



**I. Learning Objectives:** By the end of this course the learner has:

1. To understand the concept of Soil-Plant-Atmosphere continuum based on plant-water relations.
2. To study the anabolic and catabolic processes in plants.
3. To understand the role of plant growth regulators on growth, development and flowering.

**II. Learning Outcomes:** On completion of this course students will be able to:

1. Comprehend the importance of water in plant life and mechanisms for transport of water and solutes in plants.
2. Explain the role of minerals in plant nutrition and their deficiency symptoms.
3. Interpret the role of enzymes in plant metabolism.
4. Hypothesise the light reactions and carbon assimilation processes responsible for synthesis of food in plants.
5. Analyze the biochemical reactions in relation to Nitrogen and lipid metabolisms.
6. Evaluate the physiological factors that regulate growth, development and flowering in plants.

### Syllabus of theory

**Unit – 1: Plant-Water relations**

1. Importance of water to plant life, physical properties of water, diffusion, imbibition, osmosis. water potential, osmotic potential, pressure potential.
2. Absorption and lateral transport of water; Ascent of sap
3. Transpiration: stomata structure and mechanism of stomatal movements (K<sup>+</sup> ion flux).
4. Mechanism of phloem transport; source-sink relationships.

**Unit – 2: Mineral nutrition, Enzymes and Respiration**

1. Essential macro and micro mineral nutrients and their role in plants; symptoms of mineral deficiency
2. Absorption of mineral ions; passive and active processes.
3. Characteristics, nomenclature and classification of Enzymes. Mechanism of enzyme action, enzyme kinetics.
4. Respiration: Aerobic and Anaerobic; Glycolysis, Krebs cycle; electron transport system, mechanism of oxidative phosphorylation, Pentose Phosphate Pathway (HMP shunt).

**Unit – 3: Photosynthesis and Photorespiration**

1. Photosynthesis: Photosynthetic pigments, absorption and action spectra; Red drop and Emerson enhancement effect
2. Concept of two photosystems; mechanism of photosynthetic electron transport and evolution of oxygen; photophosphorylation
3. Carbon assimilation pathways (C<sub>3</sub>, C<sub>4</sub> and CAM).
4. Photorespiration - C<sub>2</sub> pathway

#### **Unit – 4: Nitrogen and lipid metabolism**

1. Nitrogen metabolism: Biological nitrogen fixation – asymbiotic and symbiotic nitrogenfixingorganisms. Nitrogenase enzymesystem.
2. Lipid metabolism: Classification of Plant lipids, saturated and unsaturated fatty acids.
3. Anabolism of triglycerides,  $\beta$ -oxidation of fatty acids, Glyoxylate cycle.

#### **Unit – 5: Plant growth - development**

1. Growth and Development: Definition, phases and kinetics of growth.
2. Physiological effects of Plant Growth Regulators (PGRs) - auxins, gibberellins, cytokinins, ABA, ethylene and brassinosteroids.
3. Physiology of flowering: Photoperiodism, role of phytochrome in flowering.
4. Seed germination and senescence; physiological changes during seed germination.

#### **IV. Textbooks:**

1. Pandey, B.P. (2013) College Botany, Volume-III, S. Chand Publishing, New Delhi
2. Ghosh, A. K., K. Bhattacharya & G. Hait (2011) A Text Book of Botany, VolumeIII, New Central Book Agency Pvt. Ltd., Kolkata

#### **V. Reference Books:**

1. Aravind Kumar & S.S. Purohit (1998) Plant Physiology – Fundamentals and Applications, Agro Botanica, Bikaner
2. Datta, S.C. (2007) Plant Physiology, New Age International (P) Ltd., Publishers, New Delhi
3. Hans Mohr & P. Schopfer (2006) Plant Physiology, Springer (India) Pvt. Ltd., New Delhi
4. Hans-Walter heldt (2005) Plant Biochemistry, Academic Press, U.S.A.
5. Hopkins, W.G. & N.P.A. Huner (2014) Introduction to Plant Physiology, Wiley India Pvt. Ltd., New Delhi
6. Noggle Ray & J. Fritz (2013) Introductory Plant Physiology, Prentice Hall (India), New Delhi
7. Pandey, S.M. & B.K. Sinha (2006) Plant Physiology, Vikas Publishing House, New Delhi
8. Salisbury, Frank B. & Cleon W. Ross (2007) Plant Physiology, Thomsen & Wadsworth, Australia & U.S.A
9. Sinha, R.K. (2014) Modern Plant Physiology, Narosa Publishing House, New Delhi
10. Taiz, L. & E. Zeiger (2003) Plant Physiology, Panima Publishers, New Delhi.
11. Verma, V. (2007) Text Book of Plant Physiology, Ane Books India, New Delhi.



**SRI YN COLLEGE(A) – NARSAPUR**  
(Affiliated to Adikavi Nannaya University)  
**III B.Sc (Hon's) Botany Major - Semester – IV, Course – 13**  
**For 2023 – 2027 batch (w.e.f. 2026 – 2027 )**  
**Plant Physiology and Metabolism**  
**Practical Syllabus**

---

**Course Outcomes:** On successful completion of this practical course, student shall be able to:

1. Conduct lab and field experiments pertaining to plant physiology.
2. Estimate the quantities and qualitative expressions using experimental results and calculations
3. Interpret the factors responsible for growth and development in plants.

**Laboratory/field exercises:**

1. Determination of osmotic potential of plant cell sap by plasmolytic method using Rhoeo/ Tradescantia leaves.
2. Calculation of stomatal index and stomatal frequency of a mesophyte, a hydrophyte and a xerophyte.
3. Determination of rate of transpiration using Cobalt chloride method / Ganong's potometer (at least for a dicot and a monocot).
4. Effect of temperature on membrane permeability by colorimetric method.
5. Study of mineral deficiency symptoms using plant material/photographs.
6. Demonstration of amylase enzyme activity and study the effect of substrate and Enzyme concentration.
7. Separation of chloroplast pigments using paper chromatography technique.
8. Demonstration of Polyphenol oxidase enzyme activity (Potato tuber or Apple fruit)
9. Anatomy of C<sub>3</sub>, C<sub>4</sub> and CAM leaves.
10. Estimation of protein by biuret method/Lowry method.
11. Minor experiments – Osmosis, Arc-auxonometer, ascent of sap through xylem, cytoplasmic streaming



**SRI YN COLLEGE(A) – NARSAPUR**  
(Affiliated to Adikavi Nannaya University)  
**IIIB.Sc (Hon's) Botany Major - Semester – V, Course – 13**  
**For 2023 – 2027 batch (w.e.f. 2026 – 2027)**  
**Plant Physiology and Metabolism**  
**Model Question Paper**

**Time: 3Hrs**

**Max. Marks: 60M**

**SECTION – I**

**Answer any FIVE questions, each question carries FOUR marks. Draw diagrams wherever necessary.**

**5 x 4M = 20M**

1. Explain (a) Diffusion (b) Imbibition
2. Mechanism of Stomatal movements
3. (a) Macro nutrients (b) Micro nutrients
4. (a) Anaerobic respiration (b) Aerobic respiration
5. Photosynthetic pigments
6. C<sub>2</sub> pathway
7. Fatty acids
8. Abscissic acid (ABA)

**Answer any FIVE questions , each question carries EIGHT mars. Draw diagrams wherever necessary.**

**5 x 8M = 40M**

**SECTION – II**

9. Explain theories of Ascent of Sap with the help of diagrams.
10. Discuss the Phloem transport in plants. Add a note on Source – Sink relationship.
11. Write an essay on classification of Enzymes.
12. Give an account on Krebs's cycle.
13. Define Photophosphorylation. Explain the non cyclic Photophosphorylation.

**SECTION – III**

14. Give an account on relations in Glycolysis.
15. Explain the mechanism of Biological N<sub>2</sub> (Nitrogen) fixation.
16. Explain the reaction in Beta – Oxidation.
17. What are Phyto hormones? Explain the Physiological effects of Auxins in Plants.
18. What is Photoperiodism? Describe the various aspects of Photoperiodism.



**SRI YN COLLEGE(A) – NARSAPUR**  
(Affiliated to Adikavi Nannaya University)  
**IIIB.Sc (Hon's) Botany Major - Semester – V, Course – 13**  
**For 2023 – 2027 batch (w.e.f. 2026 – 2027)**

**Plant Physiology and Metabolism**

**BLUE PRINT**

**Note:** The question paper setters are requested to adhere to the format given below.

| Unit       | Essay questions | Short questions | Marks allotted to the unit |
|------------|-----------------|-----------------|----------------------------|
| Unit - 1   | 2               | 2               | 24                         |
| Unit – II  | 2               | 2               | 24                         |
| Unit – III | 2               | 2               | 24                         |
| Unit – IV  | 2               | 1               | 20                         |
| Unit – V   | 2               | 1               | 20                         |



**SRI YN COLLEGE(A) – NARSAPUR**  
(Affiliated to Adikavi Nannaya University)  
**IIIB.Sc (Hon's) Botany Major - Semester – V, Course – 13**  
**For 2023 – 2027 batch (w.e.f. 2026 – 2027)**

**Plant Physiology and Metabolism**  
**Practical Model Question Paper**

---

**Time: 3Hrs**

**Max. Marks: 50**

1. Conduct the experiment 'A' (Major experiment), write aim, principle, material and apparatus / equipment, procedure, tabulate results and make conclusion.  

15M
2. Demonstrate the experiment 'B' (Minor experiment), write the principle, procedure and give inference.  

10M
3. Identify the following and justify with apt reasons.  

15M

  - C) Plant water relations / Mineral nutrition
  - D) Plant Metabolism
  - E) Plant growth and development
4. Record + Viva - voice  

$7 + 3 = 10M$

---

**Total Marks = 50M**

---