

**High Altitude Plant Physiology Research Centre
Ph. D. in Plant Physiology**

Pre-Ph. D. Course in Plant Physiology

SYLLABUS

CORE COURSES

CPP-101 Research Methodology and Instrumentation 04 Credits

Concept and components of research, Hypothesis, Variables, Research Design, Sampling, Data collection, Statistical tools in research, Research reports/Thesis writing, Presentation (Workshop, Seminar, Conference, Symposium etc.).

Colorimetry; spectrophotometry; chromatography; electrophoresis; centrifugation; fluorescence measurements; methods of plant growth analysis; gas exchange; radiation measurements; determination of stomatal aperture; leaf temperature measurements; determination of biomolecules; enzyme assays and bioseparation techniques; microscopy methods; recombinant DNA technology; clonal propagation.

Suggested reading:

An introduction to practical biochemistry by D.T. Plummer (Dr. W. Junk b.v. publishers, The Hague).

Gel electrophoresis of proteins, a practical approach by B.D. Hames (D. Rickwood, IRL press, Oxford).

Centrifuge A practical approach 2nd ed. by D. Rickwood (IRL press, Oxford). Modern Methods in Plant Analysis. K. Peach and Tracey. Narosa Publ. House, New Delhi. (1959)

CPP-102 RPE & Basic Environmental Plant Physiology 03 Credits

(A) Research and Publication and Ethics (RPE) 02 Credits

THEORY

- **RPE 01: PHILOSOPHY AND ETHICS (03 hrs.)**
 1. Introduction to philosophy: definition, nature and scope, concept, branches
 2. Ethics: definition, moral philosophy, nature of moral judgment and reactions

- **RPE 02: SCIENTIFIC CONDUCT (5 hrs.)**
 1. Ethics with respect to science and research
 2. Intellectual honesty and research integrity
 3. Scientific misconduct: Falsification, fabrication and Plagiarism (FFP)
 4. Redundant publications: duplicate and overlapping publications, salami slicing

5. Selective reporting and misrepresentation of data

• **RPE 03: PUBLICATION ETHICS (07 hrs.)**

1. Publication ethics: definition, introduction and importance
2. Best practices/standards setting initiatives and guidelines: COPE, WAME, etc.
3. Conflicts of interest
4. Publication misconduct: definition, concept, problems that lead to unethical behavior and vice versa, types
5. Violation of publication ethics, authorship and contributorship
6. Identification of publication misconduct, complaints and appeals
7. Predatory publishers and journals

PRACTICE

• **RPE 04: OPEN ACCESS PUBLISHING (04 hrs.)**

1. Open access publications and initiatives
2. SHERPA/RoMEO online resources to check publisher copyright & self-archiving policies
3. Software tool to identify publications developed by SPPU
4. Journal finder/journal suggestion tools viz JANE Elsevier Journal Finder, Springer Journal Suggester, etc.

• **RPE 05: PUBLICATION MISCONDUCT (04 hrs.)**

A. Group Discussion (02 hrs.)

1. Subject specific ethical issues, FFP, authorship
2. Conflicts of interest
3. Complaints and appeals: examples and fraud from India and abroad

B. Software tools (02 hrs.)

Use of Plagiarism software like Turnitin, Urkund and other open source software tools

• **RPE 06: DATABASE AND RESEARCH METRICS (07 hrs.)**

A. Databases (04 hrs.)

1. Indexing databases
2. Citation database: Web of Science, Scopus, etc.

B. Research Metrics (03 hrs.)

1. Impact Factor of Journal as per Journal Citation Report, SNIP, SJR, IPP, Cite Score
2. Metrics: h-index, g-index, i10 index, altmetrics

(B) Concept of Environmental Plant Physiology

01 Credit

Scope and problems of environmental plant physiology; Plant environment and its components; Structural and functional modifications in plants in relation to environment; modern concepts of climate change in relation to plant physiology.

Suggested reading:

Encyclopaedia of Plant Physiology, Volume 12A, B, C and D. Springer-Verlag - O.L. Lange, P.S. Nobel, C.B. Osmond and H. Zeigler (1983)

Environmental Physiology of Plants. - A.H. Fitter and R.K.M. Hay (3rd Ed.) (2001)

Responses of Plants to Environmental Stress Vol. I & II. Academic Press. - Levitt, J. (1980)

Physiological Plant Ecology, Larcher, Springer (2001)

ELECTIVE COURSES

The candidate will have to take any two elective courses.

EPP-101 Seed biology and reproductive physiology

04 Credits

Physiology of seed development and maturation; effect of environmental factors on seed development and maturation; definition and measurement of seed germination; seed viability relationship with water and solutes; seed vigour; seed dormancy; inception of germination; environmental factors and photoreceptors; growth regulators, membranes and germination; Juvenility; photoperiodism, vernalization and physiology of flowering; vegetative propagation.

Suggested reading:

Seeds: Physiology of Development and Germination. Plenum Press, New York.

- J.D. Bewley and M.M. Black. (2013)

Seeds: Ecology, Biogeography and Evolution of Dormancy and Germination. Academic Press. USA - C.C. Baskin and J.M. Baskin

Physiology and Biochemistry of Seed Development and Germination Vol. I & II. - J.D. Bewley and M.M. Black. (2011)

Seed Ecophysiology of Temperate and Boreal Zone Forest Trees. St. Lucie Press, USA - R.E. Farmer Jr. (1996)

Physiology and biochemistry of seeds in relation to germination, Volume 2 By J. Derek Bewley, Michael Black, Springer-Verlag, (1982)

Plant Propagation: Principles and Practices, Prentice Hall, H.T. Hartmann, D.E. Kester, F.T. Davies Jr. and R. L. Geneve (2011)

EPP-102 Photosynthesis and productivity

04 Credits

Biochemical and physical processes of photosynthesis; effects of environmental factors on photosynthesis; water relations and photosynthesis; photosynthesis in different plant forms; characteristics of C₃, C₄ and CAM species and their ecological significance;

photosynthetic, light and water use efficiencies of plants; leaf and canopy photosynthesis; respiration and environmental factors; plant adaptation to temperature and light and their relationship to photosynthesis; root/shoot interactions; total dry matter production; modeling of photosynthetic and productivity responses to environment.

Suggested reading:

Photosynthesis: Photoreactions to Plant Productivity By Yash Pal Abrol, Prasanna Mohanty, Govindjee, Kluwer Academic Publishers, 1993

Photosynthesis and the Environment By N.R. Baker, Springer, 1996.

Plant Physiological Ecology By H. Lambers, Francis Stuart Chapin (III.), Thijs Leendert Pons, Springer, 1998

Photosynthesis. Vol. 1 & 2. - Govindjee. Academic Press, New York.1982.

EPP-103

Biophysical plant physiology and ecology

04 Credits

Importance and problems; atmospheric environment and its components - Radiation (radiation laws, radiation in natural environment, radiation fluxes in and within plant communities, radiation coupling, adaptations of plants to low and high radiation); Temperature (temperature relations of plants, plant adaptation and resistances to low and high temperatures, atmospheric temperature in relation to leaf temperature); Wind (response of single leaves and whole plant to wind and its ecological significance); Plant and water relations (physical and chemical properties of water, cell water relations, liquid phase transport processes); Exchange processes in plants : radiation exchange; CO₂ exchange (photosynthesis as a resistance process); exchange of water vapour (transpiration as a resistance process, resistance network); exchange of heat energy (mechanism of leaf energy balance and its significance); Altitude, latitude and plant growth; Ecological energetics.

Suggested reading:

Plant Ecophysiology By Mular R. Narashima Prasad, John Wiley & Sons, 1997.

Physiological Plant Ecology: Ecophysiology and Stress Physiology of Functional Groups By Walter Larcher, Springer, 2003.

Biophysical Ecology - D.M. Gates, 1970

EPP-104 Biotechnological advances in plant stress biology

04 Credits

Plant Stress Biology; Plant Stress Tolerance Traits; Genetic engineering in relation to plant stress biology; Physiological role of Plant Secondary Natural Products (PSNP); Ecological aspects of PSNPs; Diversity in relation to plant adaptations under stress; Structure, biosynthetic pathways, storage and accumulation of PSNPs in sub-cellular

organelles; Phytochemical analysis of PSNPs from plant extracts; in vitro production and evaluation of PSNPs using molecular biology tools and techniques; molecular genetics techniques for improvement of PSNP production.

Secondary metabolites: their function and evolution, Volume 171 By Derek Chadwick J. Wiley, 1992.

Biotechnological Production of Plant Secondary Metabolites By Ilkay Orhan Bentham Science Publishers, 2012.