

# **Pre Ph. D. Course Work ZOOLOGY**

## **SYLLABUS**

**(With Effect From the session 2021-22)**



**P. G. DEPARTMENT OF ZOOLOGY  
FAKIR MOHAN UNIVERSITY, VYASA VIHAR  
BALASORE-756089  
ODISHA**

## P. G. DEPARTMENT OF ZOOLOGY

### PROGRAMME SPECIFIC OUTCOMES

**PSO1:** The Doctor of Philosophy program is designed to prepare each student to actively participate in research and teaching in the field of Zoology along with other fields of Life Sciences and in a University or a Research organization.

**PSO2:** Students are exposed to advanced experimental and theoretical techniques, encouraged to attend National and International conferences as well as workshops during the program.

**PSO3:** Several research areas of Zoology are interdisciplinary in nature and are funded by various funding agencies, giving students a flavour for both applied and basic research.

**PSO4:** Students in this programme acquire knowledge, critical thinking skills, and experience in conducting cutting-edge research. Students would gain proficiency in research methodology and assessment techniques in animal science

**PSO5:** Students with a PhD degree either pursue a post-doctoral position aiming for an academic career or find employment in industrial R&D laboratories.

**Duration:** One Semester (Six months)

**Total Credit requirement:** 24 credits

**Maximum Marks:** 400

**Program Structure:** Ph.D. in Zoology

### STRUCTURE

Paper No.	Code	Paper Title	Type	Full Marks (Internal + End Term)	Credit	Hours/Week
Paper – I	ZOO-PhD-I	Research Methodology and Computer Applications	Theory	100 (40 + 60)	6	6
Paper – II	ZOO-PhD-II	Applications of Techniques in Animal Sciences	Theory	100 (40 + 60)	6	6
Paper – III	ZOO- PhD-III	Research and Publication Ethics	Theory and Practical	50 (20 + 30)	3	3
Paper – IV	ZOO- PhD-IV	Literature Review	Project	100	6	6
Paper – V	ZOO- PhD-V	Preparation of Research Proposal/ Synopsis	Project	50	3	3
<b>Total</b>				<b>400</b>	<b>24</b>	

### Organization of Papers:

1. PAPER-I: Shall be organized by the respective Head of the Department in the University
2. PAPER-II: Shall be organized by the respective Head of the Department in the University
3. PAPER-III: Shall be organized by the respective Head of the Department in the University
4. PAPER-IV: Shall be organized by the respective Head of the Department in the University
5. PAPER-IV: Shall be organized by the proposed teacher guide(s) who have offered to supervise Ph.D.work in a specialized area.

### Marking Pattern:

From 2021-22 admission sessions, PhD degrees offered by the University will follow a continuous evaluation system as per the marks distribution mentioned below.

	<b>Theory papers (Paper-I and II)</b>	<b>Research and Publication Ethics (Paper-III)</b>	<b>Literature Review (Paper-IV)</b>	<b>Preparation of Research Proposal (Paper-V)</b>
<b>Total marks per paper</b>	<b>100</b>	<b>50</b>	<b>100</b>	<b>50</b>
<b>Credit per paper</b>	<b>6</b>	<b>3</b>	<b>6</b>	<b>3</b>
Internal Exam	<b>10 Marks</b> Best of the two quizzes	<b>5 Marks</b> Best of the two quizzes	----	----
	<b>20 Marks</b> Written (Mid Sem.)	<b>5 Marks</b> Group Discussion		
	<b>10 Marks</b> Presentation and Home Assignment	<b>10 Marks</b> Presentation and Home Assignment		
End Term Exam	60 Marks (Written Exam)	30 Marks (Written Exam)	<b>20 Marks</b> (Presentation)	<b>10 Marks</b> (Presentation)
			<b>60 marks</b> (Report)	<b>30 marks</b> (Report)
			<b>20 Marks</b> (Viva-voce)	<b>10 Marks</b> (Viva-voce)
<b>Total no of papers In all semester</b>	2	1	1	1
<b>Total marks</b>	200 Marks	50 Marks	100 Marks	50 Marks
<b>Grand Total of Marks</b>	400			
<b>Total Credit</b>	24			

### Scheme of Internal Evaluation (Theory):

Each theory paper consists of five units and irrespective of the credit hours assigned, will be of 100 marks, out of which, 40% will be internal marks (continuous evaluation) and 60% will be end term examination marks. There will be three components of internal evaluation – Quiz, MidTerm Written Test and Presentation & Home Assignment as per the details below.

Component	Unit(s)	Marks	Remarks
Quiz – I	I	10	Best of the two quizzes of 10 marks each will be considered
Quiz – II	III		
Mid Term (Written)	I & II	20	Students are required to make presentations and home assignments on selected topics from the <b>self-study</b> section
Presentation & Home Assignment	All	10	
<b>Total</b>	<b>I – V</b>	<b>40</b>	

### SELF SYUDY:

25% of each unit of a theory paper is earmarked for self-study by students as per UGC directives. For completion of the portion in a particular semester, the course teacher is required to take one/ two introductory classes in the beginning, one/ two summarizing classes at the end and few doubt clearing classes in between, if required. Students are required to make presentation on selected topics from the self-study section during the class in order to assess their understanding of the subject and take remedial measures, if needed. The portion earmarked for self-study has been underlined in the syllabus.

### BOARD OF EXAMINERS:

Sl. No.	Section	Examiner(s)
01	Quiz	Internal Course Teacher/ Instructor from the University P. G. Department
02	Presentation and Home Assignment	A board of examiners consisting of faculty members of the University P.G. Department, who are members of the SRC in the subject. The proposed Supervisor, if from outside the University Campus, may be coopted as a Member examiner.
03	Written (Mid Term)	Internal Course Teacher/ Instructor from the University P. G. Department
04	Written (End Term)	Examiner as appointed by the Board of Studies
05	Literature Review	A board of examiners consisting of faculty members of the University P.G. Department, who are members of the SRC in the subject. The proposed Supervisor, if from outside the University Campus, may be coopted as a member examiner.
06	Preparation of Research Proposal	A board of examiners consisting of faculty members of the University P.G. Department, who are members of the SRC in the subject. The proposed Supervisor, if from outside the University Campus, may be coopted as a member examiner.

## **PASSING PERCENTAGE & DURATION**

**Passing Marks in Individual Paper:** 50% (End Term and Internal Marks taken together) in each Theory/ Practical/ Project paper

**Passing Marks in Aggregate:** 55%

**Division:** No Division; Only Pass or Fail

**Duration:** One semester

**Back/ Improvement:** There is no provision for back/ improvement in the Ph. D. Course Work.

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**Ph.D. Course Work  
Syllabus in Zoology**

<b>Name of the Program</b>	Ph.D. Course work in Zoology	<b>Program Code</b>	ZOOPHD
<b>Name of the Course</b>	Research Methodology and Computer Application	<b>Course Code</b>	ZOO-PhD-I
<b>Hours/Week</b>	6	<b>Credits</b>	6
<b>Max. Marks.</b>	100	<b>Time</b>	6 Hours
<b>Course Objectives:</b>			
<ol style="list-style-type: none"> <li>1. To know about the research perspective in life sciences</li> <li>2. To understand the research hypothesis formulation and testing</li> <li>3. To understand the elements of research methodology</li> <li>4. To develop skills w.r.t. Research article/papers writing skills</li> <li>5. To understand significance of scientific programs in Life Sciences</li> <li>6. Biostatistics will help to train the scholars in the skilled application of statistical methods to the solution of problems encountered in public health and medicine.</li> <li>7. Biostatistics help the students in formulating the scientific questions to be answered, determine appropriate sampling techniques, coordinate data collection procedures, and conduct statistical analyses to answer those scientific questions.</li> <li>8. Biostatisticians also play vital role in the preparation of research material for publication.</li> <li>9. Show an awareness of what the major computer components are and how they act as system.</li> <li>10. Appreciate that computers need instructions to operate and acquire simple programming skills.</li> <li>11. To foster among students an interest and confidence in using computers; to encourage an understanding of the implications of computers in the modern world.</li> </ol>			
<b>Course Outcomes:</b>			
<b>CO1:</b> Students should be able to identify the overall process of designing a research study from its inception to its report.			
<b>CO2:</b> Students should know the primary characteristics of quantitative research and qualitative research.			
<b>CO3:</b> Students should be able to identify a research problem stated in a study.			
<b>CO4:</b> Students should be familiar with ethical issues in educational research, including those issues that arise in using quantitative and qualitative research.			
<b>CO5:</b> Students would gain knowledge about the assumptions, technique and applications of ANOVA			
<b>CO6:</b> Students would be able to develop and test research ideas and apply the knowledge of research designs in planning and analyzing research.			
<b>CO7:</b> Students would gain knowledge about office applications of computer in research.			
<b>Unit - I</b>			
Meaning of Research in Biological Sciences - Purpose, Characteristics and Types of Research - Process of Research - Formulation of objectives - Formulation of Hypotheses - Types of Hypotheses - Methods of testing Hypotheses - Research plan and its components - Methods of Research (Survey, Observation, case study, experimental, historical and comparative methods) - <u>Difficulties in Biological research. Identification and formation of research problem (Hypothesis). Elements in research methodology: Research design (CRD, RBD, LSD).</u>			
<b>Unit - II</b>			
Scientific database: Science Direct and Pubmed. Ethical, legal, social and scientific issues in Biological Research. <u>A brief idea about the funding agencies such as DST, DBT, ICMR, CSIR and UGC. Role of IPR in Research and Development.</u> Writing of Research Proposal, Report and Research Paper: Meaning and types - Stages in preparation Characteristics - Structure - Documentation: Footnotes and Bibliography - Editing the final draft- Evaluating the final draft- Checklist for the of a good proposal/report/research paper. Basic knowledge of organizing conferences, symposia, workshop, exhibition etc.			
<b>Unit - III</b>			
Variables in Biology, Collection, classification and tabulation of data. Frequency distribution, Diagrammatic and Graphical presentation of statistical data, Sampling techniques. Specific applications of measures of Central tendency, Dispersion, Skewness and Kurtosis in research. <u>Measures of Relationship: Correlation – Simple, Partial and multiple- Regression- Simple and multiple- Association of Attributes – applications in research</u>			

**Unit - IV**

PROBABILITY: - Meaning, Fundamental Concepts, Approaches to measurement of Probability, Random experiments, sample space, events. Mathematical definition of probability of an event. Use of permutations and combinations in calculation of probability.

PROBABILITY DISTRIBUTIONS: - Distribution of binomial, poisson and normal variables and their fittings only Binomial, Poisson and Normal, (areas method only) Distributions (including problems).

Hypothesis Testing and estimation: Fundamentals of hypothesis testing-Standard error point and interval estimates-Important non-parametric tests: Sign, Run Kruskal-Wallis tests and Mann – Whitney test. Level of significance. Definitions and applications of Chi-square test, 't' and 'f' test. Meaning of analysis of variance with linear models. Analysis of variance for one-way classified data, analysis of variance for two-way classified data.

**Unit - V**

Computer Basics: Course introduction, MS Windows basics, UNIX basics, File management, E-mail (PINE, EUDORA, Internet mail), File Transfer (ftp, WSftp).

Office Applications: MS Office 2000/XP including MS Word, MS Excel, MS PowerPoint.

**References:**

- Research Methodology- G.R. Basotia and K.K. Sharma.
- Research Methodology- C.H. Chaudhary, RBSA Publication
- Elements of Biostatistics in Health Science- W. Daniell.
- Statistical Methods for Research: S. Singh et al (1988) Central Publishing Ludhiana.
- Fundamental of Statistics – D. N. Enhance.
- Statistical Methods: S.P. Gupta. S. Chand Publication
- Fundamentals of Biostatistics- Khan and Khanna, Ukaz Publication

**Ph.D. Course Work  
Syllabus in Zoology**

<b>Name of the Program</b>	Ph.D. Course work in Zoology	<b>Program Code</b>	ZOOPHD
<b>Name of the Course</b>	Applications of Techniques in Animal Sciences	<b>Course Code</b>	ZOO-PhD-II
<b>Hours/Week</b>	6	<b>Credits</b>	6
<b>Max. Marks.</b>	100	<b>Time</b>	6 Hours
<b>Course Objectives:</b>			
<ol style="list-style-type: none"> <li>1. This paper aims to provide an introduction to various tools and techniques used to gain insight into biological processes.</li> <li>2. Handling of biological samples and chemicals—life expectancy, precautions and their uses.</li> <li>3. Solutions preparation, storage, stability, precautions, uses and their mechanism of action.</li> <li>4. The focus is on studying the techniques used for imaging, isolation, purification and characterization of bio-molecules etc—principles and applications in various areas of sciences.</li> </ol>			
<b>Course Outcomes:</b>			
<b>CO1:</b> Students would be able to develop basic appreciation of the underlying principles and practical strategy of the analytical and preparative techniques that are fundamental to study and understanding of life processes			
<b>CO2:</b> Students would be able to develop basic concepts and practical aspects of various kinds of Microscopy, Spectroscopy and separation techniques.			
<b>CO3:</b> Students would be able to understand the concept of radioisotope techniques, molecular biology techniques and their applications in research.			
<b>Unit - I</b>			
<u>Analysing the application of techniques in animal sciences research: types of microscopy; microtomy.</u> Biophysical methods: Analysis of biomolecules using UV/visible, fluorescence, circular dichroism, NMR and ESR spectroscopy, structure determination using X-ray diffraction and NMR; analysis using light scattering, different types of mass spectrometry and surface plasma resonance methods.			
<b>Unit - II</b>			
Ultracentrifugation (Velocity and buoyant density); Gel filtration, ion exchange & affinity chromatography; thin layer chromatography; gas chromatography; High pressure liquid chromatography (HPLC), Electrophoresis (starch, agarose, PAGE); Electrofocussing. <u>Enzyme technology: Animal protein/enzyme purification; application of biosensor development in different systems</u>			
<b>Unit - III</b>			
<u>Determination of toxicity: Acute, Chronic; Nucleic acid hybridization and cot curves; sequencing of nucleic acids; Southern, Northern and South -Western blotting techniques; Polymerase Chain reaction; measuring nucleic acid and protein interaction. Flow cytometry, Karoyotyping; FISH &amp; GISH; Spirometry; Animal tissue culture.</u>			
<b>Unit - IV</b>			
<u>Computational methods: Nucleic acid and protein sequence databases; data mining methods for sequence analysis, web-based tools for sequence searches, motif analysis and presentation. Phylogenetic implications of computational data.</u> Radio labelling techniques: detection and measurement; incorporation of radioisotopes in biological tissues and cells, molecular imaging of radioactive material, safety guidelines; Immunoassays & Diagnostic applications			
<b>Unit - V</b>			
<u>Introduction and application of bioinformatics. Definition and types, Nucleotide sequence database - brief note on EMBL, NCBI and DDBJ. Protein structure database [PDB]. Sequence alignment: pair wise and multiple alignments [Definition, applications, BLAST and FASTA, Clustal W, PAM and BLOSUM matrices]. ORF. Structure prediction, and molecular visualization – use of Rasmol, PDB, ExPASy and KEGG. Online tools – SDSC Biology workbench</u>			
<b>References:</b>			
<ul style="list-style-type: none"> <li>• Molecular cloning A Laboratory Manual 3rd edition Vol. 1, 2, 3- Sambrook and Russell, Churchill press, 2007</li> <li>• Molecular Cell Biology, J. Darnell, H. Lodish and D. Baltimore Scientific American Book.</li> </ul>			



**Ph.D. Course Work  
Syllabus in Zoology**

<b>Name of the Program</b>	Ph.D. Course work in Zoology	<b>Program Code</b>	ZOOPHD
<b>Name of the Course</b>	Research and Publication ethics	<b>Course Code</b>	ZOO-PhD-III
<b>Hours/Week</b>	3	<b>Credits</b>	3
<b>Max. Marks.</b>	50	<b>Time</b>	3 Hours
<b>Course Objectives:</b>			
<ol style="list-style-type: none"> <li>1. To study the philosophy of ethics</li> <li>2. To study the scientific conduct of research</li> <li>3. To study the publication ethics</li> <li>4. To know about various journal citation databases</li> <li>5. To know the importance of quality publications</li> </ol>			
<b>Course Outcomes:</b>			
By completion of course the student is able to			
CO1: Ethics in conduct of scientific research			
CO2: Know the scientific misconducts			
CO3: How to avoid plagiarism and what are the penalties of plagiarism			
CO4: Know the quality of research publications			
CO5: Write research and review articles.			
<b>Unit - I</b>			
<b>PHILOSOPHY AND ETHICS</b>			
<ol style="list-style-type: none"> <li>1. <u>Introduction to philosophy: definition, nature and scope, concept, branches</u></li> <li>2. <u>Ethics: definition, moral philosophy, nature of moral judgments and reactions</u></li> </ol>			
<b>SCIENTIFIC CONDUCT</b>			
<ol style="list-style-type: none"> <li>1. Ethics with respect to science and research</li> <li>2. Intellectual honesty and research integrity</li> <li>3. Scientific misconducts: Falsification, Fabrication, and Plagiarism (FFP)</li> <li>4. Redundant publications: duplicate and overlapping publications, salami slicing</li> <li>5. Selective reporting and misrepresentation of data</li> </ol>			
<b>Unit - II</b>			
<b>PUBLICATION ETHICS</b>			
<ol style="list-style-type: none"> <li>1. <u>Publication ethics: definition, introduction and importance</u></li> <li>2. <u>Best practices / standards setting initiatives and guidelines: COPE, WAME, etc.</u></li> <li>3. <u>Conflicts of interest</u></li> <li>4. Publication misconduct: definition, concept, problems that lead to unethical behavior and vice versa, types</li> <li>5. Violation of publication ethics, authorship and contributorship</li> <li>6. Identification of publication misconduct, complaints and appeals</li> <li>7. Predatory publishers and journals</li> </ol>			
<b>Unit - III</b>			
<b>DATABASES AND RESEARCH METRICS</b>			
(A) Databases			
<ol style="list-style-type: none"> <li>1. <u>Indexing databases</u></li> <li>2. <u>Citation databases: Web of Science, Scopus, etc.</u></li> </ol>			
(B) Research Metrics			
<ol style="list-style-type: none"> <li>1. Impact Factor of journal as per Journal Citation Report, SNIP, SIR, IPP, Cite Score</li> <li>2. Metrics: h-index, g index, i10 index, altmetrics</li> </ol>			
<b>Unit - IV</b>			
<b>Practice</b>			
<b>OPEN ACCESS PUBLISHING</b>			
<ol style="list-style-type: none"> <li>1. Open access publications and initiatives</li> <li>2. SHERPA/RoMEO online resource to check publisher copyright &amp; self-archiving policies</li> <li>3. Software tool to identify predatory publications developed by SPPU; Journal finder/journal suggestion tools</li> </ol>			

**Unit - V**

**PUBLICATION MISCONDUCT**

(A) Group Discussions

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 (2 hrs.) :Use of plagiarism software like Turnitin, Urkund and other open source software tools

**References:**

1. Bird, A. (2006). Philosophy of Science, Routledge
2. P. Chaddah (2018) Ethics in Competitive Research: Do not get scooped; do not get plagiarised.
3. Indian National Science Academy (INSA), Ethics in Science Education, Research and Governance (2019).
4. Beall, J (2012), Predatory publishers are corrupting open access. Nature, 489(7415), 179.
5. National Academy of Sciences, National Academy of Engineering and Institute of Medicine (2009). On being a Scientist: A guide to Responsible Conduct in Research, Third Edition, and national Academic press.

**Ph.D. Course Work syllabus in Zoology**

<b>Name of the Program</b>	Ph.D. Course work in Zoology	<b>Program Code</b>	ZOOPHD
<b>Name of the Course</b>	Literature review	<b>Course Code</b>	ZOO-PhD-IV
<b>Hours/Week</b>	6	<b>Credits</b>	6
<b>Max. Marks.</b>	100	<b>Time</b>	6 Hours

At the beginning of the semester (i.e. within 4 weeks) the students will select a topic of their interest pertaining to the theme of specialization in consultation with a teacher (can be the proposed Research Supervisor) and will carry out an extensive literature review on it. They have to prepare a report following a standard format of report writing and will have to submit it in the Department. The students have to give a presentation of this paper, the date of which will be decided by the teachers' council and notified by the Head of the Dept., and it will be evaluated by the Teachers' council of the Dept. who are members of the SRC in the subject.

It is important to note that the purpose of this paper is to make the budding researchers learn how to review recent and relevant scientific literature in a research field. The review report prepared by a student for this paper should not necessarily and supposed to be the part of the final PhD thesis.

**Ph.D. Course Work syllabus in Zoology**

<b>Name of the Program</b>	Ph.D. Course work in Zoology	<b>Program Code</b>	ZOOPHD
<b>Name of the Course</b>	Preparation of research proposal/Synopsis	<b>Course Code</b>	ZOO-PhD-V
<b>Hours/Week</b>	3	<b>Credits</b>	3
<b>Max. Marks.</b>	50	<b>Time</b>	-----

Based on the literature review work conducted in "ZOO-PhD-IV Literature Review" paper, the students have to develop a Research Proposal. The students will submit the proposal to the Department in form of a brief report narrating objective of the work, methodologies to be followed, expected outcome and relevance of the work. The students have to give a presentation of this paper, the date of which will be decided by the teachers' council and notified by the Head of the Dept., and it will be evaluated by the Teachers' council of the Dept. who are members of the SRC in the subject.

It is important to note that the purpose of this paper is to make the budding researchers learn how to find out the data gap by means of literature survey and thereby formulate the scope of further research in a research field. The research proposal submitted by a student for this paper should not necessarily and supposed to be the final topic of PhD thesis. The research proposal for PhD (PhD synopsis) can only be submitted once the student successfully completes the PhD course work.