

Punyashlok Ahilyadevi Holkar Solapur University, Solapur



Name of the Faculty: Science & Technology

(As per New Education Policy 2020)

Syllabus: Zoology

Name of the Course: M.Sc. I (Sem. I & II)

(Syllabus to be implemented from June 2024)



Punyashlok Ahilyadevi Holkar Solapur University, Solapur
Faculty of Science & Technology
Nep 2020 Compliant Curriculum

M.Sc. (Zoology)
Program Preamble

The Master of Science (M.Sc.) in Zoology is a comprehensive and dynamic program designed to provide students with a deep understanding of the fundamental principles of Zoology, along with the practical skills required to apply this knowledge in various scientific and technological contexts. Aligned with the vision of the National Education Policy (NEP) 2020, the program offers a flexible, multidisciplinary, and learner-centric curriculum that encourages critical thinking, innovation, and holistic development. The M.Sc. Zoology program spans four years, with each year offering a progressively advanced curriculum designed to build a strong foundation in Zoology while allowing for specialization and interdisciplinary learning. The curriculum is structured around several key components:

- 1. Major Courses:** These core courses form the backbone of the program, providing in-depth knowledge and understanding of essential Zoology concepts, theories, and methodologies. Students will engage with topics ranging from classical mechanics, electromagnetism, and thermodynamics to quantum Zoology, relativity, and modern Zoology, ensuring a robust and comprehensive education in the discipline.
- 2. Minor Courses:** Students have the opportunity to choose minor courses from related or distinct disciplines, promoting an interdisciplinary approach to learning. This flexibility allows students to complement their Zoology education with insights from fields such as mathematics, computer science, or engineering, enhancing their versatility and broadening their career prospects.
- 3. Open Electives/General Electives:** The program encourages intellectual exploration beyond the core discipline by offering a wide range of elective courses. These electives enable students to pursue their interests in diverse subjects, fostering creativity, critical thinking, and a well-rounded educational experience.
- 4. Vocational and Skill Enhancement Courses:** Practical skills and technical proficiency are integral to the program, with vocational and skill enhancement courses providing hands-on experience in areas such as computational Zoology, electronics, and instrumentation. These courses are designed to prepare students for immediate employment and equip them with the tools necessary for career advancement in various scientific and technological fields.
- 5. Ability Enhancement Courses (AEC), Indian Knowledge System (IKS), and Value Education Courses (VEC):** In alignment with NEP 2020, the program integrates courses that emphasize the Indian Knowledge System, ethical values, and life skills. These courses foster a deep appreciation for India's rich cultural heritage, while also developing essential communication and ethical decision-making skills that are vital for personal and professional growth.
- 6. Field Projects/Internships/Apprenticeships/Community Engagement Projects/On-Job Training:** To bridge the gap between theoretical knowledge and real-world applications, the program includes opportunities for field projects, internships, apprenticeships, and community engagement. These experiences provide students with practical insights, problem-solving abilities, and exposure to professional environments, enhancing their readiness for careers in Zoology and related fields.
- 7. Research Methodology and Research Projects:** Research is a critical component of the M.Sc. Zoology program, with students acquiring skills in research methodology, data collection, analysis, and scientific inquiry. By engaging in independent research projects, students are encouraged to develop innovative solutions to complex scientific problems, preparing them for advanced studies and research-oriented careers.

Multiple Entry and Multiple Exit Options

In accordance with the NEP 2020, the M.Sc. Zoology program incorporates a Multiple Entry and Multiple Exit framework, offering students the flexibility to enter or exit the program at various stages. This approach ensures that students can tailor their educational journey according to their personal and professional goals, with options to earn certificates, diplomas, or degrees based on the duration of study completed.

- **Year1:**

Upon completion of the first year, students may exit with a **Certificate in Zoology**.

- **Year2:**

After two years, students may choose to exit with a **Diploma in Zoology**.

- **Year3:**

Completion of the third year qualifies students for a **M.Sc. Degree in Zoology**.

- **Year4:**

The fourth year offers an advanced curriculum with a focus on research, allowing students to graduate with an **Honors Degree in Zoology**.

Eligibility For M.Sc. Zoology: A candidate should have Bachelor degree in Zoology/Life Sciences/Equivalent subjects (three years course after 10+2) from the recognized university.

Internal Continuous Assessment:

Section I

Unit-I Definition and Basic Concept of Biosystematics and Taxonomy	No. of lectures-15 hrs	Weightage:9-15 Marks
1. Historical resume of systematic 2. Importance and applications of biosystematics in biology 3. International Code/Commission of Zoological Nomenclature (ICZN).		
Unit – 2 Trends in Biosystematics & Molecular Phylogenetics	No. of lectures-15 hrs	Weightage:9-15 Marks
1. Chemotaxonomy, Cytotaxonomy, Molecular taxonomy		
2. Construction of phylogenetic trees: Introduction to distance method, Parsimony methods, Maximum likelihood methods		
3. Phylogeny based on amino acid sequence and nucleic acid sequence		

Section II

Unit-3: Dimensions of speciation and taxonomic Characters.	No. of lectures-15 hrs	Weightage:9-16 Marks
1. Mechanism of speciation in panmictic and apomictic species 2. Species concepts – category, different concepts, sub-species and other intra-specific categories 3. Theories of biological classification, hierarchy of categories 4. Taxonomic characters – different kinds, origin of reproductive isolation, biological mechanism, genetic incompatibility		

Unit-4 :Phylum Arthropoda	No. of lectures- 15 hrs	Weightage:8-17 Marks
<ul style="list-style-type: none"> • Taxonomic collection, preservation and curation process of identification. • Taxonomic keys- Introduction to dichotomous keys with example from insecta, recent developments in taxonomy (use of Bar Coding) • Systematic publications- different kinds of publications (reviews, revisions, monographs, short notes, new species, checklists etc.) • Process of typification of different zoological types (holotype, syntype, paratype, lectotype, neotype etc.) 		
<p>Above Unit Weightage is given for 60% marks of UA assessment only. There could be variation of 10-15% in the Unitwise weightage distribution.</p>		
<ul style="list-style-type: none"> • College Level Assessment (CA) Activities: Home assignment, self study report, review article • List of Experiments/Assignments/Field visit, etc. 		

Course code 2309104 DSC-I: Biosystematics

Practical -I

Any six of the following

(P) BIOSYSTEMATICS

1.	Collecting insect samples by using light traps / pit fall traps /Malaise trap/ Berlese Funnel
2.	Preservation of insect samples for taxonomic / systematic studies
3.	Construction of dichotomous keys by using museum specimens/insect specimens
4.	Calculation of diversity indices using zooplankton populations from fresh water resources.
5.	Statistical analysis of point of bird surveys
6.	Preparation and examination of protozoans from given samples
7.	Study of museum specimens: Invertebrates and vertebrate (30 specimens each)
8.	Study of types of invertebrate larvae -peculiarities and evolutionary significance
9.	Study of Reptilian Skulls with reference to evolutionary significance (with available samples from laboratory and using models/pictures)
10.	Submission of report based on visit to ZSI/ Sea shore/National Institute/Wild life Sanctuary/National Parks/water reservoirs.

Reference Books

1.	Keto, M: The Biology of Diversity.
2.	Avise, J. C.:Molecular markers. Natural History and Evolution, Chapman and Hall, New York.
3.	Wilson, E. O.: Biodiversity, Academic Press, Washington.
4.	Simpson, G. G.: Principles of Animal Taxonomy, Oxford IBH Publishing Company.
5.	Mayer, E.: Elements of Taxonomy.
6.	Wilson, E.O.: The Diversity of Life. W. W. Northern and Company.
7.	Tikedar, B. K.: Threatened Animals of India, ZSI Publication, Calcutta.
8.	Mayer, E. : Principles of Systematic Zoology, M. Hill Publication.



Punyashlok Ahilyadevi Holkar Solapur University, Solapur
First Year M.Sc. (Zoology) Semester-I

Vertical : DSC-II

Paper code : 2309102

Course Code DSC-II: Cell and Molecular Biology (Theory)

***Teaching Scheme**

Lectures:04 Hours/week, 04 Credits

OR

Practical:02Hours/week, 01Credit

***Examination Scheme**

UA:60 Marks

CA: 40 Marks

Program specific outcome (PSOs):

PSO 1: Understand the structure and function of key biological molecules and their roles in cellular processes.

PSO 2: Analyze the mechanisms of gene expression, regulation, and inheritance at the molecular level.

PSO 3: Apply techniques in molecular biology, such as PCR, gel electrophoresis, and DNA sequencing, to experimental research.

PSO 4: Evaluate cellular signaling pathways and their impact on cell function and behavior.

PSO 5: Investigate the molecular basis of diseases and the development of therapeutic strategies.

PSO 6: Integrate knowledge of cell and molecular biology with other disciplines such as biochemistry, genetics, and physiology.

PSO 7: Develop skills in critical thinking, data analysis, and scientific communication.

PSO 8: Conduct independent research projects, demonstrating proficiency in experimental design and data interpretation.

Program Outcome-

PO – 1 Apply the Biotechnological concepts for basic and applied research.

PO – 2 Explore new areas of research in all the branches of Biotechnology in addition to interdisciplinary fields such as Chemistry and Physics.

PO – 3 Create an awareness of the impact of Biotechnology on the environment, society, and development outside the scientific community

PO -4The students' exposure throughout the program would help them become aware of career opportunities in the biological sciences. .

PO -5 Students will gain the capacity to work effectively in multidisciplinary teams to achieve specific objectives.

PO – 6 Students will be able to expand their learning horizons by utilizing multidimensional knowledge qualities to keep up with the global pace of scientific advancement.

Course Objectives:

During this course, the student is expected to:

Course Objectives:

a) To study the cell and its components

b) To study molecular interactions within the cell

Course Outcomes:

After completing the course the student should be able to:

- Understand the turnover of biomolecules in the cells.
- Learn the interaction of biomolecules within the cell.
- Learn the dynamics of cargo transport through different compartments of cell.
- Understand the properties of transformed cells.
- Learn the current practices used in treatments of cancer.
- Understand the cascade of signal transduction and its implications in gene expression.

Section –I

Unit-1 : Cellular membranes	No. of lectures- 15	Weightage:9-16 Marks
<ul style="list-style-type: none"> • Molecular composition, arrangement and function. • Dynamic nature of plasma membrane: Transport across the cell membrane- Passive and active transport, pumps, imports, symports and antiport. Transport across epithelia. • Membrane potential and nerve impulse. • Integrins and collagens. • Cell matrix and cell matrix adhesion. 		
Unit- II: Structural organization and function of intracellular organelles	No. of lectures- 15	Weightage:9-16 Marks
<ul style="list-style-type: none"> • Nucleus, Mitochondria, Endomembrane system and Lysosomes (Origin, ultrastructure and functions) • Microfilaments and microtubules- structure and dynamics • Cilia, Flagella- structure and dynamics • Microtubular organizing centres: centriole, kinetochore, basal bodies • Intermediate filaments: structure and function. Actin- binding proteins 		

Section –II

Unit-III: Cellular organelles and Membrane trafficking	No. of lectures-15	Weightage:9-16 Marks
<ul style="list-style-type: none"> • Endoplasmic reticulum, Golgi bodies: structure and function • Protein synthesis on free and bound polysomes • Membrane proteins and other proteins in ER with suitable examples • Post-translational modifications and protein sorting in Golgi apparatus. • Lysosomes types and functions <ul style="list-style-type: none"> • Biogenesis of mitochondria 		
Unit-IV: The Cell cycle and cell signaling	No. of lectures- 15	Weightage:9-16 Marks
<ul style="list-style-type: none"> • Cell cycle • Control of cell cycle • Mitosis and biology of cancer cells: Cancer cell morphology and properties; types of cancer-causes and treatment • Cell signalling systems: G-protein coupled receptor • Tyrosine Kinase receptor: Ras-MAP Kinase pathway, Hedgehog pathway, WNT signaling pathway 		
<p>Above Unit Weightage is given for 60% marks of UA assessment only. There could be variation of 10-15% in the Unitwise weightage distribution.</p>		
<p>College Level Assessment (CA) Activities: List of Experiments/Assignments/Field visit, etc.</p>		

DSC-II: Cell and Molecular Biology
Practical-II
Any six of the following

1	Preparation of Metaphasic chromosomes using colchicine drug
2	Preparation/Demonstration of meiotic stages in the onion bud
3	Preparation of <i>Drosophila</i> culture to study of its life cycle and observation of morphological characters of male and female <i>Drosophila</i>
4	Demonstration of PolyteneChromosomes from salivary glands of <i>Chironomous/ Drosophila</i> larva using photograph or permanent slide
5	To perform cell fractionation for the isolation of nucleus from given sample/material
6	Demonstration of electrophoresis for the separation of serum proteins
7	Virtual Lab. For Cell Biology: using c-BioPortal
8	To study Cell Homeostasis using virtual lab.
9	To perform retrieval and analysis of protein sequence from protein database
10	To perform multiple sequence alignment and phylogenetic analysis based on DNA and protein sequences

Suggested Reading Materials:

•B. Albert: The Molecular Biology of Cell. Garland Publishing Inc. New York and London.
•De Robertis: Cell and Molecular Biology. Saunders College Publishing, Philadelphia
•W. H. Elliot and D. C. Elliot: Biochemistry and Molecular Biology. Oxford University Press. Oxford, New York.
Giese A. C.: Cell Physiology. Saunders College Publishing, PhiladelphiaP. C. Verma and V. K. Agrawal: Cell Biology, Genetics, Molecular Biology Evolution and Ecology. S. Chand and Company, New Delhi-55.
•SandhyaMitra: Genetic Engineering, Macmillan
•R. C. Dubey: A text Book of Biotechnology. S. Chand and Company, New Delhi-55.
•Mohan Arora: Genetic Engineering. Himalaya Publishing House
•Becker, Klein smith: The World of Cell. Pearson Education.
•Geoffrey M. Cooper: Cell-A Molecular Approach. ASM Press. Washington
•Gerald Karp: Cell and Molecular Biology. Willey International Edition
•Watson: Molecular Biology of the Gene. Pearson Education.



Punyashlok Ahilyadevi Holkar Solapur University, Solapur
First Year M.Sc. (Zoology) Semester-I

Vertical : DSE-I

Paper code : 2309107

Course Code DSE-I A: Techniques in Biology (Theory)

Teaching Scheme

Lectures:04 Hours/week, 04 Credits

OR

Practical:02Hours/week, 01Credit

***Examination Scheme**

UA:60 Marks

CA: 40 Marks

Program specific Outcome: (PSOs):

- 1. Understanding Core Concepts:** Graduates will know the structures and functions of important biological molecules and how they work together in biochemical processes.
- 2. Research Skills:** Students will learn and use techniques for biological research in labs and the field.
- 3. Problem-Solving:** Graduates will use their knowledge of cell biology, biochemistry, microbiology, and molecular biology to solve problems in biotechnology and related areas.
- 4. Data Analysis:** Students will be able to do basic math and statistics and use technology to analyze biological data.

Program outcome:

PO-1 Students will learn the basics of cell and molecular biology, including how cells are structured and function, and the molecular processes that control them.

PO-2 Students will gain skills in designing experiments, analyzing data, and using lab techniques common in cell and molecular biology.

PO-3 Students will improve their ability to think critically and solve complex biological problems.

Communication: Students will learn to effectively communicate scientific information, both in writing and speaking, to different audiences.

PO-4 Students will understand the ethical issues in cell and molecular biology research and practice, ensuring they act responsibly in their careers.

PO-5 The program will prepare students for careers in research, healthcare, biotechnology, and academia.

Course Objectives:

During this course, the student is expected to:

- To develop scientific technical expertise
- To familiarise with basic tools and techniques in biology
- To update new techniques in biology

Course Outcomes:

After completing the course the student should be able to:

- Understand the purpose of technique, its proper use and possible modifications or improvements.
- Learn the theoretical basis of technique, its principle of working and its correct application.
- Learn the construction repair and adjustment of any equipment required for a technique.
- Learn the application and accuracy of technique.
- Learn the maintenance laboratory equipment/tools, safety hazards and precautions.
- Understand the technique of cell and tissue culture. Learn the preparation of solution of given percentage and molarity.

Section –I

Unit-1 : Principles and uses of Analytical instruments	No. of lectures- 15	Weightage:9-16 Marks
<ul style="list-style-type: none"> • Spectroscopy (Spectrophotometers, NMR, FTIR), Lasers in Biology and its applications, X-Rays in Biology and its applications, • Electron Microscope (TEM, SEM), • Cryopreservation of cells, tissues, organs and organisms, Cryotomy, Freeze drying and freeze fracturing techniques. 		
Unit- II: Cell Culture Techniques	No. of lectures- 15	Weightage:9-16 Marks
<ul style="list-style-type: none"> • Design and functioning of tissue culture laboratory, Culture media preparation, • Types of culture- monolayer, suspension, capillary culture units, feeder layers, cell secretions and metabolic harvesting Cell viability testing, • Cell characterization & Cell Transformation, Modern advances in cell culture techniques 		

Section –II

Unit-III: Cellular organelles and Membrane trafficking	No. of lectures- 15	Weightage:9-16 Marks
<ul style="list-style-type: none"> • Chromatography-TLC, paper chromatography, HPLC • Electrophoresis and its types • column fractionation • Centrifugation: Ultracentrifugation and sub-cellular fractionation. • Cell separation by- flow cytometry • Radio-label techniques in biology • Radioactivity: Counter Geigometry and Scintillation Counter, Autoradiography 		
Unit-IV: Advanced techniques in molecular diagnostics:	No. of lectures-15	Weightage:9-16 Marks
<ul style="list-style-type: none"> • DNA: sequencing-Principle and methods, next generation sequencing, genome sequencing, microarray • PCR: types of PCR, primer design, applications of PCR. 		
<p>Above Unit Weightage is given for 60% marks of UA assessment only. There could be variation of 10-15% in the Unitwise weightage distribution.</p>		
<ul style="list-style-type: none"> • College Level Assessment (CA) Activities: • List of Experiments/Assignments/Field visit, etc. 		

Sr. No.	DSE-I A: Techniques in Biology Practical - III Any six of the following
1	Principle and applications of different microscopes
2	To prepare Buffers of known pH and molarity and measurement of pH of various samples, Buffering capacity
3	Separation of sugars by paper chromatography.
4	Isolation of active ingredients from natural resources by using column chromatography.
5	Separation of amino acids by paper chromatography.
6	DNA extraction and isolation.

7	Principles of electrophoresis: Analysis of DNA samples by using gel electrophoresis.
8	DNA amplification by PCR
9	Principle and working of Colorimetry and spectrophotometry
10	Cell separation by density gradient centrifugation
11	Submission of report based on visit to National/Local Biotechnology Laboratory

Suggested Reading Material:

<ul style="list-style-type: none"> • John, R.W. Masters: Animal Cell Culture. IRL Press.
<ul style="list-style-type: none"> • Robert Braun: Introduction of Instrumental Analysis. McGraw Hill International Editions.
<ul style="list-style-type: none"> • K. Wilson and K.H. Goulding: A Biologist Guide to Principles and Techniques of Practical Biochemistry. ELBS Ed.
<ul style="list-style-type: none"> • Pattabhi V.: Biophysics. Narosa Publishing House.
<ul style="list-style-type: none"> • Bisen P. S., Mathur: Tools and Techniques in Life Sciences. CBS Publishers and Distributors.
<ul style="list-style-type: none"> • Keith Wilson and John Walker: Practical Biochemistry. Cambridge low price edition.
<ul style="list-style-type: none"> • Cooper Cell: A Molecular Approach: Second Edition.



Punyashlok Ahilyadevi Holkar Solapur University, Solapur

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

Vertical : DSE-I

Paper Code: 2309108

Course Code: DSE-I B: Economic Entomology (Theory)

***Teaching Scheme**

Lectures:04 Hours/week, 04 Credits

***Examination Scheme**

UA:60 Marks

CA: 40 Marks

Program specific outcome(PSOs):

1. Knowledge Empowerment: Empowered with Knowledge of basic concepts, principles, the scientific theories and their relevance in the day-today life .
2. Skill Enhancement: To emerge as skilful, critical and creative graduates through hands on experience in the laboratories.
3. Value Enrichment: To develop value based services through outreach activities

Program outcome: (POs)

1. **Understanding Insect Biology:** Students learn about insect biology, including general entomology, systematics, morphology, physiology, and biodiversity.
2. **Pest Management:** They gain knowledge of integrated pest management (IPM) techniques, which include biological, cultural, and chemical control methods.
3. **Economic Impact:** Students learn to assess the economic importance of insects and other arthropods in agriculture and other industries.
4. **Identification Skills:** They become proficient in identifying and classifying economically important insects, understanding their life cycles, habitats, and ecological roles.
5. **Research and Application:** Students develop skills in conducting research and applying their findings to solve real-world pest management problems.

Course Objectives:

During this course, the student is expected to:

1. To familiarize the students with principles of insect pest management, including concept and philosophy of IPM. implementing IPM programme.
2. The knowledge and skills developed in the field of entomology help recognize the applications of the latest technologies across all spheres of agriculture. This leads to the development of crops with improved productivity, thereby increasing farmers' income, enhancing human health, and reducing environmental pollution. Additionally, it addresses future challenges in agricultural crops and grain storage.
3. To familiarize the students with principles of insect pest management, including concept and philosophy of IPM. implementing IPM programme.
4. The knowledge and skills developed in the field of entomology help recognize the applications of the latest technologies across all spheres of agriculture. This leads to the development of crops with improved productivity, thereby increasing farmers' income, enhancing human health, and reducing environmental pollution. Additionally, it addresses future challenges in agricultural crops and grain storage.

Course Outcomes:

After completing the course the student should be able to:

- Identify and Understand Insects and its ecology.
- Learn about pest and pest management
- Learn more about Agro-ecosystem

Section I

Unit –I Apiculture:	No. of lectures-15	Weightage:9-15 Marks
<ul style="list-style-type: none"> • Different types of bees:<i>Apis dorsata</i>, <i>Apis mellifera</i>, <i>Apis florea</i> and <i>Apis indica</i>. Stingless bees. • The Apiculture business: structure of artificial bee hive, method of cultivation, tools used, management of apiary. Disease of bees and their natural enemies. • Products: honey, wax, royal jelly, venom, propolis & economics of bee keeping. 		
Unit 2: Lac culture:	No. of lectures-15	Weightage:9-15 Marks
<ul style="list-style-type: none"> • The lac insect, hosts, culture techniques. • Natural enemies of lac insects. Processing of raw lac to fine lac and uses of lac. • Management and economics of lac culture in business 		

Section II

Unit 3: Sericulture	No. of lectures- 15	Weightage:9-16 Marks
<ul style="list-style-type: none"> • Different types of silk moths: Life cycle of Mulberry silk moth. • The Sericulture business: cultivation of mulberry, rearing of worms (procuring eggs, incubation, hatching and maintenance of larvae), overall management, diseases of silk worms. • Process of obtaining silk from cocoons and variations with reference to other silk moths; Uses of silk and economics of sericulture. 		
Unit- IV: Modern Trends in Pest Control	No. of lectures- 15	Weightage:9-16 Marks
<ul style="list-style-type: none"> • Biological Control • Autocidal Control • Integrated Pest Management (IPM) 		

Above Unit Weightage is given for 60% marks of UA assessment only. There could be variation of 10-15% in the Unitwise weightage distribution.

**College Level Assessment (CA) Activities:
List of Experiments/Assignments/Field visit, etc.**

DSE-I B: Economic Entomology Practical - IV Any Six of the following	
1	Study of Apiculture: Indigenous and exotic breeds; Study of by-products of Apiculture and its economic significance.
2	Study of major agricultural pest: Pomegranates, Sugarcane, Jowar, Cotton, Brinjal.
3	Study of different types of mouth parts of different insect groups.
4	Identification of Mosquitoes using its morphological characters.
5	Study of different types of Insect larvae.
6	Study different types of Insect traps used for pest control in Agriculture.
7	To study types of insect pest in stored grains.
8	Study of traditional/organic methods used in agricultural pest control
9	Visit to agriculture site and study the community of Insects.
10	Submission of report based on visit on visit to Sericulture/Apiculture/Pomegranate/Jowar Research Centre/Local agro-ecosystem

Suggested Reading Materials:

• A textbook of Applied Entomology, Vol 2 – K. P. Shrivastava, 1996
• Elements of Entomology – Rajendra Singh
• A textbook of forest entomology -T. V. Sathe, 2009
• Morden Entomology – D. B. Tembhare 2 nd edition, Himalaya presentation
• Principles of Insect morphology – Robert Snodgrass



Punyashlok Ahilyadevi Holkar Solapur University, Solapur
First Year M.Sc. (Zoology) Semester-I

Vertical :

Paper Code: 2309103

Course Code: Research Methodology (Theory)

***Teaching Scheme**

Lectures:02 Hours/week, 04 Credits -2

***Examination Scheme**

UA:60 Marks

CA: 40 Marks

Program specific outcome:

- Knowledge Empowerment: Empowered with Knowledge of basic concepts, principles, the scientific theories and their relevance in the day-today life .
- Skill Enhancement: To emerge as skilful, critical and creative graduates through hands on experience in the laboratories.
- Value Enrichment: To develop value based services through outreach activities

Program Specific Outcome (POs):

PO 1: Research Design: Understand and apply various research designs and methodologies.

PO 2: Data Collection: Demonstrate proficiency in data collection techniques and tools.

PO 3: Data Analysis: Analyze and interpret data using appropriate statistical methods.

PO 4: Critical Thinking: Develop critical thinking skills to evaluate research literature and methodologies.

PO 5: Ethical Research: Apply ethical principles in conducting and reporting research.

PO 6: Communication: Effectively communicate research findings through written and oral presentations.

PO 7: Problem-Solving: Utilize research skills to address and solve real-world problems.

PO 8: Interdisciplinary Integration: Integrate knowledge from various disciplines to enhance research quality.

PO 9: Technological Proficiency: Use modern software and tools for research purposes.

PO 10: Lifelong Learning: Engage in continuous learning to stay updated with advancements in research methodologies.

Course Objectives:

During this course, the student is expected to:

- a) To understand research areas.
- b) To understand research methodology
- c) Identify and discuss the role and importance of research in the social sciences.
- d) Identify and discuss the issues and concepts salient to the research process.
- e) Identify and discuss the complex issues inherent in selecting a research problem, selecting an appropriate research design, and implementing a research project.
- f) Identify and discuss the concepts and procedures of sampling, data collection, analysis and reporting.
- g) To understand research areas.

Course Outcomes:

After completing the course the student should be able to:

- Research methodology and research aptitude.
- Its national and international significance.
- Methodology to file patent and other IPRs.

Section –I


Unit 1: Foundations of Research	No. of lectures-15	Weightage:9-16 Marks
<ul style="list-style-type: none"> • Foundations of Research: Meaning, Objectives, Motivation, Utility. Concept of theory, empiricism, deductive and inductive theory. • Characteristics of scientific method – Understanding the language of research – Concept, Construct, Definition, Variable. • Research Process. Problem Identification & Formulation – Research Question – Investigation Question – Measurement Issues • Hypothesis – Qualities of a good Hypothesis, Null Hypothesis & Alternative Hypothesis. Hypothesis Testing – Logic & Importance 		
Unit II: Research Design	No. of lectures-15	Weightage:9-16 Marks
<ul style="list-style-type: none"> • Research Design: Concept and Importance in Research – Features of a good research design • Exploratory Research Design – concept, types and uses, • Descriptive Research Designs – concept, types and uses. • Experimental Design: Concept of Independent & Dependent variables. • Qualitative and Quantitative Research: Qualitative research, Quantitative research, Concept of measurement, causality, generalization, replication. Merging the two approaches. 		

Section –II

Unit III: Sampling of Research Data	No. of lectures-15	Weightage:9-16 Marks
<ul style="list-style-type: none"> • Measurement: Concept of measurement, Problems in measurement in research, Validity and Reliability. • Levels of measurement: Nominal, Ordinal, Interval, Ratio. • Sampling: Concepts of Statistical Population, Sample, Sampling Frame, Sampling Error, Sample Size, Non-Response. Characteristics of a good sample. Probability Sample: Simple Random Sample, Systematic Sample, Stratified Random Sample & Multi-stage sampling. Determining size of the sample: Practical considerations in sampling and sample size. 		
Unit IV : Analysis of Research Data	No. of lectures-15	Weightage:9-16 Marks
<ul style="list-style-type: none"> • Data Analysis: Data Preparation: Univariate analysis (frequency tables, bar charts, pie charts, percentages), Bivariate analysis: Cross tabulations and Chi-square test including testing hypothesis of association. • Interpretation of Data and Paper Writing – Layout of a Research Paper, Journals in Computer Science, Impact factor of Journals, When and where to publish? Ethical issues related to publishing, Plagiarism and Self-Plagiarism • Use of tools / techniques for Research: methods to search required information effectively, Reference Management Software like Zotero/Mendeley, Software for detection of Plagiarism 		

Reference Books:

- Anderson, Durston and Polle (1970): Thesis and assignment writing, Wiley Eastern Limited.
- Vijayaakshmi, G. and Sivapragasam, C. (2008): Research Methods-Tips and Techniques, M.J. P. Publisher, Chennai.
- Malter, K. (1972): Statistical analyss in Biology, Chapman Hall, London.
- Kothari, C.R. (2012): Research Methodology: Mthods and Techniques. Publ., New Delhi.

	<p align="center">Punyashlok Ahilyadevi Holkar Solapur University, Solapur First Year M.Sc. (Zoology) Semester-I</p> <p>Vertical : Course Code: Course Code: Research Project (Minor) 60 Hrs Credit - 04</p>
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Program Specific Outcomes (PSOs)

PSO 1: Apply advanced scientific and technological knowledge to design and conduct research projects.

PSO 2: Utilize modern tools and techniques for data collection, analysis, and interpretation.

PSO 3: Develop innovative solutions to complex scientific and technological problems.

PSO 4: Integrate interdisciplinary knowledge to enhance research quality and outcomes.

PSO 5: Communicate research findings effectively through scientific reports and presentations.

PSO 6: Demonstrate ethical practices in conducting and reporting research.

Program Outcomes (POs)

PO 1: Research Design: Understand and apply various research designs and methodologies.

PO 2: Data Collection: Demonstrate proficiency in data collection techniques and tools.

PO 3: Data Analysis: Analyze and interpret data using appropriate statistical methods.

PO 4: Critical Thinking: Develop critical thinking skills to evaluate research literature and methodologies.

PO 5: Ethical Research: Apply ethical principles in conducting and reporting research.

PO 6: Communication: Effectively communicate research findings through written and oral presentations.

PO 7: Problem-Solving: Utilize research skills to address and solve real-world problems.

PO 8: Interdisciplinary Integration: Integrate knowledge from various disciplines to enhance research quality.

PO 9: Technological Proficiency: Use modern software and tools for research purposes.

PO 10: Lifelong Learning: Engage in continuous learning to stay updated with advancements in research methodologies.

Research Project (Minor) 60 Hrs Credit -04

The course provides wide knowledge about research, experimental & sampling design,

- Data collection, analysis & interpretation of data and allows student to present the research data in scientific method
- Gains skill to solve problems using inferential statistical tools
- Learns to collect literature collection, literature citation, and components of research report – Text, tables, figures, bibliography.
- Writing of dissertations, project proposals, project reports, research papers.

Semester – II



Punyashlok Ahilyadevi Holkar Solapur University, Solapur
First Year M.Sc. (Zoology) Semester-II

Vertical : DSC/VEC

Paper Code: 2309301

Course Code: DSC-III: Embryology (Theory)

***Teaching Scheme**

Lectures:04 Hours/week, 04 Credits -2

OR

Practical:02Hours/week, 01Credit -2

***Examination Scheme**

UA:60 Marks

CA: 40 Marks

Program Specific Outcome :

PSO-1 Understanding Development: Students learn the mechanisms that control human embryogenesis and morphogenesis, including the development of tissues from germ layers and organogenesis.

PSO-2 Laboratory Skills: They gain hands-on experience with techniques such as in vitro fertilization (IVF), in vitro culture (IVC) of embryos.

PSO-3 Research Proficiency: Students develop skills in molecular techniques to study RNA and protein expression in oocytes and embryos.

PSO-4 Problem-Solving: They learn to evaluate current trends and techniques in embryology and andrology, and to develop solutions for problems related to assisted reproductive technology.

PSO-5 Ethical and Practical Knowledge: Understanding the ethical considerations and practical applications of embryology in clinical settings.

Program Outcome (POs):

PO 1: Apply basic embryology concepts to understand human development.

PO 2: Show skill in lab techniques for embryology research and practice.

PO 3: Analyze and interpret data on embryonic development and anomalies.

PO 4: Follow ethical principles in embryology studies and practices.

PO 5: Conduct independent research using proper methods.

PO 6: Communicate embryology concepts and findings clearly.

PO 7: Integrate knowledge from related fields to understand embryology.

PO 8: Engage in lifelong learning to stay updated in embryology.

Course Objectives:

During this course, the student is expected to:

a) To understand developmental biology

b) To understand embryological developmental concepts

c) To apply the knowledge of embryology in applied field

Course Outcomes:

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

After successfully completing the course, the student will be able to :

1. Develop critical understanding of how a single-celled fertilized egg become an embryo and then a fully formed adult by going through three important processes of cell division, cell differentiation and morphogenesis.

2. Understand how developmental processes and gene functions within a particular tissue or organism can provide insight into functions of other tissue and organisms.

3. Realize that very similar mechanisms are used in very diverse organisms; and development is controlled through molecular changes resulting in variation in the expression and function of gene network.

4. Understand the relevance of developmental biology in medicine or its role in development of diseases. Understand the role of genes in developments of animals

Section I

Unit I: Introduction to Embryology	No. of lectures-15	Weightage:9-15 Marks
<ul style="list-style-type: none"> • Evolution of sexual reproduction in eukaryotes. • Study and types of eggs, blastula, gastrula and mechanism of formation of three germ layers in Amphioxus, Frog, Chick and Mammals. • Detailed molecular mechanism of fertilization 		
Unit-II: Early Embryonic Development	No. of lectures-15	Weightage:9-15 Marks
<ul style="list-style-type: none"> • Basic concepts in development: Potency, commitment, specification, induction, competence, determination and differentiation. • Development up to gastrulation in human • Organization of nervous system, reproductive system; Cell aggregation and differentiation 		

Section II

Unit-III: Regulation of Development	No. of lectures- 15	Weightage:9-16 Marks
<ul style="list-style-type: none"> • Development of limbs in fishes, amphibians, reptiles, birds and Mammals • Genetic regulation of limb development in chordates 		
Unit-6: Development of <i>Drosophila</i> and <i>Caenorhabditis elegans</i>	No. of lectures-15	Weightage:8-17 Marks
<ul style="list-style-type: none"> • Regulation of development in <i>Drosophila</i>. • Cell apoptosis, its role in development of human limbs • Vulva formation in <i>Caenorhabditis elegans</i>. 		
<p>Above Unit Weightage is given for 60% marks of UA assessment only. There could be variation of 10-15% in the Unitwise weightage distribution.</p>		
<ul style="list-style-type: none"> • College Level Assessment (CA) Activities: • List of Experiments/Assignments/Field visit, etc. 		
Paper Code: 2309204 DSC-III: Embryology Practical Any six of the following		
1	Demonstration of sperm motility and analysis	
2	Study of different phases of oestrous cycle in Rat (Using photographs/permanent slides)	
3	To demonstrate acrosomal development in rat testis by PAS method (using permanent slides)	
4	Study of sperm & egg of chick	
5	Study of blastula in Amphioxus, Frog, Chick and Mammals	
6	Study of gastrula in Amphioxus, Frog, Chick and Mammals	
7	Procedure to understand embryological stage of chick:18 hours/21 hours/24 hours/33 hours/48 hours/72 hoursby non-invasive method by non-invasive method	
8	To observe and interpret metamorphic stages of insect egg with the help of models and submit the report	
9	Observation of homeotic mutants of <i>Drosophila</i> byAntennapedia complex gene (using photographs)/ Ultrabithorax complex gene	
10	Submission of report based on visit to IVF Centre/Medical college	

Reference Books	
1.	• Turner, C. D. and Bangara, J. T.: General Endocrinology.
2.	• Edwards, R. G.: Human Reproduction.
3.	• Austen, C. R. and Short, R. V.: Reproduction in Animals.
4.	• Longo, F. T.: Fertilization, Chapman & Hall.
5.	• Mathur, Ramesh: Embryology, Anmol Publications.
6.	• Morgan, T. H.: Embryology and Genetics. Agrobios India.
7.	• Balinski: Introduction to Embryology.
8.	• Scott, F. Gilbert: Developmental Biology –Sixth Edition, Sinaur Publications.



पुण्यश्लोक अहिल्यादेवी होळकर
सोलापूर विद्यापीठ
॥ विद्यया संवत्सरा ॥

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Punyashlok Ahilyadevi Holkar Solapur University, Solapur
First Year M.Sc. (Zoology) Semester-II

Vertical : DSC/VEC

Paper Code: 2309202

Course Code: DSC-IV: Animal Physiology (Theory)

***Teaching Scheme**

Lectures:04 Hours/week, 04 Credits

OR

Practical:02Hours/week, 01Credit

***Examination Scheme**

UA:60 Marks

CA: 40 Marks

Program specific Outcome: (PSO)

Understanding Key Concepts: Students will learn about how animals' bodies work at different levels, from tiny molecules to whole systems.

Practical Skills: Students will practice lab techniques like measuring how fast animals use energy, testing blood, and doing experiments.

Application of Knowledge: Students will use what they learn to solve real problems in animal health, veterinary science, and wildlife conservation.

Research Competence: Students will learn how to plan, do, and analyze research in animal physiology, helping to add to scientific knowledge.

Program Outcomes (POs)

PO-1 Students will understand the basic ideas of animal physiology, like how animals keep their bodies stable, how their nerves work, and how their hormones function.

PO-2 Students will develop skills to think critically and solve problems by analyzing data and interpreting results.

PO-3 Students will learn and apply ethical principles in their research and when handling animals.

PO-4 Students will learn to effectively share scientific information through writing, presentations, and discussions.

PO-5 Students will recognize the importance of continuing to learn and staying updated with new advancements in animal physiology.

Course Objectives:

During this course, the student is expected to:

a) To learn about structure and functions of systems

b) To focus on understanding of physiology

c) To develop critical thinking about issues of animal physiology

Course Outcomes:

After successfully completing the course, the student will be able to :

1. Understand the process of digestion and control.

2. Develop understanding in muscle structure and contraction mechanism.

3. Learn the process of respiration and transport of gases.

4. Understand kidney structure and regulation of urine formation.

Section I

Unit I: Physiology of Digestion	No. of lectures-15	Weightage:9-15 Marks
<ul style="list-style-type: none"> • Structure and function of Digestive glands • Physiology of digestion in the alimentary canal. • Absorption of carbohydrates, proteins, lipids • Metabolism of Carbohydrates, Proteins ad Lipids. • Vitamins • Hormonal control of digestion • Physiology of Stomach Ulcers: sings, symptoms, causes and treatment of ulcers 		
Unit-II: Physiology of Respiration	No. of lectures-15	Weightage:9-15 Marks
<ul style="list-style-type: none"> • Pulmonary Ventilation,Respiratory volumes and capacities • Transport of oxygen and carbon dioxide in blood • Structure of heart, origin and conduction of heart beat • Cardiac cycle and ECG • Composition of blood& mechanism of blood clotting • Physiology of Asthama: sings, symptoms, causes and treatment • Physiology of cardiovascular diseases: Cardiac arrest and coronary heart disease 		

Section II

Unit-III: Physiology of Respiration	No. of lectures- 15	Weightage:9-16 Marks
<ul style="list-style-type: none"> • Structure of nephron • Mechanism of urine formation and its regulation • Counter current Mechanism • Physiology of Kidney failure: sings, symptoms and causes of kidney failure • Treatment of kidney failure with dialysis 		
Unit-IV: Physiology of Muscle and Nerve	No. of lectures-15	Weightage:8-17 Marks
<ul style="list-style-type: none"> • Ultra-structure of smooth, skeletal and cardiac muscle • Neuromuscular Junction • Molecular and Chemical basis of muscle contraction • Structure of neuron • Resting membrane potential • Origin of Action potential • Propagation in myelinated and non myelinated nerve fibres • Physiology of Tetanus: symptoms and causes • Physiology of nervous disorders: sings, symptoms and causes of Alzheimers disease, Parkinsonsand Epilepsy 		
<p>Above Unit Weightage is given for 60% marks of UA assessment only. There could be variation of 10-15% in the Unitwise weightage distribution.</p>		
<ul style="list-style-type: none"> • College Level Assessment (CA) Activities: • List of Experiments/Assignments/Field visit, etc. 		

Paper Code: 2309205 DSC-IV: Animal Physiology Practical Any six of the Following	
1	Study of activity of salivary amylase under optimum conditions.
2	Study of activity of protease under optimum conditions.
3	Study of activity of lipase under optimum conditions.
4	Preparation of haemin crystals and hemochromogen crystals.
5	Total count of RBC and WBC
6	Estimation of Protein using suitable method
7	Estimation of Carbohydrates using suitable method
8	Estimation of lipids using suitable method
9	Estimation of haemoglobin
10	Analysis of ECG
11	Submission of report based on visit to Blood Bank / Dialysis Centre

Reference Books	
	Suggested Readings:
1	• Guyton, A.C. and Hall, J.E. (2011). Textbook of Medical Physiology, XII Edition, Harcourt Asia Pvt. Ltd/W.B. Saunders Company.
2	• Tortora, G.J. and Derrickson, B.H. (2009). Principles of Anatomy and Physiology, XII Edition, John Wiley and Sons, Inc.
3	• Widmaier, E.P., Raff, H. and Strang, K.T. (2008) Vanders Human Physiology, XI Edition, McGraw Hill



Punyashlok Ahilyadevi Holkar Solapur University, Solapur
First Year M.Sc. (Zoology) Semester-II

Vertical : DSE-II

Paper Code: 2309207

Course Code: DSE-II A: Fishery Science (Theory)

***Teaching Scheme**

Lectures:04 Hours/week, 04 Credits

OR

Practical:02Hours/week, 01Credit

***Examination Scheme**

UA:60 Marks

CA: 40 Marks

Program Specific Outcomes (PSOs)

Knowledge of Fish Biology: Students will learn about the biology, behavior, and environment of fish and other water creatures.

Fishery Management Skills: Students will learn how to manage fish populations and their habitats in a sustainable way.

Aquaculture Techniques: Students will be trained in modern fish farming methods, including breeding, raising, and harvesting fish.

Research and Data Analysis: Students will learn how to conduct research and analyze data related to fishery science.

Policy and Regulation Understanding: Students will understand the rules and regulations that govern fisheries and aquatic resources.

Program Outcomes (POs)

PO-1 Students will understand the basic principles of fishery science, including fish biology, ecology, and management.

PO-2 Students will develop skills to think critically and solve problems in fishery science.

Ethical Practices: Students will learn and apply ethical principles in managing fisheries and conducting research.

PO-3 Students will learn to effectively communicate scientific information through writing, presentations, and discussions.

PO- 4 Students will recognize the importance of continuing to learn and staying updated with new advancements in fishery science.

Course Objectives:

During this course, the student is expected to:

- This course has been designed to understand identification and classification of commercially important fishes and other aquatic vertebrates by the students.
- The course objectives are to provide the students with an introductory knowledge of fish classification.
- The students will be able to identify common species available in and around their region using morphological keys
- This course has been designed to understand identification and classification of commercially important fishes and other aquatic vertebrates by the students.
- The course objectives are to provide the students with an introductory knowledge of fish classification.
- The students will be able to identify common species available in and around

Course Outcomes:

After successfully completing the course, the student will be able to :

- Develop an understanding of the role of taxonomy in identification of fishes.
- On completion of the course the student should have obtained valuable skills in fish taxonomy and ecology including adaptive features of fishes.

<ul style="list-style-type: none"> Identifies, describes and evaluates the scientific importance of fish taxonomy.
<ul style="list-style-type: none"> Identifies, describes common species available in and around their region using morphological keys. .

Section I

Unit I: General features of Fishes	No. of lectures-15	Weightage:9-15 Marks
<ul style="list-style-type: none"> General characters and classification of fresh and marine water fishes. Identification of larval stages of major carps with examples Major keys for the identification of adult major carps Types of fish scales 		
Unit-II: Aquatic ecosystem	No. of lectures-15	Weightage:9-15 Marks
<ul style="list-style-type: none"> Aquatic ecosystems: Characteristics and faunal diversity of - Fresh, brackish and marine water ecosystems Identification of planktonic, nektonic and benthic fishes Identification and general characters of Phytoplankton and Zooplankton Role of planktons in fish culture 		

Section II

Unit-III: Aquaculture	No. of lectures- 15	Weightage:9-16 Marks
<ul style="list-style-type: none"> Culture techniques of major carps Breeding techniques, Induced breeding, breeding in happa Types of fish culture -Cage culture, Monoculture, Poly culture Types of hatcheries, hatching happa, Chinese hatchery 		
Unit-IV: Economic importance of fishes and Amazing Fishes	No. of lectures-15	Weightage:8-17 Marks
<ul style="list-style-type: none"> Fish products and by-products Fish preservation techniques Coloration in fishes, physiology of coloration Bioluminescence and physiology of light production in fishes Venomous glands and electric organs in fishes 		

Above Unit Weightage is given for 60% marks of UA assessment only. There could be variation of 10-15% in the Unitwise weightage distribution.

**College Level Assessment (CA) Activities:
List of Experiments/Assignments/Field visit, etc.**

	Paper Code: - DSE-II A: Fishery Science Practical Any six of the following
1	Studies on traditional fishing crafts and Gears
2	Temporary mounting of scales of fishes
3	Morphometric study of bony fishes
4	Preparation of salted fish by different methods
5	Aquaculture resources of World and India (Based on available data and maps)
6	Collection and identification of commercially important inland fishes
7	Collection of species of fresh water fishes
8	Estimation of hardness from fresh water reservoir
9	Collection and identification of fresh water Zooplankton
10	Identification of fresh water and marine water fishes (Using museum specimens)

11	Submission of report based on visit to Local Fish Market/Fishery Centre/ Any Aquatic Ecosystem
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Reference Books	
	Suggested Readings:
	1. Boyd, C.E. -Water Quality Management for Pond Fish Culture. Elsevier Scientific Publishing Company, 1982.
	2. Jhingran, V.G. -Fish and Fisheries of India. Hindustan Publishing Corporation India, 1982
	3. Bardach, et. al. -Aquaculture – The Farming and Husbandry of Freshwater and Marine Organisms. John Wiley & Sons, NY, 1972.
	4. Chondar, C.L. -Hypophysation of Indian major carps. Satish Book Enterprise, Agra, 1980.
	5. Santhanam, R. et. al. -A Manual of Freshwater Aquaculture. Oxford & IBH Publishing Co. Pvt. Ltd., 1987.
	6. Karunasagar, I. -Aquaculture and Biotechnology. Oxford-IBH Publishers, New Delhi,
	7. Govindan, T.K. -Fish Processing Technology, Oxford-IBH, 1985.
	8. Shang, Y.C. -Aquaculture Economic Analysis – An Introduction. 1990.
	9. Nikolsky, G.V. -Ecology of Fishes. Academic Press, NY, 1963.



Punyashlok Ahilyadevi Holkar Solapur University, Solapur
First Year M.Sc. (Zoology) Semester-II

Vertical : DSE

Paper Code: 2309208

Course Code: DSE-II B: Applied Parasitology (Theory)

***Teaching Scheme**

Lectures: 04 Hours/week, 04 Credits

OR

Practical: 02 Hours/week, 01 Credit

***Examination Scheme**

UA: 60 Marks

CA: 40 Marks

Program Specific Outcomes (PSOs)

In-depth Knowledge: Gain comprehensive knowledge about various parasites, their life cycles, host-parasite interactions, and the diseases they cause.

Diagnostic Skills: Develop the ability to diagnose parasitic infections using modern laboratory techniques and tools.

Research Proficiency: Acquire skills to conduct research in parasitology, including designing experiments, collecting data, and analyzing results.

Control Strategies: Learn to develop and implement effective strategies for the control and prevention of parasitic diseases.

Public Health Awareness: Understand the impact of parasitic diseases on public health and contribute to awareness and education programs.

Program Outcomes (POs)

PO- 1 Apply the knowledge of biology, chemistry, and other related sciences to understand and solve problems in parasitology.

PO- 2 To Identify, formulate, and analyze complex parasitological problems to reach substantiated conclusions.

PO- 3 To Utilize modern scientific tools and techniques for the investigation and management of parasitic diseases.

PO- 4 To apply ethical principles and commit to professional ethics and responsibilities in the field of parasitology.

PO- 5 Effectively communicate complex parasitological concepts and findings to both scientific and non-scientific audiences.

PO- 6 To recognize the need for and engage in lifelong learning to stay updated with advancements in parasitology.

Course Objectives:

During this course, the student is expected to:

To introduce general parasitology and impart advanced knowledge on parasitological research methods

Course Outcomes:

After successfully completing the course, the student will be able to :

- On the completion of the course, the students shall be able to Understand classification and biology of Parasites
- Learn morphology and life cycles of Parasites
- To provide technical know-how of recent human practices
- On the completion of the course, the students shall be able to Understand classification and biology of Parasites

Section I

Unit I: General Parasitology: Introduction	No. of lectures-15	Weightage:9-15 Marks
<ul style="list-style-type: none"> • Introduction, scope and branches of parasitology; host, parasite, vector, commensalism, mutualism and parasitism Classification general account on parasitic protozoans • Types of parasites & hosts: Ectoparasites, endoparasites and their subtypes; Intermediate and definite host and their subtypes • Host-parasite relationship: Host specificity: definition, structural specificity, physiological specificity, ecological specificity 		
Unit-II: Parasitic Protozoans: Trematodes: Helminths, Entomology	No. of lectures-15	Weightage:9-15 Marks
<ul style="list-style-type: none"> • Classification and general account on parasitic protozoans • Study of Habit, habitat, life cycle, mode of infection, Pathogenicity and control measures of: <i>Plasmodium vivax</i>, <i>Enamoeba histolytica</i>, <i>Naegleria fowleri</i> (Brain Eating Amoeba), <i>Giardia lamblia</i>, <i>Trypanosoma spp.</i> 		

Section II

Unit-III: Parasitic Helminths-Trematodes, Cestodes and Nematodes	No. of lectures- 15	Weightage:9-16 Marks
<ul style="list-style-type: none"> • Primary and secondary host of trematodes, egg hatching, • variation of life cycle in Monogenea and Digenea with examples • Morphology, mode of transmission, pathogenicity, laboratory diagnosis and prophylaxis of <i>Fasciolopsis buski</i> • Classification and general account on parasitic cestodes • Larval form of cestodes, comparative study of scolices in cestodes • Life cycle patterns of cestodes, Morphology, biology, mode of transmission, pathogenicity, laboratory diagnosis and prophylaxis of <i>Hymenolepis nana</i>, <i>Taenia saginata</i> • Classification and general account on parasitic nematodes:Mode of transmission, pathogenicity, laboratory diagnosis and prophylaxis <i>Trichuri strichura</i>, <i>Dracunculus medinensis</i> 		
Unit-IV: General topics in Parasitology	No. of lectures-15	Weightage:8-17 Marks
<ul style="list-style-type: none"> • Study of following parasites:Morphology, life cycle, Pathogenicity, control measures of Head louse, tick, mite (<i>Sacroptes scabei</i>) • Zoonotic diseases: signs, symptoms and causes of Bird flu, Rabies and Toxoplasmosis • Controlling measures of insect parasites: environmental management, physical, chemical, biological and genetic measures 		
<p>Above Unit Weightage is given for 60% marks of UA assessment only. There could be variation of 10-15% in the Unitwise weightage distribution.</p>		
<ul style="list-style-type: none"> • College Level Assessment (CA) Activities: • List of Experiments/Assignments/Field visit, etc. 		

DSE-II B: Applied Parasitology Practical Any six of the following	
1	Identification and classification of parasites
2	To identify parasites with help of standard taxonomical keys
3	To study the basic information on following diseases: a. Malaria b. Dengue
4	To study following Nematodes: <i>Trichuristrichura</i> , <i>Dracunculusmedinensis</i> , <i>Brugiamalayi</i>
5	To study ectoparasites from herbivorous host
6	To identify characteristics of various stains and their property in parasitology
7	Study Visit : Pathology Laboratory/ Slaughter house/ Veterinary hospital
8	Preparation of temporary mount of different parasites from samples collected from visit
9	Demonstration of <i>C. elegans</i> as a model parasite
10	Submission of report based on visit to Pathology Laboratory/ Slaughter house/ Veterinary hospital

Reference Books	
	<ul style="list-style-type: none"> • Parasitology (Protozoology and Helminthology) Thirteenth Edition by K.D. Chatterjee
	<ul style="list-style-type: none"> • Textbook of Veterinary Parasitology 5th Edition Kalyani Publication by B.B. Bhatia., K.M.L. Pathak., P.D. Juyal
	<ul style="list-style-type: none"> • Textbook of Human Parasitology (Protozoology and Helminthology) C.B.S. Publication and Distribution by Romnik Sood
	<ul style="list-style-type: none"> • Parasitology 5th Edition Arya Publication by C.P. Baveja., V. Baveja
	<ul style="list-style-type: none"> • https://www.academia.edu/30595207/Panikers_Textbook_of_Medical_Parasitology_7th_Edition_2013_PDF
	<ul style="list-style-type: none"> • Karunasagar, I. -Aquaculture and Biotechnology. Oxford-IBH Publishers, New Delhi,



Punyashlok Ahilyadevi Holkar Solapur University, Solapur
M.Sc. ZOOLOGY Part-I Syllabus (NEP) Semester-II
Paper Code: 2309203
OJT/In-house Project/ Internship/ Apprenticeship

Credits: 4

Marks: 100

Program specific outcome : (PSOs)

- Laboratory Skills: Learn to use lab equipment and conduct experiments.
- Data Analysis: Develop skills in analyzing scientific data.
- Research Methods: Understand how to design and conduct scientific research.

Program outcome: (Pos)

- **Real-World Experience:** Apply classroom knowledge in a professional setting.
- **Career Exploration:** Explore different career paths and industries.
- **Professional Networking:** Build a network of professional contacts.
- **Skill Enhancement:** Improve both technical and soft skills.
- **Workplace Adaptability:** Learn to adapt to different work environments.
- **Feedback and Improvement:** Receive feedback to improve performance and skills.

OJT/In-house Project/ Internship/Apprenticeship

- Evaluation of **OJT/In-house Project/ Internship/ Apprenticeship** shall be as per the procedure evolved by the University from time to time.
- The student shall opt for lab/ field projects / internship / apprenticeship. Lab work will be assessed for **30 hours per credit (Total=4 x 30 = 120 contact hours)**, and field projects / internship / apprenticeship will be internally assessed for 45 hours per credit under the supervision of faculty member.
- The concerned department has to maintain the details of OJT/In-house project/Internship/Apprenticeship for appropriate evaluation of students for grading and certification.

Important Note Concerning Dissection and Field Studies

As per the guidelines of 'UGC Resolution- D.O.No.F.14-6/2014 (CPP-II) dated 5th August, 2014' it is mandatory to promote the students towards knowledge component for skill development, ICT based virtual dissections be promoted. As per the notification it is necessary to encourage field trips and observations without disturbing the biodiversity. For laboratory observations existing preserved specimens and permanent slides are shown for the knowledge component. Zoology Department should be empowered with ICT based tools, infrastructure, software components and enrich with high-quality internet facilities.

Students must follow instructions as instructed from respective institutes during various kinds of study tours, field trips, project work etc. Students are entirely responsible for any sort of personal injury, harm or unfortunate incident in case of students misconduct during the course of study.