

Syllabus

Ph.D Course Work in Zoology

(With effect from the session 2022-2023)

The Ph.D. Course Worksyllabus in Zoology under credit system (2022-2023) has been placed in the meeting of Departmental Research Committee (DRC) in Zoology held on 23rd February 2022. The members of DRC recommended the syllabus and the same was subsequently submitted to the Secretary, PG Faculty Council, University of Kalyani on 24th February 2022, for approval from the University Authority. The Faculty Council of the University of Kalyani has approved the final syllabus on2022.

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) and
- 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 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 2022- 2023 Session

Paper – 1: (RM/A): Research Methodology (A) (at the faculty level)				
Course Code (RM-A)	Course title	Points 100	Credits: 4	Hours/ Week
	Quantitative Methods			
	Qualitative Methods			
	Computer Applications			
	Research Ethics			
	Training / Field Work			

Marks Distribution:	Term End Examination:		60 Marks	
	Internal Assessment:		20 Marks	
	Viva-voce Examination:		20 Marks	
	Total =	04	100	

Paper – 2: (RM/B): Research Methodology (B) (at the department level)

Course Code RM- B	Course title	Points 100	Credits: 4	Hours/ Week
	Review of Literature, Book Review Preparation of Final Report			
	Presentation of Research Papers			
Marks Distribution:	Term End Examination:		60 Marks	
	Internal Assessment:		20 Marks	
	Viva-voce Examination:		20 Marks	
	Total =	04	100	

**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 100	Credits: 4	Hours/ Week
Marks Distribution:	Term End Examination:		60 Marks	
	Internal Assessment:		20 Marks	
	Viva-voce Examination:		20 Marks	
	Total =	04	100	

Paper – 4: (ALC/B): Advanced level course on subject (B)
 (Transdisciplinary Components)## (at the department level)

Course Code (ALC/B)	Course title	Points 100	Credits: 4	Hours/Week
Marks Distribution:	Term End Examination:		60 Marks	
	Internal Assessment:		20 Marks	
	Viva-voce Examination:		20 Marks	
	Total =	04	100	

##**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
<p>For written test only</p> <p>For 20 points: 2 Pt. × 10 (out of 12)</p>	<p>For 60 Points:</p> <p>2^{1/2}pt x 4 (out of 5)=10 5pt x 6 (out of 8)=30 10p x 2 (out of 3)=20</p>

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 2022-23 Onwards)**

Paper – 1: (RM/A): Research Methodology (A) (at the faculty level)				
Course Code (RM-A)	Course title	Points 100	Credits: 4	Hours/Week
	Quantitative Methods			
	Qualitative Methods			
	Computer Applications			
	Research Ethics			
	Training / Field Work			
Marks Distribution:	Term End Examination:		60 Marks	
	Internal Assessment:		20 Marks	
	Viva-voce Examination:		20 Marks	
	Total =	04	100	

Paper – 2: (RM/B): Research Methodology (B) (at the department level)				
Course Code (RM-B)	Course title	Points 100	Credits: 4	Hours/Week
	Review of Literature, Book Review Preparation of Final Report			
	Presentation of Research Papers			
Marks Distribution:	Term End Examination:		60 Marks	
	Internal Assessment:		20 Marks	
	Viva-voce Examination:		20 Marks	
	Total =	04	100	

Paper – 3: Subject Upgradation I (Department/Subject Specific Components) (at the department level) (ALC/A): Advanced level course on subject (A)			
Course Code(ALC/A)	Course Title (Contents)	Credits: 4	Marks (FM 100)
	1) Plant-insect interaction: Semio-chemical interaction between plants and insects,Qualitative and quantitative estimation of plant volatiles, Olfactometric bioassay		
	2) Concepts on phytochemicals-based insect-pest management		
	3) Drug designing: Binding assay of ligands with cellular bio-molecules (DNA/RNA/proteins) based on spectrophotometric and calorimetric techniques, Assessment of <i>In vitro</i> cytotoxicity on cancer cell lines using biochemical methods and <i>In vivo</i> therapeutic effect of drug/small (ligands) molecules against various toxicant		
	4) Fish feed Management: Probiotics and pre-biotics as feed additives and functional food; Feedstorage;Fish diseases management.		
	5) Heavy metals & pesticide: Toxicity and ecological impacts,Heavy Metals and Pesticides as endocrinedisruptors.		
	6) Systematic biology: a. Survey of sources and interpretation of systematic data. b. Fundamentals of phylogenetic systematics. c. Informatics toolbox for systematics. d. International biodiversity resource management.		
	7) Sample preparation for Microscopy: a. Immuno-histofluorescence, fluorescence dye staining, Immuno-fluorescenceapplication in research b. Histochemical and Immuno-histochemical techniques c. Biological sample preparation for Electron Microscopy d. Collection, fixation, staining, preservation of protozoan Parasites. Morphometric analysis under Microscope		
	8) Cell culture basics: Instrumentations;Culture Media and preparation; Culture types and methods; Cell lines, maintenance and		

	storage		
	9) Cellular system biology: AnOverview		
	10) Pharmacogenomics and nanomedicine: Introduction; Pharmacogenetics in diagnosis; tools; Role of pharmacogenomics and nanomedicine in diagnosis and treatment of diseases; Formulation and characterization of nanomaterials		
	11) Model system: Model organisms and applications to human biology (disease)- <i>E.coli</i> , <i>C.elegans</i> , <i>Drosophila</i> , Fish, Mouse.		
	12) Molecular Diagnostics: Molecular interactions assay-Protein-protein and Protein-DNA; <i>Cis</i> -regulatory elementscharacterization;Gene to Genome: Sequencing strategies and development		
Marks Distribution:	Term End Examination:		60 Marks
	Internal Assessment:		20 Marks
	Viva-voce Examination:		20 Marks
	Total =	04	100

Reference Books:

1. Pillai, TVR. and M. N. Kutty., 2005. Aquaculture: Principles and Practices, Wiley- Blackwell.
2. Bose, AN., Yang, C.T., and Misra, A. 1991. Coastal Aquaculture Engineering. Oxford and IBH Publishing Co., Pvt. Ltd., NewDelhi.
3. Robert R. Stickney., 2009. Aquaculture: An Introductory Text, CAB International Publishers.
4. Clark, R.B., 1992. Marine Pollution. 3rd Edition. Clavendon Press, Oxford,UK 172pp.
5. Michael J. Kennish., 1996. Estuarine and Marine Pollution. (524 pp.) 07/002 CRC Press, NewYork.
6. Michael J.Kennish, 1997. Pollution Impacts on Marine Biotic Communities (310pp)7/77, CRC press, NewYork.
7. Trivedi, R.K.2001. Aquatic Toxicology and Toxicology (239 pp) 7/157 – ABD publishers,Jaipur
8. Yasunori Murakami, Kei Nakayama, shin – Kitamura., 2008. Biological Response to Chemical pollutants. Terra pub, Tokyo, 372pp.
9. Strachan, T and Read, A (2018) Human Molecular Genetics
10. Geoffrey M. Cooper (2019) The Cell: A Molecular Approach
11. James D. Watson, Tania A. Baker, Stephen P. Bell (2018) Molecular Biology of Gene
12. Harvey F Lodish (2018) Molecular Cell Biology.

13. Locquin and Langeron, 1983, Handbook of Microscopy. Butterwaths
14. Ausubel et al, 2002, Short Protocols in Molecular Biology. Wiley
15. S Surzycki, 2000, Basic Techniques in Molecular Biology. Springer Science, USA.
16. Helen Kreuzer, 2008, Molecular Biology & Biotechnology: A Guide for Student. ASM Press Washington DC, USA.
17. Bancroft & Stevens, 2002, Theory and Practice of Histological Techniques, Churchill-Livingstone
18. Wilson & Walker, 2006, Principles of Biochemical and Molecular Biological Techniques, Cambridge Univ. Press.
19. Norris et al, 2002, Concepts in Integrated Pest Management, Prentice-Hall
20. Pedigo, 2002, Entomology and Pest Management, 4th Edition, Prentice Hall
21. Pruthi, 1969, A Text Book of Agricultural Entomology, ICAR, New Delhi
22. Racheigl and Racheigl, 1998, Biological and Biotechnological Control of InsectPests, CRC Press

**Paper – 4: Subject Upgradation II (Transdisciplinary Components)
(at the department level)**

(ALC/B): Advanced level course on subject (B)

Course Code(AL C/B)	Course Title (Contents)	Credits (4)	Marks (FM 100)
	1. Plant alkaloids as drug bank		
	2. Bacteriology: Cultivation of bacteria-aerobic and anaerobic cultures, synchronous and asynchronous culture, batch, fed batch and continuous culture; Measurement of growth, factors affecting growth;Antibiotic/Drugresistance.		
	3. Biostatistics: Measures of central tendency and dispersal, Standard Error, Standard Deviation and Level of Significance, Regression, Correlation and Matrix analysis. <i>t</i> -test, Chi-square test and ANOVA, Non-parametric test- Spearman's Rank Correlation and Wilcoxon Signed Rank test, Use of SPSS, Chi-plot (KY-Plot) for statistical analysis, Probit analysis		
	4. Preparation of Research plan: Research proposal (write up), presentation and defense		
	5. Intellectual Property Rights (IPR) in Biological Science: Basic concepts, Patents, Trademarks, Trade secrets, Copyright, Licencing of technology, Geographical Indications, Geo Tagging, IPs relevance to Biotechnology.		
	6. Animal and Human Ethics: CPCSEA guidelines for animal experimentation, Act and Rules for Animal Experimentation and Breeding, ICMR guidelines for experiments involving humans		
	7. Good Laboratory Practice: Recording and storage/ retention of research materials/documents, User responsibilities and management of laboratory facilities 8. Laboratory Safety Measures: a. Biosafety: Primary containment for biohazards, Bio-safety levels (BSL), Biological spillage, Biological waste and treatment, Genetically modified organisms (GMOs) Safety concerns and challenges b. Chemical and Radiationsafety: Chemical and radiation hazards, Health impact, Chemical		

	Handling, Storage and transfer, Chemical emergency and Spill response, Disposal strategies		
Marks Distribution:	Term End Examination:		60 Marks
	Internal Assessment:		20 Marks
	Viva-voce Examination:		20 Marks
	Total =	04	100

Reference Books (Trandisciplinary Components):

1. Pelzar, MJJ., Chan, ECS and Kerig, NR. 1993. Microbiology – Concepts and Applications.
2. Prescott, LM., Harley, JD and Klein, DA. 1999. Microbiology, WEB Mc Graw – Hill.
3. Dubey, HC., 2004. A text book of fungi, bacteria and viruses, Vikas Publishing House.
4. Atlas, R.M. 1995. Principles of Microbiology. Mosby - Year Book Inc.
5. Ananthanaryanan, T. and Paniker, J.C.K. 2000. Text Book of Microbiology Oriental Longman Ltd., Madras
6. Rheinheimer, G. 1980. Aquatic Microbiology, John Wiley and Sons.
7. Davis, D., Dulbecco, R., Eisen, HN and Ginsberg, HS. 1980. Microbiology, Third Ed., Harper and Row Publishers, Hagerstown.
8. Rajni Gupta and Mukherji, 2001. Microbial Technology, APH, New Delhi.
9. Daniel, W.W. 1983. Biostatistics: A Foundation for analysis in the Health Sciences. John Wiley and Sons, New York.
10. Dunn, O.J. and V.A. Clark. 2001. Basic Statistics: A primer for Biomedical Science. John Wiley and Sons, New York.
11. Goon, A.M., M.K. Gupta and B. Dasgupta. 1983. Fundamentals of Statistics. Vol.I.
12. <https://sanitarac.pro/wp-content/uploads/2017/07/Good-Microbiology-Laboratory-Practice.pdf>
13. https://cdn.intechopen.com/pdfs/22127/InTech-Glp_good_laboratory_practice.pdf
14. Good Laboratory Practice by Jürg P. Seiler (2nd Edition)
15. David B. Resnik, 1998, The Ethics of Science: An Introduction. Routledge publisher, USA.
16. Callahan D. & Bok S., 1996, Ethics Teaching in Higher Education. Plenum Press, New York, USA.
17. Kapur J.N., 1996, Ethical Values for Excellence in Education and Science, WishwaPrakashan, New Delhi.
18. Tripathi A.N., 2008, Human Values. New Age International Publishers, New Delhi.