

FACULTY: Science and Technology

Scheme of Teaching, Learning, Examination & Evaluation leading to Two Years PG Degree Master of Science(Zoology)following Three Years UG Programme wef 2023-24(Two Years-Four Semesters Master's Degree Programme-NEPv23 with Exit and Entry Option

M.Sc.(Zoology) First Year Semester-I

| S. N. | Subject | Type of Course | Subject Code | Teaching & Learning Scheme | | | | | | | Duration of Exam Hours | Examination & Evaluation Scheme | | | | | | | | |
|-------|---|-------------------|-----------------------------|---|---|-----------|-------|---|-----------------|-----------|------------------------|---------------------------------|-----------------|----------------------|----------|-----------------|----------------|----------------|-----------------------|-------|
| | | | | Teaching Period Per Week | | | | Credits | | | | Maximum Marks | | | | Minimum Passing | | | | |
| | | | | Theory | | Practical | | Total Marks | Minimum Passing | | | | | | | | | | | |
| | | | | L | T | P | Total | | L/T | Practical | | Total | Theory Internal | Theory +MCQ External | Internal | External | Marks Internal | Marks External | Grade | |
| 0 | *Pre-Requisite Course(s) if applicable/MOOC/Internship/Field Work cumulatively If students wish to opt Minor Course of UG as Major for PG, balance12Credits Course will have to be completed (As and when applicable) | Th-Prq | | 0 | 0 | 0 | 0 | Additional Credits to be earned = (1) minus(2)(1). Credits from Major DSC Courses in UG(minus) (2). The Credits already earned from the Course as Minor at UG, now To be opted as Major at PG | | | 2 | 15 | 35 | | | 50 | 06 | 14 | P | |
| 1 | Research Methodology and IPR | Th-Major | 1ZOO (RM) | 4 | | | 4 | 4 | | 4 | 3 | 30 | 70 | | | 100 | 12 | 28 | P | |
| 2 | DSC-I.1(Structure and Function of Invertebrate) | Th-Major | 1ZOO 1 | 4 | | | 4 | 4 | | 4 | 3 | 30 | 70 | | | 100 | 12 | 28 | P | |
| 3 | DSC-II.1 (General Physiology) | Th-Major | 1ZOO 2 | 4 | | | 4 | 4 | | 4 | 3 | 30 | 70 | | | 100 | 12 | 28 | P | |
| 4 | DSC-III.1 (Gamete Biology) | Th-Major | 1ZOO 3 | 3 | | | 3 | 3 | | 3 | 3 | 30 | 70 | | | 100 | 12 | 28 | P | |
| 5 | DSE-I/MOOC (Tools and techniques in Biology or Wildlife Conservation and Management) | Th-Major Elective | 1ZOO 4 (TB) 1ZOO 4 (WCM) | 3 | | | 3 | 3 | | 3 | 3 | 30 | 70 | | | 100 | 12 | 28 | P | |
| | | | | | | | | | | | | | | | | | | | Minimum Passing Marks | Grade |
| 6 | DSCI and DSC II.(Lab 1) | Pr-Major | 1ZOO 5 | | | 4 | 4 | | 2 | 2 | 6 | | | 50 | 50 | 100 | | 50 | P | |
| 7 | DSC-III.and DSE I (Lab 2) | Pr-Major | 1ZOO 6 | | | 4 | 4 | | 2 | 2 | 6 | | | 50 | 50 | 100 | | 50 | P | |
| 8 | #On Job Training, Internship/Apprenticeship; Field projects Related to Major@ during vacations cumulatively | Related To DSC | | 120 Hours cumulatively during vacations of Semester I and Semester II | | | | | | 4* | | | | | | | | | | P* |
| 9 | Co-curricular Courses: Health and wellness, Yoga Education, Sports and Fitness, Cultural Activities ,NSS/NCC, Fine/Applied/Visual/Performing Arts During Semester I, II, III and IV | Generic Optional | | 90 Hours Cumulatively From Sem I to Sem IV | | | | | | | | | | | | | | | | |
| | TOTAL | | | | | | | | | 22 | | | | | | 700+50* | | | | |

Note: Exit options after M.Sc. I (1st Year PG) : 1 – To students who opt for DSE for Tools and Techniques in Biology (TB) will be awarded PG Diploma in Tools and Techniques in Biology To students who opt for DSE Wildlife Conservation and Management (WCM) will be awarded PG Diploma in Wildlife Conservation and Management on Exit.

L:Lecture,T:Tutorial,P:Practical/Practicum

Pre-requisite Course mandatory if applicable: **Prq**, Theory: **Th**, Practical/Practicum: **Pr**, Faculty Specific Core: **FSC**, Discipline Specific Core: **DSC**, Discipline Specific Elective: **DSE**, Laboratory: **Lab**, **OJT**: On Job Training: Internship/Apprenticeship: Field projects: **FP**; **RM**: Research Methodology; Research Project: **RP**, **Co-curricular Courses: CC**

Note :# On Job Training, Internship/ Apprenticeship; Field projects **Related to Major (During vacations of Semester I and Semester II) for duration of 120 hours mandatory to all the students, to be completed during vacations of Semester I and/or II. This will carry 4 Credits for learning of 120 hours. Its credits and grades will be reflected in Semester II credit grade report.**

Note: **Co-curricular Courses:** In addition to the above, CC also include but not limited to Academic activities like paper presentations in conferences, Aavishkar, start-ups, Hackathon, Quiz competitions, Article published, Participation in Summer school/Winter School/Short term course, Scientific Surveys, Societal Surveys, Field Visits, Study tours, Industrial Visits, online/offline Courses on Yoga (Yoga for IQ development, Yoga for Ego development, Yoga for Anger Management, Yoga for Eyesight Improvement, Yoga for Physical Stamina, Yoga for Stress Management, etc.). These can be completed cumulatively during **Semester I, II, III and IV. Its credits and grades will be reflected in semester IV credit grade report.**



Sant Gadge Baba Amravati University, Amravati
FACULTY: Science and Technology
Scheme of Teaching, Learning, Examination & Evaluation leading to Two Years PG Degree Master of Science(Zoology)following Three Years UG Programme wef 2023-
24(Two Years-Four Semesters Master's Degree Programme-NEPv23 with Exit and Entry Option
M.Sc.(Zoology)First Year Semester-II[Level6.0]

| S. N. | Subject | Type of Course | Subject Code | Teaching&LearningScheme | | | | | | | Duration OfExam Hours | Examination&EvaluationScheme | | | | | | | | |
|-------|---|-------------------|-------------------------------|---|---|---|-------|---------|-----------|-------|-----------------------|------------------------------|----------------------|-----------|----------------|-------------|----------------|----------------|-------|----|
| | | | | Teaching Period Per Week | | | | Credits | | | | MaximumMarks | | | MinimumPassing | | | | | |
| | | | | L | T | P | Total | L/T | Practical | Total | | Theory | | Practical | | Total Marks | Marks Internal | Marks External | Grade | |
| | | | | | | | | | | | | Theory Internal | Theory +MCQ External | Internal | External | | | | | |
| 1 | DSC-I.2Structure and function of Vertebrate | Th-Major | 2 ZOO 1 | 4 | | | 4 | 4 | | 4 | 3 | 30 | 70 | | | 100 | 12 | 28 | P | |
| 2 | DSC-II.2Molecular cell biology | Th-Major | 2 ZOO 2 | 4 | | | 4 | 4 | | 4 | 3 | 30 | 70 | | | 100 | 12 | 28 | P | |
| 3 | DSC-III.2 Ecology and Environment | Th-Major | 2 ZOO 3 | 3 | | | 3 | 3 | | 3 | 3 | 30 | 70 | | | 100 | 12 | 28 | P | |
| 4 | DSE-II/MOOC(Advance Tools and techniques in Biology or Advance Wildlife Conservation and Management | Th-Major Elective | 2ZOO 4 (ATB) 2ZOO 4 (AWCM) | 3 | | | 3 | 3 | | 3 | 3 | 30 | 70 | | | 100 | 12 | 28 | P | |
| | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | |
| 5 | DSCI.2 and DSC II.2.(Lab 3) | Pr-Major | 2 ZOO 5 | | | 4 | 4 | | 2 | 2 | 6 | | | 50 | 50 | 100 | | 50 | P | |
| 6 | DSC-III.2.and DSE II (Lab 4) | Pr-Major | 2 ZOO 6 | | | 4 | 4 | | 2 | 2 | 6 | | | 50 | 50 | 100 | | 50 | P | |
| 9 | #OnJobTraining,Internship/Apprenticeship;FieldprojectsRelatedtoMajor@duringvacations Cumulatively | Related to Major | | 120 Hours cumulatively during vacations of Semester I and Semester II | | | | | | | 4* | | | | | | | | | P* |
| 8 | Co-curricular Courses: Health and wellness, Yoga Education, Sports and Fitness, Cultural Activities ,NSS/NCC, Fine/Applied/Visual/Performing Arts During Semester I, II, III and IV | Generic Optional | | 90 Hours Cumulatively From Sem I to Sem IV | | | | | | | | | | | | | | | | |
| | | | | ExitOptionwithaPGDiplomawith4CreditsOn-the-jobtraining/internshipintherespectiveMajorsubject | | | | | | | | | | | | | | | | |
| | | | | • StudenthastoearnTotalminimum4CreditscumulativelyduringVacationsofSemesterIandSemesterIIfrominternshipinordertoexitafterFirstYearwithPG Diploma (42-44Credits)afterThreeYearUGDegree | | | | | | | | | | | | | | | | |
| | TOTAL | | | | | | | | | | 18+4* | | | | | 550 | | | | |

L:Lecture,T:Tutorial,P:Practical/Practicum

Pre-requisite Course mandatory if applicable: **Prq**, Theory : **Th**, Practical/Practicum: **Pr**, Faculty Specific Core: **FSC**, Discipline Specific Core: **DSC**, Discipline Specific Elective: **DSE**, Laboratory: **Lab**, **OJT**: On Job Training; Internship/ Apprenticeship; Fieldprojects: **FP**; **RM**: ResearchMethodology;ResearchProject:**RP**, **Co-curricular**

Courses:CCNote:#OnJobTraining,Internship/Apprenticeship;FieldprojectsRelatedtoMajor(DuringvacationsofSemesterIandSemesterII)fordurationof120hoursmandatorytoallthestudents,tobecompletedduringvacationsof SemesterIand/orII.

This will carry 4 Credits for learning of 120 hours. Its credits and grades will be reflected in Semester II credit grade report.

Note: **Co-curricular Courses:** In addition to the above, CC also include but not limited to Academic activities like paper presentations in conferences, Aavishkar, start-ups, Hackathon, Quiz competitions, Article published, Participation in Summer school/Winter School/Short term course, Scientific Surveys, Societal Surveys, Field Visits, Study tours, Industrial Visits, online/offline Courses on Yoga (Yoga for IQ development, Yoga for Ego development, Yoga for Anger Management, Yoga for Eyesight Improvement, Yoga for Physical Stamina, Yoga for Stress Management, etc.). These can be completed cumulatively during **Semester I, II, III and IV. Its credits and grades will be reflected in semester IV credit grade report.**



Sant Gadge Baba Amravati University, Amravati

Name of the Programme: M.Sc. (Sem-I) Subject: Zoology (NEPv23)

POs:

The post graduate course of Zoology will provide theoretical as well as experimental knowledge as per the courses included under the syllabi by which build up creativity in students will lead towards thorough learning and development of ideas of research work and will become ready to face recent challenges. Students can attain the employability skills through the experiences based on their practical knowledge.

After completion of MSc in Zoology successfully, the students would be able to.....

1. Demonstrate the significance of the topics of syllabi and evaluate its relevance. Think creatively for its gravity and develop ideas.
2. Interpret scientific ideas and can do its analysis. Create experiments independently and draw inferences by sharing it with others.
3. Derive information from various digital sources. Develop skills for scientific writing and present the data and analyse it scientifically.
4. Articulate scientific ideas lay down a hypothesis; design the pathway to develop research ideas.
5. Acquaint skills in handling the instruments and different techniques through practicals and developing the scientific temperaments for research.
6. Develop competence through healthy atmosphere and quality intercommunication with different groups.
7. Understand environmental and sustainability issues and its sensitivity in relation to regional relevance.
8. Get the facility of different training and internship programs through job-oriented curriculum
9. Utilize the sources confidently and independently and develop self-sustenance.

PSOs:

Upon completion of the programme successfully, students would be able to

1. Learn to prepare the checklist and inventories through the identification of the fauna in local areas being Melghat Tiger Reserve and Pohra Forest are very nearer to survey.
2. Gain comprehensive knowledge about different animals and develop confidence to handle them during research work.
3. Interpret metabolic pathways, their correlation in concern with prokaryote and eukaryotes.
4. Compare genetic aspects, genetic traits, diseases and their specific causes.
5. Survey and analyse data of the various kinds of diseases in the locality.
6. Understand various strategies and phenomena related to animal reproduction and their development.
7. Get acquainted with conservation strategies and environmental threats to reduce and save energy through Wildlife Week Celebration.
8. Compare the different developmental events during embryogenesis of different animals.

EMPLOYABILITY POTENTIAL

After Completion of this course Field Biologist or Ecologist in different govt. establishments like- NTCA, Division Office, Wildlife Wings Wildlife Consultant EIA Report Designing Firm,

Wildlife Conservation Educator in NGOs like WWF, WCT, WTI,

Conservation Geneticist in research organisations,

GIS Specialist in Govt Establishments,

Environmental Impact Assessment (EIA) Specialist: Assessing the potential impact of development projects on wildlife and proposing mitigation measures.

Wildlife Forensics Specialist in research labs

Research Associate or Assistant: Assisting senior researchers in wildlife conservation projects and data analysis.

Wildlife Photographer or Filmmaker: Using visual media to raise awareness about wildlife conservation and natural habitats.

Wildlife Tour Guide or Naturalist: Conducting guided tours in wildlife sanctuaries, national parks, or eco-tourism sites.

Wildlife Project Manager: Overseeing and coordinating conservation projects aimed at protecting specific wildlife species or habitats.

Environmental Educator: Developing and delivering educational programs related to wildlife conservation and environmental protection.

Environmental Scientists, Ecologist, Environmental manager, scientific technical writer, zoo manager, lab technician

M. Sc. Zoology (NEPv23) Semester-I

| Course: Research Methodology and Intellectual Property Rights | | |
|--|---|-----------------------------------|
| Subject Code: 1ZOO (RM) | No. of Credits: 4 | No. of hours per week: 4 |
| Exam duration: 3Hrs | Maximum Marks: 100 (External:70 Internal:30) | Total No. of contact hours: 60 |

COs 1ZOO (RM)

Upon completion of this course successfully, students would be able to get

1. Fundamental knowledge and skills required to conduct effective research in the field.
2. Covers various research methodologies, experimental design, analysis, interpretation, scientific communication and ethics in research.
3. Understand the role of research methodology in Science/Zoology.
4. Understand literature review process and formulation of a research problem.
5. Understand data collection methods and basic instrumentation.
6. Learn various statistical tools for data analysis.
7. Learn technical writing and communication skills required for research.
8. IPR aims to equip students with a comprehensive understanding of intellectual property laws, principles and practices.
9. Create awareness about intellectual property rights and patents.

| Units | Syllabus Content | Hours |
|--------------|-------------------------|--------------|
|--------------|-------------------------|--------------|

| | | |
|---|---|----|
| 1 | <p>1.0 Definition of research, characteristics of research</p> <p>1.1 Research process: Steps, objectives, and types of research</p> <p>1.2 Identifying research problems and formulating research questions</p> <p>1.3 Problem Formulation, objectives of research problems, Hypothesis</p> <p>1.4 Literature review and conducting a systematic review of relevant literature</p> | 10 |
| 2 | <p>2.0 Sources of data: Primary, Secondary and Tertiary</p> <p>2.1 Observation methods in research</p> <p>2.2 Survey methods and questionnaires in research</p> <p>2.3 Conducting wildlife surveys and biodiversity assessments</p> <p>2.4 Mark-recapture methods and population estimation in Zoological studies</p> <p>2.5 Remote sensing and GIS applications in Zoological research.</p> | 10 |
| 3 | <p>3.0 Introduction to statistical analysis using software packages (e.g., R, SPSS)</p> <p>3.1 Descriptive statistics</p> <p>3.2 Inferential statistics: Parametric and non-parametric tests in research.</p> <p>3.3 Data visualization techniques</p> <p>3.4 Designing and conducting experiments in Zoological studies</p> <p>3.5 Animal handling, ethics, and welfare in experimental research</p> <p>3.6 Analysis of data collected from field experiments and laboratory experiments in Zoology.</p> | 10 |
| 4 | <p>4.0 Scientific writing: Writing of Review of literature for thesis.</p> <p>4.1 Writing Research articles,</p> <p>4.2 Preparing reports and project proposals.</p> <p>4.3 Preparing effective visuals and presentations for conferences</p> <p>4.4 Writing review articles.</p> | 10 |
| 5 | <p>5.0 Research data bases: Scopus, web of science, google scholar etc.,</p> <p>5.1 Methods to search required information effectively,</p> <p>5.2 Reference Management Software like Zotero/ Mendeley, Software for paper formatting like LaTeX/ MS Office.</p> <p>5.3 Peer-review process and publication ethics in research</p> <p>5.4 Plagiarism- Software for detection of Plagiarism.</p> | 10 |
| 6 | <p>6.0 Introduction of Intellectual Property Rights (IPR).</p> <p>6.1 Introduction to TRIPS and WTO.</p> <p>6.2 Kinds of Intellectual property rights-Copy Right, Patent, Trade Mark, Geographical Indication and Traditional Knowledge.</p> | 10 |

| | | |
|--|---|--|
| | <p>6.3 Patent: Meaning of Patent, Types, Inventions which are not patentable, Registration Procedure, Rights and Duties of Patentee, Surrender and Revocation of Patents, Infringement, Remedies & Penalties.</p> <p>6.4 Copy Right: Definition & Types of Copy Right, Registration procedure, Assignment & license, Terms of Copy Right, Piracy, Infringement, Remedies, Copy rights with special reference to software.</p> | |
|--|---|--|

References:

1. Ranjit Kumar, "Research Methodology: A Step-by-Step Guide for Beginners SAGE Publications Ltd., 2011.
2. Wayne Goddard, Stuart Melville, "Research Methodology: An Introduction" JUTA and Company Ltd, 2004.",
3. C.R. Kothari, "Research Methodology: Methods and Trends", New Age International, 2004.
4. S.D. Sharma, "Operational Research", Kedar Nath Ram Nath & Co., 1972.
5. B.L. Wadehra, "Law Relating to Patents, Trademarks, Copyright Designs and Geographical Indications", Universal Law Publishing, 2014.
6. Donald Cooper, Pamela Schindler, "Business Research Methods", McGraw-Hill publication, 2005.
7. <https://youtu.be/ur-pIS0CxOg>
8. https://www.youtube.com/live/qEFHM_uBwo8?feature
9. <https://youtu.be/5o57j4FEIpM>

| Course: Structure and Functions of Invertebrates | | |
|---|---|-----------------------------------|
| Subject Code: 1 ZOO1 | No. of Credits: 4 | No. of hours per week: 4 |
| Exam duration: 3Hrs | Maximum Marks: 100 (External:70 Internal:30) | Total No. of contact hours: 60 |

Cos 1ZOO1

Upon completion of this course successfully, students would be able to -----

1. Describe various methods of taxonomy.
2. Differentiate between different methods of taxonomy.
3. Identify different types of feeding in invertebrates.
4. Describe mechanisms of chemoreception and photoreception in invertebrates.
5. Conjecture the stage of metamorphosis in insects from concentrations of different hormones.
6. Differentiate between different modes of reproduction.

| Unit | Contents | Hours |
|-------------|--|--------------|
| Unit-I | 1.0 Origin, development and utility of systematics (taxonomy) 1.1 Artificial System of classification, Phenetic taxonomy and phylogenetic classification 1.2 Advantages and Disadvantages of molecular taxonomy 1.3 Taxonomic Categories 1.4 Species as a category | 10 |
| Unit-II | 2.0 Organization of coelom: Acoelomates, pseudocoelomates | 10 |

| | | |
|----------|---|----|
| | <p>and Coelomates</p> <p>2.1 Ultrastructure and mechanism of movement of protozoan flagella and cilia</p> <p>2.2 Hydrostatic movements in Annelida and Echinodermata</p> <p>2.3 Patterns of feeding and digestion in lower metazoa</p> <p>2.4 Filter feeding in Polychaeta</p> | |
| Unit-III | <p>3.0 Organs of Respiration: Gills and Trachea</p> <p>3.1 Aquatic Respiration in <i>Pila</i></p> <p>3.2 Tracheal Respiration in Insects</p> <p>3.3 Circulatory system in Prawn</p> <p>3.4 Water vascular system in Echinodermata</p> | 10 |
| Unit-IV | <p>4.0. Excretion in Protozoa</p> <p>4.1 Excretory structures and functions in Annelids</p> <p>4.2 Malpighian tubules: structure and functions in Insects</p> <p>4.3 Primitive nervous system: Coelenterata and Echinodermata</p> <p>4.4 Advanced nervous system: Annelida and Arthropoda</p> | 10 |
| Unit-V | <p>5.0 Mechanoreceptors in Non-chordates</p> <p>5.1 Chemoreception in invertebrates</p> <p>5.2 Photoreception in invertebrates</p> <p>5.3 Eyes in Platyhelminthes, Annelida and Cephalopoda</p> <p>5.4 Functional Morphology of compound eye in Insects</p> | 10 |
| Unit-VI | <p>6.0 Reproductive mechanisms in <i>Paramecium</i> and <i>Obelia</i></p> <p>6.1 Sexual Reproduction in Cockroach</p> <p>6.2 Metamorphosis in insects</p> <p>6.3 General account and affinities of Ctenophora and Rotifera</p> <p>6.4 Larval forms in Echinodermata: Metamorphosis and</p> | 10 |

| | | |
|--|---------------------------|--|
| | Phylogenetic Significance | |
|--|---------------------------|--|

LIST OF PRACTICALS

1. Museum Study:- Taxonomy of animal specimens/charts / photographs/ models/ video clipping available in the laboratory representing major orders of Non-chordata, **other than studied during previous courses.**

2. Anatomy of Any 2 Systems by demonstration and labelling with available resources like C.D./chart/ models/ Video clippings/ PPT/ Preserved dissected specimens etc. from **Earthworm/ Cockroach/Prawn** or similar available non-chordate animals. **(Any 1 Animal)**

3. Mounting / Stained permanent preparations:-

i. *Paramecium, Vorticella, Euglena*

ii. Rotifers from fresh water

iii. Mouth parts of mosquito, housefly or any pest /vector insect.

iv. Wings of small insects (Mosquito, Drosophila, housefly)

4. Photographic collection and Comments on campus/local faunal diversity with reference to their ecology.

a. Earthworms used in vermiculture (any three species)

b. Any five butterfly species

c. Any five dragonfly species

5. Qualitative analysis of Zooplanktons

6. Identification of diversity of mosquitoes from local area and description of their morphological characters.

7. Study of available Permanent stained slides/ ICT based sources: Whole mounts of Larval forms: Planula, Redia, Cercaria, Cysticercus, bladder worm, Trochophore, Nauplius, Zoa, Mysis, Veliger, Bipinnaria, Echinopluteus, Auricularia, Tornaria.

REFERENCES:

1. Hyman, L.H. The invertebrates. Vol. I. Protozoa through Ctenophora, McGraw Hill Co., New York.

2. Barrington, E.J.W. Invertebrate structure and function. Thomas Nelson and Sons Ltd., London.
3. Jagerstein, G. Evolution of Metazoan life cycle, Academic Press, New York & London.
4. Hyman, L.H. The invertebrates. Vol.2. Mc Graw Hill Co., New York.
5. Hyman, L.H. The invertebrates Vol.8. McGraw Hill Co., N.Y. and London.
6. Barnes, R.D. Invertebrate Zoology, III edition. W.B. Saunders Co., Philadelphia
7. Russel-Hunter, W.D. A biology of higher invertebrates, the Macmillan Co.Ltd., London.
8. Hyman, L.H. The invertebrate's smaller coelomate groups, Vol. V. McGraw Hill Co., New York.
9. Read, C.P. Animal Parasitism. Prentice Hall Inc., New Jersey.
10. Sedgwick, A. A. Student text book of Zoology. Vol, I, II and III. Central Book Depot, Allahabad.
11. Parker, T.J. Haswell, W.A. Text Book of Zoology, Macmillan Co., London.
12. Borradaile, L.A. and F.A. Potts: The Invertebrates: Asia Publishing
13. House, Bombay, London Nigam: Biology of non-chordata, S. Nagin Chand.
14. Anderson, D. T. (Ed.) (2001). Invertebrate Zoology. 2 nd ed. Oxford University Press.
15. Ruppert, E. E., Fox, R. & Barnes R. D. (2003). Invertebrate Zoology: A Functional Evolutionary Approach. 7 th ed. Brooks Cole.
16. Barrington, E. J. W. (1981). Invertebrate Structure and function. 2nd ed. ELBS & Nelson.
17. Brusca, R. C. & Brusca, G. J. (2002). Invertebrates. 4 th ed. Sinauer Associates.
18. Meglitsch, P. A. & Schram, F. R. (1991). Invertebrate Zoology. Oxford University Press.
19. Pechenik, J. A. (1998). Biology of the Invertebrates, 4th Ed. McGraw Hill.
20. Hickman, C.P., Roberts, L.S., Larson, A., I'Anson, H., Eisenhour, D.J. (2006) Integrated Principles of Zoology, 13th Ed. McGraw Hill
21. Moore, J. (2006). An Introduction to the Invertebrates. 2nd Edition Cambridge University Press.
22. Jordan, E.L. and Verma, P.S. (2009). Invertebrate Zoology. S. Chand Publications
23. Kotpal, R. L. (2018). Modern Textbook of Zoology (11th Edition). Rastogi Publications
24. Tembhare, D. B. (20) Modern Entomology. Himalaya Publications

DISTRIBUTION OF MARKS DURING PRACTICAL EXAMINATION

EXTERNAL MARKS

| | |
|--|----------|
| 1. Anatomical labelling | 04 Marks |
| 2. Experiment from Section 5 or 6 | 04 Marks |
| 3. Identify given Spots 3 slides & 3 specimens | 12 Marks |
| 4. Viva-voce | 05 Marks |
| <hr/> | |
| TOTAL | 25 Marks |

INTERNAL MARKS

| | |
|---|----------|
| 1. Certified Class Record | 10 Marks |
| 2. Submission of Permanent slides/Photographic collection | 10 Marks |
| 3. Student Performance | 05 Marks |
| <hr/> | |
| TOTAL | 25 Marks |

| Course: General Physiology | | |
|-----------------------------------|---|-----------------------------------|
| Subject Code: 1 Z002 | No. of Credits: 4 | No. of hours per week: 4 |
| Exam duration: 3Hrs | Maximum Marks: 100 (External:70 Internal:30) | Total No. of contact hours: 60 |

Upon completion of this course successfully, students will be able to -----

1. To develop a deep understanding of enzymes, hormones, respiratory pigments and neurotransmitters.
2. To understand the concept of Thermoregulation, osmoregulation, chemiluminescence and camouflage with suitable examples.
3. To understand the various functional components of an organism.
4. To explore the complex network of these functional components.
5. To comprehend the regulatory mechanism for maintenance of function in the body.
6. To understand the concept of special senses.

| Units | Syllabus Content | Hours |
|--------------|---|--------------|
| 1 | 1.0. Nomenclature and Classification of enzymes, mechanism of enzyme action, factors affecting rate of enzyme-catalyzed reaction, Regulation of Enzyme action. 1.1 Respiratory pigments in animals- types and their functions. 1.2 Classification of hormones ; mechanism of hormone action. 1.3 Types of neurotransmitter ; Mechanism of transmission through synapse and neuromuscular junction. | 10 |
| 2 | 2.0 Thermoregulation: Exothermic and endothermic regulation 2.1 Osmoregulation in fishes and amphibians. 2.2 Mechanism of chemiluminescence in invertebrates. 2.3 Camouflage mechanism: types - physiology and significance. | 10 |
| 3 | 3.0 Metabolism of Carbohydrates: glycolysis, citric acid cycle, gluconeogenesis, Glycogenolysis, Glycogenesis. 3.1 Metabolism of lipids: oxidation of saturated fatty acids with even and odd number of carbon-atoms. 3.2 Catabolism of amino acids: Transamination, deamination, urea cycle. 3.3 Mechanical and chemical digestion of carbohydrates, proteins and lipids. | 10 |

| | | |
|---|--|----|
| 4 | <p>4.0 Types of Muscle: Ultra structure, chemical composition, mechanism of contraction.</p> <p>4.1 Structure and types of neurons: Resting membrane potential, action potential, Impulse transmission through myelinated and unmyelinated nerve fibers.</p> <p>4.2 Mechanism of reflex action.</p> <p>4.3 Hormones and their functions- pituitary, pineal, thyroid, pancreas and adrenal.</p> | 10 |
| 5 | <p>5.0 Mechanism of respiration, pulmonary ventilation, transport oxygen and carbon dioxide in blood.</p> <p>5.1 Control of Respiration</p> <p>5.2 Composition of blood and their functions::; haemopoiesis, Blood clotting mechanism</p> <p>5.3 Structure of mammalian heart, cardiac cycle, ECG, Blood pressure and it regulation.</p> | 10 |
| 6 | <p>6.0 Structure of kidney and its functional unit; mechanism of urine formation.</p> <p>6.1 Special Senses- Smell- receptor, pathway, Taste- taste buds, pathway.</p> <p>6.2 Special Senses- Vision- Structure of eye ball, retina, image forming mechanism, colour vision and color blindness.</p> <p>6.3 Special sense- Hearing- Functional anatomy of ear, function of middle ear, organ of corti.</p> | 10 |

REFERENCE BOOKS

- 1) Animal Physiology: Adaptation and Environmental, Nelson K. S. (ed) Cambridge University Press, Cambridge, UK.
- 2) Barrington, E.J.W.1975. An Introduction to General and Comparative Endocrinology. Clarendon Press, Oxford
- 3) Bentley, P.J.1971. Endocrine and osmoregulation, Springer Verlag, New York.
- 4) Comparative Physiology (Handbook of Physiology): Vol. 1, 2, Dantzler, W.H. (ed.) Oxford University Press, New York, USA
- 5) General and Comparative Animal Physiology, Hoar W. S. (ed), Prentice Hall, India.
- 6) Guyton, A.C. and Hall, J.E.; Text book of medical physiology, 10th Ed, Saunders, Harcourt, India.
- 7) Hoar, W.S. General and comparative physiology, Prentice, Hall Inc./England Wood cliffs, New Jersey.
- 8) Heilmeyer, L.M.G. Cellular regulation of protein phosphorylation, springer-verlag, Berlin Heidelberg, New York.
- 9) Herkat, P.C.and Mathur, P.N.1976. Text Book of Animal Physiology.S.Chand Co. Pvt, Ltd., New Delhi.
- 10) Karpati, G., Jones, D.H. and Griggs. R.C. Disorders of Voluntary Muscle, 7th Edn, Cambridge University Press.
- 11) Palmen, J.D. Brown, I.R and Hastings, J.W.1970. Biological clocks, Academic Press, London.

- 12) Prosser, C.L. and Brown, F.A. comparative Animal Physiology 2 nd Ed. W.B. Saunders, Philadelplina.
- 13) Ruegg, J.C., Calcium in muscle activation, Springer Verlag Berlin Heidelberg, New York. 25
- 14) Schmidt Nelssen, K.1985. Animal Physiology. Adaptation and Environment Club, London.
- 15) Turner, C.D. General Endocrinology, 4th Ed. W.B. Saunders, Philadelphia London.
- 16) Welson, A. 1979. Principles of Animal Physiology.McMillan Publishing Co. Inc. New York.

Practical's-

1. Demonstration of action of salivary amylase, trypsin and pepsin.
2. Demonstration of hemoglobin concentration in normal and pathological condition.
3. Estimation of glucose in blood by spectrophotometer or colorimeter.(Source of sample : local recognized pathology laboratory).
4. Estimation of total blood proteins by spectrophotometer or Colorimeter.(Source of sample: local recognized pathology laboratory).
5. Demonstration of rate of O₂ consumption in aquatic animals under various environmental stresses.
6. Counting of RBC in blood using Hemocytometer.
7. Counting of WBC in blood using Hemocytometer.
8. Qualitative detection of nitrogenous waste products (Ammonia, urea, uric acid) in given sample.
9. Demonstration of kymograph unit, Respirometer through available resources.
10. Measurement of Blood pressure.
11. Study of camouflage vertebrates.

Distribution of Practical Marks

External Marks

| | |
|-------------------------------------|-----------------|
| 1 Major physiology experiments..... | 10 |
| 2 Minor physiology experiments..... | 10 |
| 3. Viva voce..... | 05 |
| TOTAL | 25 Marks |

Internal Marks

| | |
|---|-----------------|
| 1. Class record..... | 10 |
| 2. Survey based on physiology practical ----- | 05 |
| 3. Student Performance ----- | 10 |
| TOTAL | 25 Marks |

| | | |
|--|--|--|
| | | |
|--|--|--|

Name of the Programme: M.Sc. (Sem-I) Subject: Zoology

| | | |
|-------------------------------|---|-----------------------------------|
| Course: Gamete Biology | | |
| Subject Code: 1 ZOO 3 | No. of Credits: 3 | No. of hours per week: 4 |
| Exam duration: 3Hrs | Maximum Marks: 100 (External:70 Internal:30) | Total No. of contact hours: 45 |

Cos: 1ZOO3

After learning this course, students would be able to.....

1. Study spermatogenesis and oogenesis in eukaryotes.
2. Determine different events and their mechanisms during fertilization and its consequent changes.
3. Learn assisted reproduction techniques to overcome infertility.
4. Understand Ex vivo and In vivo gene therapy etc.
5. Learn about contraception and methods

| Unit No | Content | Hours |
|---------|---|-------|
| 1 | 1.0 Spermatogenesis in mammals and its regulation. 1.1 Gamete specific gene expression. 1.2 Formation and composition of semen. 1.3 Assessment of sperm functions. 1.4 Oogenesis in mammals and its regulation. 1.5 Ovarian follicular growth: Morphology, endocrinology and molecular biology. 1.6 Ovulation and its regulation | 07 |
| 2 | 2.0 Cell surface molecules in sperm-egg recognition. 2.1 Reaction of sperm: Sperm motility, capacitation, chemotaxis, acrosome reaction, fusion of sperm and egg plasmalemma. 2.2 Reaction of egg: Formation of fertilization cone, 2.3 Prevention of polyspermy. 2.4 Amphimixis. | 07 |
| 3 | 3.0 Patterns of cleavage. 3.1 Blastulation in Frog. 3.2 Blastulation in Chick. 3.2 Gastrulation in Frog. 3.3 Gastrulation in Chick 3.4 Fate Map in Frog and Chick | 08 |
| 4 | 4.0 Causes of infertility in humans. 4.1 <i>In vitro</i> fertilization: Superovulation, Collection and cryopreservation of gametes, <i>In vitro</i> gamete maturation, Screening of genetic disorders, Procedure of IVF. 4.2 ICSI, GIFT and ZIFT. 4.3 Disadvantages of assisted reproduction. 4.4 Cloning of animals by nuclear transfer. | 08 |
| 5 | 5.0 Transgenic animals: Procedure and Application 5.1 Gene knock technology: Procedure and application 5.2 Gene therapies: Ex-vivo gene therapy , In-vivo gene therapy 5.3 Antigens and antisense therapy | 08 |
| 6 | 6.0 Contraception: Physical barriers. 6.1 Hormonal methods. 6.2 Emergency contraceptives. 6.3 Surgical methods. 6.4 Intrauterine contraceptive devices (IUCDs). | 07 |

| | | |
|--|-------------------------------------|--|
| | 6.5 Concept of immunocontraception. | |
|--|-------------------------------------|--|

PRACTICALS-

1. Elementary idea of animal ethics in Laboratories.
2. Morphology and histology of non-chordate and chordate ovary and testis (Insects, snails, frog and rat).
3. Oogenesis and spermatogenesis through gonad histological preparation.
4. Study of different types of eggs on the basis of their yolk content.
5. Observation of frog spawn embryos and larvae up to metamorphosis and study of stages of development.
6. Study of cleavages in *Limnea* in laboratory.
7. Mounting of larvae of *Limnea/Bellamia*.
8. Study of development of *Amphioxus*, Frog, Chick and pig through slides and whole mounts/available ICT based alternatives.
9. Morphogenesis and growth study of chick development.
10. Sperm count.
12. Study of abnormal sperm count.
13. Semen analysis(Fructose estimation).
14. Bio-assay of LH by OAAD test.
15. Bioassay of estrogen using uterotrophic vaginal response or Analysis of ovarian/adrenal lipids by TLC.
16. Oocyte maturation in major carp fish using germinal vesicle breakdown test by the induction of maturation-inducing steroid.

The examinee shall be required to produce at the practical examination the following:

Practical record book duly signed by teacher in charge and certified by the Head of the Department as a bonafide work of the examinees.

Note: Besides these any other additional experiment relevant to the syllabi depending on resources

References:

1. Long J.A.Evan H.M.1922:the oestrous cycle in the Rat and its associated phenomenon.
2. Nalbandou. A.C. – Reproductive physiology
3. Prakash A.S. 1965-66 Marshall's, Physiology Reproduction (3 Vol.)
4. Gilbert, S.F. Developmenal Biology, Sinauer Associated Inc. Massachulsetts.
5. Ethan Bier, thecold Spring.Thecoldspring Harbor laboratory Press, New York.
6. Balinsky B.I. Introduction to Embryology sanders, Phliedelphia.
7. Berril N.J. and Karp. G.Development Biology. McGraw Hill New York.
8. Davidson ,E.H. GeneActivity During Early Development. Academic Press, New

York.

9. Wolpert Principles of Development-
10. Slack Essential Developmental Biology-
11. Principles of Development, 3rd edition (2007), Lewis Wolpert, Publisher- Oxford University Press.
12. An Introduction to Embryology, 5th edition(2004), B.I.Balinsky. Publisher–Thomas Asia Pvt.Ltd
13. Developmental Biology, (2001), R. M. Twyman, Publisher - Bios Scientific Publishers LTD.
14. Concepts of Genetics, 9th edition (2008), William S. Klug, Michael R. Cummings, Charlotte Spencer, and Michael A. Palladino, Publisher-Benjamin Cummings
15. Genes IX, 9th edition (2008), Benjamin Lewin, Publisher-Jones and Barlett Publishers Inc.
16. Principles of Genetics, 4th edition, (2006), Snustad D. Peter and Simmons J. Micheal, Publisher-John Wiley and Sons. Inc.
17. Genetics, (1999), Daniel J. Fairbanks, W. Ralph Andersen Publisher-Brooks/Cole Pub Co.
18. Principles of Genetics, 8th edition (1991), Eldon J. Gardner, D. P. Snustad, M.J. Simmons, and D. Peter Snustad Publisher-John Wiley and Sons. Inc.
19. Microbial Genetics, (1987), David Freifelder, Publisher-Jones & Bartlett
20. General Genetics, (1985), Leon A. Snyder, David Freifelder, Daniel L. Hartl Publisher-Jones and Bartlett.
21. Genetics, 3rd edition, Monroe W. Strickberger, (1968), Publisher- Macmillan Publishing Co.

Distribution of Practical Marks of part A:

External Marks

| | |
|-------------------------|-----------------|
| 1 Major experiment..... | 15 Marks |
| 2 Minor experiment..... | 10 Marks |
| TOTAL | 25 Marks |

Internal Marks

| | |
|------------------------------|----------|
| 3. Class record..... | 10 Marks |
| 4. Viva voce..... | 10 Marks |
| 5. Student Performance ----- | 05 Marks |

TOTAL **25 Marks**

| Course: Tools And Techniques In Biology | | |
|--|---|-----------------------------------|
| Subject Code: 1 Z004 (TB) | No. of Credits: 3 | No. of hours per week: 3 |
| Exam duration: 3Hrs | Maximum Marks: 100 (External:70 Internal:30) | Total No. of contact hours: 45 |

Cos :1Z004 (TB)

- 1) Student will develop real time problem solving skills using techniques like electrophoresis, chromatography based applications based questions and projects.
- 2) The course will help to understand the principles and applications of different biophysical techniques.
- 3) The Course will able to differentiate in between structure, size, shape, dynamics, polarity, and modes of interaction of biological molecules.
- 4) To get acquainted with Cytological and histological techniques.

| Units | Syllabus Content | Hours |
|--------------|--|--------------|
| 1 | 1.0 Light microscope and phase contrast microscope. 1.1 Electron microscope. 1.2 Microtechnique: Tissue fixation, Dehydration, clearing, embedding, Block-making, Trimming. 1.3 Microtome: Rotary. 1.4 Methods of staining and mounting. | 07 |
| 2 | 2.0 Basic operation of digital weighing balance. 2.1 Working of autoclave and Oven. 2.2 Handling of Pipettes and Micropipettes. 2.3 Hot Water Bath. 2.4. C.O.D. and B.O.D. Incubators. | 07 |
| 3 | 3.0 Density gradient centrifugation. 3.1 Unit gravity centrifugation. 3.2 Affinity adsorption. 3.3 Anchorage-based techniques | 08 |

| | | |
|---|---|----|
| 4 | 4.0 Paper and Thin Layer Chromatography. 4.1 Gas chromatography. 4.2 Ion exchange chromatography and its uses 4.3 Affinity chromatography and its uses. | 08 |
| 5 | 5.0 Cellulose acetate paper electrophoresis and its uses. 5.1 Separation of DNA by Agarose gel electrophoresis. 5.2 Separation of proteins by SDS-PAGE electrophoresis. 5.3 Capillary electrophoresis. | 08 |
| 6 | 6.0 Principle and uses of Colorimeter. 6.1 Spectrophotometer and its uses. 6.2 Fluorescence Spectrophotometer and its uses. 6.3 Atomic Absorption Spectroscopy and its uses. | 07 |

List of Practicals.

1. Preparation of fixatives - Alcohol, Acetone, Formalin, Bouin's fluid, Cornoy fluid.
2. Preparation of Alcoholic grades, dehydration and clearing of tissues.
3. Embedding and block making, trimming of block.
4. Honing and stropping Knives
5. Section cutting and spreading.
6. Preparation of various stains -Borax carmine Acetocarmin, Aceto-orcein, Haematoxyline, eosin.
7. Staining of the sections, (Double Staining), mounting.
8. Determine absorption spectrum of Haemoglobin.
9. Spectrophotometric determination of dyes (different color compound).
10. Separation of emulsion by simple centrifugation.
11. Sedimentation of red blood cell by centrifugation.
12. Paper chromatography of amino acids.
13. Thin layer chromatographic separation of sugars.
14. Separation of DNA mixture by agarose gel electrophoresis.

References:-

1. Molecular cell Biology, J. Darnell , H. Lodish & D. Baltimore , Scientific American Book , Inc. USA.

2. Molecular cell Biology of the cell , B Alberts , D Bray , J. Lewis , M. Raff , K. Roberts and J. D. Watson . Garland Publishing Inc. New York.
3. The cell a molecular approach: Cooper
4. Molecular cell biology: Gerald Karp
5. Animal Cell Culture – A practical approach, Ed. John R.W.Masters. IRL Press.
6. Introduction to instrumental analysis, Robert Braun. McGraw Hill International Editions.
7. A Biologists Guide to Principles and Techniques of Practical Biochemistry. K. Wilson & K.H. Goulding, ELBS Edn.
8. Foundation in microbiology : Talaro
9. Microbiology: Pelczar
10. Biology of micro- organisms : Madigan, Martinko and Parker.
11. Biophysical chemistry- Principles and technique: Upadhyay, Nath
12. Developing **Bioinformatics** Computer Skills: An Introduction to Software Tools for Biological Applications: Gibas, Cynthia, Jambeck, Per:
13. Introduction to Computational Biology : MAPS, Sequences and Genome : By Michael S.Waterman, Published by CRC Press; (June 1, 1995).
14. Data Analysis and Classification for Bioinformatics by A.Jagota, Published by Bioinformatics by the Bay Press; (August 1, 2000) ISBN0970029705.
15. Molecular Modelling and Simulation by Tamar Schlick, Published by Springer Verlag (August 19, 2002) ISBN : 038795404X.

Distribution of Practical Marks of part B:

External Marks

| | |
|--------------------------|-----------|
| 1 Major experiments..... | 15 |
| 2 Minor experiments..... | 10 |
| Total | :25 Marks |

Internal Marks

| | |
|------------------------------|----|
| 3. Class record..... | 10 |
| 4. Viva voce..... | 10 |
| 5. Student Performance ----- | 05 |

Total :25 Marks

| Course: Wildlife Conservation and Management | | |
|---|---|--------------------------------|
| Subject Code: 1ZOO4 (WCM) | No. of Credits: 3 | No. of hours per week: 3 |
| Exam duration: 3Hrs | Maximum Marks: 100 (External:70 Internal:30) | Total No. of contact hours: 45 |

COs 1ZOO4 (WCM)

1: Define and Explain Wildlife Conservation: Students will articulate the definition and significance of wildlife conservation, discussing its role in preserving biodiversity and ecological balance.

2: Examine Wildlife Management Techniques: Students will demonstrate the ability to apply wildlife management techniques, including assessing wildlife populations, habitat management, and the establishment of wildlife corridors.

3: Analyze Legal and Policy Frameworks: Students will analyze the legal and policy frameworks governing wildlife conservation, with an understanding of international conventions and the roles of governmental and non-governmental organizations.

4: Evaluate Human-Wildlife Interactions: Students will evaluate the interactions between humans and wildlife, identifying potential conflicts and proposing strategies for mitigation.

5: Design Sustainable Wildlife Tourism Practices: Students will design and justify sustainable wildlife tourism practices, considering economic benefits and ethical considerations.

6: Promote Conservation Awareness through Education: Students will design educational initiatives to raise conservation awareness, emphasizing responsible wildlife viewing practices and ethical wildlife management.

| Units | Syllabus Content | Hours |
|--------------|--|--------------|
| 1 | 1.0 Definition of wildlife conservation and its importance 1.1 History and evolution of wildlife conservation 1.2 Current challenges and threats to wildlife populations 1.3 Role of wildlife conservation in maintaining ecological balance | 7 |
| 2 | 2.0 Understanding biodiversity and its significance in wildlife conservation 2.1 Types of ecosystems and their roles in supporting wildlife habitats 2.2 Ecological relationships between species and their impact on wildlife populations 2.3 Conservation of keystone species and their influence on ecosystem health | 7 |
| 3 | 3.0 Habitat management and restoration 3.1 Population surveys & Monitoring, its Tools & Techniques 3.2 Translocation, reintroduction, Ex-situ & In-situ breeding 3.3 Wildlife Diseases and their Management | 8 |

| | | |
|---|--|---|
| 4 | 4.0 Protected areas and their significance in conservation 4.1 Relationship between wildlife conservation and tourism 4.2 Sustainable wildlife tourism and its economic benefits 4.3 Ethics in wildlife tourism | 8 |
| 5 | 5.0 Understanding human-wildlife interactions 5.1 Mitigation of conflicts between wildlife and human 5.2 Conservation by participation & Participatory platforms 5.3 Community-based conservation initiatives and their impact | 8 |
| 6 | 6.0 Overview of wildlife conservation laws and regulations 6.1 International conventions and treaties related to wildlife conservation. 6.2 Role of governmental and non-governmental organizations in wildlife conservation 6.3 Ethical considerations and challenges in wildlife management | 7 |

List of Practical

1. DNA Extraction from scat or any sample
2. Analysis of Wildlife Hair Sample
3. Project on Assessment of any one ecosystem and identifying Biotic & Abiotic components of the visited ecosystem and anthropogenic activities, threats.
4. Project on conflict resolution strategies on human-wildlife interactions based on case studies or self-experience.
5. Project on the natural resource survey of the area and identify and analyze threats to the environment and wildlife.
6. Case studies or presentations on successful examples of sustainable wildlife management initiatives.

REFERENCES

1. **"Wildlife Management in India"** by Rangarajan M.
2. **"Ecology and Wildlife Management"** by Kailash Chandra Bebarta
3. **Wildlife Conservation in India"** by Hemendra Singh Panwar

4. **"Wildlife Biodiversity Conservation: A Book of Abstracts"** by Chandrakasan Sivaperuman, C. Selvanayagam, and R. Raghunathan
5. **"Indian Forestry: A Breakthrough Approach to Forest Service"** by K. Manikandan and S. Prabhu
6. "Indian Wildlife Insights" by Ashok Kumar
7. **"Conservation at the Crossroads: Science, Society, and the Future of India's Wildlife"** edited by Ghazala Shahabuddin and K. Sivakumar
8. **"Conservation Biology: Foundations, Concepts, Applications"** by Fred Van Dyke
9. "The Diversity of Life" by Edward O. Wilson
10. **"Sustaining Life: How Human Health Depends on Biodiversity"** by Eric Chivian and Aaron Bernstein
11. **"Wildlife Ecology, Conservation, and Management"** by John M. Fryxell, Anthony R. E. Sinclair, and Graeme Caughley
12. **"Principles of Conservation Biology"** by Martha J. Groom, Gary K. Meffe, and C. Ronald Carroll
13. **"Introduction to Conservation Genetics"** by Richard Frankham, Jonathan D. Ballou, and David A. Briscoe
14. **"Wildlife Management and Conservation: Contemporary Principles and Practices"** by Paul R. Krausman and James W. Cain III
15. **"The Sixth Extinction: An Unnatural History"** by Elizabeth Kolbert
16. **"Saving the World's Wildlife: WWF's First Fifty Years"** by David Shepherd
17. **"Conservation Psychology: Understanding and Promoting Human Care for Nature"** by Susan Clayton and Gene Myers

DISTRIBUTION OF MARKS DSE-I (PART B)

EXTERNAL

| | |
|---|----|
| 1. DNA Extraction from scat or any sample/Analysis of Wildlife Hair Sample----- | 10 |
| 2. Project (case studies) report as per syllabus----- | 10 |
| 3. Viva-voce----- | 05 |
| <hr/> | |
| TOTAL | 25 |

INTERNAL

| | |
|---|----|
| 1. Survey/Field Visit----- | 15 |
| 2. Presentation on successful examples of sustainable wildlife----- management initiatives | 10 |
| <hr/> | |
| TOTAL | 25 |

SANT GADGE BABA AMRAVATI UNIVERSITY, AMRAVATI

Name of the Programme: M.Sc. (Sem-II) Subject: Zoology (NEPv23)

| Course: Structure and Functions of Vertebrates | | |
|---|---|-----------------------------------|
| Subject Code: 2 ZOO 1 | No. of Credits: 4 | No. of hours per week: 4 |
| Exam duration: 3Hrs | Maximum Marks: 100 (External:70 Internal:30) | Total No. of contact hours: 60 |

COs: 2ZOO1

Upon completion of this course successfully, students would be able to -----

1. Describe merits and demerits of different types of taxonomic keys.
2. Differentiate between binomial and trinomial nomenclature.
3. Describe rules of International Code of Zoological Nomenclature (ICZN).
4. Identify various derivatives of integument in vertebrates.
5. Describe characteristic features of Agnatha.
6. Differentiate between different types of kidneys.
7. Justify position of protochordates among chordates

| Unit | Contents | Hours |
|-------------|---|--------------|
| Unit-I | 1.0 Types of Taxonomic keys, their merits and demerits. 1.1 Binomial and trinomial nomenclature 1.2 Principles and application of important rules of International Code of Zoological Nomenclature (ICZN) 1.3 Origin and classification of chordates | 10 |
| Unit-II | 2.0 Characters, classification and evolutionary significance of Protochordata 2.1 Characteristic features of Agnatha and development of Ammocoete larva 2.2 General characters and affinities of Dipnoi 2.3 Structure of integument in different classes of vertebrates, derivatives of integument: Glands, scales, horns, feathers, claws and hairs | 10 |
| Unit-III | 3.0 Comparative account of Jaw suspension in vertebrates 3.1 Comparative account of girdle and limbs 3.2 Structure of tooth and dentition in Mammalia 3.3 Anatomy of gut in relation to feeding habits-herbivores, carnivores and omnivores | 10 |

| | | |
|---------|--|----|
| Unit IV | 4.0 Evolution of heart in vertebrates 4.1 Evolution of aortic arches and portal systems 4.2 Respiratory organs in fishes and amphibians 4.3 Air sacs in birds | 10 |
| Unit V | 5.0 Comparative anatomy of brain in relation to its function 5.1 Nerves: Cranial, peripheral and autonomous nervous system 5.2 Sense organs, simple receptors, organs of olfaction and taste, lateral line system and electric organs 5.3 Evolution of urinogenital system in vertebrates | 10 |
| Unit VI | 6.0 Origin of paired fins 6.1 Origin of Birds, Migration in Birds 6.2 Cetacea: General characters and adaptations 6.3 Evolution of Man: Primate ancestors of man from Oligocene, Miocene, Pliocene epochs. Pleistocene hominids. | 10 |

List of Practical:

1. Anatomy of Any Two Systems by demonstration and labelling with available resources like C.D./chart/ models/ Video clippings/ PPT/ Preserved dissected specimens etc. from a major carp fish / Rat / mouse / rabbit or similar available chordate animals (**Any one animal**)

2. Study of stained permanent slides by ICT based sources: Mammalian Histology:

Skin, bone, regions of alimentary canal, digestive glands, lung, kidney. gonads

Protochordates: Salpa (Whole mount); Doliolum (Whole mount); Amphioxus (Whole mount), Oral hood of Amphioxus, Pharynx of Amphioxus,

Fishes: Ampulla of Lorenzini, Types of scales

Amphibia: Ciliated epithelium, Striated muscles, Unstriated muscles,

Aves: Pecten of Pigeon,

Mammals: Blood Smear

3. Photographic collection and Comments on campus / local faunal diversity with reference to their ecology.

- a. Any 05 local Freshwater fish species with fin formulae
- b. Any three snake species
- d. Any three migratory birds

4. Preparation of Slides

- a. Hair impressions of cat, dog, rabbit, buffalo, human beings etc.
- b. Mounting of fish scales

5. Museum Study:-

Taxonomy of animal specimens / charts / photographs / models / video clipping available in the laboratory representing major orders of Protochordata and Chordata, other than studied during previous courses.

DISTRIBUTION OF MARKS DURING PRACTICAL EXAMINATION

EXTERNAL MARKS

| | |
|--|----------|
| 1. Anatomical labelling | 4 Marks |
| 2. Experiment from Section 4 | 4 Marks |
| 3. Identify given Spots 3 slides & 3 specimens | 12 Marks |
| 4. Viva-voce | 5 Marks |
| Total:- | |
| | 25 marks |

INTERNAL MARKS

| | |
|---|----------|
| 1. Certified Class Record | 10 Marks |
| 2. Student Performance | 05 Marks |
| 3. Submission of Permanent slides/Photographic collection | 10 Marks |
| Total:- | |
| | 25 marks |

REFERENCES:

1. Carter, G.S. Structure and habit in vertebrate evolution-Sedgwick and Jackson, London.
2. Eccles, J.C. The understanding of the brain. Mc Graw Hill co., New York and London.
3. Kingsley, J.S. Outlines of Comparative Anatomy of Vertebrates. Central Book Depot, Allahabad.
4. Kent, C.G. Comparative Anatomy of Vertebrates.
5. Malcom Jollie, Chordata morphology. East-West Press Pvt. Ltd. New Delhi.
6. Milton Hilderbrand. Analysis of vertebrate structure. IV Ed. John Wiley and Sons Inc., New York.
7. Monielli, A.R. The chordates, Cambridge University Press, London.
8. Smith, H.S. Evolution of chordata structure. Hold rinehart and Winstoin Inc., New York.
9. Sedgwick, a.A. Students Text Book of Zoology, Vol.II.
10. Tansley, K. Vision in vertebrate. Chapman and Hall Ltd., London.

11. Torrey, T.W. Morphogenesis of vertebrates. John Wiley and Sons Inc., New York and London.
12. Walters, H.E. and Sayles, L.D. Biology of vertebrates. MacMillan & Co., New York.
13. Wolstenholme, E.W. and Knight, J. (Ed). Taste and smell invertebrates, J&A Churchill, London.
14. Romer, A.S., Vertebrate Body, IIIrd Ed. W.B. Saunders Co., Philadelphia.
15. Young, J.Z. Life of vertebrates. The Oxford University Press, London.
16. Young, J.Z. Life of mammals, Oxford University Press, London.
17. Colbert, E.H. Evolution of the vertebrates, John Wiley and Sons Inc., New York.
18. Romer, A.S. Vertebrate Paleontology, 3rd Edn. University of Chicago Press, Chicago.
19. Clark, W.E. History of the Primates IV Edn. University of Chicago Press, Chicago.
20. Weichert, C.K. and Presch, W. Elements of chordate anatomy, 4th Edn. McGraw Hill Book Co, New York.
21. Messers, H.M. An introduction of vertebrates anatomy
22. Montagna, W. Comparative anatomy. Hohn. Wiley and Sons Inc.
23. de Deer, S.G. Embryos and Ancestors. Clarendon Press, Oxford.
24. Andrews, S.M. Problems in vertebrate evolution. Academic Press, New York.
25. Waterman. A.J. chordata structure and function. Macmillan Co., New York.
26. Bhamrah and Juneja, Chordate Zoology, Anmol Publishers, N. Delhi Bhamarah and Juneja, Invertebrate Zoology, Anmol Publishers, N. Delhi.
27. Barbiur, T. Reptiles and Amphibians: Their habits and adaptations. Hongton Miffin Co., New York.
28. Kingsley Noble, G. The biology of the Amphibia. Dover Publications, New York.
29. Smyth. Amphibia and their ways. The McMillan Co., New York.
30. Andrevos, S.M., Miles, R..S. and Walker, A.D. Problems in invertebrate evolution. Academic Press, New York.
31. Boolotian and Stiles: College Zoology (Macmillan)
32. Campbell: Biology (Benjamin)
33. Marshall and Williams: Text Book of Zoology
34. Wolfe: Biology the Foundations (Wadsworth)
35. Wilson. Biodiversity, Academic Press, Washington.
36. G.G. Simpson. Principle of animal taxonomy, Oxford IBH Publishing Company
37. E. Mayer. Elements of Taxonomy.
38. E.O. Wilson. The Diversity of Life (The College Edition), W.W. Northern & Co.
39. Tripathi, R.S. Biosystematics and taxonomy
40. Hildebrand, M. (1995). Analysis of Vertebrate Structure. John Wiley & Sons.
41. Kardong, K. V. (2002). Vertebrates: Comparative anatomy, function evolution. Tata McGraw Hill.
42. Kent, G. C. & Carr, R. K. (2001). Comparative anatomy of the Vertebrates. 9th ed. McGraw Hill.
43. Hickman, C.P., Roberts, L.S., Larson, A., I'Anson, H., Eisenhour, D.J. (2006) Integrated Principles of Zoology, 13th Ed. McGraw Hill
44. Kardong, K. (2006). Vertebrates: comparative anatomy, function, evolution, 6th edition. McGraw Hill Publications
45. Kotpal, R. L. (2018). Modern Textbook of Zoology (11th Edition). Rastogi Publications

Weblink to Equivalent MOOC on SWAYAM if relevant:

• <https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=2rAs1Puvga4LW93zMe83aA>

•Weblink to Equivalent Virtual Lab if relevant:

•<https://www.youtube.com/watch?v=PfWVMq4RDNw>•<https://www.youtube.com/watch?v=cCWHeq8H4TY>•<https://youtu.be/uK6TAPBaBq0>•<https://www.youtube.com/watch?v=B4lyIDOXH3A>

| | | |
|---|---|-----------------------------------|
| Course: - MOLECULAR CELL BIOLOGY | | |
| Subject Code: 2ZOO2 | No. of Credits: 4 | No. of hours per week: 4 |
| Exam duration: 3Hrs | Maximum Marks: 100 (External:70 Internal:30) | Total No. of contact hours: 60 |

COs: 2ZOO2

1. At the end of the course, the student has a strong foundation on the functions of the cell.
2. This course imparts students the knowledge about how cell to cell communication occurs to carry out different functions of the cell.
3. The course will help to understand the basic principles of signal transduction mechanisms, in particular the concepts of response specificity, signal amplitude and duration, signal integration and intracellular location
4. It will help the students to provide knowledge about cytoskeleton of the cells and how it gives strength, shape and motility to the cell.
5. Have an overview of the different intracellular transport pathways in the eukaryotic cell, and understand how proteins and lipids affect these processes.

| Units | Syllabus Content | Hours |
|-------|---|-------|
| 1 | 1.0 Biochemical composition of biomembranes. 1.1 Transport across cell membrane and Transporters. 1.2 Transport across epithelia 1.3 Basement membrane(basal lamina): structural and cross-linking components. 1.4 Collagens & other proteins of extracellular matrix. 1.5 Cell-cell adhesion and Cell-matrix adhesion. 1.6 Gap junctions and connexins. | 10 |
| 2 | 2.0 Modes of cell signaling (autocrine, juxtacrine, paracrine and endocrine). 2.1 Signaling molecules. 2.2 G protein-coupled receptors that activate or inhibit adenylyl cyclase. 2.3 G protein-coupled receptors that regulate ion channels. 2.4 G protein-coupled receptors that activate phospholipase C. 2.5 Receptor protein-tyrosine kinases , Receptor protein-tyrosine phosphatases. 2.6 Receptor protein-guanylyl cyclases and Cytokine receptors. 2.7 Receptor blockers. | 10 |
| 3 | 3.0 Second messengers. 3.1 Ion channels and electrical signaling. 3.2 Signal transduction by G protein-coupled receptors. 3.3 Signal transduction by receptor enzymes. 3.4 JAK-STAT pathway , Smad pathway, Wnt pathway, and hedgehog pathway. 3.5 Signal transduction in vision, gustation and olfaction. | 10 |
| 4 | 4.0 Phases of eukaryotic cell cycle. 4.1 Cyclins & cyclin-dependent kinases (CDKs). 4.2 DNA replication block & its removal. 4.3 Cell cycle checkpoints. 4.4 Regulation of CDK-Cyclin activity. 4.5 Programmed cell death (Apoptosis): Mechanism (intrinsic and extrinsic) & significance. | 10 |

| | | |
|---|---|----|
| 5 | 5.0 Structure of microfilaments. 5.1 Dynamics and functions of microfilaments. 5.2 Microfilament membrane-binding proteins & their functions. 5.3 Structure, dynamics and functions of microtubules. 5.4 Structure and functions of intermediate filaments | 10 |
| 6 | 6.0 Protein synthesis in eukaryotes 6.1 Protein uptake into ER. 6.2 Co- & Post-translational modifications of proteins in ER. 6.3 Protein sorting in Golgi apparatus. 6.4 Vesicle formation and fusion. 6.5 Transport of proteins across nuclear membrane. | 10 |

List of Practicals

1. Determination of molecular weights of proteins by SDS-PAGE
2. Light microscopic demonstration of Plasma membrane. (Oil red O, Sudan black B)
3. Demonstration of mitochondria by vital staining.
4. Histochemical demonstration of extracellular matrix. (glycoproteins-Alcian blue pH 12.5, PAS)
5. Histochemical demonstration of Lysosomes by demonstrating acid phosphatase activity.
6. Histochemical demonstration of DNA & RNA by Feulgen & MGPY technique. (Source of tissue: Animal wastes from local recognized slaughter houses/ poultry farms/ fish markets etc.)
- 7 Study of bone marrow cells.
8. Culturing of protozoans (Paramecium, Amoeba and Volvox)

References:-

1. Molecular cell Biology, J. Darnell , H. Lodish & D. Baltimore , Scientific American Book , Inc. USA.
2. Molecular cell Biology of the cell , B Alberts , D Bray , J. Lewis , M. Raff , K. Roberts and J. D. Watson . Garland Publishing Inc. New York.
3. The cell a molecular approach: Cooper
4. Molecular cell biology: Gerald Karp
5. Animal Cell Culture – A practical approach, Ed. John R.W. Masters. IRL Press.

6. Introduction to instrumental analysis, Robert Braun. McGraw Hill International Editions
- 7.A Biologists Guide to Principles and Techniques of Practical Biochemistry. K. Wilson & K.H. Goulding, ELBS Edn.
8. Foundation in microbiology : Talaro
9. Microbiology: Pelczar
10. De Robertis- E. D. P., - Cell and Molecular Biology , I. S. E. publication.
- 11.Turner P. C. and Mc Lennan - Molecular Biology ; Viva Books Pvt. Ltd.
12. Benjamin Lewis - Gene VIII , Oxford press.
- 13.Watson J. D. - Molecular biology of Gene ., Benjamin publication.
- 14.Darnell J. - Molecular cell Biology ; Scientific American Books USA.
15. Alberts B., Bray D. Lewis J.- Molecular Biology of the Cell , garland publishing Inc.

DISTRIBUTION OF MARKS DURING PRACTICAL EXAMINATION

EXTERNAL MARKS

| | |
|--------------------------|----------|
| 1. Major Experiment | 12 Marks |
| 2. Minor Experiment from | 08 Marks |
| 3. Viva-voce | 5 Marks |
| Total:- | |
| | 25 marks |

INTERNAL MARKS

| | |
|-----------------------------------|----------|
| 4. Certified Class Record | 10 Marks |
| 5. Student Performance | 05 Marks |
| 6. Submission of Permanent slides | 10 Marks |
| Total:- | |
| | 25 marks |

| Course: Ecology and Environment | | |
|--|---|-----------------------------------|
| Subject Code: 2ZO03 | No. of Credits: 3 | No. of hours per week: 3 |
| Exam duration: 3Hrs | Maximum Marks: 100 (External:70 Internal:30) | Total No. of contact hours: 45 |

Cos: 2ZO03

After completion of the Environment and Ecology course the students from different and or biology background, the students will be able to :

1. Understand the concepts and principles of ecology.
2. Understand the structural and functional aspects of biodiversity and the need for its conservation.
3. Be aware of the suitable use of field techniques, data collection, mapping, analysis and interpretation.
4. Be able to take up interdisciplinary research and teaching in ecology and environment.
5. Making the people and the society aware towards better understandings of the environmental ethics, issues and challenges before the vast growing population of the state and the country as well.

| Units | Syllabus Content | Hours |
|--------------|--|--------------|
| 1 | 1.0 Structure of Ecosystems- Abiotic and Biotic components. 1.1 Types of Ecosystems: Terrestrial ecosystem, fresh water ecosystem. (Lentic and lotic) 1.2 Marine ecosystem. 1.3 Ecological pyramids: - Types, limitations and importance. 1.4 Cycling of materials; water, carbon, nitrogen and phosphorus. 1.5 Food chain and food web in different ecosystem. | 07 |
| 2 | 2.0 Ecological niche. 2.1 Biodiversity Conservation Strategies and Conservation Tool (In-situ and Ex-situ Methods of Conservation). 2.2 IUCN, IUCN Red Lists. 2.3 Major Sanctuaries, National Parks, Tiger Reserves in India and Maharashtra. | 07 |

| | | |
|---|--|----|
| | <p>2.4 State Wildlife Board: Functions and Working.</p> <p>2.5 Biodiversity hot spots in India.</p> | |
| 3 | <p>3.0 Interspecific interactions; Commensalism, mutualism, competition and predation.</p> <p>3.1 Intraspecific interactions and density dependence.</p> <p>3.2 Ecological succession (Hydrosere, Xerosere and Lithosere).</p> <p>3.3 Invasive species and control.</p> <p>3.4 Types Extinction of Species (Natural, Mass, Anthropogenic)</p> <p>3.5 Consequences of Extinction of Species</p> | 08 |
| 4 | <p>4.0 Air pollution: Sources and harmful effects.</p> <p>4.1 Water pollution: Sources and harmful effects</p> <p>4.2 Land pollution: Sources and harmful effects</p> <p>4.3 Alterations of ecosystem function: acid rain, nuclear winter.</p> <p>4.4 Global warming and ozone hole.</p> <p>4.5 Effects of Mining on Environment.</p> | 08 |
| 5 | <p>5.0 Salient feature of Waste management.</p> <p>5.1 E-Waste management.</p> <p>5.2 Bio-medical waste management.</p> <p>5.3 Maharashtra State Pollution Control Board-Working and Functions.</p> <p>5.4 Hazardous and Other Wastes (Management & Trans boundary Movement) Rules, 2016.</p> <p>5.5 Biosafety programs.</p> | 08 |
| 6 | <p>6.0 Impact of Agriculture on Environment.</p> <p>6.1 Sustainable Agriculture: Rain water harvesting.</p> <p>6.2 Eco-tourism – Advantages & Disadvantages of Eco-tourism</p> <p>6.3 Man-Animal Conflicts in India.</p> <p>6.4 Poaching activities in India.</p> <p>6.5 International treaties for wildlife conservation</p> | 07 |

List of Practicals :-

- 1) Water quality analysis: B.O.D., C.O.D. and Hardness.
- 2) Collection of fauna from wetland and diversity analysis.
- 3) Photographic collection and preparation of checklist of birds from local wetland.
- 4) Analysis of waste water for heavy metals.
- 5) Visit to local polluted site, observations and remedial measures.
- 6) Construction of Food chain/food web of the visited area.
- 7) To identify the sources of air/water/soil/noise pollution of your area.
- 8) Prepare a chart of biodegradable and non biodegradable pollutants generated in your locality.
- 9) Identification of important food plants of mammals in a given area.
- 10) Study of strategy for preventing and managing human-wildlife conflicts.
- 11) To prepare a checklist of invasive species.
- 12) To study the Zooplankton communities in a fresh water ecosystem.

References:-

1. Smith, T.M. and Smith R.L. 2022. Elements of Ecology, Pearson Education, India.
2. Cain, ML, Bowman, WD and Hacker SD 2022. Ecology, 2nd Edition, Sinauer Associates Inc.
3. Odum, E. P. (2010). Fundamentals of Ecology, Oxford and IBH Publishing Co. Pvt. Ltd.
4. Environmental Impact Assessment- G.N.Vankhede Biotech Publishers, Delhi
5. Ecology and Biogeography of India- Mani, M.S. : 1974. Junk. Publ. The Hague.
6. Singh, J.S., S.P and Gupta, S.R. 2022. Ecology, Environment and Resource Conservation, Anamaya Publ., New Delhi.
7. Miller. G.T. 2004. Environmental Science. Thomson, California.
8. Chapman, J.L.and M.J. Reiss. 2019. Ecology: Principles and Applications. Cambridge Univ. Press.
9. Krebs, C.J. 2008. Ecology: The experimental Analysis of Distribution and Abundance (6th Edition), Benjamin Cummings Publ.
10. Toxicology - A Sood , Sarup and Sons, New Delhi.
- 11 Environmental biodegradation, Ramkumar, Sarup and Sons , New Delhi.
12. Toxicology by Parikh.
13. Poisoning by Drugs and Chemicals – Cooper.
- 14 Environmental Management of Toxic and Hazardous Chemical – Madhuraj.
- 15 Environmental Biology - J. L. Blish.
16. Environmental Physiology - Philips G.
17. Toxicology Mechanism and Analytical Methods - Stewarts and Stratman.
18. Ecology and Biodiversity By P.C.Joshi;Today's and Tomorrow's Publishers and Printers, Ansari Road New Delhi.

DISTRIBUTION OF MARKS DURING PRACTICAL EXAMINATION**EXTERNAL MARKS**

| | |
|--------------------------|----------|
| 1. Major Experiment | 12 Marks |
| 2. Minor Experiment from | 08 Marks |
| 3. Viva-voce | 5 Marks |
| <hr/> | |
| Total:- | 25 marks |

INTERNAL MARKS

| | |
|---|----------|
| 1. Certified Class Record | 10 Marks |
| 2. Student Performance | 05 Marks |
| 3. Submission of Check list of invasive species | 10 Marks |
| <hr/> | |
| Total:- | 25 marks |

| Course: Advanced Tools and Techniques | | |
|--|---|-----------------------------------|
| Subject Code: 2ZOO4 (ATB) | No. of Credits: 3 | No. of hours per week: 3 |
| Exam duration: 3Hrs | Maximum Marks: 100 (External:70 Internal:30) | Total No. of contact hours: 45 |

COs : 2ZOO4

1. Here students are taught to deal with different tools and techniques applicable in biological
2. research including various types of microscopes, spectrophotometer and bioinformatics software. etc.
3. The theory session mainly focuses on understanding the principles and working mechanisms of different instruments.
4. Learning of Principle and applications of different radioactive material.
5. Learning phylogeny construction by using bioinformatics software.
6. Develop skills of advanced instrumentation.

| Units | Syllabus Content | Hours |
|--------------|---|--------------|
| 1 | 1.0 Scanning electron microscopy. 1.1 Transmission electron microscopy. 1.2 Atomic Force microscopy. 1.3 Chemical analyzer and its uses. | 07 |
| 2 | 2.0 Radioisotope and their biological applications 2.1 Sample preparation for radioactive counting of biological samples. 2.2 Metabolic labeling 2.3 Autoradiography. 2.4 Liquid scintillation. | 07 |
| 3 | 3.0 ESR. 3.1 NMR spectrometers. 3.2 Flame photometer. 3.3 Plasma emission spectroscopy. 3.4 Principle and uses of X- ray crystallography | 08 |

| | | |
|---|--|----|
| 4 | 4.0 Basic concepts of bioinformatics: Scope and application. 4.1 Sequence databases: GeneBank, EMBL Nucleotide sequence databank, DNA Data Bank of Japan (DDBJ). 4.2 Sequence alignment: Local and global sequence alignment, Homology algorithms (BLAST, FASTA). 4.3 Methods of phylogenetic tree construction: UPGMA, Neighbor joining. 4.4 Maximum parsimony, Maximum likelihood methods. | 08 |
| 5 | 5.0 RIA and its uses. 5.1 ELISA and its types. 5.2 PCR (thermal cycler) 5.3 Gel documentation and its uses. | 08 |
| 6 | 6.0 Documentation for Instrumentation systems and procurement procedures. 6.1 Design of typical research laboratory. 6.2 Methods of sterilization. 6.3 Bio-safety measurement and IPR's. | 07 |

List of Practicals

1. Detection of Na⁺ and K⁺ by Chemical analyzer.
2. Detection of serum Bilirubin by Chemical analyzer.
3. Sub cellular fractionation of chicken liver.
4. Amplification of any gene by using PCR (thermal cycler).
5. Understanding PubMed database.
6. Multiple sequence alignment by using ClustalW.
7. Perform a BLAST of given protein / nucleic acid sequence and interpretation of the results.
8. Construction of phylogenetic tree using bioinformatics software.
9. Perform a primer designing by using bioinformatics tools.
10. Detection of target protein by using antibodies:ELISA method

REFERENCES

1. Braun,R.(1988)Introduction to instrumental analysis, J. Chem. Educ., 65 (12), pp A336.
2. Boyer, R.F. (1993) Modern Experimental Biochemistry, 2nd edition, BenjaminCummings.
3. Clark, J.M. and Swizer R.L. (2000) Experimental Biochemistry, 3rd edition, W.H. Freeman & Co Ltd.
4. Cooper, G.M. (1997) The Cell-A Molecular Approach. ASM press.
5. Freifelder, D.M. (1982) Physical Biochemistry, W.H. Freeman and Co.
6. Masters, J. R.W. (2000) Animal Cell culture- A practical approach. 3 edition, OUP Oxford.
7. Locquin, M. and Langeron M. (1983) Handbook of Microscopy, Butterwaths – Heinemann.

8. Wilson, K. and Goulding K.H.(1986) A biologist Guide to principles and Techniques of Practical Biochemistry London.
9. Wilson ,K.and Walker J.(2000) Practical Biochemistry, 5th edition, Cambridge University Press.
10. Foundations of Bioinformatics and Systems Biology by University of Michigan
11. Structural Bioinformatics by Graham Kemp and Per-Georg Nyholm

DISTRIBUTION OF MARKS DURING PRACTICAL EXAMINATION

EXTERNAL MARKS

| | |
|--------------------------|----------|
| 1. Major Experiment | 12 Marks |
| 2. Minor Experiment from | 08 Marks |
| 3. Viva-voce | 05 Marks |
| | |
| Total:- | 25 marks |

INTERNAL MARKS

| | |
|--|----------|
| 1. Certified Class Record | 10 Marks |
| 2. Student Performance | 05 Marks |
| 3. Submission of Phylogenetic tree by using software | 10 Marks |
| | |
| Total:- | 25 marks |

| Course: Advance Wildlife Conservation and Management | | |
|---|---|-----------------------------------|
| Subject Code: 2ZOO4 (WCM) | No. of Credits: 3 | No. of hours per week: 3 |
| Exam duration: 3Hrs | Maximum Marks: 100 (External:70 Internal:30) | Total No. of contact hours: 45 |

COs: 2ZOO4

- 1.Understand the significance of ecosystem services and biodiversity in wildlife conservation, recognizing their importance in supporting human well-being and ecosystem health.
- 2.Analyze the role of biodiversity in ecosystem functions and comprehend the potential threats posed to wildlife and habitats.
- 3.Describe the principles of wildlife ecology and population dynamics, including factors influencing wildlife populations and their growth.
- 4.Recognize migratory patterns and behavioural adaptations in wildlife and understand their ecological significance
- 5.Apply the core principles of conservation biology to design effective strategies for wildlife protection.
- 6.Explore conservation approaches outside protected areas, considering community-based conservation and conservation breeding for endangered species.
- 7.Demonstrate the ability to engage local communities as partners in wildlife conservation, understanding their perspectives and involving them in decision-making processes.

8. Facilitate stakeholder dialogue and conflict resolution to address human-wildlife conflicts and promote coexistence.

| Units | Syllabus Content | Hours |
|--------------|---|--------------|
| 1 | 1.0 Biodiversity assessment techniques: Surveys, camera traps, remote sensing, and DNA analysis. 1.1 Population monitoring: Methods for estimating population sizes, density, and trends. 1.2 Species identification: Field identification skills and use of field guides and taxonomic keys. 1.3 Gene flow and connectivity: Assessing gene flow and understanding its significance in maintaining population connectivity. | 7 |
| 2 | 2.0 Protected Areas and Landscape Conservation 2.1 Wildlife Corridors and connectivity 2.2 Ecological Impacts of Corridors 2.3 Human-Wildlife Conflict and Corridor Management | 7 |
| 3 | 3.0 Conservation genetics: Genetic diversity, genetic bottlenecks, and their implications for conservation. 3.1 Metapopulation dynamics: Understanding the dynamics of fragmented populations and connectivity. 3.2 Wildlife translocation and reintroduction: Principles and techniques for relocating and reintroducing species. 3.3 Population viability analysis: Evaluating the long-term survival prospects of wildlife populations. | 8 |
| 4 | 4.0 Habitat assessment: Identifying critical habitats, mapping, and prioritizing areas for conservation. 4.1 Habitat restoration techniques: Reforestation and wetland restoration 4.2 Ecosystem services: Understanding the ecological services provided by different habitats. 4.3 Human-wildlife conflict management: Techniques to reduce conflicts and promote coexistence. | 8 |

| | | |
|---|--|---|
| 5 | <p>5.0 eDNA analysis: Exploring the use of environmental DNA (eDNA) to detect the presence of species in their habitats.</p> <p>5.1 Molecular tools in conservation genetics: Introduction to DNA barcoding, microsatellite analysis, and next-generation sequencing in wildlife conservation.</p> <p>5.2 AI and machine learning: Applications of artificial intelligence and machine learning in wildlife monitoring and data analysis.</p> <p>5.3 Application of drones, acoustic monitoring, and geospatial analysis in wildlife conservation.</p> | 8 |
| 6 | <p>6.0 Principles of Sustainable Wildlife Management</p> <p>6.1 Conservation and Sustainable Development</p> <p>6.2 Climate Change and Wildlife Conservation</p> <p>6.3 Emerging Challenges and Future Prospects</p> | 7 |

List of Practicals

A. DNA extraction and analysis for species identification and genetic studies

1. DNA Extraction
2. PCR
3. Gel electrophoresis, for species identification and genetic studies.
4. eDNA Sampling

B. Survey and Field studies

1. Biodiversity surveys in local natural areas, using transects to record animal species diversity.
2. Organize a camera trapping exercise to capture images of wildlife in a specific area, and then use the data to estimate species abundance and activity patterns.
3. Remote Sensing and Habitat Mapping:
4. Conduct a field-based habitat assessment to identify critical habitats and prioritize areas for conservation based on ecological significance.
5. Survey on habitat restoration project, such as reforestation or wetland restoration, to enhance ecosystem functionality and biodiversity.
6. Study and quantify the various ecosystem services provided by a specific habitat or ecosystem, such as carbon sequestration or water purification.
7. GIS tools to Understand wildlife corridors and connectivity

C. Review research and presentation on emerging challenges, such as invasive species or emerging diseases, and potential solutions for future wildlife conservation efforts.

D. Scientific projects and report writing on wildlife conservation

REFERENCES

1. "Methods for Monitoring Terrestrial Animals, Habitats, and Ecological Processes" by William J. Sutherland
2. "Camera Trapping for Wildlife Research" by Francesco Rovero and Fridolin Zimmermann
3. "Remote Sensing and GIS for Ecologists: Using Open Source Software" by Martin Wegmann, Benjamin Leutner, and Stefan Dech
4. "DNA Barcoding in Marine Perspectives: Assessment and Conservation of Biodiversity" by Azhaguraj Radhakrishnan, Jennifer D. Dailianis, and Tomoo Sawabe
5. "Introduction to Conservation Genetics" by Richard Frankham, Jonathan D. Ballou, and David A. Briscoe
6. "Metapopulations and Wildlife Conservation" by Dale R. McCullough
7. "Reintroduction of Fish and Wildlife Populations" by David S. Jachowski, Joshua J. Millspaugh, Paul L. Angermeier, and Rob Slotow
8. "Quantitative Conservation Biology" by R. A. Mittermeier, C. G. Mittermeier, G. A. B. da Fonseca, A. B. Rylands, and K. E. Brandon
9. "Ecological Restoration: Principles, Values, and Structure of an Emerging Profession" by Andre F. Clewell and James Aronson
10. "The Economics of Ecosystems and Biodiversity: Ecological and Economic Foundations" by Pushpam Kumar
11. "Resolving Human-Wildlife Conflicts: The Science of Wildlife Damage Management" by Michael Conover
12. "Climate Change and Biodiversity" by Thomas E. Lovejoy and Lee Hannah
13. "Wildlife Corridors and Connectivity in the United States" by Jodi A. Hilty, William Z. Lidicker Jr., and Adina M. Merenlender
14. "Wildlife Conservation in a Changing Climate" by J. Ashander and S. Rahbek
15. "Environmental DNA: For Biodiversity Research and Monitoring" by Pierre Taberlet, Aurélie Bonin, and Lucie Zinger
16. "Artificial Intelligence for Wildlife Conservation" by Mahendra S. Baag, Mamta Baag, and Rashmi Sharma

17. "Sustainable Wildlife Management" by Claudio Sillero-Zubiri and Mike Hoffmann
18. "Sustaining Life on Earth: Environmental and Human Health through Global Governance" by Eric Chivian, Aaron Bernstein, and Sangwon Suh

DISTRIBUTION OF MARKS DSE-II (PART B)

EXTERNAL

| | |
|---|----|
| 1. Practical from Section A ----- | 10 |
| 2. Project (case studies) report as per syllabus----- | 10 |
| 3. Viva-voce----- | 05 |
| <hr/> | |
| TOTAL | 25 |

INTERNAL

| | |
|--|----|
| 1. Survey/Field Visit----- | 15 |
| 2. Scientific Project and Report writing ----- | 10 |
| <hr/> | |
| TOTAL | 25 |

