M.Sc II Year (Semester III) Zoology Core Paper 1

Biosystematics, Biodiversity and Evolutionary Biology

Programme/Class: Degree	Year: 2	Semester: 3
Subject: Zoology		
Course Code: **M050301T**	Course Title: **Biosystematics, Biodiversity and Evolutionary Biology**	

Course outcomes:

At the end of this course the students will be able to:

- To provide the basic concepts, importance, status and interaction between organisms and environment

Credits: 4	Core Compulsory
Max. Marks: 25+75	Min. Passing Marks: 33 %
Total No. of Lectures= 60	

Unit	Topics	Total No. of Lectures (60)
I	• Taxonomy and classification • Concepts, terminology and types of taxonomy and classification • Principles of classification • Concept and preambles of ICZN • Proteins and nucleic acids in modern taxonomy	15
II	• Biodiversity: concept, types and measurement • Indian Biodiversity: geographical distribution • Biodiversity hotspots in India • Significance of biodiversity	15
III	• Threats to wildlife • Wildlife protection Act, Biodiversity Act • Wildlife conservation strategies (ex situ and in situ) • Role of government and NGOs in wildlife conservation • Community participation and movements for wildlife conservation	15
IV	• Evolutionary theories • Mechanisms of speciation • Evolutionary forces • Adaptive radiation • Co-evolution	15

	• Convergent and divergent evolution • Molecular evolution • Phylogenetic gradualism and punctutated equilibrium	

Suggested Readings:

1. Principles of Systematic Zoology by Ernst Mayr, McGraw Hill, New York
2. Principles of Animal Taxonomy by G.G.Simpson, Columbia University Press, Scientific Publisher.
3. Evolution: An Introduction by S.C.Stearns and R.F.Hoekstra, Oxford University Press, New York
4. Evolution by N. H. Barton, D.E.G. Briggs, J.A. Eisen, D. B. Goldstein and N.H. Patel, Cold Spring Harbor Laboratory Press, New York.
5. Ridley,M (2004) Evolution III Edition Blackwell publishing Hall, B.K. and Hallgrimson, B (2008). Evolution IV Edition. Jones and Barlett
6. What is biodiversity by James Maclaurin and Kim Sterelny, U.Chicago.Edu.
7. Schuh, R.T., and A.V.Z. Brower. 2009. Biological Systematics: Principles and Applications, 2nd Ed. Cornell University Press. 311+xi pp.
8. Wiley, E. O. and B. S. Lieberman. 2011. Phylogenetics: Theory and Practice of Phylogenetic Systematics, 2nd Ed. Wiley-Blackwell. 406+xvi pp.
9. Williams, D. M. and M. C. Ebach. 2010. Foundations of Systematics and Biodiversity. Springer. 309+xvii pp.
10. Biodiversity and Ecosystem Functioning by E.D. Shulze and H. A. Moonthy, Spriger Publication.
11. Methods and Practice in biodiversity Conservation by David Hawks worth, Springer publication
12. A Text Book of Biodiversity by K.V. Krishnamurthy, CBS Publication
Caughley, G., and Sinclair, A.R.E. (1994). Wildlife Ecology and Management. Blackwell Science.
18. Pushpesh. J. Wildlife & Forest Conservation A Status Report. Swastik
19. Anderson Stanley.Managing Our Wildlife Resources. Prentice Hall, 3rd Edition
20. Martin Winter. Wildlife Biology. Syrawood Publishing House
21. Kasen Hurst. Wildlife Conservation & Management. Larsen & Keller
22. Martin Winter. Wildlife Conservation &Management .Syrawood Publishing House
23. Martin Winter. Wildlife Protection & Management. Callisto Reference
24. Kendall W.L . Wildlife Study Design . SJ
25. Andrew Wright. Forest Ecology. Black Prints
26. Rajesh Gopal. Fundamental of Wildlife Management. Natraj Publishers

Suggested Continuous Evaluation Methods:

- Seminar/ Presentation on any topic of the above syllabus
- Test with multiple choice questions/ short and long answer questionsAttendance

Further Suggestions:

It widens the scope for students to join Government and Non-Government organization up skillingthe people at different levels as per their socio-economic structure.

At the End of the whole syllabus any remarks/ suggestions:

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M.Sc. II Year (Semester III) Zoology Core Paper 2

Developmental Biology and Immunology

Programme/Class: Degree	Year: 2	Semester: 3
Subject: Zoology		
Course Code: **BM050302T**	Course Title: **Developmental Biology and Immunology**	

- **Course outcomes:**
  - how the single cell formed at fertilisation forms an embryo and then a fully formed adult organism.
  - integration of genetics, molecular biology, biochemistry, cell biology, anatomy and
  - physiology during embryonic development, and the treatment of birth defects and infertility in humans.
  - To develop basic understanding about Immunity, its organization and their mechanisms.
  - To understand in detail the basic immune mechanism related to different Immunological diseases & disorders.
  - To create and develop the ideology about different vaccines, immune treatment mechanisms, cancer immunotherapy and latest experimental immune system.

Credits: 4	Core Compulsory
Max. Marks: 25+75	Min. Passing Marks: 33 %
Total No. of Lectures= 60	

Unit	Topics	Total No. of Lectures (60)
I	**Gamete fertilization and early development** • **S**tructure and recognition of the gametes • Sperm capacitation and acrosomal reaction • Gamete binding and fusion, and the prevention of polyspermy • Cleavage patterns • Gastrulation • Neurulation	15
II	**Comparative account of underlying mechanisms in vertebrate development** • Morphogenesis and cell adhesion • Evidence for genomic equivalence • Differential gene expression • Cell-cell communication in development • Primary organizers, induction and competence • Early development of fish, birds, and mammals	15
III	**Later developmental processes** • The dynamics of organ development • Development of eye	15

	• Development of kidney • Development of limb • Metamorphosis: the hormonal reactivation of development • Amphibian metamorphosis • Metamorphosis in insects • Regeneration • Epimorphic regeneration of salamander Limbs • Compensatory regeneration in the mammalian Liver • Morphallactic regeneration in hydras • Aging: the biology of senescence	
IV	**Immune system & responses** • Types of Immunity (Innate, Adaptive, humoral, cell-mediated) 02 • Cells of Immune system (B & T lymphocytes, Phagocytes, Granulocytic cells, Mast • cells, NK Cells, Dendritic cells) 02 • Organs of Immune system- (Primary and secondary lymphoid organs-Thymus, • marrow, Bone lymph nodes, spleen, MAST) 02 • Generation of B &T cell responses 06 • Immunoglobulins (structure, Types/Classes & functions) • Epitopes • Maturation, differentiation and activation of BCR and TCR • Monoclonal and polyclonal antibodies • Antibody diversity • Organization & Expression of Immunoglobulin genes	• 15

Suggested Readings:

1. Developmental Biology: T. Subramaniam, (Reprint) 2013, Narosa Publishing House Pvt. Ltd., New Delhi
2. Essential Developmental Biology: Jonathan M. W. Slack, (3rd ed.) 2012, Wiley-Blackwell.
3. Developmental Biology: From a Cell to an Organism (Genetics & Evolution) eBook:Russ Hodge, 2009, Infobase Publishing.
4. Current Topics in Developmental Biology: Roger A. Pedersen, Gerald P. Schatten, 1998 Elsevier.
5. Developmental biology: Werner A. Müller, 2012, Springer Science & Business Media.
6. Human Embryology and Developmental Biology E-Book:Bruce M. Carlson, 2018, Elsevier Health Sciences.
7. Developmental Biology:Michael J. F. Barresi, Scott F. Gilbert, 2019, Oxford University Press.
8. Thomas J. Kindt, Richard A. Goldsby, Barbara A. Osborne, Janis Kuby (2007) Kuby Immunology. W H Freeman
9. Delves Peter J., Martin Seamus J., Burton Dennis R., Roitt Ivan M. (2017). Roitt's Essential Immunology, 13th Edition. Wiley Blackwell
10. Immunology by Ian. R. Tizard Saunders college Publishing Chicago, New York.
11. Nandini Shetty (2005) Immunology Introductory Textbook. New Age International.

Suggested Continuous Evaluation Methods:

- Seminar/ Presentation on any topic of the above syllabus
- Test with multiple choice questions/ short and long answer questionsAttendance

Further Suggestions:

It widens the scope for students to join Government and Non-Government organization up skillingthe people at different levels as per their socio-economic structure.

At the End of the whole syllabus any remarks/ suggestions:

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M.Sc 2 Year (Semester III) Zoology Core Paper 3

Ecology, Environmental Biology and Toxicology

Programme/Class: Degree	Year: 2	Semester: 3
Subject: Zoology		
Course Code: **M050303T**	Course Title: **Ecology, Environmental Biology and Toxicology**	

Course outcomes:

At the end of this course the students will be able to:

- To develop in the student an understanding of environmental structure and function
- To develop in the student an understanding of global environmental issues
- To develop in the student an understanding of significance and conservation of wild life
- To develop in the student an understanding of xenobiotics, their mode of action and damage caused

Credits: 4	Core Compulsory
Max. Marks: 25+75	Min. Passing Marks: 33 %

Total No. of Lectures= 60

Unit	Topics	Total No. of Lectures (60)
I	**Ecosystem and Population ecology** • Concept, production and decomposition • Biosphere and biomes • Biogeochemical cycles • Population ecology	15
II	**Community ecology** • Community ecology and ecological succession • Concept of habitat ecology and ecological niche • Island biogeography	15
III	**Global environmental problems** • Environmental pollution • Waste management • Environmental monitoring • Acid rain • Greenhouse effect and global warming • Depletion of ozone layer • Climate change	15
IV	**Exposure of toxicants** • Different routes/methods of exposure, frequency & duration of exposure	15

	• Dose-response relationship • Selective toxicity: • concept, significance • Basic mechanisms of selective toxicity **Toxicity Tests:** Bioassay, Acute toxicity tests for terrestrial and aquatic animals, Chronic toxicity tests Concept of maximum acceptable toxicant concentration (MATC) and safe concentration **Factors affecting toxicity** Factors related to the chemical exposure Surrounding medium and the organisms	

Suggested Readings:

1. Ecology: Theories & Applications. Peter D. Stiling, 2001, Prentice Hall.
2. Ecological Modeling. 2008. Grant, W.E. and Swannack, T.M., Blackwell.
3. Ecology: The Experimental Analysis of Distribution and Abundance. Charles J. Krebs, 2016, Pearson Education Inc.
4. Elements of Ecology. T.M. Smith and R.L. Smith, 2014, Pearson Education Inc.
5. Environmental Chemistry. 2010. Stanley and Manahan, E. CRC, Taylor & Francis. London.
6. Environment. Raven, Berg, Johnson, 1993, Saunders College Publishing.
7. Essentials of Ecology. G.T. Miller, Jr. & Scott. E. Spoolman, 2014, Brooks/Cole, Cengage Learning.
8. Freshwater Ecology: A Scientific Introduction. 2004. Closs, G., Downes, B. and Boulton, A. Wiley-Blackwell publisher, Oxford.
9. Fundamental Processes in Ecology: An Earth system Approach. 2007. Wilkinson, D.M. Oxford University Press, UK.
10. Fundamentals of Ecology. E.P. Odum&Gray. W. Barrett, 1971, Saunders.
11. Principles of Terrestrial Ecosystem Ecology. 2011. Chaplin, F.S., Matson, P.A. &Vitousek, P.M. Springer.
12. Omkar and Pervez, A.(2017). Concepts of Toxicology. A Textbook for U.G. and P.G. students. Publ. by Vishal Publishing Co. Jalandhar.
13. Derelanko&Auletta. Handbook of Toxicology, 3rd Ed. CRC Press
14. Casarett&Doull's Toxicology: The Science of Poisons" 8th Ed. Edited by Curtis A. Klaassen& John B. Watkins III
15. Principles of Biochemical Toxicology" by J.A.Timbrell, 4th Ed. Informa Press
16. Mechanistic Toxicology", U.A.Boelsterli, 2nd Ed. CRC Press.

Suggested Continuous Evaluation Methods:

- Seminar/ Presentation on any topic of the above syllabus
- Test with multiple choice questions/ short and long answer questionsAttendance

Further Suggestions:

It widens the scope for students to join Government and Non-Government organization up skillingthe people at different levels as per their socio-economic structure.

At the End of the whole syllabus any remarks/ suggestions:

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M.Sc 2 Year (Semester III) Zoology Core Paper 4

Practical on Evolution, Non- Chordates, and Cell Biology

Programme/Class: Degree	Year: 2	Semester: 3
Subject: Zoology		
Course Code: **M0504304P**	Course Title: **Practical on Evolution, Non- Chordates, and Cell Biology**	

Course Outcomes

At the end of this course, the students will be able to:

CO1: Demonstrate practical understanding of evolutionary concepts through the study of fossils, phylogenetic trees, connecting links, and adaptive features.

CO2: Identify, classify, and describe major non-chordate phyla using museum specimens, permanent slides, and diagnostic morphological characters.

CO3: Apply appropriate taxonomic tools and keys for identification and comparison of non-chordate organisms.

CO4: Perform cell biology techniques, including microscopy, identification of cell organelles, and study of mitosis and meiosis using prepared and temporary slides.

CO5: Conduct basic cytological and biochemical experiments, demonstrating an understanding of cellular structure, function, and organization.

CO6: Record observations accurately, prepare labeled diagrams, and analyze experimental data using scientific methodology.

CO7: Correlate practical observations with theoretical principles of evolution, organismal diversity, and cellular processes.

CO8: Follow laboratory safety measures, ethical guidelines, and scientific integrity while performing zoological practicals.

Credits: 4	Core Compulsory
Max. Marks: 25+75	Min. Passing Marks: 33 %
Total No. of Lab/ Practicals= 60	

Unit	**Topics**	**Total No. of Labs**

		(60)
I	• Analogy & Homology • Adaptive Radiations • Fossils, their models & Videos • Convergence & Divergence • Dichotomous Key through an example • Techniques of Animal preservation • 3-D Models of human evolution.	15
II	• General anatomy (Dissections / Models / Charts / Computer simulation) (a) Earthworm (b) Prawn / Squilla / Crab (c) Sepia / Loligo/ Octopus (d) Cockroach • Mounting (Permanent) Material Provided or material from dissected animals. **Note: Only animals that are permitted by wildlife protection act, 1972**	15
III	Biochemical qualitative tests for Proteins/ Lipids / Carbohydrates • Colorimetric quantitative estimation of Proteins & Carbohydrates • Study of Salivary amylase, enzyme action and effect of PH and Temperature on it. • Paper & Thin Layer Chromatography • 3-D Models of amino acids and structure of proteins.	15
IV	Study Of Cell & Cell organelles, Giant Chromosomes, DNA & its replication through Photographic Plates/ Models/ Computer simulation • Permanent slides of Mitosis & Meiosis • 3-D Models of DNA and RNA • Preparation of (a) slide of Onion root tip by Squash Technique to study stages of Mitosis, fixation and Staining techniques of the treated Tissue Material	15

Suggested Readings:

- https://www.biologysimulations.com/evolution
- https://amrita.olabs.edu.in/?sub=79&brch=16&sim=132&cnt=4
- https://education.nationalgeographic.org/resource/fossil
- https://www.britannica.com/science/evolution-scientific- theory/Convergent-and-parallel-evolution

- https://people.umass.edu/~mcclemen/581Proteins.html
- https://amrita.olabs.edu.in/?brch=18&cnt=1&sim=236&sub=79 https://lab-training.com/thin-layer-chromatography-tlc/
- https://edu.rsc.org/practical/thin-layer-chromatography- practical-videos-16-18-students/4012270.article
- https://edu.rsc.org/practical/paper-chromatography-practical- videos-14-16-students/4011446.article

Suggested Continuous Evaluation Methods:

- Seminar/ Presentation on any topic of the above syllabus
- Test with multiple choice questions/ short and long answer questionsAttendance

Further Suggestions:

It widens the scope for students to join Government and Non-Government organization up skillingthe people at different levels as per their socio-economic structure.

M.Sc. 2 Year (Semester 3) Zoology
Paper 5 Research project/internship/field or survey work M050305R

Programme/Class: Masters Degree	**Year:** 2	**Semester : 3**
Subject: Biotechnology(**Research project/internship/field or survey work**)		**Credit: 4**
CourseCode: **M050305R**	Course Title: **Research project/internship/field or survey work**	
Topic wll be decided		

M.Sc 2 Year (Semester IV) Zoology Core Paper 1

Applied Fish and Fisheries

Programme/Class: Degree	Year: 2	Semester: 4
Subject: Zoology		
Course Code: **M050401T**	Course Title: **Applied Fish and Fisheries**	

Course outcomes:
At the end of this course the students will be able to:

- Global environmental issues, their causes, consequences and amelioration.
- To understand the importance of Fishes and their conservation.

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Credits: 4	Core Compulsory
Max. Marks: 25+75	Min. Passing Marks: 33 %

Total No. of Lectures= 60

Unit	Topics	Total No. of Lectures (60)
I	**Fish biology** Study of morphometric and meristic characteristics Study of length-weight and length-length relationship Determination of age and growth using scale, otolith and operculum Estimation of absolute and relative fecundity Artificial breeding of Indian major carp	15
II	**Fish ecology** Physicochemical analysis of pond water Estimation of DO Estimation of hardness Estimation of alkalinity Estimation of pH Estimation of temperature	15
III	**Fish biodiversity assessment** Biodiversity: concepts, patterns and measurement Relative abundance Measurement and estimation of species richness and evenness Species diversity indices Phenotypic Plasticity and Genetic Differentiation in Traits	15
IV	**Fish taxonomy and biosystematics** Fish collection and preservation Identification of ichthyo-fauna through keys Fish fin formula **Chromosome manipulation and genotoxicity assessment**	15

	DNA isolation of fish DNA polymorphism through RAPD Micronuclei test (MNT)	

Suggested Readings:

1. William RD and Matthew G. 1984. Multivariate Analysis, Methods and Applications. John Wiley & Sons.
2. Biradar RS. 2002. Course Manual on Fisheries Statistics. 2nd Ed. CIFE, Mumbai.
3. Welch PS. 2003. Limnological Methods. Narendra Publ. House.
4. Nelson JS. 2006. Fishes of the World, John Wiley and Sons, Inc., New Jersey.

Suggested Continuous Evaluation Methods:

- Seminar/ Presentation on any topic of the above syllabus
- Test with multiple choice questions/ short and long answer questionsAttendance

Further Suggestions:

It widens the scope for students to join Government and Non-Government organization up skillingthe people at different levels as per their socio-economic structure.

At the End of the whole syllabus any remarks/ suggestions:

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M.Sc II Year (Semester IV) Zoology Core Paper 2

General Parasitology

Programme/Class: Degree	Year: 2	Semester: 4
Subject: Zoology		
Course Code: **M050402T**	Course Title: **General Parasitology**	

Course outcomes:
At the end of this course the students will be able to:

adequate knowledge on parasites and parasitism with an emphasis on the physiology, biochemistry, ecology and evolution of parasites, and

- an understanding of the molecular taxonomy of parasites, and the interface of parasitism/immunity in the context of the host-parasite interactions.

Credits: 4	Core Compulsory
Max. Marks: 25+75	Min. Passing Marks: 33 %

Total No. of Lectures= 60

Unit	Topics	Total No. of Lectures (60)
I	**Introduction to Parasitology** • General introduction; basic definitions and concepts; career in parasitology • Animal associations (phoresy, symbiosis, mutualism, symbiosis, parasitism) • Types of hosts and parasites; Host specificity; Parasitic adaptation • Parasitology and human welfare	15
II	**Physiology and biochemistry** • Ultrastructure of the tegument • Physiology of digestion, excretion and respiration • Metabolism of protein, lipid and carbohydrate • Physiology of reproduction and egg–shell formation	15
III	**Ecology, evolution and immunology of parasites** Mechanism of infection Dimensions and saturation of niches of parasites Parasite manipulation of host behaviour Host–parasite coevolution Host–parasite interactions (tissue damage, tissue changes, immunological adaptations of parasitism)	15
IV	**Molecular biology and bioinformatics** • Extraction, preservation, and amplification of DNA • Quantitative and qualitative analysis of nucleic acid	15

	(spectrophotometry and gel electrophoresis) • DNA sequencing • DNA barcoding • Bio–molecular databases in bioinformatics • Phylogenetic tree and its reconstruction (distance-based methods, maximum parsimony, maximum likelihood)	

Suggested Readings:

1.*Animal Parasitology* by JD Smyth. Cambridge University Press.
2. *Essentials of Parasitology* by GD Schmidt. Brown Publishers
3. *Encyclopaedia of Bioinformatics and computational biology* byShobaRanganathan, Michael Gribskov, Kenta Nakai, Christian Schonbach.
4. *Evolutionary Parasitology: The Integrated Study of Infections, Immunology, Ecology, and Genetics* by Paul Schmid–Hempel. OUP Oxford.
5. *Foundation of Parasitology* by GD Schmidt LS Roberts. McGraw Hill Publishers.
6. *General Parasitology* by TC Cheng. Academic Press
7. *Helminths, Arthropods and Protozoa of domesticated animals* byEJLSoulsby.ELBS and BailliereTindall. London.
8. *Human Parasitology* by BJ Bogitsh, CE Carter, TN Oeltmann. Academic Press.
9. *Introduction to Parasitology* by AC Chandler & CP Read. John Wiley & Sons Inc.
10. *Parasite genomics protocols* by SE Melville. Humana Press.
11.*Parasitology* by Chaterjee K.D. Medical Pulisher Calcutta.
12. *Parasitology: The Biology of animal parasites* by ER Noble GA Noble
13. *Modern Parasitology* by FEG Cox. Blackwell Scientific Publications.
14.*Molecular Parasitology* by JE Hyde. Open University Press. London.

Suggested Continuous Evaluation Methods:

- Seminar/ Presentation on any topic of the above syllabus
- Test with multiple choice questions/ short and long answer questionsAttendance

Further Suggestions:

It widens the scope for students to join Government and Non-Government organization up skillingthe people at different levels as per their socio-economic structure.

At the End of the whole syllabus any remarks/ suggestions:

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M.Sc II Year (Semester IV) Zoology Core Paper 3

Quantitative Biology and Bioinformatics

Programme/Class: Degree	Year: 2	Semester: 4
Subject: Zoology		
Course Code: **M050403T**	Course Title: Quantitative Biology and Bioinformatics	

Course outcomes:

- To describe the basics and application of Biostatistics.
- To explain the principle and working of instruments in a biology laboratory.
- To learn the basics of bioinformatics.

Credits: 4	Core Compulsory
Max. Marks: 25+75	Min. Passing Marks: 33 %

Total No. of Lectures= 60

Unit	Topics	Total No. of Lectures (60)
I	**Biological data** • Data on a ratio scale • Data on an interval scale • Data on an ordinal scale • Data on a nominal scale • Types of statistics: inferential and descriptive • Parametric and non-parametric tests (concepts and applications)	15
II	**Measures of central tendency** (individual observations, discrete and continuous series) • Mean (simple and weighted) • Median • Mode (analysis using group table) **Measures of dispersion** (individual observations, discrete and continuous series) • Range and mean deviation • Standard deviation • Kurtosis and skewness	15
III	**Correlation and regression** Types and methods of studying correlation Karl Pearson's coefficient of correlation and determination Regression equation (X on Y and Y on X) Regression lines **Tests of significance and their application**: t-test, Chi-square test **Analysis of variance:** One-way and two-way ANOVA	15

IV	**Bioinformatics** • Basics of computers (CPU, I/O units and operating systems) • Concept of homepages, websites, World Wide Web, URLs, and use of search engines • Databases: nucleic acids, genomes, protein sequences and structures, SNP db, Finding scientific articles. • Information retrieval from biological databases, Entrez, SRS • Pairwise and multiple sequence alignments (CLUSTALW), BLAST • Phylogenetic analysis	15

Suggested Readings:

1. Biostatistical Analysis (Fourth Edition) by Jerrold H. Zarr, Pearson Education Inc., Delhi.
2. Statistical Methods (Eighth Edition) by G. W. Snecdecor and W. G. Cochran, Willey Blackwell
3. Biostatistics (Tenth Edition) by W.W. Daniel and C. L. Cross, Wiley
4. Introductory Biological Statistics (Fourth Edition) by John E. Havel, Raymond E. Hampton and Scott J. MeinersDavid Mount, 2004, Bioinformatics: Sequence and Genome Analysis, 2nd Edition, Cold Spring Harbor Laboratory Press
5. Jonathan Pevsner, 2003, Bioinformatics and Functional Genomics, 1st Edition, Wiley- Liss Publications.
6. Lesk, A. M. (2002). Introduction to Bioinformatics. Oxford: Oxford University Press.
7. Mount, D. W. (2001). Bioinformatics: Sequence and Genome Analysis. Cold Spring Harbor, NY: Cold Spring Harbor Laboratory Press.
8. Baxevanis, A. D., & Ouellette, B. F. (2001). Bioinformatics: a Practical Guide to the Analysis of Genes
9. Westhead *et al* (2003). Bioinformatics: Instant Notes Viva Books

Suggested Continuous Evaluation Methods:

- Seminar/ Presentation on any topic of the above syllabus
- Test with multiple choice questions/ short and long answer questionsAttendance

Further Suggestions:

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At the End of the whole syllabus any remarks/ suggestions:

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M.Sc II Year (Semester IV) Zoology Core Paper 4

Practical on Fish Biology, Parasitology and Bioinformatics

Programme/Class: Degree	Year: 2	Semester: 4
Subject: Zoology		
Course Code: **M050404P**	Course Title: **Practical on Fish Biology, Parasitology and Bioinformatics**	

After successful completion of this practical course, the students will be able to:

Perform standard laboratory and field-based experiments related to **environmental biology**, including analysis of water, soil, and ecological parameters using scientific methods.

Identify, classify, and prepare **taxonomic keys, museum specimens, and diagnostic characters** of major **Chordata groups** through hands-on practical work.

Conduct **animal physiology experiments** to study functions of respiratory, circulatory, muscular, nervous, and excretory systems using appropriate instruments and protocols.

Demonstrate proficiency in **microscopy, dissection techniques, slide preparation, and physiological recording instruments** relevant to zoological studies.

Analyze experimental data, record observations systematically, and interpret results with scientific reasoning and accuracy.

Apply **laboratory safety practices, ethical guidelines, and environmental awareness** during practical and field-oriented activities.

Correlate practical findings with theoretical concepts of **environmental adaptation, chordate evolution, and physiological regulation**.

Develop skills for **research orientation, problem-solving, and experimental design**, preparing students for higher research and professional applications in zoological sciences.

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Credits: 4	Core Compulsory
Max. Marks: 25+75	Min. Passing Marks: 33 %

Total No. of Lab/ Practicals= 60

Unit	Topics	Total No. of Labs (60)
I	Measurement of climatic factors such as Temperature & relative humidity • Estimation of Temperature, PH, Alkalinity, Hardness of water, soil analysis, Texture, Salinity • Numerical Problems of Population density • Determine texture of various soil samples.	15

	• A field study of any one of the habitat to be assigned to the group of students. Tour Of any Wildlife sanctuary/ Park/ Reserve to study behavioural activities of animals and prepare a short report • Projects on wildlife.	
II	Study of Museum specimens of animals from all Chordate groups (a) (Protochordata to Mammals) (b) Anatomy (Models / Charts/ Computer simulation) (c) Cranial Nerves, Afferent & efferent blood vessels of any Food fish. (d) Study of differences between Poisonous & Non-Poisonous snakes and Biting mechanisms. (e) Perching mechanism, Air sacs of Pigeon (f) Reproductive System & Neck Nerves of Rat (g) Osteology: Comparative study of Axial & Appendicular skeleton from Fish, Amphibia, Reptiles, Aves, Mammals. Palate in Birds, Carapace & Plastron of Turtle, skull of Mammals. (h) Histology: Comparative study from prepared slides of skin, Ovary, Testis, Pancreas, Liver, Brain, stomach & Intestine.	15
III	• Permanent Mounting, Different types of scales in Fish, Feathers of Bird, Note: Use of animals for Dissection/ Practical work, subjects to the condition that they are not banned under the Wildlife Protection Act & UGC guidelines	15
IV	Enumeration of number of RBC/ WBC by Hemocytometer/ Blood Analyzer • Estimation of Haemoglobin percentage by Haemometer • Differential leucocyte count using Leishman's Stain • Preparation of Haemin Crystals • Physiological & Endocrinological disorders through charts/ Photographic plates/ computer simulation • ABO Blood group typing (Agglutination reaction) Imprinting in Birds • Study of Food preferences and feeding behaviour of an insect pest •Conditioning relex • Communication in Bees • To study nests and nesting habits of the birds and social insects. • Study of circadian functions in hum	15

Suggested Readings:

1. https://labmonk.com/estimation-of-total-red-blood-corpuscles- rbc-count

2. https://labmonk.com/estimation-of-haemoglobin-content#:~:text=The%20graduated%20tube%20is%20filled,acid
3. %20in%20the%20graduated%20tube. https://www.labtestsguide.com/differential-leukocyte-count-dlc- test-procedure https://www.ebiologylab.com/experiments/haemin-crystals
4. https://www.ebiologylab.com/home

Suggested Continuous Evaluation Methods:

- Seminar/ Presentation on any topic of the above syllabus
- Test with multiple choice questions/ short and long answer questionsAttendance

Further Suggestions:

It widens the scope for students to join Government and Non-Government organization up skillingthe people at different levels as per their socio-economic structure.

At the End of the whole syllabus any remarks/ suggestions:

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M.Sc. II Year (Semester IV) Zoology

Paper 5 Research project/internship/field or survey work (M050405R)

Programme/Class: Degree	**Year:** 2	**Semester : 1V**
Subject: Biotechnology(**Research project/internship/field or survey work**)		
CourseCode: **M050405R**	Course Title: **Research project/internship/field or survey work**	
Topic will be decided		