M.sc Botany Practical 2026-27

Semester 1

Phycology

Experiment 1

Objective

To study the morphology and microscopic structure of Nostoc and prepare a temporary stained slide for observation under a microscope.

Protocol / Procedure

1. Take a clean glass slide.
2. Place a small portion of Nostoc on the slide using a needle.
3. Add one drop of water or glycerine.
4. Tease the material gently to spread the filaments.
5. Add 1–2 drops of stain (Safranin or Methylene Blue).
6. Leave it for about 1 minute.
7. Remove excess stain using blotting paper.
8. Carefully place a cover slip without trapping air bubbles.

Observation

Under the compound microscope, observe the following features of Nostoc:

1. Colony appears gelatinous and greenish-blue.
2. Numerous unbranched filaments (trichomes) are embedded in a mucilaginous sheath.
3. Cells are rounded or bead-like.
4. Larger thick-walled pale cells called heterocysts are present at intervals.

Result

The prepared slide shows characteristic features of Nostoc including trichomes, vegetative cells, heterocysts, and mucilaginous sheath, confirming the specimen as a blue-green alga (cyanobacterium).

Experiment 2

Objective

To study the morphology and microscopic structure of Chlorella by preparing a temporary stained slide and observing it under a microscope.

Protocol / Procedure

1. Take a clean glass slide.
2. Place one drop of algal suspension on the slide using a dropper.
3. Add a drop of glycerine if required.
4. Add 1–2 drops of stain (Safranin, Iodine, or Methylene Blue).
5. Leave the stain for about 1 minute.
6. Remove excess stain with blotting paper.
7. Carefully place a cover slip over the preparation without trapping air bubbles.

Observation

Under the compound microscope, observe the following features of Chlorella:

1. Cells are small, spherical, and unicellular.
2. Cells appear green due to the presence of chlorophyll.
3. Each cell has a distinct cell wall.
4. A large cup-shaped chloroplast is present inside the cell.
5. Cells are non-motile and occur singly.

Result

The temporary stained slide shows characteristic unicellular green algal cells with chloroplasts and cell walls, confirming the specimen as Chlorella.

Experiment 3

Objective

To study the morphology and microscopic structure of Acetabularia by preparing a temporary stained slide and observing it under a microscope.

Protocol / Procedure

1. Take a clean glass slide.
2. Place a small portion of the thallus or cap of Acetabularia on the slide.
3. Add one drop of water or glycerine.
4. Tease the material gently using a needle for proper spreading.
5. Add 1–2 drops of stain (Safranin or Methylene Blue).
6. Allow staining for about 1 minute.
7. Remove excess stain using blotting paper.
8. Carefully place a cover slip to avoid air bubbles.

Observation

Under the compound microscope, observe the following features of Acetabularia:

1. The thallus is unicellular and large.
2. It consists of three parts, Rhizoid (base) ,Stalk , Umbrella-shaped cap
3. The cell contains a single large nucleus located in the rhizoid region.
4. Cytoplasm contains many chloroplasts.

Result

The temporary stained slide shows the characteristic umbrella-shaped unicellular thallus with rhizoid, stalk, cap, and chloroplasts, confirming the specimen as Acetabularia.

Experiment 4

Objective

To prepare a temporary stained slide of Vaucheria and study its morphological and microscopic characteristics under a compound microscope.

Protocol / Procedure

1. Take a clean and dry glass slide.
2. Place a small filament of Vaucheria on the slide using forceps.
3. Add one drop of water or glycerine.
4. Tease and spread the filament gently with a needle.
5. Add 1–2 drops of Safranin or Methylene Blue stain.
6. Leave the stain for about one minute.
7. Remove excess stain with blotting paper.
8. Carefully place a cover slip over the specimen avoiding air bubbles.

Observation

Observe the slide under low and high power of the microscope and note the following features of Vaucheria:

1. Thallus is long, tubular, branched, and filamentous.
2. Filaments are coenocytic (multinucleate) and aseptate (without cross walls).
3. Cytoplasm is present along the periphery.
4. Numerous chloroplasts are distributed in the cytoplasm.
5. Rhizoids may be present for attachment.
6. Reproductive structures such as oogonia and antheridia may be visible.

Result

The temporary stained preparation shows branched coenocytic filaments with chloroplasts and reproductive structures characteristic of Vaucheria.

Mycology and plant pathology

Experiment 5

Objective

To prepare a temporary slide of *Plasmodiophora brassicae* from infected roots and study its microscopic characters.

Procedure

1. Take a diseased swollen root (club root).
2. Wash gently with water to remove soil particles.
3. Cut a very thin transverse section (T.S.) of infected root using a sharp razor.
4. Place the section in a drop of water on a clean slide.
5. Add 1–2 drops of lactophenol cotton blue stain.
6. Keep for 1–2 minutes for proper staining.
7. Remove excess stain using blotting paper.
8. Place cover slip carefully to avoid air bubbles.
9. Observe first under low power and then high power of microscope.

Observation

Under microscope observe:

- Enlarged host cells
- Multinucleate plasmodium
- Thick-walled resting spores
- Brownish spore masses inside cortical cells

Result

The temporary mount of infected root shows characteristic plasmodial bodies and resting spores of Plasmodiophora brassicae, confirming the presence of plasmodiophore fungus-like organism.

Experiment 6

Objective

To study the symptoms of Green Ear Disease of pearl millet and identify its causal organism.

Protocol/procedure

1. Take infected leaf or ear portion showing downy growth.
2. Using needle, scrape a small amount of fungal growth.
3. Place it in a drop of lactophenol cotton blue on a clean slide.
4. Tease gently to separate structures.
5. Place cover slip carefully.
6. Observe under low and high power microscope.

Observevation:

- Hyaline coenocytic mycelium
- Branched sporangiophores
- Sporangia/zoospores

Result

The specimen shows characteristic green ear symptoms and microscopic structures of Sclerospora graminicola, confirming Green Ear Disease of pearl millet.

Experiment 7

Objective

To prepare a microscopic slide and observe Tikka disease in groundnut plants.

Protocol/Procedure

1. Collect infected groundnut leaves showing brown or black spots.
2. Cut a small portion from the diseased area using a blade.
3. Place the sample on a clean glass slide.
4. Add 1–2 drops of lactophenol cotton blue stain.
5. Tease the tissue gently with a needle to separate fungal structures.
6. Place a cover slip carefully to avoid air bubbles.
7. Remove excess stain using blotting paper.
8. Observe under low and high power of the microscope.

Observation Septate fungal mycelium , Conidiophores arising in clusters and multicellular conidia

Result The prepared slide showed fungal structures associated with Tikka disease of groundnut caused by leaf spot fungi.

Bryophytes and pteridophytes

Experiment 8

Objective

To study the transverse section (T.S.) of the thallus of Riccia and identify its internal structure under a microscope.

Protocol / Procedure

1. Take a fresh thallus of Riccia and place it in water.
2. Hold the thallus between pith or potato pieces for support.
3. Using a sharp razor, cut very thin transverse sections (T.S.).
4. Transfer the thin sections into a watch glass containing water.
5. Select the thinnest section with the help of a brush.
6. Stain the section with safranin for 1–2 minutes.
7. Wash gently with water to remove excess stain.
8. Place the section on a clean glass slide.
9. Add a drop of glycerine.
10. Carefully place the cover slip without air bubbles.
11. Observe under low and then high power of the microscope.

Observations The T.S. of Riccia thallus shows the following structures:

1. Dorsal Region (Upper Region)

- Contains vertical rows of chlorophyllous cells.
- Air spaces or air canals are present between the cells.
- This region is photosynthetic.

2. Ventral Region (Lower Region)

- Composed of colorless parenchymatous storage cells.
- Rhizoids and scales arise from the lower surface.
- Rhizoids help in absorption and attachment.

3. Midrib Region

- The central portion is thicker than the margins.
- Stores food materials.

4. Rhizoids

Two types may be observed:

- Smooth-walled rhizoids
- Tuberculate rhizoids

Result

The transverse section of Riccia thallus showing differentiation into photosynthetic dorsal region and storage ventral region.

Experiment 9

Objective

To prepare and study the transverse section (T.S.) of the thallus of Marchantia and observe its internal structure under a microscope.

Protocol / Procedure

1. Take a healthy thallus of Marchantia and wash it with water.
2. Place the thallus between pith or potato pieces for support.
3. Cut thin transverse sections (T.S.) using a sharp razor.
4. Transfer the sections into water in a watch glass.
5. Select the thinnest section with a brush.
6. Stain the section with safranin for 1–2 minutes.
7. Wash gently with water to remove extra stain.
8. Place the section on a clean slide.
9. Add a drop of glycerine.
10. Carefully place a cover slip without trapping air bubbles.
11. Observe the slide under low and high power of the microscope.

Observations

The T.S. of Marchantia thallus shows the following parts:

1. Upper Epidermis

- Single-layered protective layer.
- Contains barrel-shaped air pores.

2. Air Chambers

- Present below the upper epidermis.
- Arranged in rows.
- Contain chlorophyllous filaments.

3. Photosynthetic Region

- Green cells present inside air chambers.
- Helps in photosynthesis.

4. Storage Region

- Lower region made of colorless parenchymatous cells.
- Stores food materials.

5. Lower Epidermis

- Bears scales and rhizoids.

6. Rhizoids

Two types are observed: Smooth-walled rhizoids and Tuberculate rhizoids . These help in absorption and attachment.

Result

The transverse section of Marchantia thallus showed differentiated photosynthetic and storage regions along with air chambers and rhizoids.

Experiment 10

Objective

To prepare and study the transverse section (T.S.) of the stem of Lycopodium and observe its internal structure under a microscope.

Protocol / Procedure

1. Take a fresh stem of Lycopodium and wash it with water.
2. Hold the stem between pith or potato pieces for support.
3. Cut very thin transverse sections (T.S.) using a sharp razor.
4. Transfer the sections into a watch glass containing water.
5. Select the thinnest section with the help of a brush.
6. Stain the section with safranin for 1–2 minutes.
7. Wash gently with water to remove excess stain.
8. Place the section on a clean glass slide.
9. Add a drop of glycerine.
10. Carefully place a cover slip without trapping air bubbles.
11. Observe the prepared slide under low and high power of the microscope.

Observations

The T.S. of Lycopodium stem shows the following structures:

1. Epidermis

- Outermost single-layered protective covering.
- Covered with cuticle.

2. Cortex

- Present below the epidermis.
- Composed mainly of parenchymatous cells.
- Outer cortex may contain sclerenchyma for support.

3. Endodermis

- Distinct single layer surrounding the vascular tissue.

4. Pericycle

- Located just inside the endodermis.
- Made of thin-walled cells.

5. Vascular Tissue

- Stele is protostelic.
- Xylem and phloem are arranged alternately.
- Xylem consists mainly of tracheids.
- Phloem surrounds the xylem patches.

6. Pith

- Usually absent in Lycopodium stem.

Result

The transverse section of Lycopodium stem showed a protostelic vascular system with distinct epidermis, cortex, and vascular tissues.

PGBY-106N: Gymnosperm and Paleobotany

Experiment 1: Study of External Morphology of Cycas

Objective: To study the vegetative and reproductive morphology of Cycas.

Materials Required
Fresh or preserved Cycas plant parts, hand lens, dissecting needle, notebook.

Protocol

a) Collect fresh specimens of Cycas including leaves, stem portions, and reproductive structures.

b) Observe the general habit of the plant and note whether it is tree-like or shrub-like.

c) Examine the stem carefully for scars, crown arrangement, and branching pattern.

d) Observe coralloid roots and identify their shape and position.

e) Study compound leaves and note leaflet arrangement and venation.

f) Observe male cone and identify microsporophylls.

g) Observe megasporophylls in female plants and identify ovules.

h) Use a hand lens for detailed observation of reproductive parts.

i) Draw neat labeled diagrams of vegetative and reproductive structures.

j) Record all distinguishing characteristics in the practical notebook.

Experiment 2: Anatomy of Cycas Leaflet

Objective: To study internal anatomical structure of Cycas leaflet.

Materials Required: Fresh leaflet, razor blade, slides, cover slips, safranin stain, glycerin, microscope.

Protocol

a) Take a fresh leaflet of Cycas and wash it properly.

b) Cut very thin transverse sections using a sharp razor blade.

c) Transfer sections into water using a brush.

d) Select the thinnest section for staining.

e) Stain the section with safranin for 2–3 minutes.

f) Wash excess stain with distilled water.

g) Mount the section in glycerin on a clean slide.

h) Place a cover slip carefully avoiding air bubbles.

i) Observe under low and high power of microscope.

j) Identify epidermis, hypodermis, mesophyll, vascular bundles, and transfusion tissue.

k) Draw labeled diagrams and record observations.

Experiment 3: Study of Male Cone of Pinus

Objective: To examine structure and organization of male cone in Pinus.

Materials Required: Preserved male cone, dissecting needle, forceps, slides, microscope.

Protocol

a) Take a preserved male cone specimen of Pinus.

b) Observe external shape, size, and arrangement of scales.

c) Remove a microsporophyll carefully using forceps.

d) Observe pollen sacs attached to the lower surface.

e) Prepare temporary mount of pollen grains.

f) Observe winged pollen grains under microscope.

g) Identify sporophyll, microsporangia, and pollen grains.

h) Draw detailed labeled diagrams.

i) Compare observations with textbook description.

j) Record all findings systematically.

Experiment 4: Observation of Gymnosperm Wood Anatomy

Objective: To study anatomical features of gymnosperm wood.

Materials Required
Prepared slides of gymnosperm wood, microscope, notebook.

Protocol

a) Clean microscope lenses before observation.

b) Place prepared slide on microscope stage.

c) Observe under low power first.

d) Identify tracheids and annual rings.

e) Observe bordered pits carefully under high power.

f) Identify resin canals if present.

g) Compare softwood characteristics with angiosperm wood.

h) Draw neat labeled diagrams of observed structures.

i) Note special features of gymnosperm wood.

j) Record observations in tabular form.

5. Identification of Fossils

Objective: To identify different fossil plant types.

Materials Required
Fossil specimens/photographs/models, hand lens, charts.

Protocol

a) Arrange fossil specimens systematically on laboratory table.

b) Observe external appearance and texture of each fossil.

c) Identify whether fossil is impression, compression, cast, or petrifaction.

d) Examine visible plant structures carefully.

e) Compare fossils with reference charts or manuals.

f) Classify fossils into appropriate groups.

g) Note geological significance of each fossil.

h) Draw sketches of important fossil types.

i) Prepare comparative notes among fossils.

j) Record final identification and observations.

PGBY-107N: Anatomy, Reproduction and Morphogenesis

Experiment 5: Study of Shoot Apex Anatomy

Objective: To examine the internal structure of shoot apical meristem.

Materials Required: Shoot tips, razor blade, slides, stain, microscope.

Protocol

a) Collect fresh shoot tips from healthy plants.

b) Wash thoroughly with distilled water.

c) Cut very thin longitudinal sections using a razor blade.

d) Transfer sections into watch glass containing water.

e) Stain sections with safranin for 2 minutes.

f) Wash excess stain gently.

g) Mount stained section in glycerin.

h) Observe under microscope beginning with low power.

i) Identify tunica, corpus, and leaf primordia.

j) Draw labeled diagrams and record observations.

Experiment 6: Anatomy of Monocot and Dicot Stem

Objective: To compare anatomical structures of monocot and dicot stems.

Materials Required: Fresh stem samples, razor, slides, safranin, microscope**.**

Protocol

a) Take fresh monocot and dicot stem specimens.

b) Cut thin transverse sections from both stems.

c) Transfer sections into water.

d) Stain sections with safranin.

e) Wash excess stain carefully.

f) Mount sections on separate slides.

g) Observe vascular bundle arrangement under microscope.

h) Identify cortex, epidermis, vascular bundles, and pith.

i) Compare arrangement in both stems.

j) Draw comparative diagrams and record differences.

Experiment 7: Study of Pollen Germination

Objective: To observe in vitro pollen germination.

Materials Required: Fresh pollen grains, sucrose solution, slides, microscope.

Protocol

a) Prepare 10% sucrose solution in distilled water.

b) Place one drop of solution on clean slide.

c) Dust fresh pollen grains over the drop.

d) Cover gently with cover slip.

e) Keep slide undisturbed for 10–15 minutes.

f) Observe under microscope.

g) Identify pollen tube emergence.

h) Measure pollen tube length if required.

i) Calculate percentage of germinated pollen grains.

j) Record observations and draw diagrams.

Experiment 8: Preparation of Tissue Culture Medium

Objective: To prepare nutrient medium for plant tissue culture.

Materials Required: MS medium chemicals, agar, sucrose, distilled water, pH meter, autoclave.

a) **Protocol**
b) Measure required quantity of distilled water.
c) Add MS nutrient salts carefully.
d) Add sucrose and dissolve completely.
e) Add agar while heating gently.
f) Adjust pH to 5.7–5.8 using NaOH or HCl.
g) Make final volume with distilled water.
h) Dispense medium into culture bottles.
i) Plug bottles with cotton or caps.
j) Sterilize medium in autoclave at 121°C for 15 minutes.
k) Cool and store medium for further use.

Experiment 9: Callus Induction Experiment

Objective: To induce callus formation from explants.

Materials Required: Plant explants, sterilized medium, laminar airflow chamber, forceps.

a) **Protocol**
b) Select healthy explants such as leaf or stem pieces.
c) Wash explants under running water thoroughly.
d) Surface sterilize using sodium hypochlorite solution.
e) Rinse explants with sterile distilled water.
f) Transfer explants onto sterilized culture medium aseptically.
g) Seal culture bottles properly.

h) Incubate cultures under controlled temperature conditions.

i) Observe cultures regularly for contamination.

j) Note initiation of callus after several days.

k) Record color, texture, and growth of callus.

PGBY-108N: Taxonomy of Angiosperm and Economic Botany

Experiment 10: Study of Floral Characters

Objective: To study floral morphology of angiosperms.

Materials Required: Fresh flowers, dissecting needle, forceps, hand lens.

Protocol:

a) Collect fresh flowers of selected plants.

b) Observe color, symmetry, and arrangement of floral parts.

c) Remove sepals carefully using forceps.

d) Observe petals, stamens, and carpels individually.

e) Count floral parts and note fusion if present.

f) Observe ovary position carefully.

g) Use hand lens for minute structures.

h) Draw floral parts separately.

i) Prepare floral formula from observations.

j) Record all characters systematically.

Experiment 11: Herbarium Preparation

Objective: To prepare and preserve herbarium specimens.

Materials Required: Plant specimens, blotting paper, newspaper, herbarium sheets, glue.

Protocol

a) Collect healthy plant specimens with flowers/fruits.

b) Remove excess soil and unwanted materials.

c) Arrange specimen properly between newspapers.

d) Place blotting papers on both sides.

e) Press specimen using plant press.

f) Dry specimens for several days changing papers regularly.

g) Mount dried specimen on herbarium sheet using glue.

h) Attach label containing scientific details.

i) Cover herbarium sheet properly for protection.

j) Store herbarium sheets in dry condition.

Experiment 12: Use of Dichotomous Keys

Objective: To identify plants using dichotomous keys.

Materials Required: Plant specimens, flora/manual, hand lens.

Protocol

a) Observe specimen carefully for diagnostic characters.

b) Start with first pair of contrasting statements in key.

c) Select statement matching specimen character.

d) Follow indicated number to next statement.

e) Continue process sequentially.

f) Observe floral and vegetative characters carefully.

g) Confirm identification with flora/manual description.

h) Record scientific name and family.

i) Note important identifying features and prepare final classification report.