

### Entrance Syllabus for M.Phil. (Environmental Plant Biology) –HAPPRC

1. Growth and development of plants. Juvenility, shoot growth, types of shoots, patterns of shoot growth, cambial growth and its regulation. Physiological aspects of pruning and dwarfing. Growth measurements.
2. Water and its role in plants, properties and functions of water in the cell, water relations, water potential of plant cells.
3. Mechanism of water uptake by roots transport in roots, movement of water in plants, water loss from plants, energy balance, solar energy, input energy dissipation at crop canopy level. Water relations of tree species.
4. Evapotranspiration, plant factors influencing transpiration rate. Stomata, structure function - Mechanism of stomatal movement, antitranspirants. Concepts of transpiration rate and water use efficiency.
5. Physiology of water high temperature and salinity stress
6. Climate- Analytical methods to determine long term changes in environment- Tree ring, cellulose, stable carbon isotope discrimination, stable  $^{18}\text{O}$  discrimination for hydrological changes. Likely changes in climate in future and its impact on crop and ecosystems. The greenhouse gases and global warming.  $\text{CO}_2$  as an important greenhouses gas, global carbon deposits, fluxes in the sinks and sources.
7. Approaches to contain atmospheric  $\text{CO}_2$  level. Effect of elevated  $\text{CO}_2$  on plant growth and development. Methane as a greenhouse gas. Prediction on global warming, GCM models, effects on climate and biota.
8. High temperature and  $\text{CO}_2$  interaction on plant growth and productivity, ionising radiation UV-B chlorofluoro carbon (CFC)–their impact on ozone layer- ozone hole and alteration in UV-B radiation.
9. Effects of UV-B radiation on plant ecosystem, repair and acclimation to UV-B damage.
10. Carotenoids and their role in membrane stabilization. Air pollution,  $\text{SO}_2$ ,  $\text{NO}$ , methane, ozone, peroxy acetyl nitrate and their effect on ecosystem. Industrial and domestic effluent- their effect, on aquatic ecosystem, plant growth and development.
11. Abiotic Stress Responses in Plants Abiotic stresses affecting plant productivity. Basic principles of a crop improvement programme under stress, interactions between biotic and abiotic stresses. Drought characteristic features, water potential in the soil-plant-air continuum.
12. Development of water deficits, energy balance concept, transpiration and its regulation – stomatal functions/VPD. Physiological process affected by drought. Drought resistance mechanisms: Escape, dehydration postponement (Drought avoidance), Dehydration tolerance, and characteristics of resurrection plants. Osmotic adjustment Osmoprotectants, stress proteins. Water use efficiency as a drought resistance trait.
13. Physiology of Flowering and Reproduction Evolutionary history of flowering plants (angiosperms). Semelparous and iteroparous reproduction, monocarpic and perennial life etc. Flowering phenomenon, effect of plant age, juvenility- transition to

flowering. Flowering nature and classification of plants. Photoperiodic responses and the mechanisms in short and long day plants. Theories related to flowering. Endogenous substances and flowering. Control of flowering. Thermoperiodism - photo and thermo-period interactions. Vernalization-mechanism. Photomorphogenesis, photoreceptors, phytochrome, cryptochrome, physiology of flowering, photoperiodism and vernalization. Optimization in flowering response-to environmental features (light, temperature, stress) etc.

14. Outlines of major pathways (Photosynthesis, Respiration, carbohydrate, nitrogen and lipid metabolism, secondary metabolites) in plants.

**SUGGESTED READINGS:** 1. Biochemistry and Physiology of Plant Hormones (second edition). Springer-Verlag. New York USA. 2. Nobel, P.S. 1999. Physiochemical and Environmental Plant Physiology (Second edition). Academic Press, San Diego, USA. 3. Noggle, G.R and Fritz, G.F. 1977. Introductory Plant Physiology. Prentice Hall. New Delhi. 4. Salisbury, F.B. and Ross, C.W. 1992. Plant Physiology (4th edition). Wadsworth Publishing Co., California, USA 5. Singhal, G.S., Renger, G., Sopory, S.K., Irrgang, K.D. and Govindjee 1999. Concepts in Photobiology: Photosynthesis and Photomorphogenesis. Narosa Publishing House, New Delhi. 6. Taiz, L. and Zeiger, E. 1998. Plant Physiology (2nd edition). Sinauer Associates, Inc., Publishers, Massachusetts, USA. 7. Thomas, B. and Vince-Prue, D. (1997) Photoperiodism in Plants (Second edition). Academic Press, San Diego, USA.