Syllabus

Ph.D. Course Work in Zoology

(With effect from the session 2025-2026)

The Ph.D. Course Work syllabus in Zoology under credit system (2022-2023) has been placed in the meeting of Departmental Research Committee (DRC) in Zoology held on 3rd January 2025. The members of DRC recommended the syllabus and the same was subsequently submitted to the Secretary, PG Faculty Council, University of Kalyani on 20th January 2025, for approval from the University Authority. The Vice chancellor , University Of kalyani has approved the final syllabus on 04th February 2025 considering ratification in FC.

Chairman,
DRC, Department of Zoology
University of Kalyani,
Kalyani, W.B.
India

Preamble

The research scholars of Department of Zoology shall have to undergo a Ph.D. course work of 16 credits, to be completed in 1 semester. The course comprises four components:

a. **Research Methodology I (at the faculty level)** (4 credits),
b. **Research Methodology II (at the department level)** (4 credits)
c. **Subject Upgradation I (Department/Subject Specific Components)** (4 credits)
d. **Subject Upgradation II (Transdisciplinary Components)** (4 credits).

Keeping the importance of research in present scenario and to enhance the quality of research, the Ph. D. Course Work Syllabus in Zoology has been designed as a pre-requisite for the students to continue with the Ph.D. programme in the department. The programme aims at facilitating the research endeavours in students and to culture essential quality research among the students who joined the Ph.D. programme from the academic year 2022-23. The course further aims at familiarizing the perspectives, pedagogy and their implications in various areas of investigations.
As per the UGC guidelines, the research scholars who are admitted under the Ph. D. Programme will have to undergo a Ph.D. Coursework. The details of discipline-specific and research theme-specific courses are given below.

Ph.D. Coursework Syllabus

Department of Zoology, University of Kalyani

Effective from 2025- 2026 Session

Paper – 1: (RM/A): Research Methodology (A) **(at the faculty level)**				
Course Code (RM-A)	**Course title**	**Points 50**	**Credits: 4**	**Hours/ Week**
	Quantitative Methods			
	Qualitative Methods			
	Computer Applications			
	Research Ethics			
	Training / Field Work			
Marks Distribution:	Term End Examination:		30 Marks	
	Internal Assessment:		10 Marks	

	Viva-voce Examination:		10 Marks	
	Total =	02	50	

Paper – 2: (RM/B): Research Methodology (B) **(at the department level)**				
Course Code RM- B	**Course title**	**Points 50**	**Credits: 4**	**Hours/ Week**
	Review of Literature, Book Review Preparation of Final Report			
	Presentation of Research Papers			
Marks Distribution:	Term End Examination:		30 Marks	
	Internal Assessment:		10 Marks	
	Viva-voce Examination:		10 Marks	
	Total =	02	50	

Paper – 3: (ALC/A): Advanced level course on subject (A) **(**Department/Subject Specific Components**) (at the department level)**				
Course Code (ALC/A)	**Course title**	**Points 50**	**Credits: 4**	**Hours/ Week**
Marks Distribution:	Term End Examination:		30 Marks	
	Internal Assessment:		10 Marks	
	Viva-voce Examination:		10 Marks	
	Total =	02	50	

Paper – 4: (ALC/B): Advanced level course on subject (B) **(**Transdisciplinary Components)## **(at the department level)**				
Course Code (ALC/B)	**Course title**	**Points 50**	**Credits: 4**	**Hours/ Week**
Marks Distribution:	Term End Examination:		30 Marks	
	Internal Assessment:		10 Marks	
	Viva-voce Examination:		10 Marks	
	Total =	02	50	

##Transdisciplinary Components: Topics which are not taught in the specific subject but they are directly or indirectly associated with their daily research activities.

Question Pattern

Internal Assessment	End Term Examination
For written test only For 10 points: 2 Pt. × 05 (out of 06)	**For 30 Points:** $2^{1/2}$ptx2 (out of 3)=5 5ptx3 (out of 5)=15 10ptx1 (out of 2)=10

Programme Objectives:

The Ph.D. Course work programme in Zoology is designed to understand the basic and advanced biology concepts and techniques to define various research problems. The syllabus has been re-structured to understand the principles, operations and applications of laboratory equipment so that scholar could handle them and develop scientific temperament. It aims to gain an appreciation and knowledge of using animals for research and to deal with animal handling and the animal ethical issues. The syllabus further aims to provide expertise on various statistical tools and soft wares to analyse the data obtained.

Programme Specific Outcomes:

The Research scholars are trained during their Ph.D. course on how to develop critical thinking and independent outlook to identify a problem and design experiments. The emphasis are given to address a particular question (which has not been raised earlier) by using skills and specific knowledge they inculcate during the training which are relevant to their own research interests, including theories and methods of intervention. The Ph.D. course work in Zoology will help the research scholar to develop and equip the student with skills to conceive research ideas, to analyze problems, evaluate and validate results, and draw reasonable conclusions thereof. The students after successfully completing the programme will help them acquire knowledge, critical thinking skills, and experience in conducting cutting-edge research. Students would also gain proficiency in research methodology and assessment techniques in animal science. This course will facilitate the students on demonstrating the ability to make original and significant contributions to the scientific knowledge base in their area of research including publications, grant writing and conference presentations.

Department of Zoology
University of Kalyani
PhD Course Work Syllabus (Session 2025-26 Onwards)

Paper – 1: (RM/A): Research Methodology (A) **(at the faculty level)**				
Course Code (RM-A)	**Course title**	Points 50	**Credits: 2**	**Hours/ Week**
	Quantitative Methods			
	Qualitative Methods			
	Research Ethics			
	Computer Applications			
	Training / Field Work			
Marks Distribution:	Term End Examination:		30 Marks	
	Internal Assessment:		10 Marks	
	Viva-voce Examination:		10 Marks	
	Total =	02	50	

Group – A (Syllabus for Research Methodology)

Unit 1: Introduction to Research Methodology: Research: Definition, Importance, Characteristics, Types of Research - Research question –Survey of Literature – Formulation of hypothesis, Research process – research design and research plan - Types of research methods

Unit 2: Types of data - Sources of data - Methods of collecting data – Sampling methods

Unit 3: Qualitative Research Methods

Unit 4: Quantitative research methods

GROUP - B (Research Ethics and Research Communication)

Unit 1: Ethical Aspects of Undertaking Research

Concept of Philosophy, Research Philosophy, Approaches to Theory Development in Research, Ethical Judgements in Research

Unit 2: Managing Scientific Conduct

Concept of Academic Integrity: Integrity Concepts, Academic integrity; Scientific Misconduct and Research Fraud (Falsification, Fabrication and Plagiarism: FFP): Scientific misconduct, Research Fraud, Intellectual Honesty in Research; Redundant publications: Duplicate and Overlapping publications,

Unit 3: Publication Ethics

Concept of Publication Ethics, Research Ethics: Concept and Objectives, Ethics Committee, Managing Publication Ethics through Best Practices Standards: COPE, WAME; Publication & Research Misconduct: Concept of Research Misconduct, Concept of Plagiarism, Nature of Plagiarism, UGC Guidelines on Levels of Plagiarism, Plagiarism : AI vs AI; Plagiarism Detection

Software-Selection of Appropriate Software, Violation of Publication Ethics, Authorship and Contributorship - Conflict of Interest: Note on Violation of Publication Ethics, Authorship and Contributorship, Conflict of Interest; Identification of Publication Misconduct and Appeal; Concept of Publication Misconduct, Responding to allegations of possible misconduct; Predatory Journals and Publishers: Backdrop, Meaning of Predatory Journal, Characteristics of a Predatory Journal; Way to Find Predatory Journals and Publishers, Role of Academic Community to Fight Against Predatory Publication

Unit 4: Scientific Writing

Structure and components of Scientific Reports, Preparation of Project Proposal, Preparation of manuscript for Seminar Presentation and Publication of Research paper, Components of Doctoral Thesis, Footnotes and Referencing Styles.

Group – C (Computer Applications)

Unit1. Technology and Tools for Research: Brief description of Computer Hardware & Software; Preliminary knowledge of Computer Technology, Peripheral devices and their uses; Preliminary knowledge of Operating Systems; Basics of Word processing, spreadsheet and slides preparation (offline and cloud-based software).

Unit 2. Bioinformatics and Biostatistics: Data Science & Statistical Tools: Statistical packages (R, SPSS etc.),

Paper – 2: (RM/B): Research Methodology (B) **(at the department level)**				
Course Code (RM-B)	**Course title**	**Points 50**	**Credits: 2**	**Hours/ Week**
	Review of Literature,		15 Marks	
	Teaching Assistantship##		15 Marks	
Marks Distribution:	Term End Examination:			
	Internal Assessment:		10 Marks	
	Viva-voce Examination:		10 Marks	
	Total =	02	50	

##Teaching Assistantship: (Supervisor)

Familiarize students with the pedagogical practices of effective class room delivery and knowledge evaluation system

Activities

1. The scholars shall attend Master degree classes of his/her supervisor to observe the various transaction modes that the supervisor follows in the class room delivery or transaction process one period per week.

2. The scholars shall be assigned one period per week under the direct supervision of his/her supervisor to teach the Master degree students adopting appropriate teaching strategy(s).

Evaluation Criteria

The scholars shall be given a topic relevant to the Master degree course of the current semester as his/her specialization to prepare lessons and deliver in the class room before the master degree students for one hour (45 minutes teaching + 15 minutes interaction). The scholars shall be evaluated for a total of 15 marks comprising content knowledge (5 marks), explanation and demonstration skills (3 marks), communication skills (2 marks), teaching techniques employed (2 marks), and classroom interactions (3)

Paper 3: Subject upgradation (Department/ subject specific components) **At the departmental level** **ALC/A: Advanced level course on subject (A)**	**Credits: 4**	**Marks (FM 50)**
Course Title (Contents)		
Preparation of Research plan: Research proposal (write up), presentation and defense		
Intellectual Property Rights (IPR) in Biological Science: Basic concepts, Patents, Trademarks, Trade secrets, Copyright, Licencing of technology, Geographical Indications, Geo Tagging,		
Laboratory Safety Measures: a. ***Biosafety*:** Biohazards, Bio-safety levels (BSL), Biological spillage, Biological waste and treatment, b. ***Chemical and Radiation safety*:** Chemical and radiation hazards, Health impact, Chemical Handling, Storage and transfer, Chemical emergency and Spill response, Disposal strategies		
Biostatistics: Measures of central tendency and dispersal, Standard Error, Standard Deviation and Level of Significance, Regression, Correlation, *t*-test, Chi-square test and ANOVA		
Animal and Human Ethics: CCSEA guidelines for animal experimentation, Act and Rules for Animal Experimentation and Breeding, Filling up the proposal form for ethical clearance; ICMR guidelines for experiments involving humans		
Good laboratory practice: Recording /storage retention of research materials/ documents. User responsibilities and management of laboratory facilities.		
Term End Examination:		30 Marks
Internal Assessment:		10 Marks
Viva-voce Examination:		10

		Marks
Total =	**04**	**50**

Reference:

Pillai, TVR. and M. N. Kutty., 2005. Aquaculture: Principles and Practices, Wiley- Blackwell.

Bose, AN., Yang, C.T., and Misra, A. 1991. Coastal Aquaculture Engineering. Oxford and IBH Publishing Co., PVt. Ltd., NewDelhi.

Robert R. Stickney., 2009. Aquaculture: An Introductory Text, CAB International Publishers.

Clark, R.B., 1992. Marine Pollution. 3rd Edition. Clavendon Press, Oxford,UK 172pp.

Michael J. Kennish., 1996. Estuarine and Marine Pollution. (524 pp.) 07/002 CRC Press, NewYork.

Michael J.Kennish, 1997. Pollution Impacts on Marine Biotic Communities (310pp)7/77, CRC press, NewYork.

Trivedi, R.K.2001. Aquatic Toxicology and Toxicology (239 pp) 7/157 – ABD publishers,Jaipur

Yasunori Murakami, Kei Nakayama, shin – Kitamura., 2008. Biological Response to Chemical pollutants. Terra pub, Tokyo, 372pp.

Strachan, T and Read, A (2018) Human Molecular Genetics

Geoffrey M. Cooper (2019) The Cell: A Molecular Approach

James D. Watson, Tania A. Baker, Stephen P. Bell (2018) Molecular Biology of Gene

Harvey F Lodish (2018) Molecular Cell Biology.

Locquin and Langeron, 1983, Handbook of Microscopy. Butterwaths

Ausubel et al, 2002, Short Protocols in Molecular Biology. Wiley

S Surzycki, 2000, Basic Techniques in Molecular Biology. Springer Science, USA.

Helen Kreuzer, 2008, Molecular Biology & Biotechnology: A Guide for Student. ASM Press Washington DC, USA.

Bancroft & Stevens, 2002, Theory and Practice of Histological Techniques, Churchill-Livingstone

Wilson & Walker, 2006, Principles of Biochemical and Molecular Biological Techniques, Cambridge Univ. Press.

Norris et al, 2002, Concepts in Integrated Pest Management, Prentice-Hall

Pedigo, 2002, Entomology and Pest Management, 4th Edition, Prentice Hall

Pruthi, 1969, A Text Book of Agricultural Entomology, ICAR, New Delhi

Racheigl and Racheigl, 1998, Biological and Biotechnological Control of InsectPests, CRC Press

Paper 4: Subject upgradation II (Transdisciplinary components) **(At Departmental level)** **(ALC/B): Advanced level course on subject (B)**	**Credits (4)**	**Marks (FM 50)**
Course Title (Contents)		
Plant-insect interaction: Semio-chemical interaction between plants and insects, Qualitative and quantitative estimation of plant volatiles, Insect olfaction and olfactometric assay; Plant alkaloids as drug bank; Concepts on phytochemicals-based insect-pest management		
Fish feed Management: Probiotics and pre-biotics as feed additives and functional food; Feed storage; Fish diseases management.		
Drug designing: Binding assay of ligands with cellular bio-molecules (DNA/RNA/proteins) based on spectrophotometric and calorimetric techniques, Structure- activity relationship		
Model system: Model organisms and applications to human biology (disease)- *E.coli*, *C.elegans,* Drosophila, Fish, Mouse.		
Microscopy techniques: Immuno-histofluorescence, fluorescence microscopy Histological and Histochemical methods: Tissue preparation for Light microscopy, EM		
Bacterial and Eukaryotic Cell culture basics:		
Molecular Diagnostics: DNA amplification**-**PCR, RFLP, Molecular separation- SDS-PAGE, Agarose Gel, Molecular interactions Assays, Sequencing strategies, Microarray techniques.		
Pharmacogenomics and nanomedicine: Pharmacogenetics in disease diagnosis; Formulation and characterization of nanomaterials		
Toxicological studies : Chronic/Acute toxicity studies and techniques		
Term End Examination:		30 Marks
Internal Assessment:		10 Marks
Viva-voce Examination:		10 Marks
Total =	**04**	**50**

Reference (Trandisciplinary Components):

Pelzar, MJJ., Chan, ECS and Kerig, NR. 1993. Microbiology – Concepts and Applications.

Prescott, LM., Harley, JD and Klein, DA. 1999. Microbiology, WEB Mc Graw – Hill.

Dubey, HC., 2004. A text book of fungi, bacteria and viruses, Vikas Publishing House.

Atlas, R.M. 1995. Principles of Microbiology. Mosby - Year Book Inc.

Ananthanaryanan,T.and Paniker, J.C.K. 2000. Text Book of Microbiology Oriental Longman Ltd., Madras

Rheinhemer, G. 1980. Aquatic Microbiology, John Wiley and Sons.

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Rajni Gupta and Mukherji, 2001. Microbial Technology, APH, New Delhi.

Daniel, W.W. 1983. Biostatistics: A Foundation for analysis in the Health Sciences. John Wiley and Sons, New York.

Dunn, O.J. and V.A. Clark. 2001. Basic Statistics: A primer for Biomedical Science. John Wilety and Sons, New York.

Goon, A.M., M.K. Gupta and B. Dasgupta. 1983. Fundamentals of Statistics. Vol.I.

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David B. Resnik, 1998, The Ethics of Science: An Introduction. Routledge publisher, USA.

Callahan D. & Bok S., 1996, Ethics Teaching in Higher Education. Plenum Press, New York, USA.

Kapur J.N., 1996, Ethical Values for Ecellence in Education and Science, WishwaPrakashan, New Delhi.

Tripathi A.N., 2008, Human Values. New Age International Publishers, New Delhi.