

## DISCIPLINE SPECIFIC CORE COURSE – 15: Plant Physiology

### CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

| Course title & Code              | Credits  | Credit distribution of the course |          |                     | Eligibility criteria                       | Pre-requisite of the course (if any) |
|----------------------------------|----------|-----------------------------------|----------|---------------------|--|--------------------------------------|
|                                  |          | Lecture                           | Tutorial | Practical/ Practice |  |                                      |
| <b>Plant Physiology – DSC 15</b> | <b>4</b> | <b>2</b>                          | <b>0</b> | <b>2</b>            | Class XII pass with Biology/ Biotechnology | <b>Nil</b>                           |

#### Learning objective:

7. To introduce the basic principles of plant structure and function and its application in related fields.

#### Learning outcomes: On completion of the course the students will be able to:

8. understand the structure and function of plants
9. comprehend and compare various tissue systems in plants and their role
10. realise the importance of water, soil and atmosphere in the life of organisms
11. appreciate the ability of plants to sense the environment and adapt
12. interpret and evaluate the significance of regulator molecules in controlling life forms
13. apply the principles of plant physiology to solve problems in related fields

#### Unit 1: Plant-water relations

**04 Hours**

Water potential and its components, water absorption by roots, water movement via symplast, apoplast and aquaporins, root pressure, guttation, ascent of sap, cohesion-tension theory, transpiration, factors affecting transpiration, anti-transpirants

#### Unit 2: Mineral nutrition

**04 Hours**

Essential and beneficial elements, macro- and micro-elements, criteria for essentiality, roles of essential elements, chelating agents, phytosiderophores, mineral nutrition in hydroponics and aeroponics.

#### Unit 3: Nutrient uptake

**05 Hours**

Transport of ions across cell membrane, passive absorption, simple and facilitated diffusion (carrier and channel proteins), Fick's law, active absorption, proton ATPase pump, electrochemical gradient, ion flux, uniport, co-transport (symport, antiport)

#### Unit 4: Translocation in the phloem

**03 Hours**

Composition of phloem sap, phloem loading and unloading, Pressure-Flow Model, source-sink relationship

**Unit 5: Plant growth regulators****08 Hours**

Chemical nature (basic structure, precursor), physiological roles, bioassays and applications of Auxins, Gibberellins, Cytokinins, Abscissic Acid, Ethylene; Other growth regulators - Jasmonic Acid, Brassinosteroids, Nitric Oxide. Mechanism of action of Auxin. Introduction to interactions among plant growth regulators.

**Unit 6: Physiology of photo-sensory molecules****03 Hours**

Discovery, chemical nature, mode of action and role of phytochrome, cryptochrome and phototropin in photomorphogenesis

**Unit 7: Physiology of flowering****02 Hours**

Concept of florigen, photoperiodism, CO-FT Model of flowering, vernalization.

**Unit 8: Seed dormancy****01 hour**

Seed dormancy -causes and methods to induce and/or overcome dormancy

**Practicals****60 Hours**

9. Determination of osmotic potential of plant cell sap by plasmolytic method.
10. Determination of water potential of potato tuber cells by weight method.
11. Determination of water potential of potato tuber cells by falling drop method.
12. Study of effect of light on the rate of transpiration in excised leafy twig.
13. Calculation of stomatal index and stomatal frequency from the lower surface of leaves of a mesophyte and a xerophyte.
14. To calculate the area of an open stoma and percentage of leaf area open through stomata in a mesophyte and a xerophyte (lower surface).
15. To study the effect of different concentrations of ABA on stomatal closure.
16. To study the effect of light and dark on seed germination.
17. To study induction of amylase activity in germinating barley grains.
18. To study the effect of ethylene on fruit ripening.
19. To study the effect of auxin on rooting.

**Suggested Readings:**

6. Hopkins, W. G., Huner, N. P. A. (2009). Introduction to Plant Physiology, 4th edition. New Delhi, Delhi: Wiley India Pvt. Ltd.
7. Taiz, L., Zeiger, E., Moller, I. M., Murphy, A. (2018). Plant Physiology and Development, 6th edition. New York, NY: Oxford University Press, Sinauer Associates.
8. Kochhar, S.L., Gujral, S.K. (2020). Plant Physiology: Theory and Applications. New Delhi, Delhi: Foundation Books, 2<sup>nd</sup>Edn. Cambridge University Press India Pvt, Ltd.

**Additional Resources:**

- Bajracharya, D. (1999). Experiments in Plant Physiology: A Laboratory Manual. New Delhi, Delhi: Narosa Publishing House.
- Bhatla, S.C., Lal, M.A. (2018). Plant Physiology, Development and Metabolism. Singapore: Springer Nature, Singapore Pvt. Ltd.

**Note: Examination scheme and mode shall be as prescribed by the Examination Branch, University of Delhi, from time to time.**