

H.N.B. Garhwal University, Srinagar Garhwal
High Altitude Plant Physiology Research Centre
M. Phil - Environmental Plant Biology
SYLLABUS

I Semester

Core Papers: All compulsory

CEPB-101: Methodology and Instrumentation

Credits 04

Concept and application of biostatistics in plant biology; Statistical tools; Modeling and computer applications in plant biology. Concept and components of research - objectives, basic steps, research problem, hypothesis, Research Design; Sampling; Variables; Data collection; Research reports writing - review, main body, references; Presentation (Workshop, Seminar, Conference, Symposium etc.).

Colorimetry; spectrophotometry; chromatography; electrophoresis; centrifugation; determination of biomolecules; enzyme assays and bioseparation techniques; recombinant DNA Technology. Microscopy methods, fluorescence measurements; methods of plant growth analysis; gas exchange measurements; clonal propagation.

Suggested Readings:

1. An introduction to practical biochemistry by D.T. Plummer (Dr. W. Junk b.v. publishers, The Hague).
2. Gel electrophoresis of proteins, a practical approach by B.D. Hames (D. Rickwood, IRL press, Oxford).
3. Centrifuge A practical approach 2nd ed. by D. Rickwood (IRL press, Oxford).
4. HPLC methods on drug analysis by Montee, K. Ghosh (Springer book India Pvt. Ltd. Panchsheel park, New Delhi)
5. Micro computers in biology, a practical approach by C.R. Ireland and S.P. Long, (Centre for Science and Environment, New Delhi)
6. Analysis of Essential oil by Gas Chromatograph and Mass Spectrometry by Y. Masada (John Wiley & Sons 1986).

CEPB-102: RPE & Basic Environmental Plant Biology

Credits 03

(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) Basic Environmental Plant Biology

Credits 01

Plant environment and its components; Scope and problems of environmental plant biology; Plant responses and adaptations to environmental stresses. Implications of climate change.

Suggested Readings:

1. Plant Physiology by Salisbury and Ross.
2. Plant Physiological Ecology by Hans Lambers, F. Stuart Chapin and Thijis L. Pons, Springer (2008).
3. Plant Physiology by Lincoln Taiz and Eduardo Zeiger, Sinauer Associates (2010).

Elective Papers: The candidate will have to take any two elective papers

EEPB-101: Reproductive Physiology of Seed Plants

Credits 04

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 dormancy; inception of germination; environmental factors and photoreceptors; growth regulators, membranes and germination; Juvenility; photoperiodism, vernalization and physiology of flowering; vegetative propagation.

Suggested Readings:

1. Seeds: Physiology of Development, Germination and Dormancy By J. Derek Bewley, Kent Bradford, Henk Hilhorst, Hiroyuki Nonogaki.. Springer , 2013
2. Physiology and biochemistry of seeds in relation to germination 1 Development, Germination, and Growth By J. Derek Bewley, Michael Black Springer London, Limited, 2011
3. Physiology and biochemistry of seeds in relation to germination, Volume 2 By J. Derek Bewley, Michael Black, Springer-Verlag, 1982

EEPB-102: Photosynthetic Mechanisms and Plant Productivity:

Credits 04

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 Readings:

01. **Photosynthesis: Photoreactions to Plant Productivity** By Yash Pal Abrol, Prasanna Mohanty, Govindjee, Kluwer Academic Publishers, 1993
02. **Photosynthesis and the Environment** By N.R. Baker, Springer, 1996.
03. **Plant Physiological Ecology** By H. Lambers, Francis Stuart Chapin (III.), Thijs Leendert Pons, Springer, 1998

EEPB-103: Biophysical Plant Biology

Credits 04

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 Readings:

1. Plant Ecophysiology By Mular R. Narashima Prasad, John Wiley & Sons, 1997.
2. Physiological Plant Ecology: Ecophysiology and Stress Physiology of Functional Groups By Walter Larcher, Springer, 2003.

EEPB-104 Plant Secondary Metabolism

Credits 04

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.

Suggested Readings:

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

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

II Semester

CEPB-201: Dissertation

Credits 21

Each candidate will be allotted a topic related to the optional course he or she selects. The candidate shall have to do experimentation in the allotted topic and submit the results with methodology used and proper interpretation of the data in the form of a dissertation.