

SHRI GURU RAM RAI UNIVESITY

PATEL NAGAR, DEHRADUN-248001, UTTARAKHAND, INDIA

[Estd. by Govt. of Uttarakhand, vide Shri Guru Ram Rai University Act no. 03 of 2017 & recognized by UGC u/s 2(f) of UGC Act 1956]



SYLLABUS FOR Pre Ph.D. Botany School of Basic & Applied Sciences

(w.e.f 2025-2026)

SHRI GURU RAM RAI UNIVERSITY, PATELNAGAR, DEHRADUN-
UTTARAKHAND-248001

PRE- Ph. D. COURSE IN BOTANY

Course Code	Course Title	Credit	Marks for		Total Marks
			IA*	EE**	
Core Paper					
PRMC 101	Research methodology	4	20	60	80
RPEC 102	Research & Publications Ethics	2	10	30	40
PBOC103	Plant Science: Basics and Applied Aspects	4	20	60	80
Optional Paper					
PBOE104	Biodiversity, Resource Botany and Ethnobotany	4	20	60	80
PBOE105	Habitat Ecology, Environment and Natural Resource Management and Remote Sensing	4	20	60	80
PBOE106	Basic and Applied Palynology	4	20	60	80
PBOE107	Plant Pathology and Pathogen Interaction	4	20	60	80
Compulsory Paper					
PBOF108	Field Work	4	80	-	80
		Total	210	390	600

CORE COURSE**PRMC 101: RESEARCH METHODOLOGY****Credit: 04**

Course Outcome: The student will be able to

- CO-1 To develop understanding of the basic framework of research process.
CO-2 To develop an understanding of various research designs and techniques.
CO-3 To identify various sources of information for literature review and data collection.
CO-4 To develop an understanding of the ethical dimensions of conducting applied research
CO-5 Appreciate the components of scholarly writing and evaluate its quality.
CO-6 To create the research design and experimental approaches to conduct research.
-

Unit I-Concept & Types of Research

Meaning and importance of Research, Types of Research, Selection and formulation of Research Problem, Research Design, Classification of Research, Pure and Applied Research, Exploring or Formulative Research, Descriptive Research, Diagnostic Research/Study, Evaluation research/Studies, Action Research, Experimental Research, Historical Research.

Unit II –Methods Research

General Survey of various Methods including Survey Method, Interdisciplinary Method, Case Study Method, Sampling Method, Observation Method, Interview Method, Schedule Method, Questionnaire Method, Documentary Method, Library Method, Historical Method and Scientific Method. Characteristic Features of Scientific Method; Empirical Verifiable, Cumulative, Self - Correcting, Deterministic, Ethical & Ideological neutrality (Value Free).

Unit III - Data Collection and Data Analysis

Collection, Objectives and Classification of Data, Aims, Methods and Objects of Tabulation of Data, Forms and Processes of Interpretation and Presentation of Data, Primary, Secondary and Tertiary Data, Construction and adaptation of instruments, administration of questions and tests, Data organization in SPSS & Excel, Graphical representation of data, Testing of Hypothesis: Logical and Statistical Techniques.

Unit IV- Report Writing

Locating Information on a Topic of Interest, Acquiring Copies of Articles of Interest, The Nature of Scientific Variables, Conceptual Versus Operational Definitions of Variables, Levels of Measurement, Various Paradigms, The Basic Format for a Research Report, Identification of the Parts of a Research Report, Citation and Referencing Styles, Essentials of Report Writing, Aids for Writing Good Research Report.

Suggested Readings:

- 1) Bagchi, Kanak Kanti (2007) Research Methodology in Social Sciences: A Practical Guide, Delhi, Abijeet Publications.
 - 2) Kothari, C.R (2004) Research Methodology: An Introduction, Delhi, New Age.
 - 3) Cooper, R. Donald and Pamela S. Schindler (2003) Business Research Methods, Delhi, Tata McGraw-Hill.
 - 4) Flyvbjerg, Bent (2001) Making Social Science Matter: Why Social Inquiry Fails and How it can Succeed Again, United Kingdom, Cambridge University Press.
 - 5) Goodde and Hatte (1952) Methods in Social Research, New York, McGraw – Hill.
-

RPEC-102: RESEARCH AND PUBLICATION ETHICS**Credit: 02****Course Outcome: The student will be able to**

- CO-1 To develop an understanding of research ethics, publications misconduct and plagiarism.
- CO-2 To develop Intellectual honesty and research integrity.
- CO-3 To identify various sources of information for data bases and research matrices.
- CO-4 To develop an understanding of Open access publications and initiatives.
- CO-5 Appreciate the components of scholarly writing and evaluate its quality.
- CO-6 To create the research matrices based on cite score.

Unit I-Philosophy and Ethics

Introduction to philosophy: definition, nature and scope, concept, branches. Ethics: definition moral philosophy, nature of moral judgements and reactions.

Unit II-Scientific Conduct

Ethics with respect to science and research, Intellectual honesty and research integrity, Scientific misconducts: Falsification and Plagiarism (FFP), Redundant publication: duplicate and overlapping publication, salami slicing, Selective reporting and misrepresentation of data.

Unit III-Publication Ethics

Publication ethics: definition, introduction and importance, Best practices / standards setting initiatives and guidelines: COPE, WAME, etc. Conflicts of interest, Publication misconduct: definition, concept, problems that lead to unethical behavior and vice versa, types, violation of publication ethics, authorship and contributor ship, Identification of publication misconduct, complaints and appeals, Predatory publishers and journals Practice.

Unit IV-Open Access Publishing

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

Unit V-Publication Misconduct

Group Discussion, Subject specific ethical issues, FFP, authorship, Conflicts of interest, Complaints and appeals: examples and fraud from India and abroad. Software tools, Use of plagiarism software like Turnitin, Urkund and other open source software tools.

Unit VI-Databases and Research Metrics

Databases, Indexing databases, Citation databases: Web of Science, scopus, etc., Research Metrics, Impact factor of journal as per journal Citation report, SNP, SJR, IPP, Cite score, Metrics: h-index, g index, i10 index, altmetrics.

PBOC 103: PLANT SCIENCE: BASICS AND APPLIED ASPECTS
04**Credit:****Course Outcome: The student will be able to**

- CO-1 Knowledge about the thallus, classification, ecology and identification related to lower cryptogams and phanerogams.
- CO-2 Learn the classification, distribution, economic and ecological importance of Gymnosperms in India with special reference to Himalaya.
- CO-3 Understand the concept of diffusion, osmosis and water potential.
- CO-4 Understand the structure, composition and functional mechanisms of various biologically important molecules like carbohydrates, amino acids, proteins and lipids.
- CO-5 Identify and apply classical and modern tools and methods of plant breeding.
- CO-6 Learn the basic and advanced concepts, principles and applications of plant tissue culture and genetic engineering.

Unit I. Cryptogams:

Classification, habit and habitats; Diversity and ecological adaptation; Methods of collection, preservation and identification; Research Journals devoted to lower plants.

Unit II. Phanerogams:

Identification and distribution of Himalayan Gymnosperms with their aesthetic and economic importance. Diagnostic features for classification of flowering plants; Himalayan flora and biodiversity; Conservation status of important Himalayan species;

Unit III. Physiology, Biochemistry and Analytical techniques:

Functions of biological molecules, cell and organisms as biochemical entities; Metabolism and biochemical energetics. Biochemical techniques: Buffers, pH, strength of solution, acids, bases, homogenization, differential centrifugation and chromatography. Isotopic tracer techniques, Principles of microscopy, Electrophoresis.

Unit IV: Plant Breeding:

Objectives, activities and achievements. Breeding methods for self, cross pollinated and clonal crops; Breeding for resistance to various stresses and quality; Biotechnology applications in crop improvement, IPR and plant breeders rights (PBR), Green Revolution.

Unit V: Biotechnology and Genetic Engineering:

Biotechnology: Basic concepts, principles and scope. Plant cell and tissue culture: General introduction, history, scope, concept of cellular differentiation, totipotency, application of Plant tissue culture techniques, Recombinant DNA technology and its applications

Suggested Reading

1. Mehrotra, R.S. and Aneja, R.S. 1998. An Introduction to Mycology. New Age Intermediate Press.
2. Kumar, H.D. 1988. Introductory Phycology. Affiliated East-West Press Ltd., New Delhi.
3. Smith, G.M. 1955. Cryptogamic Botany. Vol. I and II. Tata Mc Graw Hill, New Delhi.
4. Bhatnagar, S.P. and Mitra, A. 1996. Gymnosperms. New Age International Pvt. Ltd., New Delhi.
5. Gaur, R.D. 1999. Flora of District Garhwal: NW Himalaya. Transmedia, Srinagar, Garhwal.

6. Stace, C.A. 1989. Plant Taxonomy and Biosystematics (2edition). Edward Arnold Ltd., London.
7. Singh, B.D. 2002. Plant Breeding Principles and Methods. Kalyani Publ. New Delhi.
8. Noggle, G.R and Fritz, G.F. 1977. Introductory Plant Physiology. Prentice Hall. New Delhi.

9. Salisbury, F.B. and Ross, C.W. 1992. Plant Physiology (4th edition). Wadsworth Publishing Co., California, USA.
10. Bhojwani, S.S. and Razdan, M.K. 1996. Plant Tissue Culture: Theory and Practice (a revised edition). Elsevier Science Publishers, New York, USA.
11. Bhojwani, S.S. 1990. Plant Tissue Culture: Applications and Limitations. Elsevier Science Publishers, New York, USA.
12. Shantharam, S. and Montgomery, J.F. 1999. Biotechnology, Biosafety & Biodiversity. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.

OPTIONAL COURSE

PBOE104: BIODIVERSITY, RESOURCE BOTANY AND ETHNOBOTANY Credit : 4

Course outcome: The students will be able to

CO-1 Understand the global and regional patterns of biodiversity.

CO-2 Learn the concepts and principles, threats and conservation of biological diversity.

CO-3 Learn the concept of species extinction, endangered species, Red and Green Data Books.

CO-4 Apply the taxonomic evidences and taxonomic tools.

CO-5 Learn the concepts of Ethnobotany and its study tools with special reference to Himalaya.

CO-6 Learn the importance of Sanctuaries, National Parks and Biosphere Reserves.

Unit I

1. Biodiversity: Concept, biodiversity of major groups including microbial biodiversity, distribution, maintenance and loss of biodiversity.
2. Concepts of species in relation to biodiversity and systematics.
3. Biodiversity in India. Species and genetic biodiversity with reference to Himalaya.

Unit II

1. Taxonomic tools in the study of biodiversity: Nomenclature, herbaria, floras, monographs, histological, cytological, phytochemical, and serological and biochemical techniques.
2. Plant collection and preservation techniques.
3. Dynamics of floristic diversity: Concept of phytogeography: Endemism, hotspots; invasions and introduction.
4. Plant exploration in India with special reference to North-West Himalaya.

Unit III

1. Concept of threatened categories (rare, endangered, vulnerable), Red Data Book.
2. Conservation of Biodiversity: Concept, Environmental policies, Biosphere Reserves, National Parks, Sanctuaries, Botanical Gardens, Pollen storage and Seed Banks, Tissue culture and role of biotechnology in conservation of biodiversity; Cryopreservation. CITES, IUCN, The criteria for assessment of rare plant conservation; Environmental awareness and people's participation in conservation of biodiversity.

Unit IV

1. Identification and evaluation of biodiversity particularly with reference to plant resources:
 - a. Cultivated: brief account of cultivated plant diversity
 - b. Wild: Detailed account of wild plant diversity with reference to food, fodder, timber, medicine, dyes, tannins, beverages, essential oils and aesthetics with particular reference to north-west Himalaya; Wild relatives of cultivated plants, weeds and aliens.

Unit V

1. Ethnobotany: concept, methods of study and analysis, linkage with other sciences, world perspectives, Indian perspectives. Traditional knowledge in natural resource

utilization and conservation with particular emphasis on germplasm conservation.

2. Basic knowledge of Intellectual Property Rights (IPR).

Suggested Readings:

1. Lawrence, H.W. 1951. Taxonomy of Vascular Plants. Reprint Oxford and IBH, New Delhi.
2. P.C. Trivedi and Niranjana Sharma. (2017). Plant Resource Utilization and Conservation. Pointer Publication, Jaipur.
3. Singh, J.S., Singh, S.P., Gupta, S. (2006). Ecology, Environment and Resource Conservation. New Delhi, India: Anamaya Publications.
4. Dhar, U. 1993 (Ed.). Himalayan Biodiversity: Conservation Strategies, Gyanodaya Prakashan, Nainital.
5. Groombridge, B. and Jenkins, M.D. 2000. Global Biodiversity. Earth's living resources in the 21st century, UK. World Conservation Monitoring Center. Pp 246.

**PBOE 105: HABITAT ECOLOGY, ENVIRONMENT AND NATURAL
RESOURCE MANAGEMENT AND REMOTE SENSING**

Credit: 4**Course outcome: The student will be able to**

CO-1- Understand the organization and development of vegetation of Himalayas.

CO-1-Understand the traditional knowledge of Non-timber forest products, medicinal and aromatic plants.

CO-3- Learn and analyse the climate change and its consequences in relation to the CO₂ fertilization, global warming, sea level rise and threats of UV radiation.

CO-4- Understand the fundamentals, and applications of remote sensing in ecological and forestry research.

CO-5- Understand the natural resources, their classification and consumption pattern emphasizing with sustainability of natural resource.

CO-6- Critically think about environment impact assessment, planning and significance.

Unit I

Habitat Ecology: Introduction to Habitat Ecology, Ecological and evolutionary perspectives and concepts; Major habitats, deserts, grasslands and forests, wetlands; Classification, functions and values; Factors affecting wetlands habitats.

Factors influencing terrestrial habitats: drought, floods, tides, soil erosion, grazing, lopping, felling, fire, encroachment, pollution, developmental projects, successional changes and wild life habitats.

Unit II

Natural Resource Management: Natural resources- introduction, classification, utilization, consumption pattern with emphasis on sustainability of natural resources. Policies and strategies for appropriate sustainable resource management and its potential to livelihood security.

Unit III

Environment Management: Concept of environment management; Environmental protection and fundamental rights; Man and environment.

Environment Impact Assessment (EIA); Planning and significance; EIA Reports and environment management plans; Case study.

Disaster Management, Classification; Concepts of land slides and earthquakes in Uttarakhand Himalaya and its mitigation.

Global warming and climatic change; Indicators and consequences, loss of biodiversity.

Impact of climatic change on natural resources and strategies for mitigation.

Unit IV

Applied Ecology: Forest types of Uttarakhand and other Himalayan provinces, Forest heritage in Garhwal Himalaya; Classification; forest products (NTFPs, medicinal and aromatic plants, fibre, etc.); Ethnobotanical heritage (traditional health care and knowledge system). Wildlife, Protected area management. Introduction to Silviculture, Floriculture and Pomology.

Unit V

Remote Sensing: Principles and Practical applications of Remote Sensing techniques.

Interpretation of photographs and imagery; Digital analysis of imagery.

Geographic Information System; Principles and basics of GIS; Applications in terrestrial and aquatic habitats.

Basics of Global Positioning System, GPS satellite and GPS utility.

Suggested Readings:

1. Barbour, M.G., Burk, J.H. and Pitts, W.D. 1987. Terrestrial Plant Ecology. Benjamin/Cummings Publication Company, California
2. Begon, M., Harpor, J.L. and Townsend, C.R. 1996. Ecology. Blackwell Science, Cambridge, USA
3. Chapman, J.L. and Reiss, M.J. 1988. Ecology: Principles and Applications. Cambridge University Press, Cambridge, U.K.
4. Heywood, H.V. 1995. Global Biodiversity Assessment.
5. Lochwood, M., Worboys, G.L. and Ashish, K. 2006. Managing Protected Areas: A Global Guide.
6. Odum, E.P. 1983. Basic Ecology. Saunders, Philadelphia
7. Smith, R.L. 1996. Ecology and Field Biology. Harper Collins, New York.
8. Singh, J.S. Singh, S.P. and Gupta, S.R. 2005. Ecology, Environment and Resource Conservation. Anamaya Publ., F-154/2 Ladosarai, New Delhi- 110 030. anamayapub@vsnl.net.in

PBOE 106: BASIC AND APPLIED PALYNOLOGY**Credit: 4****Course outcome: The students will be able to**

- CO1- Remember about the general concepts of palynology and understand the process of microsporogenesis, formation of microspore tetrads and polarity of spores and pollen grains.
- CO2- Understand structure and development of pollen wall development.
- CO3- Examine the morphological features of Spore-pollen.
- CO4- Analyze and identify the various aspects of Palyno-taxonomy
- CO5- Summarized the importance of Aeropalynology with reference to allergy.
- CO6- Generalized the concepts Palynology and Pollination Biology

Unit I

Palynology: General Introduction and history, Importance of Palynology in plant taxonomy, pollen biotechnology, aerobiology and pollen allergy, forensic palynology, melissopalynology, palaeopalynology and in hydrocarbon exploration.

Unit II

Microspores tetrads and polarity of spores and pollen grains. Pollen spore morphology: symmetry, shape, size. Exine stratification, NPC system for numerical expression, Apertural details, exine stratification, surface structure and sculpture of sporoderm, LO analysis and edge analysis, chemical nature of sporopollenin, development of pollen wall, ubisch body and exineless pollen grains.

Unit III

Melisso palynology: Definition, history and scope. Melissopalynological research in India.

Honey: definition, composition, chemical and physical characteristics, deterioration, heavy metal contamination and adulteration. Bee products.

Methods in Melissopalynology: Qualitative and quantitative analysis (According to International Commission for Bee Botany), Estimation of absolute number of plant elements in honey.

Botanical and geographical origin of honey.

Unit IV

Apiculture: Definition, history and scope. Apicultural research in India.

Different species of bees, morphology, anatomy, colony organization and life cycle, social behaviour of bees, reproduction, queen rearing.

Unit V

Bee keeping equipment, Seasonal management, Bee enemies and bee diseases. Role of bees in increasing the productivity of agro-horticultural crops in Indian Economy.

Recent trends in Apiculture. Role of bee keeping in rural development.

SUGGESTED READINGS:

1. Crane, Eva., Walker, Penelope and Day Rosemany. 1984. Directory of Important World Honey Sources: International Bee Research Association, London.
2. Erdtman, G. 1952. Pollen Morphology and Plant Taxonomy, Angiosperms; Almquist and Wiksell, Stockholm.
3. Nair, P.K.K. 1966. Essentials of Palynology; Asia Publication House, Lucknow.
4. Wodehouse, R.P. 1935. Pollen Grains: Hafner Publication Co.

PBOE 107: PLANT PATHOLOGY AND PATHOGEN INTERACTION**Credit: 4****Course outcomes:**

- CO-1 Remember the concepts of nomenclature and classification, fungal biodiversity, reproduction in fungi.
- CO-2 Understand the knowledge of plant viruses in terms of composition, structure and nature of plant viruses.
- CO-3 Develop procedure for understanding of evolution, classification and nomenclature of plant-pathogenic bacteria.
- CO-4 Explain in detail different plant management strategies.
- CO-5 Summarized the biology of major, and emerging pathogens and pests of crop plants
- CO-6 Combine theoretical and practical knowledge of plant disease and pest management

Unit I

Types of plant pathogens, mode of infection, pathogenesis strategies –fungus, bacteria, nematodes, nonhost pathogens, viruses, subviral agents viroids, satellite viruses, satellite RNAs. Initial establishment, multiplication and spread of pathogens, symptoms host ranges

Unit II

Nature, causes and classification of plant pathogen; Dissemination and methods of preservation and control of plant diseases, Host-parasite relationship, plant defense mechanism.

Unit III

Fungal disease of plant crops- rice, wheat, maize, sugarcane, cotton and groundnut; fruit crops- apple, peach, mango, citrus and grapes; vegetable crops- crucifers, tomato, potato and brinjal; other crops- tobacco, turmeric and coriander.

Unit IV

Bacterial diseases of field crops, vegetable, fruits and other economically important plants. Viral diseases of field crops, vegetable, fruits and other economically important plants. Nematode disease of plants: a knowledge of some important nematode disease of economically important crops.

Unit V

Application of biofertilizers in production of healthy and vigorous transplants in nursery. Role of mycorrhiza in growth of plants.

SUGGESTED READING:

1. Mehrotra, RS. 1980. Plant Pathology. Tat McGrawHill.
2. Singh, RS. 1998. Plant Disease. Oxford & IBH Publ.
3. Bilgrami, KS. &Dubey, H.C. 1976. Vikas Publ. House, New Delhi.

PBOF108: FIELD WORK**CREDIT: 4**

Assessment will be based on work assigned by head of the department like to attend or present research paper/s in Seminar/ conference, write up on review literature and field visits for sample collection/tour report submission etc.