

UNIVERSITY OF MUMBAI



**Program: Ph. D. Entrance Test
(PET)**

Course: Zoology

Syllabus for Ph. D. Entrance Test

UNIVERSITY OF MUMBAI

Syllabus of Ph.D. (Zoology) Entrance Test (PET)

To be implemented from the Academic Year 2021-2022.

Part A: Research Methodology

UNIT I: Scientific Communication

1. Concept of Scientific Research: Concept of good research. Nature and types of research; research methods, experimental design, research process (formulation of problem, literature survey, Developing working problem, designing methodology of data collection, Analysis of Data and its presentation).
2. Survey of Literature and Problem Definition, Literature Search, Procedure, Sources of Literature, Planning of Review work, Note Taking, Libraries and Documentation and management of bibliography with software (e.g. MS Word/EndNote/Zotero/Mendeley, etc.).
3. Types of research:
 - a. Pure and applied
 - b. Structured and unstructured
 - c. Descriptive, correlational, explanatory, exploratory, historical, comparative and experimental
4. Publications and Research Journals - Types of research journals, Impact factors of Journals, Predatory Journals Review process - benefits and drawbacks of single blind, double blind and open peer review process, Understanding "h - index" and "i10 - index", SCOPUS, Google Scholar, Web of Science, Process to obtain ISSN and ISBN
5. Project Proposal and research funding agencies – Research grants, scholarships and funding (CSIR, DBT, DST, DST- INSPIRE Fellowship), Lady Tata Memorial Trust.

UNIT II: Ethics in Zoological Research

1. Originality, Integrity, Intellectual Property Rights – Patents, Plagiarism in research.
2. Ethical issues and bio-safety regulation: DBT Guidelines for Bio-safety, Institutional Bio-safety committee and its functioning. Documents for registration, renewal and reconstitution of IAEC as per CPCSEA guidelines

3. Proposal layout for permission from IAEC for use of animals in research, Proposal layout based on recombinant DNA safety guidelines from IBSC, Proposal layout for use of transgenic animals in research.
Ethics in use of Experimental animals: Institutional Animal ethics committee, and Institutional ethical committee, CPCSEA guidelines for animal experimentation.
4. Biodiversity laws: Guidelines and regulations of Bio-resources utilization for commercial and research purpose. The Biological Diversity Act, Wildlife (Protection) Act, Forest (Conservation) Conservation Act.

UNIT III: Biostatistics

1. Sampling strategy and sampling size determination, eliminating extraneous variables
2. Processing of data: Classification and tabulation.
3. Data Analysis: Descriptive- Measurement of Central Tendencies, Measures of Variations, Correlation, Regression, multiple discriminant analysis (MDA), Analysis of Variance (ANOVA), Analysis of Co-Variance (ANCOVA). Level of significance and p-value, Normal distribution.
4. Concept of probability, Inferential- Hypothesis testing, T- tests, Chi-square test, post-hoc tests.
5. Introduction to computer programs used for biostatistics: MS-Excel, SPSS, STATISTICA, PAST, r- statistics, PRIMER, etc.
6. Biodiversity Indices

UNIT IV: Bioinformatics

1. Introduction to internet, Use of internet in Research activities, working knowledge of e-resources for research SciNet, JSTOR, Shodhganga, EBSCOhost, INLIBNET, NLIST-e-journals and e-books.
2. Databases: NCBI, Swiss-prot, PIR, PDB, KEGG, PubMed, The Catalogue of Life, Biodiversity databases.
3. Biological data archiving and retrieval: BLAST, Accession, and GI-Number, BIN.

References:

1. Barnes & Gray, (2003). Bioinformatics for Geneticists. John Wiley & Sons Ltd.U.K.
- 2. Brendan Hennessy. (2006), Writing Feature Articles, Fourth edition, Focal Elsevier.**
3. Campbel, (2006), Discovering Genomics, Proteomics and Bioinformatics. LPE
4. DharmapalanBiju (2012). Scientific Research Methodology. Narosa Publishing House, New Delhi.

5. Hunt & Livesey, (2006), Functional Genomics. Oxford 4
6. Jennifer Peat. (2002). Scientific Writing Easy when you know how. BMJ Books.
7. Kothari C.R. (2009). Research Methodology: Methods and Techniques (2ndedn.). New Age International Publishers, New Delhi.
8. Lesk, (2006), Bioinformatics 2/e. Oxford
9. Margaret Cargill and Patrick O'Connor (2009). Writing Scientific Research Articles: Strategy and Steps. Willey-Blackwell, A John Wiley & Sons, Ltd., UK.
10. Mount, (2006), Bioinformatics 2/e. CBS
11. Paul Oliver (2005). Writing Your Thesis. Vistar Publications, New Delhi.
12. Rastogi, (2008), Fundamentals of Biostatistics, ANE Books
13. Sharma, (2008), Text Book of Biostatistics-I&II, Discovery Publishing
14. Snedecor & Cochran, (1968), Statistical Methods, Oxford & IBH
15. Westhead et al, (2003), Bioinformatics Instant Notes. Viva Books (Indian ed.)

Part B: II: Zoological Science

UNIT I: Non-chordates

- 1.1. General characters and classification, Locomotion in Protozoa - amoeboid, flagellar, ciliary, gliding, Morphology, life cycle, pathogenicity and control measures: Plasmodium, Entamoeba
- 1.2. General characters and classification, Life history of *Ascaris lumbricoides* and its parasitic adaptations
- 1.3. General characters and classification, Diversity in habit and habitat, Adaptive radiation in Class Polychaeta
- 1.4. General characters and classification, Larval forms of Crustacea; social life, moulting and metamorphosis in Insecta; Vision in Arthropoda, Affinities of Onychophora
- 1.5. General characters and classification, Water vascular system in Echinodermata
- 1.6. Hemichordates: General characters and classification, e.g. Balanoglossus

UNIT II: Chordates

Protochordates-

1. Origin and ancestry of Protochordates, similarities and differences with invertebrates and chordates,
2. Urochordates- Life history of Herdmania and its phylogenetic affinities
3. Comparative Anatomy and of respiration- Gills, skin and lungs
4. General organization of Nervous system in Chordates
5. Circulation: Heart and Aortic arches
6. Mammalia- Origin of Mammals, Phylogeny of terrestrial and aquatic mammals.

Unit-III: Developmental Biology

1. General organization of reproductive systems in Chordates
2. Patterns of Cleavage, Blastulation and Gastrulation
3. Placentation in Mammals
4. Cryopreservation of gametes and embryos
5. Induced breeding in fish – technique and applications

UNIT IV: Laboratory Techniques in Biology

1. Microscopy: Light microscopy, Electron microscopy (SEM and TEM), Fluorescence Microscopy, Confocal Microscopy, Camera lucida, Image processing and Microscopic measurements.
2. Principle and Applications
 - a) pH meter
 - b) Colorimeter
 - c) Spectrophotometer
 - d) Electrophoresis
3. Microtomy
4. Chromatography: Principle and applications, Adsorption, Ion exchange, Gel permeation, Affinity
5. Techniques for qualitative and quantitative detection of carbohydrates, lipids, Proteins and hormones, tracer techniques.
6. Classification of enzymes, nomenclature, concept of activation energy, Enzyme kinetics,

References

1. Modern text book of Zoology – Invertebrates; Eleventh; Edition R.L. Kotpal; Rastogi publication
2. Invertebrate Zoology; E.L. Jordan and P.S. Verma
3. A manual of Zoology - Part I, Invertebrata; Ayyar, M. Ekambaranath
4. Invertebrate Zoology - Vol 1; Parker and Haswell
5. Modern text book of Zoology – Vertebrates; Professor R.L. Kotpal; Rastogi publication; Third Edition
6. Vertebrate Zoology; E.L. Jordan and P.S. Verma
7. A manual of Zoology, Vol. II Vertebrata; Ayyar, M. Ekambaranath
8. Vertebrate Zoology – Volumes of different Phyla; Hyman L.H.●
9. Gabe M. – Histochemical techniques. Pub. Springer Verlag, New York.
10. Rastogi S.C. Essentials of Animal Physiology New Age International,
11. Scott F. Gilbert & Michael J. F. Barresi -Developmental Biology 11th Edition (PDF)
12. Stoward P.J.– Fixation in Histochemistry. Pub. Chapman and Hill, London.
13. Thompson S.W.– Selected Histochemical and Histopathological Methods.Pub. C.C.T.I., USA.
14. Embryology –Mohan P.Arora