

COURSE TITLE: BOTANY-IV (PLANT PHYSIOLOGY AND ECOLOGY)

CREDIT HOURS: 3

Syllabus Outline:

a) Plant Physiology:

Water relations, Mineral nutrition, Photosynthesis, Respiration, Growth.

b) Ecology:

Introduction, Soil, Light and Temperature, Water, Wind, Population Ecology, Community Ecology.

c) Plant Physiology:

1) Water relations (water potential, osmotic potential, pressure potential, matric potential), Absorption and translocation of water.

2) **Mineral Nutrition:** Soil as a source of minerals, Passive and active transport of nutrients. Essential mineral elements, role and deficiency symptoms of macronutrients.

3) **Photosynthesis:** Introduction, Oxygenic and non-oxygenic photosynthesis Mechanism: light reactions (electron transport and photophosphorylation) and dark reactions (Calvin cycle), Differences between C₂ and C₃ plants, factors affecting photosynthesis.

4) **Respiration:** Definition and respiratory substrates. Mechanism of Glycolysis, Krebs cycle. Electron transport and oxidative phosphorylation. Anaerobic respiration, Energy balance in aerobic and anaerobic respiration.

5) **Growth:** Definition; role of Auxins, Cytokinins, Abscisic acid and Ethylene in controlling growth, Gibberellins

6) **Photoperiodism:** Definition, historical background, Classification of plants based on photoperiodic response, Role of phytochromes, and hormones and metabolites in photoperiodism.

7) **Dormancy:** Definition and causes of seed and bud dormancy; methods of breaking seed dormancy. Physiological processes during seed germination.

8) **Plant Movements:** Classification. Phototropism, Nastic movements. Gravitropism and their mechanisms.

d) Ecology:

1) Introduction, aims and applications of Ecology.

2) Soil: Physical and chemical properties of soil (soil formation, soil texture, pH, EC, organism and organic matter etc) and their relationship to plants.

3) Light and temperature: Quality of light, diurnal and seasonal variations, Ecophysiological responses.

4) Water: Field capacity and soil water holding capacity. Characteristics of xerophytes and hydrophytes, Effects of precipitation on distribution of plants.

- 5) Wind: wind as an ecological factor and its importance
- 6) Population Ecology: Introduction to population ecology.
- 7) Community Ecology,
 - i) Ecological characteristics of plant community
 - ii) Methods of sampling vegetation (Quadrat and line intercept)
 - iii) Succession
 - iv) Major vegetation types of the local area.
- 8) Ecosystem Ecology,
 - i) Definition and components of ecosystem,
 - ii) Food chain and food web.
 - iii) Biogeochemical cycles, definition, types with emphasis on Nitrogen and Hydrological cycles.

Evaluation Criteria

Examination	Type	Marks
Internal Examination	Sessional Work	15%
	Mid-Semester	25%
External Examination	Final Semester	60%

Books Recommended:

1. Taiz, L. and Zeiger, E. (2010). *Plant Physiology*. 5th Edition. Sinauers Publishing, Company. Inc. California.
2. Illahi, I. (2009). *Plant Physiology. Biochemical Processes in Plants*. UGC Press.
3. Witham F.W, and Devlin. Blaydes, D.F. and Devline, R.M (1986) *Exercises in Plant Physiology*. Prindle, Weber and Schmidt, Boston.
4. Schultz, E. (2005). *Plant Ecology*. (2nd Ed.) Springer-Verlag, Berlin.
5. Smith, R. L. (2002). *Ecology and Field Biology*. Harper and Row Publishers, New York.
6. Salisbury F.B. and Ross C.B. (2002). *Plant Physiology*. (7th Ed.), Wordsworth Publishing Co. Belmont CA.
7. Ricklefs. R.E. (2001). *The Economy of Nature*. W.H. Freeman and Company .UK.
8. Hopkins, W.B. (2000). *Introduction to Plant Physiology*. 2nd Ed. John Wiley and Sons. New York.
9. Rick, R.E. (2000). *Ecology*. (1st Ed.) W.H. Freeman and Company, U.K.
10. Smith R. L. (2000). *Elements of Ecology*. Harper and Row Publishers, New York.

11. Subrahmanyam, N.S. and Sambamurthy. A.V.S.S. (2000). *Ecology*. Narosa Publishing House, New Delhi.
12. Townsend, C.R., Harper, J.L. and Begon, M.E. (2000). *Essentials of Ecology*. Blackwell Scientific Publications, U.K.
13. Barbour, M.O., Burke, H.J. and Pitts, D.W. (1999). *Terrestrial Plant Ecology*. The Benjamin, Cumming Publishing Co. California, USA.
14. Hussain, F. (1999). *Field and Laboratory Manual of Plant Ecology*. National Academy of Higher Education, Islamabad.
15. Krebs, C. J. (1997). *Ecology and Field Biology*. Addison Wesley Longman Inc, New York.
16. Chapman, J.L. and Reiss, M.J. (1995). *Ecology. Principles and Applications*. Cambridge University Press. U.K.
17. Odum, E.P. (1970). *Basic Ecology*. V/B. Saunders. Philadelphia.

COURSE TITLE: BOTANY LAB-IV (PLANT PHYSIOLOGY AND ECOLOGY)

CREDIT HOURS: 1

Syllabus Outline:

Water uptake by swelling seeds, loss of permeability by beet root cells, Rate of transpiration by means of potometer, Cobalt chloride paper method, Extraction of chlorophyll and separation of component pigments, Studies of absorption spectra, Winkler's method to determine oxygen utilization by a respiring plant, amylase from germinating seeds and its effect on starch breakdown, carbon dioxide evolution during respiration by titration method, seed germination

a) Plant Physiology:

1. Determination of uptake of water by swelling seeds when placed in sodium chloride solution of different concentrations.
2. Determination of the temperature at which beet root cells lose their permeability.
3. Determination of the effects of environmental factors on the rate of transpiration of a leafy shoot by means of a potometer by cobalt chloride paper method.
4. Extraction of chlorophyll from the leaves and separation of component pigments on a paper chromatogram. Study of Absorption Spectra using Spectrophotometer.
5. Estimation of oxygen utilized by a respiring plant by Winkler's method.
6. Extraction of amylase from germinating wheat seeds and *study* of its effect on starch break down.
7. Measurement of carbon dioxide evolution during respiration of germinating seeds by the titration method.
8. Effect of light and temperature on seed germination.

b) Ecology:

1. Determination of physical and chemical characteristics of soil.
2. Measurement of light and temperature.
3. Measurement of vegetation by Quadrat and Line Intercept Methods.
4. Measurements of wind velocity.
5. Field trips to ecologically diverse habitats.

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4. Schultz, E. (2005). *Plant Ecology* (2nd Ed.) Springer-Verlag, Berlin.
5. Smith, R. L. (2002). *Ecology and Field Biology* Harper and Row Publishers, New York.
6. Salisbury F.B. and Ross C.B. (2002). *Plant Physiology* (7th Ed.), Wordsworth Publishing Co. Belmont CA.
7. Ricklefs. R.E. (2001). *The Economy of Nature* W.H. Freeman and Company. UK.
8. Hopkins, W.B. (2000). *Introduction to Plant Physiology* (2nd Ed.) John Wiley and Sons. New York.
9. Rick R.E. (2000). *Ecology*. (1st Ed.) W.H. Freeman and Company, UK.
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11. Subrahmanyam, N.S. and Sambamurthy. A.V.S.S. (2000). *Ecology*. Narosa Publishing House, New Delhi.
12. Townsend, C.R., Harper, J.L. and Begon, M.E. (2000). *Essentials of Ecology* Blackwell Scientific Publications, UK.
13. Barbour, M.O., Burke, H.J. and Pitts, D.W. (1999). *Terrestrial Plant Ecology*. The Benjamin, Cumming Publishing Company California, USA.
14. Hussain F. (1999). *Field and Laboratory Manual of Plant Ecology* National Academy of Higher Education, Islamabad.
15. Krebs, C. J. (1997). *Ecology and Field Biology*. Addison Wesley Longman Inc, New York.
16. Chapman, J.L. and Reiss, M.J. (1995). *Ecology Principles and Applications*. Cambridge University Press. U.K.
17. Odum, E.P. (1970). *Basic Ecology* V/B. Saunders. Philadelphia.