPER V: TAXONOMY AND ECONOMIC BOTANY.**  
**PRACTICAL-V**

**Time: 3 hours**

|                                                                                                          |                      |
|----------------------------------------------------------------------------------------------------------|----------------------|
| 1. Assign the specimen A, B, and C to their respective families giving diagnostic features.              | <b>Max marks: 30</b> |
| 2. Describe D in technical terms, draw the floral diagram with floral formula.                           | <b>2x3=6</b>         |
| 3. Identify the specimens E, F, G, H and I with their morphological biological, and economic importance. | <b>4x1=4</b>         |
| 4. Record with field report                                                                              | <b>2x5=10</b>        |
| 5. Submission                                                                                            | <b>3+2=5</b>         |
|                                                                                                          | <b>1/2x10=5</b>      |

**SCHEME**

- One Archichlamydeae, one Metachlamydeae, one Monocot (Identification 1/2 marks, Classification 1/2 mark. Diagnostic Features 01 mark)
- Monocot/Dicot plant (Technical details 2marks, Floral diagram- 1marks, Floral formula 1mark)
- Root/stem/leaf modification/inflorescence/fruit and /economic Importance. (Identification 1/2mark, diagram 1/2mark, description 1mark, for Economic importance, identification with family 1mark, parts use 1/2mark, economic uses 1/2mark)
- Class Record -03 marks; Field Report 02 marks.
- Submission of ten Herbarium of families studied- Herbarium -5 marks

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### Model Question Paper

[Paper – V TAXONOMY AND ECONOMIC BOTANY]

Time:- 3 Hrs

**Max Marks :- 60**

I. Answer the following by choosing the correct choice:

$$30 \times 1 = 30$$

1. Botanical name of the Coconut Plant is:-  
a) *Oryza sativa* c) *Cocos nucifera*  
b) *Brassica oleracea* d) *Mangifera indica*
2. The largest family among the Dicotyledoneae is:-  
a) Rubiaceae c) Cucurbitaceae  
b) Asteraceae d) Amaranthaceae
3. Epigynous, gamopetalous family is :-  
a) Rutaceae c) Annonaceae  
b) Asteraceae d) Lamiaceae
4. Tetramerous flowers are seen in the gamopetalous family of :-  
a) Brassicaceae c) Rutaceae  
b) Rubiaceae d) Amaranthaceae
5. The condition of androecium in Cucurbitaceae is:-  
a) Polyandrous c) Diadelphous  
b) Synandrous d) Syngenesious
6. Fruit, Cucurbitaceae is:-  
a) Pepo c) Pome  
b) Hesperidium d) Samara
7. Polypetalous irregular corolla is seen in:-  
a) Rosaceae c) Lamiaceae  
b) Papilionaceae d) Brassicaceae
8. Gynobasic style is characteristic of the family:-  
a) Lamiaceae c) Solanaceae  
b) Compositae d) Papilionaceae
9. Bicarpellary ovary with parietal placentation is found in:-  
a) Lamiaceae c) Solanaceae  
b) Brassicaceae d) Magnoliaceae
10. Cleistogamous flower is seen in :-  
a) Annonaceae c) Cucurbitaceae  
b) Rutaceae d) Commelinaceae
11. In Sugarcane inflorescence is a :-  
a) Spike c) Catkin  
b) Panicle d) Verticillaster
12. Tetradyamous condition of androecium is one of the striking features of :-  
a) Papilionaceae c) Rubiaceae  
b) Brassicaceae d) Cucurbitaceae



26. The science of Cytotaxonomy is based on-
- Shape and size of cell
  - Cell organelles
  - Cytochrome "C"
  - Chemical composition of Cytoplasm
27. In Engler and Prantl's system of classification
- Monocot proceeds diocots
  - Dicots proceeds monocots
  - Gymnosperms are in between dicot and monocots
  - Gymnosperms after monocots and dicots.
28. Indicate which one of the following statements, does not apply to the family Poaceae.
- Fistular stem
  - Inflorescence spikes
  - Gynoeceium bicarpellary
  - Ovary with two feathery stigmas
29. Taxonomic category in taxonomic hierarchy which end with-ales is:-
- Family
  - Order
  - Class
  - Species
30. The Botanical name of Sitapal is:-
- Artabotrys uncinatas*
  - Michelia champaka*
  - Annona squamosa*
  - Polyalthia longifolia*

## II. Answer any six of the following

6x5=30

- Give a brief account on Bentham & Hooker system of classification.
- Explain the acts & principles of ICBN.
- Write short notes on Cytotaxonomy.
- Write salient features of Orchidaceae.
- Mention the diagnostic characters of family Asclepiadaceae.
- Give a comparative account of Androeceium & Gynoeceium in Lamiaceae & Acanthaceae.
- Mention the economic importance of any two spices you have studied.
- Discuss the importance of a national level Botanical garden.
- Describe the floral characters of Papilionaceae.

**V SEMESTER**  
**PAPER VI-CYTOLOGY, GENETICS, EVOLUTION AND PLANT BREEDING**

|                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                               |
|------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------|
| <b>UNIT I:</b>   | <b>HISTORY OF CYTOLOGY:</b> Cell as a fundamental unit of life and organism – modern concepts. Microscopy : Light, fluorescent and electron microscope. Live imaging techniques for studying cell and tissues.                                                                                                                                                                                                                                                                                                                                                                                                                                      | <b>45 Hrs</b><br><b>3 Hrs</b> |
| <b>UNIT II:</b>  | <b>CHROMOSOME BIOLOGY :</b> Structure of eukaryotic chromosome; centromere, kinetochore and telomere. Nucleosome and its importance in the organisation of eukaryotic chromosome. Types of Chromosomes; biarmed and holocentric types. Numerical changes in chromosome number, polyploidy and aneuploidy – trisomics and monosomics. Karyotype concept and its relevance in the genomic era; c-value and genome size. Euchromatin and heterochromatin.                                                                                                                                                                                              | <b>10 Hrs</b>                 |
| <b>UNIT III:</b> | <b>CELL DIVISION :</b> Discovery; cell cycle and its regulation with reference to cell division. Mitosis : phases, significance in growth and development and in cancer–Apoptosis (PCD). Meiosis – phases – significance in gametogenesis in plants. Chromosomal aberrations manifested during meiosis - Deficiency, duplication, translocation and inversion.                                                                                                                                                                                                                                                                                      | <b>10 Hrs</b>                 |
| <b>UNIT IV:</b>  | <b>GENETICS:</b> Introduction: Gregor Mendel – his life and contribution to genetics. Genotype and phenotype. Law of dominance, segregation of genes, Independent assortment of genes. Incomplete dominance, Interaction of genes – supplementary and complementary factors. Epistasis, multiple factor inheritance; linkage and crossing over.<br><br><b>POST MENDELIAN GENETICS</b><br>Gene concept and Chromosomal basis of heredity. Extra chromosomal inheritance : Plasmid DNA, chloroplast & mitochondrial inheritance, Cytoplasmic male sterility and its role in hybrid seed production. Genetic problems in relation to topics in Unit 4. | <b>12 Hrs</b>                 |
| <b>UNIT V:</b>   | <b>EVOLUTION :</b> Theories of Darwin, DeVries and Lamarck; modern concepts of evolution – 2 R Hypothesis: evolution by gene duplication; modern synthesis. “Big Bang” theory<br><b>PLANT BREEDING :</b> Aims & objectives of plant breeding – a historical account. Basic techniques of plant breeding. Vegetative propagation methods – Cutting, grafting, layering, gootee, cloning Intergeneric and interspecific hybridization, maintenance of germplasm, pollen banks, quarantine methods.                                                                                                                                                    | <b>10 Hrs</b>                 |

**V SEMESTER–PRACTICAL PAPER VI**  
**PAPER VI-CYTOLOGY, GENETICS, EVOLUTION AND PLANT BREEDING**

**Total Units 12**

|    |                                                                                              |          |
|----|----------------------------------------------------------------------------------------------|----------|
| 1  | Preparation of cytological stains – Aceto carmine, Aceto orcein and Feulgen's stain.         | 01 Unit  |
| 2  | Mitosis from Allium root tips–Aceto carmine and Feulgen's techniques.                        | 02 Units |
| 3  | Meiosis from Allium flower buds.                                                             | 02 Units |
| 4  | Salivary gland chromosomes of Drosophila or Chironomous larvae.                              | 01 Unit  |
| 5  | Karyotype and Idiogram : Camera Lucida drawing.                                              | 01 Unit  |
| 6  | Permanent slides of Mitosis.                                                                 | 01 Unit  |
| 7  | Permanent slides of Meiosis.                                                                 | 01 Unit  |
| 8  | Emasculation and bagging of the flower buds of Cassia / Peltophorum.                         | 01 Unit  |
| 9  | Genetic problems and laboratory mind teasers.                                                | 02 Units |
| 10 | Submission : Record and Slides: two Mitosis, two Meiosis and one Salivary gland chromosomes. |          |

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**V SEMESTER**  
**PAPER VI - CYTOLOGY, GENETICS, EVOLUTION AND PLANT BREEDING PRACTICAL**  
**QUESTION PAPER**

**Time : 3 Hrs.**

**Max. Marks : 30**

|    |                                                                                             |       |
|----|---------------------------------------------------------------------------------------------|-------|
| 1. | Prepare a temporary mitotic slide from material <b>A</b> ; identify the stage with diagram. | 6     |
| 2. | Prepare a temporary meiotic slide from material <b>B</b> ; identify the stage with diagram. | 6     |
| 3. | Identify and comment on <b>C</b> along with a sketch.                                       | 3     |
| 4. | Identify and comment on slides <b>D and E</b> with suitable sketches.                       | 3+3   |
| 5. | Solve the Genetic Problem <b>F</b>                                                          | 4     |
| 6. | Submission of record and slides                                                             | 2½+2½ |

**SCHEME OF VALUATION**

1. Preparation – 4 marks, identification of stage – 1 mark and diagram – 1 mark.
2. Preparation – 4 marks, identification of stage – 1 mark and diagram – 1 mark.
3. Karyotype - slide or sketch / Salivary gland Chromosomes – slide or sketch. Sketch – 1  
 mark, identification – ½ mark , comment 1 ½ marks
4. One slide from mitosis and one slide from meiosis. Identification - ½  
 mark, sketch – ½ mark, comment – 2 marks.
5. Genetic problems from
  - i. Dihybrid cross and test cross
  - ii. Incomplete dominance
  - iii. Complementary factors
  - iv. Supplementary factors
  - v. Epistasis.
6. Submissions : 2 Mitotic and 3 Meiotic permanent slides – 2 ½ marks.  
 Class Record – 2 ½ marks.

## MODEL QUESTION PAPER

### V Semester Paper VI

#### Cytology, Genetics, Evolution and Plant Breeding

Time : 3 Hrs.

Total Marks: 60

I. Answer the following by choosing the correct choice:

30 X 1 = 30

1. The word "cell" was first coined by
  - a) Robert Hooke
  - b) Hugo von Mohl
  - c) Purkinje
  - d) Robert Brown
2. The name "protoplasm" was given by
  - a) Robert Hooke
  - b) Hugo von Mohl
  - c) Purkinje
  - d) Robert Brown
3. The Cell theory was proposed by
  - a) Robert Brown
  - b) Schleiden and Schwann
  - c) Robert Hooke
  - d) Rudolf Virchow
4. The presence of chromosomes in the cells was first noticed by
  - a) Waldeyer
  - b) Flemming
  - c) Hofmeister
  - d) Strasburger
5. The term "chromosome" was first used by
  - a) Hofmeister in 1848
  - b) Flemming in 1879
  - c) Strasburger in 1875
  - d) Waldeyer in 1888
6. The Chromosome theory of Inheritance was first proposed by
  - a) Gregor Mendel
  - b) Sutton and Boveri
  - c) Beadle and Tatum
  - d) Johansen
7. The compound microscope was first invented by
  - a) Anton von Leuwenhoek
  - b) Robert Hooke
  - c) Zacharias Jensen
  - d) All the three
8. For observation under electron microscope the specimen must be
  - a) Dry and dead
  - b) Dry and living
  - c) Wet and living
  - d) Wet and dead
9. The non-stainable gap between the two arms of a chromosome is called
  - a) Kinetochore
  - b) Primary constriction
  - c) Centromere
  - d) b and c
10. During metaphase the attachment of spindle fibres takes place on
  - a) Telomere
  - b) Kinetochore
  - c) Centromere
  - d) Secondary constriction
11. A chromosome with terminal centromere is called
  - a) Metacentric
  - b) Acentric
  - c) Acrocentric
  - d) Telocentric

12. The Nucleosome model for ultra structure of chromosomes was proposed by
  - a) C L F Woodcock
  - b) Both a & b
  - c) R.D. Kornberg
  - d) Balbiani
13. The 2009 Nobel Prize in medicine has been awarded for the work on
  - a) Ribosome
  - b) Telomere
  - c) Kinetochore
  - d) Centromere
14. The lowest diploid number of  $2n = 2$  has been reported in
  - a) *Drosophila melanogaster*
  - b) *Ophioglossum reticulatum*
  - c) *Ascaris megalocephalus*
  - d) *Haplopappus gracilis*
15. The highest haploid number of  $n = 631 + 10$  fragments has been recorded in
  - a) *Drosophila melanogaster*
  - b) *Ophioglossum reticulatum*
  - c) *Ascaris megalocephalus*
  - d) *Haplopappus*
16. Any increase or decrease in chromosome number that affects one or two chromosomes in the complement is called
  - a) Monoploidy
  - b) Aneuploidy
  - c) Diploidy
  - d) Polyploidy
17. Aneuploidy in which the change in chromosome number is expressed as  $2n + 1$  is called
  - a) Monosomics
  - b) Trisomics
  - c) Nullisomics
  - d) Tetrasomics
18. The centromere in a chromosome represents
  - a) Euchromatic region
  - b) Genetically inert region
  - c) Heterochromatic region
  - d) b & c
19. The karyotype represents the somatic chromosome complement seen in
  - a) Prophase
  - b) Anaphase
  - c) Metaphase
  - d) Telophase
20. Replication of chromosomes in cell cycle takes place during
  - a) G-1 phase
  - b) S-Phase
  - c) G-2 phase
  - d) Interphase
21. Crossing over in Meiosis - I occurs during
  - a) Leptotene
  - b) Pachytene
  - c) Zygotene
  - d) Diplotene
22. The pairing of homologous chromosomes in Meiosis - I is facilitated by
  - a) Golgi complex
  - b) Synoptoneal complex
  - c) Chromosomal complex
  - d) Gene complex
23. The chromosomal aberration that affects atleast two chromosomes during meiosis is called
  - a) Duplication
  - b) Translocation
  - c) Inversion
  - d) Deletion
24. The term "Genetics" was proposed by
  - a) Gregor Mendel in 1866
  - b) Charles Darwin in 1858
  - c) Bateson in 1906
  - d) Watson and Crick in 1953

25. The genetic constitution that an organism receives from its parents is called
  - a) Phenotype
  - b) Ecotype
  - c) Genotype
  - d) D N A finger print
26. In a cross between red flowered 4 O' clock plant with the white flowered one, the F<sub>2</sub> ratio is 1:3:1 between red, pink and white. Therefore it is
  - a) Monohybrid cross
  - b) Incomplete dominance
  - c) Dihybrid cross
  - d) Epistasis
27. Darwin's theory of evolution is based mainly on
  - a) Struggle for existence
  - b) Natural selection
  - c) Variations
  - d) All the three
28. The modern concept of evolution is referred to as
  - a) Molecular evolution
  - b) R Hypothesis
  - c) Evolution by Gene Duplication
  - d) b & c
29. "Father of Green Revolution" in India is
  - a) M.S. Swaminathan
  - b) Hargobind Khorana
  - c) Norman Borlaug
  - d) Ragi Lakshmanaiah
30. The hybrid wheat variety produced by Dr. M.S. Swaminathan was named as
  - a) Sonora 64
  - b) Sharbati Sonora
  - c) Lerma Rojo
  - d) Shera

## II ANSWER ANY SIX OF THE FOLLOWING

6 X 5 = 30

1. What is cell theory? Explain a modern concept of cell as a fundamental unit of life and organism.
2. Describe the construction and working of the electron microscope (SEM or TEM)
3. Explain the ultrastructure of eukaryotic chromosome with a neat labelled sketches.
4. What is polyploidy? Differentiate between autopolyploidy and allopolyploidy with examples.
5. Describe the important stages of prophase-I of meiosis.
6. What is reciprocal translocation? Explain its effects on inheritance of characters in plants.
7. Explain supplementary factor inheritance with an example.
8. What is artificial selection? Explain any two types of artificial selections in plant breeding.
9. Discuss de Vries' theory of organic evolution.

## VI SEMESTER

### PAPER VII: Molecular Biology, Genetic Engineering & Plant Physiology – 1.

45 Hrs

- UNIT I:** **Molecular Biology** Introduction, discovery, chemical nature & replication of genetic material, genetic code, non genetic RNA, Biosynthesis of proteins, Regulation of gene action in prokaryotes & eukaryotes. 8 hrs
- UNIT II:** **Genetic Engineering & Biotechnology** A Concise account of methods used in 'Recombinant DNA' technology, Gene libraries, screening of Genomic DNA library, application of genetic engineering technology in agriculture. A brief account on hazards & safe guards of genetic engineering technology with special reference to Bt crops. A brief account of Bioinformatics and its uses 15 hrs  
**Microbial Biotechnology:** Uses of microbes in Industry & agriculture. Fermentation - production of Ethanol, production of Enzymes–Amylases. Production of antibiotics–Penicillin.
- UNIT III:** **Plant Physiology - Water relations:** Importance of water, Diffusion, Osmosis, Water potential, Osmotic Potential, Membrane & their permeability. 8 hrs  
**Absorption of water–** Mechanisms of water absorption, factors affecting rate of water absorption
- UNIT IV:** **Mechanism of ascent of Sap –** Vital and Physical force theories : 6 hrs  
**Transpiration –** Loss of water, Types, Mechanism, Stomatal Dynamics, Stomatal Mechanism, Significance, Factors affecting transpiration, anti-transpirants, Guttation.
- UNIT V:** **Mineral nutrition in plants –** Major & Minor Elements , their deficiency symptoms in plants 8 hrs  
**Phloem transport–** Transport of organic solutes. Path of transport, Vein loading and unloading. Transcellular or streaming hypothesis, contractive protein hypothesis, mass flow hypothesis, electro osmosis), Source – Sink concept

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## VI SEMESTER

### PAPER VII: Molecular Biology, Genetic Engineering & Plant Practical 12 Units

|                                                       |                                                                       |         |
|-------------------------------------------------------|-----------------------------------------------------------------------|---------|
| 1                                                     | Qualitative tests for starch, protein and reducing sugars.            | 02Units |
| 2                                                     | Determination of osmotic potential of cell sap by plasmolytic method. | 01 Unit |
| 3                                                     | Determination of Stomatal Index .                                     | 01 Unit |
| 4                                                     | Structures of stomata in hydrophytes, mesophytes and xerophytes       | 01 Unit |
| 5                                                     | Streaming of protoplasm to show cyclosis                              | 01 Unit |
| 6                                                     | Determination of pH of plant samples by using indicators              | 01 Unit |
| 7                                                     | Study of deficiency symptoms – Chlorosis, Necrosis. Hydroponics       | 03Units |
| 8                                                     | Study of phloem transport by ringing experiment.                      | 01 Unit |
| Visit to Bioinformatics/ Molecular Biology Laboratory |                                                                       |         |

### VI - Semester Practical Question Paper

#### PAPER VII: Molecular Biology, Genetic Engineering & Plant Physiology - I

Time ; 3 Hours

Max Marks : 30

|     |                                                                                                |      |
|-----|------------------------------------------------------------------------------------------------|------|
| 01. | Conduct the biochemical test of the sample 'A'                                                 | 5    |
| 02. | Determine the osmotic potential of cell sap by plasmolytic method<br>stomatal index material B | 7    |
| 03. | Determine the pH of the given sample C                                                         | 2    |
| 04. | Comment on experiment D & E                                                                    | 3+ 3 |
| 05. | Class Record + Submission (Tour Report)                                                        | 5+ 5 |

#### Scheme of Valuation

- Samples – Starch, Protein & Reducing sugar (Positive test- 2 marks; Negative test – 3 marks)
- (Conducting the experiment – 2 marks; Principle –2 marks; Procedure –1 marks; Result – 2 Marks)
- Extract from Root, Stem Leaves of a plant to be given (Determination of pH- 1 mark; Comment – 1 marks)
- Experiments:
  - Streaming of protoplasm
  - Suction force due to transpiration
  - Mineral deficiency
  - Mass flow hypothesis
  - Ringing experiment
  - Hydroponics(Identification – 1 mark; Comment –2 marks)
- Class Record – 5 marks

## MODEL QUESTION PAPER

### VI - Semester

#### PAPER VII: Molecular Biology, Genetic Engineering & Plant Physiology - I

I. Answer the following by choosing the correct choice:

1 x 30 = 30

- The diameter of z-DNA is  
a.  $20\text{\AA}$  b.  $45\text{\AA}$  c.  $18\text{\AA}$  d.  $34\text{\AA}$
- Nucleoside consists of  
a. Sugar + phosphate c. Sugar + purine + phosphate  
b. Sugar + pyrimidine + phosphate d. Sugar + pyrimidine + purine
- Single stranded DNA molecules are found in  
a. TMV b. Rose sarcoma virus c. Small pox virus d. Bacteria
- The 'C' value of DNA refers to  
a. Total amount of DNA per haploid genome b. Total amount of DNA per Somatic cell.  
c. Total amount of DNA present in heterozome d. Total amount of DNA present in Autosome
- Plasmids are  
a) Viruses c. Extra chromosomal genetic element of bacteria  
b) New type of microorganisms d. Genetic element of bacteria
- The term Bt refers to  
a. *Bacillus thuringiensis* c. Bacterial transformation  
b. Bacterial transcription d. Bacillus transformation
- Okazaki fragment are produced during  
a. DNA synthesis b. Protein synthesis c. RNA synthesis d. Protein metabolism
- DNA which is transformed synthetically using enzymes is  
a. Recombinant DNA b. DNA c. Complementary DNA d. RNA
- Osmosis is possible through  
a. Permeable membrane b. mpermeable membrane c. Semi-permeable membrane d. Membrane
- Loss of water in the liquid form from the aerial parts of the plant is  
a. Guttation b. Evaporation c. Transpiration d. Respiration
- Phloem transport can be detected through  
a. Microscope b. Telescope c. Autoradiography d. Radiography
- In protoplast fusion technique which of the following enzymes are used  
a) Cellulase & Pectinase b. Amylase & Pectinase c. Lipase & Pectinase d. Amylase & Lipase
- Antibiotics are mostly obtained from  
a) Viruses b. Cyanobacteria. c. Actinomycetes. d. Algae.
- A cell becomes turgid when placed in  
a. Isotonic solution b. Hypotonic solution c. Hypertonic solution d. Acidic solution
- Loss of water from the aerial parts of plant in the form of water vapour is called  
a. Guttation b. Transpiration c. Evaporation d. Respiration
- The main force behind passive absorption of water by roots is  
a. Root pressure b. Transpiration pull c. Osmotic pressure d. Evaporation

17. The diffusion of solvent molecules into the solution through a semi-permeable membrane is  
a. Imbibition      b. Diffusion      c. Osmosis      d. Evaporation
18. Water potential is expressed in SI units as  
a. Atmospheres      b. Bars      c. Pascals      d. Grams
19. Stomata open in the night in  
a. C<sub>3</sub> Plants      b. C<sub>4</sub> Plants      c. CAM Plants      d. Hydrophytes
20. DPD equals  
a. OP- TP      b. OP + WP      c. TP - OP      d. OP + TP
21. Active absorption of water by roots from soil is mostly affected by  
a. Tension in cell sap due to transpiration.      b. Osmotic concentration of cell sap.  
c. Sucking power of root hair.      d. Typical tissue organisation.
22. The Soil water that is available for plants is  
a. Capillary water      b. Hygroscopic water      c. Gravitational water      d. Chemically bound water
23. Pulsation theory to explain Ascent of sap was proposed by  
a. Dixon and Jolly      b. J.C. Bose      c. Curtis and Clark      d. Clark
24. Root pressure is maximum when  
a) Transpiration is high and absorption is very low  
b) Transpiration is low and absorption is very high  
c) Transpiration is high and absorption is very high  
d) Transpiration is low and absorption is very low
25. The cohesive force between molecules of water contributes to  
a. Osmosis      b. Translocation      c. Plasmolysis      d. Ascent of sap
26. The apparatus used to measure root pressure  
a. Photometer      b. Manometer      c. Auxanometer      d. Barometer
27. Which of the following is a micronutrient  
a. Mn      b. N      c. Mg      d. Ca
28. Chlorosis occurs due to  
a. Strong light      b) Excessive respiration      c. Darkness      d. Deficiency of Iron or Mg
29. Iron deficiency causes  
a. Necrosis in old leaves      b. Dwarfness      c. Defoliation      d. Interveneal chlorosis in young leaves
30. Plants absorb Zn in the form of  
a. Zinc Sulphate      b. Zinc phosphate      c. Zinc nitrate      d. Zinc Borate

**II Answer any six of the following**

6 x 5

1. Explain regulation of gene action in Eukaryotes
2. Explain cloning vectors
3. Explain cDNA Library.
4. Describe the process of Penicillin production.
5. Explain factors affecting rate of water absorption in plants
6. Describe the process of vein loading
7. Describe the mechanism of Transpiration in plants
8. Explain the role of minor elements in plant nutrition.

**I SEMESTER**  
**PAPER VIII –Plant Physiology – II**

|                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 |
|------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| <b>UNIT I:</b>   | <b>Enzymes:</b> Nomenclature, classification, chemical composition, prosthetic groups, Coenzymes, Cofactors, Vitamins, properties of enzymes, Mechanism of enzyme action, Enzyme kinetics, factors affecting enzyme activity, Inhibition of enzyme action (Competitive, Non Competitive, feedback), Allosteric enzymes. <b>Nitrogen Metabolism:</b> Sources of nitrogen, nitrogen fixation, <i>nif</i> genes, nitrate metabolism, Assimilation of ammonia, Synthesis of Amino acids and Nitrogen cycle.                                                                                                                                      | 45 hrs<br>10hrs |
| <b>UNIT II:</b>  | <b>Photosynthesis</b> – Introduction, ultra structure of the chloroplast, photosynthetic apparatus, Principles of light absorption, Emerson's enhancement effect, photosystems I & II, Light reaction –Hill reaction, mechanism of electron and proton transport, Photophosphorylation (cyclic, non-cyclic and pseudocyclic), Carbon reactions (Calvin Cycle, C <sub>4</sub> – Pathway, CAM), Factors affecting the process. <b>Photorespiration</b> – Organelles involved, mechanism and significance. <b>Analytical techniques:</b> A brief account of Colorimetry, Chromatography, Electrophoresis, Tracer Technique and Autoradiography. | 10hrs           |
| <b>UNIT III:</b> | <b>Respiration</b> – Introduction, Mechanism of aerobic respiration – glycolysis, TCA cycle, ETS and Oxidative phosphorylation, mechanism of anaerobic respiration (Alcoholic Fermentation and Lactic acid Fermentation), Pentose phosphate pathway, Respiratory Quotient and its significance, factors affecting respiration.                                                                                                                                                                                                                                                                                                               | 7 hrs           |
| <b>UNIT IV:</b>  | <b>Plant growth and Growth regulators</b> – Definition of growth, kinetics, Factors affecting growth; Phytohormones: Discovery, metabolism, Physiological effects, mode of action of auxins, gibberellins, cytokinins, ethylene and ABA. Application of these hormones in agriculture and horticulture. <b>Plant movements</b> – A brief account on the classification and types of movements.                                                                                                                                                                                                                                               | 8 hrs           |
| <b>UNIT V:</b>   | <b>Photobiology:</b> A brief account of dormancy, Photoperiodism, Phytochrome and its role, Florigen concept, Vernalization, biological clock and Circadian Rhythms. <b>Stress physiology:</b> Water stress, heat stress, salt stress and mechanisms of plant response to water and related stresses. <b>Defence mechanism:</b> A brief account of secondary metabolites (Phenolics, Flavonoids and alkaloids) and their role in plant defence.                                                                                                                                                                                              | 10 hrs          |

**References**

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## VI SEMESTER

### Practical Paper VIII –Plant Physiology

Total Units 12

- |                                                                                                |          |
|------------------------------------------------------------------------------------------------|----------|
| 1. Estimation of chlorophyll by colorimetric analysis                                          | 02 Units |
| 2. Separation of photosynthetic pigments by paper chromatography and measurement of Rf values. | 01 Unit  |
| 3. Determination of rate of photosynthesis at different wavelengths of light.                  | 01 Unit  |
| 4. Determination of rate of photosynthesis at different concentrations of CO <sub>2</sub> .    | 01 Unit  |
| 5. Estimation of Ascorbic acid content in a plant sample                                       | 01 Unit  |
| 6. Determination of RQ of carbohydrates, fats and proteins.                                    | 01 Unit  |
| 7. Effect of phytohormones on plant growth (Bioassays)                                         | 03 Units |
| 8. Study of geotropism, phototropism and hydrotropism.                                         | 02 Units |
| 9. An Industrial visit to study the manufacture of alcohol / antibiotics / enzymes             |          |

## VI SEMESTER

### PAPER VIII –Plant Physiology – II

Time 3 Hrs

Max Marks: 30

- |                                                                                                           |       |
|-----------------------------------------------------------------------------------------------------------|-------|
| 1. Separate the Photosynthetic pigments from sample A by paper chromatography and measure their Rf values | - 7   |
| 2. Estimate the ascorbic content in the sample B                                                          | - 7   |
| 3. Comment on Experiments C & D                                                                           | - 6   |
| 4. Class Records & Field report                                                                           | - 5+5 |

#### Scheme of Valutaion

1. Requirements – 1 Mark, Principle – 2 Marks, Procedure and Conducting the experiment – 2 Marks, Rf Values – 2 Marks
2. Requirements – 1 Mark, Principle – 1 Mark, Procedure and Conducting the experiment – 3 Marks, Result – 2 Marks )
3. Experiments
  - a) Photosynthesis at different wave lengths of light
  - b) Respirometer experiment for RQ
  - c) Anaerobic respiration
  - d) Hydrotropism
  - e) Phototropism
  - f) Geotropism (Klinostat Expt)
4. Class record & field report.

5+5

## MODEL QUESTION PAPER

### VI SEMESTER

#### PAPER VIII –Plant Physiology – II

Time : 3 Hours

Max Marks = 60

I Answer the following by choosing the correct choice

1 x 30 = 30

- The fixation of nitrogen in root nodules of legumes takes place in the presence of an enzyme.  
a. Nitrogenase b. Nitrate reductase c. Carboxylase d. Nitrite reductase
- Amino acids synthesis in plants occurs by  
a. Oxidation c. Nitrification  
b. Reductive amination d. Transformation
- Oxido-reductases catalyse  
a. Oxidation – reduction reactions c. Involve group transfer  
b. Hydrolytic reactions d. Isomerization reactions
- Coenzyme – A (Co A or Co A – SH) is a derivative of  
a. Riboflavin b. Pantothenic acid c. Ascorbic acid d. Vitamin B<sub>2</sub>
- Warburg's effect is  
a. Inhibitory effect of high oxygen concentration on Photosynthesis  
b. Inhibitory effect on respiration c. Nastic movements d. Photoperiodism
- Feed back inhibition is due to  
a. Accumulation of the end product which cause inhibition in the activity of the first enzyme of the series.  
b. Accumulation of enzymes. c. Accumulation of substrates. d. Accumulation of co-factors.
- The pigments which exhibits fluorescence  
a. Xanthophyll b. Ubiquinone c. Chlorophyll d. Carotene
- In pigment system II, the reaction centre is  
a. P<sub>680</sub> b. P<sub>700</sub> c. P<sub>673</sub> d. P<sub>72</sub>
- When cell converts light energy into chemical energy, which of the following reaction would take place.  
a.  $ADP + ip = ATP$  c.  $ATP - ip = ADP$   
b.  $AMP + ip = ADP$  d.  $GDP + ip = GTP$
- Kranz anatomy is found in  
a. Stems of C<sub>4</sub> plants. c. Stems of C<sub>3</sub> plants.  
b. Leaves of C<sub>4</sub> plants. d. Leaves of C<sub>3</sub> plants.
- Rubisco is  
a. Reductase b. Hydrogenase c. Carboxylase d. Ligase
- The number of carbon atoms present in ribulose -biphosphate is  
a. 6 b. 5 c. 4 d. 3
- Respiration is  
a. Anabolic and exergonic c. Anabolic and endergonic  
b. Catabolic and exergonic d. Catabolic and Endergonic
- In respiration of organic acid substrate, the R.Q shall be  
a. Unity b. Zero c. Less than one d. More than unity
- Number of Carbon atoms present in citric acid, Oxaloacetic acid and pyruvic acid are respectively  
a. 6, 3, & 3 b. 5, 4 & 3 c. 6, 4 & 3 d. 6, 4 & 2

16. Two molecules of ATP are formed during final oxidation of  
a. NADH ( $H^+$ )      b.  $FADH_2$       c. NADPH ( $H^+$ )      d.  $NAD^+$
17. The first pentose sugar formed in PPP of respiration is  
a. Ribulose - 5 - phosphate      b. Ribose - 5 - phosphate  
c. Xylulose - 5 - phosphate      d. Deoxyribose - 5 - phosphate
18. The term fermentation was coined by  
a. Cruickshank      b. Pasteur      c. Kostytscher      d. Buchner
19. Zeatin is a  
a. Auxin      b. Gibberellins      c. Cytokinin      d. ABA
20. Stomatal closure is induced by  
a. Auxin      b. Ethylene      c. Gibberellins      d. ABA
21. Gibberellins bring about  
a. Yellowing of leaves      b. Senescence      c. Internodal Elongation      d. Dwarfing of tall plants
22. Natural Auxin is  
a. IAA      b. 2, 4 - D      c. 2, 4, 5-T      d. NAA
23. Avena curvature test is a bioassay for  
a. Auxin      b. Cytokinin      c. Gibberellins      d. Ethylene
24. 2,4-D is  
a. Weedicide      b. Rodenticide      c. Insecticide      d. Nematicide
25. Which one of the following is a stress hormone?  
a. Benzyl aminopurine      b. Dichloro phenyl acetic acid      c. Ethylene      d. Abscissic acid
26. The phenomenon of photoperiodism was discovered by  
a. Garner and Allard      b. Ganong      c. Flemming      d. Altman
27. Phytochrome is  
a. A non - proteinaceous pigment      b. Exists in two interconvertible forms  
c. An enzyme      d. Found exclusively in thallophytes
28. The termed vernalization was coined by  
a. Lysenko . T. D.      b. Chouard      c. Gessner      d. Pasteur
29. Richmond - Lang refers to  
a. Ripening of fruits      b. Delaying senescence      c. Premature fall of leaves      d. Bolting
30. Desmodium gyrans exhibits  
a. Tactic movements      b. Trophic movements      c. Nastic movements      d. Ciliary movements

## **II Answer any six of the following**

6 x 5 = 30

1. What are enzymes? Discuss the mechanism of action of enzymes.
2. Describe biochemical reactions of Calvin's cycle.
3. Describe the process of alcoholic fermentation.
4. Describe briefly the trophic movements in plants.
5. Give an account of photorespiration.
6. Discuss the role of phytohormones in agriculture and horticulture.
7. What is photoperiodism? Explain its physiology and importance.
8. Explain the role of secondary metabolites in plant defence.

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5150-BUP-300-May 2010

