SHRI GURU RAM RAI UNIVERSITY

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

Pre-Ph.D. Course Work (Zoology)

Effective from Academic Session
(2023-2024)

Course Structure and the Assessment Scheme

Pre-Ph.D. Course Work in Zoology

S.N.	Paper Code	Subject	Total Credit	Total marks (External + Internal)	Minimum marks to be scored for successful completion
1.	**PRMC 101**	Research Methodology	4	80 (60+20)	40
2.	**RPEC 102**	Research & Publications Ethics	2	40 (30+10)	20
3.	**PPZC 103**	Subject Specific (Core Paper): Tools & Techniques	4	80 (60+20)	40
4.	**PPZE 104 (a/b) (Anyone)**	Subject Specific (Elective Paper): a. Aquatic Ecology b. Biodiversity and Conservation	4	80 (60+20)	40
5.	**PPZF 105**	Fieldwork	4	80 (00+80)	40
		Total	**18**	**360**	**180**

Paper-I: Research Methodology (Compulsory)
Code: PRMC 101

Credit: 04

Course Outcome (CO):

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

Unit I-Concept & Types of Research **01**

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 **01**

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 **01**

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 **01**

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.

References:

1) Bagchi, Kanak Kanti (2007) Research Methodology in Social Sciences: A Practical Guide, Delhi, Abhijeet 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.

Paper-II: Research & Publication Ethics (Compulsory)

Code: RPEC 102

Credit: 02

Course Outcome (CO):

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

Unit I-Philosophy and Ethics **0.2**

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

Unit II-Scientific Conduct **0.3**

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 **0.5**

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 contributorship, Identification of publication misconduct, complaints and appeals, Predatory publishers and journals Practice.

Unit IV-Open Access Publishing **0.25**

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 **0.25**

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 **0.5**

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

Paper III: Tools & Techniques (Core paper)
Code: PPZC 103

Credit-04

Course Outcome (CO):

1. To familiarize students with the basic concepts and applications of modern techniques used in Biological research.
2. The students will be able to understand the principle and workings of the different microscopes.
3. The students will be able to understand the principle and workings of different microtomes. Centrifuges, Colorimeters, spectrophotometers, etc.
4. To understand the techniques of colorimetry, spectrometry, Chromatography, and Centrifugation along with their applications in analyzing different samples.
5. To develop analytical skills to evaluate the methods for quality analysis of various samples (water, soil, etc.).
6. To synthesize and apply concepts from multiple sub-disciplines in biological research.

Unit I

Killing and Fixation, Collection and Preservation of Biological Samples; Staining Techniques (used for the Animal Tissue, Microbs (*E. coli,* etc.), etc.

Unit II

Different types of microscope (Light microscope, Compound microscope, dark field microscope, Phase contrast microscope, Normaski microscope, Confocal microscopy, Transmission electron microscopy (TEM) and scanning electron microscopy (SEM)), Cells sorting flow cytometry, Inverted microscope, Stereoscopic microscope. Processing methods in Microscopy.

Application and Different Types of Microtomes; Rocking, Rotary, Freezing Microtomes, Ultra Microtomes, Cryo-techniques.

Unit III

Theory of instrumentation and application of colorimetry; Principles and applications of Spectrophotometry [UV- Visible spectrophotometry (UV-VIS)], Atomic Absorption Spectrometry (AAS), Flame Emission Spectrometry and Inductively Coupled Plasma Absorption Emission Spectrometry (ICP-AES and ICP-MS); FTIR; NMR; XRF; XRD; Kjeldhal's Assembly; Nephelometry and Turbidimetry; Chromatography: Paper Chromatography, TLC, GC and HPLC; RDS/HVAS; Impingers. Principle and application of Centrifugation (High-speed Centrifuges, and Ultra Centrifuges). pH meters.

Unit IV

Physicochemical analysis of water: Equipment, Collection of the sample, Determination of total hardness, alkalinity, pH, EC, TDS, TSS, temperature, turbidity, water Current/velocity, BOD and COD, etc. **Metal analysis in water and soil**: Equipment, Sampling and Sample Preparation, Analysis of metal ions. Collection of soil samples from fields and study of soil sampling tools.

Recommended Books:

1. Sharma, V.K.: Techniques in Microscopy and Cell Biology Tata McGraw Hill, 1991.
2. Alberts et al.: Molecular Biology of the cell (2nd ed.), Garland, 1989.
3. Biochemical Technique: Theory & Practical J.F. Robyt & B.J. White $ 30.95. Waveland Press, Inc.
4. Jayaraman: Laboratory Manual in Biochemistry.
5. Keith Wilson and John Walker (2000), Practical biochemistry- Principles and techniques. Cambridge University Press.
6. Avinash Upadhyay, Kakoli Upadhyay, Nirmalendu Nath (2006). Biophysical Chemistry- Principles and Techniques. Himalaya Publishing House.

Paper IV: Aquatic Ecology (Elective-a)
Code: PPZE 104a

Credit-04

Course Outcome (CO):

1. Knowledge about the present status as well as threats to the habitats and biological diversity in various aquatic habitats.
2. To understand the physicochemical and biological properties of streams, lakes, wetlands, etc.
3. Gain in-depth knowledge of hydrobiology, abiotic factors, aquatic organisms and drivers for their degradation.
4. Realize the need to adopt appropriate strategies for the conservation and management of all waterbodies.
5. Comprehend the origin and importance of streams, wetlands, other freshwater bodies and their relation to climate change.
6. Evaluate the course of evolution of aquatic organisms and the basic concepts of biological productivity of aquatic flora and fauna.

Unit-I

Properties of water, Hydrologic cycle, Watersheds. Management of Aquatic Ecosystems, Introduction to Aquatic Insects and Fish Fauna of Uttarakhand.

Unit II

Stream Flow & Physical Structure, Chemistry of streams & Biological communities of streams

Unit III

Lake origin and Morphometry, Light and Physical structure of lake & Biological communities of lake

Unit IV

Wetlands origin, Hydrology and Physical structure, Biological communities of wetlands

Recommended Books:

1. Sharma: Ecology and Environment (Rastogi Publication, 7th ed. 2000)
2. WT Edmondson: Freshwater Biology
3. HBN Hynes: Freshwater Ecology
4. WK Dodds: Freshwater Ecology
5. Rivers for Life: Managing water for people and nature, Sandra Postel, Brain D. Richter.

Paper IV: Biodiversity and Conservation (Elective-b)
Code: PPZE 104b

Credit-04

Course Outcome (CO):

1. To understand the global and regional patterns of biodiversity.
2. Learn the concept, principle, threats, and conservation of biological diversity.
3. Learn about the use and significance of various tools used for the study of biodiversity.
4. Learn the concept of species extinction, endangered species, and Red Data Books.
5. Realize the significance of sustainable use of resources and conservation of biodiversity effectively and scientifically
6. Learn about the legal frameworks and international programs and agreements related to biodiversity conservation and restoration ecology

UNIT-I

Biodiversity: Definition, Concept, Scope. Types of Biodiversity: Species, Genetic, Community, Ecosystem. Measurement of biodiversity. Factors governing biodiversity. Endemic species: Definition, Concept, and Scope. Biodiversity Hot spots

UNIT-II

Concept of threatened categories. Red Data Book. Threats to habitats and Biological diversity. Endangered species.

UNIT-III

Biodiversity Protection: Steps Taken by Indian Government, Important Indian Acts and Policies related to Environment and Biodiversity. Biodiversity Action Plans. Biodiversity conservation and management strategies: In-Situ and Ex-Situ Conservation of Animals. Zoogeography (Wildlife Distribution) in India.

UNIT-IV

Introduction to the Fish Fauna of Uttarakhand.

Study of Socio-Economic and cultural factors associated with biodiversity exploitation and conservation.

Recommended Books:

1. KJ Gaston & JI Spicer: Biodiversity: An Introduction
2. Negi: An Introduction to Wildlife Management, 1983.
3. Majupuria T C: Wildlife Wealth of India Tecprress Service, Bangkok, 1986.
4. Saharia: Wildlife of India Nataraj Publishers, Dehradun.
5. Krebs: Ecology (4th ed.) Harper Collins College Publisher

Paper V: Fieldwork

Code: PPZF-105

Credit-04

Assessment will be based on work assigned by the Head of the Department/Senior Research Supervisor for attending or presenting research paper/s in Seminars/conferences, write-up on review of literature and field visits for sample collection/tour report submission, etc.