

**Punyashlok Ahilyadevi Holkar
Solapur University, Solapur**



NAACAccredited-2022
'B⁺⁺'Grade(CGPA2.96)

Name of the Faculty : Science & Technology

(As per New Education Policy 2020)

Syllabus: Zoology

Name of the Course :B.Sc. II (Sem. III &IV)

(Syllabus to be implemented w.e.f. from June 2025)



**Punyashlok Ahilyadevi Holkar Solapur University,
Solapur Faculty of Science & Technology Nep 2020
Compliant Curriculum B. Sc. (Zoology) Program
Preamble
Second Year B. Sc. (Zoology) Semester-III/IV**

The Bachelor of Science (BSc) 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 BSc 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 BSc Zoology program, with students acquiring skills in research methodology, data collection, analysis, and scientific inquiry. By engaging in Punyashlok Ahilyadevi Holkar Solapur University, Solapur Faculty of Science & Technology Nep 2020 Compliant Curriculum B. Sc. (Zoology) Program Preamble 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 BSc 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 BSc 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 BSc Zoology: A candidate should have bachelor's degree in Zoology/Life Sciences/Equivalent subjects (three years course after 10+2) from the recognized university.

The scheme of evaluation of performance of candidates shall be based on University assessment as well as College internal assessment as given below.

For B.Sc. Part-II Zoology sem III& IV the internal assessment will be based on Internal tests, Home assignment, Tutorials, Seminars, Group discussion, Brain storming sessions etc. as given below.


Scheme of Evaluation As per the norms of the grading system of evaluation, out of 100 marks, the candidate has to appear for college internal assessment of 40 marks and external evaluation(University assessment)of 60 marks.

Theory:(100marks) University Examination (60 marks):

No. of theory papers:2 (paper III and paper IV of 30 marks each)

Internal Continuous Assessment:(40 marks and 20 marks each for two papers)

- (a) Internal test-Home assignment/tutorials/seminars/viva/group discussion/outreach programs. II Semester -Theory:(100marks)
- (b) University Examination (60marks): No. of theory papers:2(paper-III and paper –IV of 30 marks each) Internal Continuous Assessment:(40 marks and 2 marks each for two papers)
- (c) Internal test-Home assignment/tutorials/seminars/viva/group discussion/outreach programs. Internal Continuous Assessment:(20marks):
- (d) (a)Internal practical test-Scheme of marking:10marks
(b)Viva/group discussion/model or chart/attitude/attendance/overallbehavior:10marks

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|  | <p>Punyashlok Ahilyadevi Holkar Solapur University, Solapur Faculty of Science & Technology Nep 2020 Compliant Curriculum B. Sc. (Zoology) Program Specific Outcomes (PSOs)</p> |
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| Students graduating from BSc (Zoology) will able to : |
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| <p>PSO1: Mastery of Core Zoology Concepts: Techniques and Methodologies discussed in the vital topics like Cell Biology, Genetics, Molecular Biology manifest the knowledge in research specific areas and studies by protection of endangered species, Wildlife Management, Climatic changes and Global Management are discussed as a paper to improvise the subject knowledge for identifying any problems related and in helping the impacted environment and biodiversity.</p> <p>PSO2: Experimental and Analytical Skills: demonstrate proficiency in designing and conducting experiments, using modern laboratory equipment, and employing analytical techniques to interpret and present scientific data effectively.</p> <p>PSO3: Application of Zoology in Technology and Research: Exhibit Skills in areas related to their individual specialization like genetic engineering, biotechnology, bioinformatics in relation to current developments and related fields in the domain; helps to apply the knowledge of internal structure of cell, its functions in control of various metabolic functions of organisms.</p> <p>PSO4: Demonstrated Understanding of Animal Diversity: • Knowledge of scientific classification and evolutionary relationships of major animal groups. • Appreciation of the breadth of animal diversity.</p> <p>PSO5: Structure-Function Relationships: • Recognized how structure relates to function across different biological levels (molecules, cells, organs, organisms, populations, species) for major animal groups.</p> <p>PSO6: Applied Biological Sciences and Career Opportunities: Familiarity with applied zoology fields (e.g., sericulture, apiculture, aquaculture, industrial microbiology, DNA technology, medicine) and their career prospects</p> |
| Program Outcome (POs): |
| <p>PO 1: Fundamental Knowledge: Gain a comprehensive understanding of the basic concepts and principles of zoology, including the classification, structure, function, and evolution of animals. This includes studying various animal phyla, their physiological processes, and ecological interactions.</p> <p>PO 2: Laboratory Skills: Develop proficiency in laboratory techniques and procedures essential for zoological research. This includes skills in microscopy, dissection, histology, and molecular biology techniques such as DNA extraction, PCR, and gel electrophoresis.</p> <p>PO 3: Fieldwork Competence: Acquire the ability to conduct field studies to observe and analyze animal behavior, population dynamics, and habitat interactions. This involves learning methods for sampling, data collection, and ecological surveying in various environments.</p> |

PO 4: Data Analysis: Learn to analyze and interpret biological data using appropriate statistical methods and software. This includes understanding how to design experiments, collect data, perform statistical tests, and present findings in a scientifically rigorous manner.

PO 5: Research Skills: Develop the ability to design and conduct independent research projects in zoology. This involves formulating research questions, developing hypotheses, designing experiments, collecting and analyzing data, and drawing valid conclusions.

PO 6: Critical Thinking: Enhance critical thinking skills to evaluate scientific literature, research findings, and current issues in zoology. This includes the ability to critically assess the methodology, results, and implications of scientific studies.

PO 7: Ethical Practice: Apply ethical principles in the study and practice of zoology. This includes understanding the ethical considerations in animal research, conservation efforts, and the responsible use of biological resources.

PO 8: Communication: Develop effective communication skills to convey zoological concepts and research findings to both scientific and general audiences. This includes writing scientific reports, presenting research findings, and engaging in public outreach and education.

PO 9: Interdisciplinary Integration: Integrate knowledge from related fields such as genetics, ecology, environmental science, and biotechnology to enhance the understanding of zoological studies. This interdisciplinary approach helps in addressing complex biological questions and environmental issues.


PO 10: Lifelong Learning: Foster a commitment to lifelong learning to stay updated with advancements in zoology and related fields. This includes engaging in continuous professional development, attending workshops and conferences, and staying informed about new research and technologies.

PAH SOLAPUR UNIVERSITY , SOLAPUR - (As per NEP 2020)

Semester–III

| Course Code | Title of Papers | Distribution of Marks for Examination | | | Total credit |
|--|--|---------------------------------------|----|-------|--------------|
| | | CA | UA | Total | |
| DSC1-3(2+1) | Cell Biology GO4-0104 (Theory) | 20 | 30 | 50 | 3 |
| PRDSC1-3(2+1) | Practical based on DSC-1 -3 (Practical) | 20 | 30 | 50 | 2 |
| DSC1-4(2+1) | Fundamentals of Biochemistry | 20 | 30 | 50 | 3 |
| | Practical based on DSC-1 -4 (Practical) | 20 | 30 | 50 | 2 |
| DSC2-3 (2+1) | Introduction to Genetics | 20 | 30 | 50 | 3 |
| | Practical based on DSC-2 -3 (Practical) | 20 | 30 | 50 | 2 |
| DSC2-4 (2+1) | Techniques in Biology | 20 | 30 | 50 | 3 |
| | Practical based on DSC-2 -4 (Practical) | 20 | 30 | 50 | 2 |
| GE/OE | Forensic Science (Theory) | 20 | 30 | 50 | 2 |
| SEC/VSC1 (2) | Vermitechnology | 20 | 30 | 50 | 2 |
| SEC/VSC2 (2) | Apiculture | 20 | 30 | 50 | 2 |
| | | 20 | 30 | 50 | 2 |
| TotalMarks+Credit forSemester-III | | | | | 26 |

| Semester–IV | | | | | |
|---|--|------------|------------|-------------|-----------|
| DSC1-5 (2+1) | Principles of Ecology | 20 | 30 | 50 | 3 |
| PRDSC1-5 (2+1) | Practical based on DSC-1 -5 (Practical) | 20 | 30 | 50 | 3 |
| DSC1-6 (2+1) | Animal Physiology | 20 | 30 | 50 | 3 |
| | Practical based on DSC-1 -6 (Practical) | 20 | 30 | 50 | 3 |
| DSC2-5 (2+1) | Biological pest Management | 20 | 30 | 50 | 3 |
| | Practical based on DSC-2-5 (Practical) | 20 | 30 | 50 | 3 |
| DSC2-6 (2+1) | Endocrinology | 20 | 30 | 50 | 3 |
| | Practical based on DSC-2-6 (Practical) | 20 | 30 | 50 | 3 |
| | Ornithology | 20 | 30 | 50 | 2 |
| | Sericulture | 20 | 30 | 50 | 2 |
| FP1/CEP1(2) | Field Project | | | 50 | 2 |
| VEC1(2) | Environmental Science ENS-24 | 20 | 30 | 50 | 2 |
| Total Marks+Credit for Semester-II | | 110 | 440 | 550 | 44 |
| Total Marks+Credit for Semester-I | | 110 | 440 | 550 | 44 |
| Total Marks+Credit for Semester-II | | 110 | 440 | 550 | 44 |
| Total Marks and Credit | | 220 | 880 | 1100 | 88 |

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|  | Punyashlok Ahilyadevi Holkar Solapur University, Solapur Second Year B. Sc. (Zoology) Semester-III Course Code: DSC1-3(2+1) (Theory) (Practical) Course Code: Cell Biology |
| *Teaching Scheme Lectures:04 Hours/week, 04 Credits -2 OR Practical:02Hours/week, 01Credit-2 | *Examination Scheme UA: Marks CA: Marks |
| Program Specific Outcome (PSOs)of cell biology: PSO1 Understanding the structure and function of cells PSO2 Learning about cell organelles and how they relate to their functions PSO3 Understanding the process of central dogma PSO4 Learning about cell division, cell membranes, | |
| Program Outcome: PO1 Understand the basic concepts of cell biology PO2 Understand the cell cycle and its phases PO3 Understand the concept of a cell and study ultra structure of prokaryotic and eukaryotic cell PO4 Understand and implement basic concepts of biology and blend the knowledge with concepts from other branches of science to have proficiency in interdisciplinary branches | |
| Course Objectives: 1 To Understand the concept of a cell and study ultrastructure of prokaryotic and eukaryotic cell 2 To Describe various models of structure of plasma membrane with emphasis on Fluid Mosaic Model and understand various functions of plasma membrane 3 To Understand the ultrastructure and functions of cell organelles 4 To Understand the cell cycle and its phases | |
| Course Outcomes: 1 Understand the cell cycle and its phases 2 Describe various models of structure of plasma membrane with emphasis on Fluid Mosaic Model and understand various functions of plasma membrane 3 Understand the ultrastructure and functions of smooth and rough endoplasmic reticulum; golgibodies; mitochondria 4 Understand the structure, types of chromosomes | |

Section I

| Unit 1 | Number of Marks | Weightage |
|---|-----------------|-----------|
| Overview of Cells Prokaryotic and Eukaryotic cells, Virus | | |
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| Unit 2 | Number of Marks | Weightage |
|--|-----------------|-----------|
| Plasma Membrane Singer & Nicholson's model of plasma membrane. An overview of active transport and passive transport, across membranes: Uniport, Antiport, Symport | | |
| | | 3 |

| Unit 3 | Number of Marks | Weightage |
|--|-----------------|-----------|
| Endomembrane System Structure and Functions: Endoplasmic Reticulum, Golgi apparatus, Lysosomes | | |
| | | 6 |

| Unit 4 | Number of Marks | Weightage |
|--|-----------------|-----------|
| Unit 4: Mitochondria Mitochondria: Ultrastructure, Semi-autonomous nature, Endosymbiotic hypothesis and functions. | | |
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Section II

| Unit 1 | Number of Marks | Weightage |
|--|-----------------|-----------|
| Cytoskeleton Structure and Functions: Microtubules, Microfilaments, Intermediate filaments | | |
| | | 04 |

| Unit 2 | Number of Marks | Weightage |
|--|-----------------|-----------|
| Nucleus 05 Structure and functions of Nucleus, Nuclear envelope, Nuclear pore complex, Nucleolus, Chromatin: Euchromatin, Heterochromatin and nucleosome | | |
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| Unit 3 | Number of Marks | Weightage |
|--------|-----------------|-----------|
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| Chromosome 04 Types of chromosomes, Acrocentric chromosome, metacentric chromosome, telocentric chromosome, acentric chromosome | | |
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| Unit 4 | Number of Marks | Weightage |
| Cell Division 02 Cell cycle, Mitosis and Meiosis | | |
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| College Level Assessment (CA) Activities: Home assignment, Review article, Class test, Field visit, Seminar |
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| Practical's 1. Preparation of temporary stained squash of onion root tip to study various stages of mitosis. 2. Study of various stages of meiosis in onion flower buds. 3. Demonstration/ Observation of Barr body using permanent slide 4. Study of selective permeability by using egg cell membrane 5. Study of principle and parts of microscope 6. Cytological preparation of Mitochondria using vital stain-Jannus green-B 7. Sub cellular fractionation of liver to separate nucleus and mitochondria 8. Study of C-bioportal and virtual cell biology |
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| References list 1. Karp, G. (2010). Cell and Molecular Biology: Concepts and Experiments. VI Edition. John Wiley and Sons. In 2. Molecular Biology of the Cell, V Edition, Garland publishing Inc., New York and London. 3. De Robertis, E.D.P. and De Robertis, E.M.F. (2006). Cell and Molecular Biology. VIII Edition. 4. Lippincott Williams and Wilkins, Philadelphia 5. Cooper, G.M. and Hausman, R.E. (2009). The Cell: A Molecular Approach. V Edition. ASM 6. Press and Sunderland, Washington, D.C.; Sinauer Associates, MA. 7. Becker, W.M., Kleinsmith, L.J., Hardin. J. and Bertoni, G. P. (2009). The World of the Cell. VII 8. Edition. Pearson Benjamin Cummings Publishing, San Francisco 9. Bruce Albert, Bray Dennis, Lewis Julian, Raff Martin, Roberts Keith and Watson James (2008). 10. World of the cell William Klug Pearson Education, Delhi |
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|  | Punyashlok Ahilyadevi Holkar Solapur University, Solapur Second Year B. Sc. (Zoology) Semester-III Course Code: DSC1-4(2+1)(Theory)(Practical) Course Code: Fundamentals of Biochemistry |
| *Teaching Scheme Lectures: 04 Hours/week, 04 Credits -2 OR Practical: 02 Hours/week, 01 Credit-2 | *Examination Scheme UA: Marks CA: Marks |
| <p>Program Specific Outcome (PSOs):</p> <p>PSO1-Understanding chemical reactions Learning how different chemical reactions work and how living organisms use them</p> <p>PSO2-Understanding how molecules interact Learning how the chemical properties of molecules determine how they interact and react with each other</p> <p>PSO3-Understanding metabolism Learning how nutrient molecules are metabolized in physiological and pathological conditions</p> <p>PSO4- Identifying pathological processes Learning to identify pathological processes and correlate them with clinical symptoms and signs</p> <p>Program Outcome:</p> <p>PO1 -Understanding chemical properties: Students learn how chemical properties of molecules determine how they interact and react with each other.</p> <p>PO2-Understanding chemical reactions: Students learn about different types of chemical reactions and how living organisms use them.</p> <p>PO3-Understanding the structure of molecules: Students learn about the structure of amino acids, nucleotides, nucleic acids, DNA and RNA, lipids, and mono, di, and trisaccharides.</p> <p>PO4-Understanding the functions of molecules: Students learn about the functions of vitamins, nucleic acids, DNA and RNA, lipids, and mono, di, and trisaccharides.</p> <p>Course Objectives:</p> <ol style="list-style-type: none"> 1. Understanding the relationship between structure and function Students will learn how the structure of biomolecules determines their function and regulation. 2. Understanding the role of water and vitamins Students will learn about the importance of water as a biological solvent and vitamins as vital ingredients of life. 3. Developing analytical and technical skills Students will develop analytical, technical, and critical thinking skills. 4. Learning about the chemical nature of biological macromolecules Students will learn about the chemical nature of biological macromolecules, their three-dimensional construction, and the principles of molecular recognition <p>Course Outcomes:</p> | |

1-Developing scientific inquiry and problem-solving skills: Students should develop the ability to conduct scientific inquiry and solve problems.

2-Developing quantitative and analytical skills: Students should develop quantitative and analytical skills.

3-Developing communication skills: Students should develop communication skills.

4-Developing information literacy and ethical analysis skills: Students should develop the ability to locate, understand, and evaluate scientific information.

Section I

| Unit 1 | Number of Marks | Weightage |
|---|-----------------|-----------|
| Bio-elements: Introduction, Significance of O ₂ , CO ₂ , and Phosphorus | | |
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| Unit 2 | Number of Marks | Weightage |
|--|-----------------|-----------|
| Carbohydrates : Structure and biological significance of Monosaccharides and Disaccharides | | |
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| Unit 3 | Number of Marks | Weightage |
|---|-----------------|-----------|
| Lipids Structure and biological significance of physiologically important saturated and unsaturated fatty acids, Triacylglycerols | | |
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| Unit 4 | Number of Marks | Weightage |
|--|-----------------|-----------|
| Amino acids: Structure and Classification of amino acids | | |
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Section II

| Unit 1 | Number of Marks | Weightage |
|------------------|-----------------|-----------|
| Proteins: | | |

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| Levels of organization in proteins (Primary and Secondary only), simple and conjugate proteins with examples | | |
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| Unit 2 | Number of Marks | Weightage |
|--|-----------------|-----------|
| Nucleic acids: Purines and Pyrimidines, Nucleosides, and Nucleotides, Base pairing of nucleic acid, Types of DNA and RNA | | |
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| Unit 3 | Number of Marks | Weightage |
|--|-----------------|-----------|
| Vitamins : Definition and Classification, functions, deficiency diseases | | |
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| Unit 4 | Number of Marks | Weightage |
|--|-----------------|-----------|
| Enzymes: Introduction and Classification, Mechanism of enzyme action, Factors affecting enzyme actions | | |
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| College Level Assessment (CA) Activities: Home assignment, Review article, Class test, Field visit, Seminar | | |
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| Practicals |
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| 1. Qualitative tests of functional groups in carbohydrates, proteins and lipids. 2. Estimation of phosphate content in soil samples. 3. Detection of protein denaturation using heat or chemicals 4. Estimation of protein by colorimetric method. 5. Demonstration of amino acids using paper chromatography. 6. Estimation of Vitamin C (Ascorbic Acid) 7. Estimation of carbohydrates by colorimetric method. 8. To study of the difference between water soluble and lipid soluble vitamins. 9. Isolation of DNA. 10. Effect of pH and temperature on enzyme activity- Amylase. |

| References list |
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| 1. Cox, M.M and Nelson, D.L. (2008). Lehninger's Principles of Biochemistry, V Edition, W.H. Freeman and Co., New York. |
| 2. Berg, J.M., Tymoczko, J.L. and Stryer, L. (2007). Biochemistry, VI Edition, W.H. Freeman and Co., New York. |
| 3. Murray, R.K., Bender, D.A., Botham, K.M., Kennelly, P.J., Rodwell, V.W. and Well, P.A. (2009). Harper's Illustrated Biochemistry, XXVIII Edition, International Edition, The McGraw- Hill Companies Inc. |
| 4. Hames, B.D. and Hooper, N.M. (2000). Instant Notes in Biochemistry, II Edition, BIOS Scientific Publishers Ltd., U.K. |
| 5. Watson, J.D., Baker, T.A., Bell, S.P., Gann, A., Levine, M. and Losick, R. (2008). Molecular Biology of the Gene, VI Edition, Cold Spring Harbor Lab. Press, Pearson Pub. |
| 6. Guyton, A.C. & Hall, J.E. (2006). Textbook of Medical Physiology. XI Edition. Hercourt Asia PTE Ltd. /W.B. Saunders Company. |

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| 7. Handbook of Biochemistry and Molecular Biology by Roger L. Lundblad (Editor); Fiona MacDonald (Editor) |
| 8. "Biochemistry" by Satyanarayana |

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|  | <p align="center"> Punyashlok Ahilyadevi Holkar Solapur University, Solapur Second Year B. Sc. (Zoology) Semester-III Course Code: DSC2-3/2-6(2+1) (Theory) Course Code: Introduction to Genetics </p> |
| <p> *Teaching: Scheme Lectures: 04 Hours/week, 04 Credits -2 OR Practical: 02 Hours/week, 01 Credit-2 </p> | <p>*Examination Scheme UA: Marks CA: Marks</p> |
| <p> Program Specific Outcome (PSOs): PSO1:-Understanding Genetic Principles: Ability to explain and apply fundamental genetic concepts and theories. PSO2:-Research Skills: Proficiency in designing and conducting genetic research, including data analysis and interpretation. PSO3:- Technological Proficiency: Competence in using modern genetic and bioinformatics software. PSO4:- Problem Solving: Capability to solve complex genetic problems and develop innovative solutions. </p> | |
| <p> Program Outcome:- PO1: Understand Basic Genetic Concepts - Grasp fundamental principles of genetics, including inheritance patterns. PO2: Analyze Genetic Data - Develop skills in collecting, analyzing, and interpreting genetic data. PO3: Apply Genetic Knowledge - Use genetic concepts to solve basic problems and understand genetic variation in populations. PO4: Use Genetic Tools - Gain proficiency in using common genetic tools and techniques - karyotyping. PO5: Explore Genetic Disorders - Learn about common genetic disorders and their impact on individuals and families. </p> | |
| <p> Course Objectives: CO-1: Explore Genetic Disorders - Learn about common genetic disorders and their impact on individuals and families. CO-2: Develop skills in collecting, analyzing, and interpreting genetic data. CO-3: Apply genetic knowledge to solve basic problems and understand genetic variation within populations. CO-4: Recognize and discuss ethical, legal, and social implications of genetic research and technologies. </p> | |
| <p> Course Outcomes: CO-1: Demonstrate understanding of fundamental genetic principles, including inheritance patterns, DNA structure, and gene function. CO-2: Collect, analyze, and interpret genetic data effectively. </p> | |

CO-3: Apply genetic knowledge to solve basic problems and understand genetic variation within populations.

CO-4: Utilize common genetic tools and techniques.

Section I

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|---|---------------------------|---------------------------|
| UNIT I:- | Number of Lectures | Weightage of Marks |
| 1.1.Mendelian Genetics:- Introduction about Mendelian work. | | |
| 1.2.Monohybrid cross- Law of dominance, Law of segregation, Incomplete Dominance | | |
| 1.3.Dihybrid Cross- Law of Independent Assortment | 08 | 2 to 8 |

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| UNIT II: - Linkage, Crossing Over | Number of Lectures | Weightage of Marks |
| 2.1. Linkage – Complete and Incomplete Linkage with suitable example, Importance of Linkage | | |
| 2.2. Crossing Over – Mechanism of Crossing over, Cytological Proof of Crossing Over, Importance of Crossing Over | 07 | 2 to 8 |


Section II

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| UNIT III: - Sex Determination | Number of Lectures | Weightage of Marks |
| Chromosomal Mechanism sex determination in Drosophila and Human, Genetic Disorder: Klinefelters Syndrome and Turners Syndrome. | 08 | 2 to 8 |

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| UNIT IV: - Polygenic Inheritance | Number of Lectures | Weightage of Marks |
| Polygenic Inheritance with suitable examples | 07 | 2 to 6 |

References list

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| 1. Gardner, E.J., Simmons, M.J., Snustad, D.P. (2008). Principles of Genetics. VIII Edition. Wiley India |
| 2. Snustad, D.P., Simmons, M.J. (2009). Principles of Genetics. V-Edition. John Wiley and Sons Inc |
| 3. Klug, W.S., Cummings, M.R., Spencer, C.A. (2012). Concepts of Genetics. X Edition. Benjamin Cummings |
| 4. Russell, P. J. (2009). Genetics- A Molecular Approach.III Edition. Benjamin Cummings |
| 5. Griffiths, A.J.F., Wessler, S.R., Lewontin, R.C. and Carroll, S.B. Introduction to Genetic Analysis. IX Edition. W. H. Freeman and Co. |
| 6. Fletcher H. and Hickey I. (2015). Genetics. IV Edition. GS, Taylor and Francis Group, New York and London |

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|  | <p>Punyashlok Ahilyadevi Holkar Solapur University, Solapur Second Year B. Sc. (Zoology) Semester-IV Course Code: DSC2-3/2-4/2-5/2-6(2+1)(Theory)(Practical) Course Code: Techniques in Biology</p> |
| <p>*Teaching Scheme Lectures:04 Hours/week, 04 Credits -2 OR Practical:02Hours/week, 01Credit-2</p> | <p>*Examination Scheme UA: Marks CA: Marks</p> |
| <p>Program Specific Outcome (PSOs): PSO1: Graduate students will be able to demonstrate and apply the knowledge of sterilization techniques in for performing biological experiments. PSO2: Graduate students will be able to demonstrate and apply the principles of microscopy for making microscopic observations. PSO3: Students will be able to gain the knowledge of Photometric techniques and its applications and hematological techniques. PSO4: Student will be able to use techniques like centrifugation, chromatography electrophoresis for isolation of bio molecules.</p> | |
| <p>Program Outcome: PO 1: Fundamental Knowledge: Gain a comprehensive understanding of the basic concepts and principles of zoology, including the classification, structure, function, and evolution of animals. This includes studying various animal phyla, their physiological processes, and ecological interactions. PO 2: Laboratory Skills: Develop proficiency in laboratory techniques and procedures essential for zoological research. This includes skills in microscopy, dissection, histology, and molecular biology techniques such as microscopy and gel electrophoresis etc. PO 3: Data Analysis: Learn to analyze and interpret biological data using appropriate statistical methods and software. This includes understanding how to design experiments, collect data, perform statistical tests, and present findings in a scientifically rigorous manner. PO 4: Research Skills: Develop the ability to design and conduct independent research projects in zoology. This involves formulating research questions, developing hypotheses, designing experiments, collecting and analyzing data, and drawing valid conclusions</p> | |
| <p>Course Objectives: 1 To inculcate the knowledge of sterilization techniques. 2 To enable students to handle compound microscope at different resolutions. 3 To understand the mechanism of working of colorimeter. 4 To understand the separation mechanism of biomolecules by using chromatography.</p> | |
| <p>Course Outcomes: 1 Students will be able to use sterilization techniques while performing biological experiments. 2 Students will be able to operate microscope to observe microscopic things. 3 Students will be able to use colorimeter for component analysis in samples. 4 Students will be able to isolate biomolecules by using chromatography technique.</p> | |

Section I


| Unit 1 | Number of Marks | Weightage |
|--|------------------------|-----------|
| Sterilization techniques 1.1 Dry heat sterilization 1.2 Wet heat or moist heat sterilization: Boiling, Steaming, Tyndallization, Autoclaving, Pasteurization. 1.3 Filtration: Earthenware, Asbestos, Sintered glass, Membrane. 1.4 Radiations: Ionizing and Non Ionizing radiations, Ultraviolet Radiation 1.5 Laminar air flow- Principle and Mechanism of Working. Vertical and Horizontal Laminar air flow. 1.6 Chemical Methods of sterilization: Properties of ideal disinfectant, Action of disinfectants, Factors affecting disinfectants, Types of disinfectants- Alcohols, Aldehydes, Phenols, Halogens, Heavy metals, dyes, Hydrogen peroxide, Beta propiolactone 1.7 Gaseous Sterilization Formaldehyde, Ethylene oxide, plasma | | 4 |
| Unit 2 | Number of Marks | |
| Microscopy 2.1 Brief history of Microscopes. 2.2 Principles of Microscopy 2.3 Basic quality parameters of microscopic images: Focus, Brightness, Contrast, Resolution 2.4 Magnification and resolution 2.5 Types of Microscopes: Parts, working mechanism and Applications. 1. Simple microscope 2. Compound microscope 3. Phase-Contrast microscope 4. UV Microscope 5. Fluorescence Microscope 6. Confocal Laser Scanning Microscope | | 4 |

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| 7. Transmission Electron microscope (TEM) | | |
| 8. Scanning electron microscope (SEM) | | |
| Unit 3 | Number of Marks | Weightage |
| Photometric Technique | | 3 |
| 3.1 Principles | | |
| 3.2 Beers -Lambert's law. | | |
| 3.3 Colorimeter: Parts, Instrumental design, working mechanism, applications. | | |
| Unit 4 | Number of Marks | Weightage |
| Separation Technique -Chromatography | | 4 |
| 4.1 Principle | | |
| 4.2 Component phases- Mobile, Stationary, Supporting medium. | | |
| 4.3 Meaning of basic terms: Adsorption, Eluent, Elution, Elution time, Stationary phase, Normal phase, Reverse Phase, Resolution, Retardation factor (Rf) Value. | | |
| 4.4 Types of Chromatography: Principle and Mechanism of working. | | |
| A. On the basis of interaction of solute to stationary phase- a. | | |
| Adsorption chromatography | | |
| b. Partition chromatography | | |
| c. Ion exchange chromatography | | |
| d. Molecular exclusion chromatography | | |
| B. On the basis of chromatographic bed shape | | |
| a. Column chromatography | | |
| b. Thin layer chromatography | | |
| c. Paper chromatography | | |
| C. Techniques by physical state of mobile phase | | |
| a. Gas chromatography | | |
| b. Liquid chromatography | | |
| c. Affinity chromatography | | |

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| d. Super critical fluid chromatography | | |
| Unit 1 | Number of Marks | Weightage |
| Separation Technique- Centrifugation | | 4 |
| 5.1 Principle of Centrifugation Centrifugal force | | |
| 5.2 Basics of Sedimentation | | |
| 5.3 Types of Centrifugation a. Preparative Centrifugation b. Analytical Centrifugation | | |
| 5.4 Types and Design of Preparative Rotors a. Swinging bucket rotors b. Fixed angle rotors c. Vertical tube rotors d. Zonal rotors | | |
| 5.5 Separation Methods in Preparative Centrifugation a. Differential Centrifugation b. Density gradient Centrifugation c. Rate Zonal centrifugation d. Isopycnic Centrifugation | | |
| 5.6 Separation Methods in Analytical centrifugation | | |
| 5.7 Application of Centrifugation | | |
| Unit 2 | Number of Marks | Weightage |
| Unit III. Hematological Techniques | | 4 |
| Composition of Blood | | |
| Blood smear: Preparation and staining | | |
| Hemocytometer | | |
| Erythrocyte sedimentation rate | | |
| Osmotic fragility Test | | |
| Red cell morphology | | |
| White Blood cell morphology | | |

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| Blood clotting time Hemoglobinometer Hemocytometer Blood cell count –Total count of RBCs Differential count of WBCs and their significance. Glucometer. | | |
| Unit 3 | Number of Marks | Weightage |
| Photometric Technique 3.1 Principles 3.2 Beers -Lambert's law. 3.4 Spectrophotometer- Parts, Instrumental design, working mechanism, applications, Types- Single beam and Double beam | | 3 |
| Unit 4 | Number of Marks | Weightage |
| Electrophoresis Principle of Electrophoresis Different types of electrophoresis 1.Moving boundary electrophoresis 2- zone electrophoresis : [A]- Paper Electrophoresis , [B] Gel Electrophoresis 3- Isoelectric focussing 4- Immunoelectrophoresis Agarose gel Electrophoresis- Properties of agarose gel, migration and separation of nucleic acids in agarose gel, Preparation of Buffer. Application of Agarose Gel electrophoresis. Polyacrylamide Gel electrophoresis (PAGE)- Properties of Polyacrylamide Gel, Native continuous PAGE, Native discontinuous continuous PAGE, SDS PAGE. Application of PAGE. | | 4 |
| College Level Assessment (CA) Activities: Home assignment, Review article, Class test, Field visit, Seminar | | |
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| Practical's |
| <ol style="list-style-type: none"> 1. Isolation of amino acids by using Paper Chromatography. 2. Study of Colorimeter and estimation of protein concentration from the given sample by suitable method. 3. Study of spectrophotometer and estimation of glucose concentration from the given sample by DNS method. 4. Study of Centrifuge machine and isolation of cell constituents. 5. Preparation of blood smear and identification of WBCs (leucocytes). 6. Study of Neubauer chamber for RBC cell count 7. Study of Neubauer chamber for WBC cell count 8. Study of Osmotic fractionation of RBC. 9. Measurement of blood sugar by using Glucometer. |
| References list |
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| 8. Pearse, A.G.E. (1980-1993) Histochemistry - Theoretical and applied, Volume I-III, Churchill-Livingstones. |
| 9. Plummer, D. (2017) An Introduction to Practical Biochemistry (3 rd edition) McGraw Hill. |
| 10. Wilson, K. and Walker, J. (2010) Experimental Biochemistry, Cambridge. |
| 11. Biotechniques -N.Arumugam and V.Kumaresan ,Saras publication |
| 12. Biochemistry Dr.N. Arumugam,Dulsy Fatima,L.M .Narayanan,Prof. K.Nallisingam,Dr.R.P Meyyan Pillai ,Prof.S.Prasannakumar , Saras publication |
| 13. Biological Techniques By P.R. Yadav Discovery Publishing House Pvt. Limited |
| 14. Biological Techniques By Kishore R Pawar Nirali Prakashan, Educational Publishers |

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|  | Punyashlok Ahilyadevi Holkar Solapur University, Solapur Second Year B. Sc. (Zoology) Semester-III/IV Vertical : Open Elective – III /IV General Elective- III/IV Course Code:- GO4-GE-OE-204 (Theory) Course Code: Forensic science (forensic Zoology) | |
| *Teaching Scheme Lectures:04 Hours/week, Credits 02 | *Examination Scheme UA: Marks CA: Marks | |
| Program Specific Outcome (PSOs): PSO1. To provide a platform for students and forensic scientist to exchange views, checkouts collaborative programs and work in holistic manner for the advancement of Forensic Science PSO2. To understand skills for Detection of crime with scientific aid. PSO3. To emphasize on forensic entomology assists in death investigations. PSO4. To review the steps necessary for achieving highest excellence in forensic science. | | |
| Program Outcome: PO1. To understand wildlife forensics aid in conserving natural resources PO2. To generate talented human resource, commensurating with latest requirements of forensic science. PO3. How wildlife forensics aid in conserving natural resources. PO4. The forensic significance of DNA typing. | | |
| Course Objectives: After studying this paper the students will know – <ol style="list-style-type: none">1. To disseminate information on the advancements in the field of forensic science.2. Acquaint the student with Role of forensic science in crime detection3. The fundamental principles and functions of forensic science.4. To emphasize the importance of scientific methods in crime identification and detection | | |
| Course Outcomes: <ol style="list-style-type: none">1. To create awareness of techno crimes and use of new emerging techniques in crime detection.2. To use technological advancements in the investigation of crimes and its occurrences.3. To make them aware about starting private detective agencies in future.4. To highlight the importance of Forensic Science for perseverance of the society. | | |
| Section I | | |
| Unit 1 | Number of lectures | Weightage |
| Historical aspects of forensic science. Definitions and concepts in forensic science. Scope of forensic science. Need of forensic science. Basic principles of forensic science. Functions of forensic science. | 4L | 2-4 |

| Unit 2 | Number of lectures | Weightage |
|---|---------------------------|------------------|
| Fundamentals of Wildlife Forensic. Significance of wildlife Forensic. Protected and endangered species of animals and plants, Illegal trading in wildlife items, such as skin, fur, bone, horn, teeth, flowers and plants. Identification of pug marks of various animals. | 3 L | 4-5 |
| Criminal investigation, identification of animals by teeth, claws, ivory, antlers, furs, skins, bitemarks, pugmarks, Identification of blood, excreta, and other visceral samples. Wildlife protection act, endangered species, CITES, Census of wild life population, Smuggling and poaching, crime scene search., Forensic Significances and cases. | 3L | 4-5 |


Section II

| Unit 3 | Number of lectures | Weightage |
|---|---------------------------|------------------|
| Forensic Entomology Basics of forensic entomology. Insects of forensic importance. Collection of entomological evidence during death investigations. | 3 L | 2-4 |
| Post Mortem Interval: role of entomology in determination of PMI, Introduction to insects of forensic importance, Determination of PMI, Determining the age of blow fly life cycle stages | 2L | 2-4 |
| Unit 4 | Number of lectures | Weightage |
| Genetic material – Discovery, experiments, composition and structure of DNA and RNA, | 4 L | 4-6 |

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|---|------------|------------|
| organization of DNA in chromosomes, DNA replication, genetic code, protein synthesis, Mendelian principles, sex linkage and sex determination systems, Introduction to recombinant DNA technology, its applications in health, agriculture, industries & forensics. | | |
| DNA extraction from various sources- methods- scientific basis of DNA typing- Basis of heredity- genes, alleles, polymorphism, variations- Population genetics: introduction- molecular aspects of DNA | 4 L | 4-6 |

College Level Assessment (CA) Activities: Home assignment, Review article, Class test, Field visit, Seminar

| References list |
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| 15. S. Chowdhuri, Forensic Biology, BPRD, New Delhi (1971). |
| 16. R. Saferstein, Forensic Science Handbook, Vol. III, Prentice Hall, New Jersey (1993). |
| 17. J.M. Butler, Forensic DNA Typing, Elsevier, Burlington (2005). |
| 18. B.B. Nanda and R.K. Tiwari (2001). Forensic Science in India: A Vision for the Twenty First century, Select Publishers, New Delhi |
| 19. Richard Li (2015), "Forensic Biology", CRC Press, Boca Raton, 2nd Edition. |
| 20. Jason H. Byrd, James L. Castner (2009), "Forensic Entomology: The Utility of Arthropods in Legal Investigations", CRC Press, Boca Raton, 2 nd Edition. |
| 21. L. Stryer, Biochemistry, 3rd Edition, W.H. Freeman and Company, New York (1988). |
| 22. S.H. James and J.J. Nordby, Forensic Science: An Introduction to Scientific and Investigative Techniques, 2nd Edition, CRC Press, Boca Raton (2005). |
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|  | Punyashlok Ahilyadevi Holkar Solapur University, Solapur Second Year B. Sc. (Zoology) Semester-III/IV SEC-1/2/3/4 Course Code: GO4-SEC-104 Course Code: Vermitechnology (Practical Course) |
| Practical:02Hours/week, 01Credit- 2 | *Examination Scheme UA: Marks CA: Marks |
| Program Specific Outcome (PSOs): PSO1 Students can construct their own compost farm PSO2 Students residing in cities can produce vermicompost in small scale for garden/household plants. PSO3. Students will learn the skill of vermicomposting and get jobs in educational institutes as vermicompost/vermiculture technician PSO4 The candidate can learn to generate income by supplying verms, vermiwash, & vermi compost | |
| Program Outcome: PO1 PO2 PO3 PO4 | |
| Course Objectives: CO1. To study and understand the basic classification of earthworm CO2. To understand the vermicomposting methods CO3. Aspire to work in preparing Vermicomposting and vermi-culturing CO4. To study the vermicomposting Technical awareness of vermicomposting in home and maintenance CO5. To study the application of vermicomposting in agriculture and horticulture1 | |
| Course Outcomes: 1The students acquire the knowledge in vermitechnology 2students will be able to compost in a limited space and describe the decomposing process. The interested students will get the knowledge of composting,Students will get the employment, They can generate employments, They will also turn towards organic farming, Will help to maintain the environment pollution free and will get the knowledge of biodiversity of local earthworms 3Students/ farmers by using vermicompost in their field can increase the crop yield. 2. By developing and propagating vermicompost technology students will directly or indirectly help to prevent environmental pollution, by using vermicompost in the field and thereby increasing crop yield he will help to solve food problems. 3. It will lead towards organic farming and healthy food. 4. In today's world, recycling of garbage has become necessary in order to sustain our health and environment which can be achieved through vermicomposting. | |

Practical -

1. Key to identify different types of earthworms.
- 2.
3. Field trip- collection of native earthworms and their identification
4. Study of life stages and development of *Eisenia foetida*
5. Study of life stages and development of *Eudrilus eugeniae*
6. Collection of organic waste Decomposition of organic raw material and Preparation of vermibeds, maintainance of vermicompost unit and Vermiculture, vermiwash
7. Study of different methods of vermicomposting
8. Proposal writing for funding agency for starting Vermicompost Unit.
9. Project on vermicompost treatment on plant growth (Field work/ by pot method)./Documentation report based on their home Vermicompost unit
 1. Study of systematic position, habit habitats and external characters of *Eisenia foetida*.
 10. Vermicompost analysis: Macro and micro nutrients and microbial analysis of vermico

References list.

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2. Edwards,C.A.,Bohlen,P.J, Lindon,D.R and Subler,S “Earthworms in Agroecosystems. In:Earthworm Ecology and Biogeography in North America” Lewis Publisher,Boca Raton., FL,PP:185-213.1995
3. Edwards,C.A & Bohlen,P.J.,, “Biology and Ecology of Earthworms” 3 rd Edition.,Springer Science & Business Media, 1996.
4. Mary Violet Christy ,A., “Vermitechnology”, MJP Publishers. 200

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|  | Punyashlok Ahilyadevi Holkar Solapur University, Solapur Second Year B. Sc. (Zoology) Semester-III/IV SEC-1/2/3/4 Course Code: GO4-SEC-104 Course Code: Apiculture |
| Practical: 02 Hours/week, 01 Credit- 2 | *Examination Scheme UA: Marks CA: Marks |
| Program Specific Outcome (PSOs): PSO1 Student will gain knowledge of Beekeeping PSO2 Student will understand the principles of sustainable beekeeping PSO3 Student will handle all tools and equipment in the concerned industry PSO4 Student will learn essential skillset for beekeeping practice | |
| Program Outcome: PO1 Student will learn whole process of apiculture and beekeeping PO2 It will fulfil the industry demand PO3 Student will learn essential skillset PO4 It will promote self-employment | |
| Course Objectives: 1 Disseminate the knowledge of tools and equipment required for bee keeping 2 To teach principles of sustainable beekeeping 3 To make student aware about beekeeping business 4 Transform beekeeping into an enduring practice | |
| Course Outcomes: 1 Student will identify species of Honey bee and differentiate its castes 2 Student will learn techniques of Beekeeping 3 Student will learn the role of equipment required for beekeeping 4 Student will understand the economics of Beekeeping | |
| Practical - | |
| 1. Morphological identification of Bee species: <i>Apisindica</i> , <i>Apismellifera</i> , <i>Apis dorsata</i> & <i>Apis florea</i> | |
| 2. Study of caste system in <i>Apisindica</i> : Queen bee, Drone bee and Worker bee | |
| 3. Study of Structural arrangement of pro and metathoracic leg in worker bee | |
| 4. Study of Structural arrangement of sting apparatus and wax gland in worker bee | |
| 5. Demonstration of Bee box | |
| 6. Study of bee keeping equipment's: Honey extractor, knife, smoker, Hive tool, overall, bee veil, high boots, bee brush | |


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| 7. Bee diseases: Nosema disease, Sacbrood disease and Chalk brood disease |
| 8. Study of Bee Predator: King crows, Wasps |
| 9. Study of Bee products: Honey, Bee wax, Pollens, Royal Jelly, Propolis and Bee venom |
| 10. Visit to Beekeeping center |

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| References list |
| 1. Abrol, D.P. (1997) Bees and Beekeeping, Kalyani Publisher, New Delhi |
| 2. Abrol, D.P. (2010) A Comprehensive guide to Bees and Beekeeping, Scientific Publisher, New Delhi |
| 3. Withhead, S.B. (2010) Honey bees and their management Axis books Publisher, Jodhpur |
| 4. Nagaraja, N. and Rajagopal, D. (2013) Honey bees: Diseases, Parasites, Pests, Predator and their management. M.J.P. Publisher, Chennai |
| 5. Dharamsing and Singh, D.P. A Handbook of Beekeeping, Agrobios India (Publisher), Jodhpur |

Syllabus: Zoology

Name of the Course :B.Sc. II (Semester IV)

(Syllabus to be implemented from June 2025)

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|  | PunyashlokAhilyadeviHolkar Solapur University, Solapur Second Year B. Sc. (Zoology) Semester-IV Course Code: DSC1-5-(2+1)(Theory)(Practical) Course Code: Principles of Ecology | |
| *TeachingScheme Lectures:04 Hours/week, 04 Credits -2 OR Practical:02Hours/week, 01Credit-2 | *Examination Scheme UA: Marks CA: Marks | |
| Program Specific Outcome (PSOs): PSO1 PSO2 PSO3 PSO4 | | |
| Program Outcome: PO1 PO2 PO3 PO4 | | |
| Course Objectives: 1 Understand the key principles of ecology at the individual, population, community, and ecosystem levels. 2Analyze the flow of energy and matter in ecosystems. 3 Examine the diversity and distribution of life on Earth. 4 Evaluate the effects of human activity on ecological processes. 5 Develop skills in ecological research methods (if lab/fieldwork is included) | | |
| Course Outcomes: 1. Understanding ecological organization at different levels (organism, population, community, ecosystem, biome) 2. Ability to explain the importance of biotic and abiotic factors in shaping ecosystems. 3. Students will be able to explain core ecological concepts, including energy flow, nutrient cycling, and the structure and function of ecosystems. 3. Students will describe and analyze different types of species interactions (e.g., predation, competition, mutualism, parasitism) and their impact on community structure. 4. Students will understand the importance of biodiversity and its role in ecosystem stability and resilience, and will be able to assess threats to biodiversity. 5. Students will critically assess human activities, such as urbanization, agriculture, and deforestation, and their effects on ecosystems and biodiversity. | | |
| Section I | | |
| Unit 1 | Number of Marks | Weightage : total 30 lecture |
| Introduction to Ecology - Definition and scope of ecology,History of ecology, Autecology and synecology | | |
| | | 02 |

| Unit 2 | Number of Marks | Weightage |
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| Population Ecology Brief idea about attributes of population: Density, natality, mortality, life tables, survivorship curves. | | |
| | | 05 |

| Unit 3 | Number of Marks | Weightage |
|---|-----------------|-----------|
| Animal Associations- Brief idea and definitions <ul style="list-style-type: none"> Intraspecific associations: Parental care in fishes, groupism and social behavior Interspecific associations: commensalism, mutualism, predation and parasitism | | |
| | | 05 |

| Unit 4 | Number of Marks | Weightage |
|---|-----------------|-----------|
| The Physical Environment and Abiotic Factors <ul style="list-style-type: none"> Climate, weather, and biomes - Temperature, light, water, water, water hardness, humidity, soil, oxygen and carbon dioxide and nutrients as environmental factors Environmental gradients and climate change | | |
| | | 03 |

Section II

| Unit 1 | Number of Marks | Weightage |
|---|-----------------|-----------|
| Community Ecology Community characteristics: species richness, dominance, diversity indices, abundance. | | |
| | | 04 |

| Unit 2 | Number of Marks | Weightage |
|---|-----------------|-----------|
| Ecosystem General characteristics & faunal adaptations in: <ul style="list-style-type: none"> Aquatic (freshwater ecosystem: lotic and lentic) & Terrestrial (grassland and desert ecosystem). | | |
| | | 05 |

| Unit 3 | Number of Marks | Weightage |
|--|-----------------|-----------|
| Ecosystem Ecology <ul style="list-style-type: none"> • Energy flow in ecosystems (trophic levels, food webs, primary production) • Biogeochemical cycles (carbon, nitrogen, phosphorus) • Ecosystem services and human impacts | | |
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| Unit 4 | Number of Marks | Weightage |
|--|-----------------|-----------|
| <p style="text-align: right;">02</p> Applied Ecology, Biodiversity and Conservation <ul style="list-style-type: none"> • Brief idea of: Biodiversity hot-spots and sacred groves in India with examples • Measuring biodiversity: species richness, evenness, and genetic diversity • Biodiversity hotspots and the importance of conservation • Human impacts on biodiversity (habitat loss, invasive species, climate change) | | |
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| College Level Assessment (CA) Activities: Home assignment, Review article, Class test, Field visit, Seminar |
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| Practical's |
| <p>1 Study and construction of ecological pyramid from given data: i) Members of Grass land ecosystem – Grasshopper, Rat Snake, Grass, Herbs, Shrubs, Weeds, Trees, Vulture, Squirrel, Centipede, Scorpion, Rabbit and Indian Bustard.</p> <p>ii) Members of Pond ecosystem – Sponge, Nepa, Leech, Planaria, Hydra, Lymnea, Planorbis, Heron, Kingfisher, Cyclops, Daphnia, Tortoise, Diatoms Vallisneria, Hydrilla, Chara and Spirogyra.</p> <p>2 Calculation of Shannon-Weiner diversity index from the given data/ model. (At least 5 Examples)</p> <p>3 Study of an aquatic ecosystem: Identification of Zooplankton with the help of permanent slides (Spotters),</p> <p>4 Estimation of Dissolved Oxygen (Winkler's method) from given sample</p> <p>5 Estimation of Carbon dioxide (CO₂) from given sample</p> <p>6 Estimation of Total Hardness content from given sample</p> <p>8 Estimate population size and density of a particular species with quadrat-based census</p> <p>9. Study Visit: Report on a visit to National / Central / State institutes / Local water bodies/National Park/Biodiversity Park/Wild life sanctuary, Observation of zooplanktons. Plankton collection tools and technique. Review article</p> |

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| References list |
| 1. Colinvau, P. A. (1993). Ecology. II Edition. Wiley, John and Sons, Inc. |
| 2. Concept of Ecology, N Arumugam, Saras Publication |
| 3. Krebs, C. J. (2001). Ecology. VI Edition. Benjamin Cummings. |
| 4. Odum, E.P., (2008). Fundamentals of Ecology. Indian Edition. Brooks/Cole |
| 5. Robert Leo Smith Ecology and field biology Harper and Row publisher |
| 6. Ricklefs, R.E., (2000). Ecology. V Edition. Chiron Pres |

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|  | Punyashlok Ahilyadevi Holkar Solapur University, Solapur Second Year B. Sc. (Zoology) Semester-IV Course Code: DSC1-6(2+1)(Theory)(Practical) Course Code: Animal Physiology |
| *Teaching Scheme Lectures: 04 Hours/week, 04 Credits -2 OR Practical: 02 Hours/week, 01 Credit-2 | *Examination Scheme UA: Marks CA: Marks |
| Program Specific Outcome (PSOs): PSO1 Perform procedures as per laboratory standards in the areas of Taxonomy, Physiology, Ecology, Cell biology, Genetics, Applied Zoology, Toxicology, Entomology, Sericulture, Biochemistry, Fish biology, Animal breeding and Clinical Pathology. PSO2 Analyze the mechanisms involved in life processes up to the molecular level. PSO3 To have competent problem-solving skills in the basic area of zoology. PSO4 Acquire skills about team work and ethical awareness and adopt scientific temper and leadership concerned for nation building. | |
| Program Outcome: PO1 PO2 PO3 PO4 | |
| Course Objectives: 1 The course deals with various physiological functions in mammals. 2 The course highlights on some of the important aspects viz. tissues, histology of the mammalian organs, nervous and muscular system. 3 The course highlights on some of the important aspects viz., Reproductive Physiology and cycle. 4 The course highlights on some of the important aspects viz. In-vitro Fertilization and Endocrine System | |
| Course Outcomes: 1 Classify cells and tissue 2 Understand the functioning of nerve cells & muscle cells. 3 Interpolate the coordination of hormones involved in reproductive physiology 4 Understand the importance of IVF | |

Section I

| Unit 1 | Number of Marks | Weightage |
|--|-----------------|-----------|
| Tissues & Histology of following mammalian organs 08 Tissues 1.1 Structure, location, classification and functions of: epithelial tissue, connective tissue, muscular tissue and nervous tissue. Blood –Types of blood cells (RBC, WBC, Platelets, Plasma), functions of blood cells | | |

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| 1.2 Histology of following mammalian organs i) Tooth ii) Salivary gland iii) Stomach iv) Ilium v) Kidney vi) Liver vii) Testis viii) Ovary | | |
| | | |

| Unit 2 | Number of Marks | Weightage |
|---|-----------------|-----------|
| Muscle &Nervous System 07 2.1 Types of muscles cells (smooth, Striated, cardiac) 2.2 Ultra structure of skeletal muscle 2.3 Molecular and chemical basis of muscle contraction. 2.4Structure of neuron 2.5 Resting membrane Potential 2.6 Origin of action potential and it's propagation across the nerve fibres ; Structure of Synapse and Synaptic transmission | | |
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| Unit 3 | Number of Marks | Weightage |
|--|-----------------|-----------|
| Reproductive System09 3.1 Pituitary gland- FSH and LH hormones 3.2 Male &female sex hormones 3.3 Reproductive Cycle 3.3.1 Oestrous cycle and Menstrual cycle 3.3.2 Hormonal control of pregnancy, parturition and lactation. 3.4 Contraception methods: Physical, oral contraceptives pills, IUD, surgical methods. 3.5 In-vitro Fertilization - Technique of IVF and its applications | | |
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| Unit 4 | Number of Marks | Weightage |
|---|-----------------|-----------|
| Endocrine System 06 4.1 Structure and function of endocrine glands: Pineal, Pituitary, Thyroid, Parathyroid, Pancreas, Adrenal. | | |
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Section II

| Unit 1 | Number of Marks | Weightage |
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| Unit 2 | Number of Marks | Weightage |
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| Unit 3 | Number of Marks | Weightage |
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| Unit 4 | Number of Marks | Weightage |
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| College Level Assessment (CA) Activities: Home assignment, Review article, Class test, Field visit, Seminar |
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| Practical's |
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| <p>1 Observation and detail explanation of following tissue with reference to structure ,location and functions (with CD/Slide/Model/Chart).</p> <p>i) Epithelial ii) Connective iii) Muscular iv) Nervous</p> <p>2 Study of histological structures (T.S./V.S.) - of Mammalian organs using permanent slides (Spotters): i) Tooth ii) Salivary gland iii) Stomach iv) Ileum v) Kidney vi) Liver vii) Testis viii) Ovary</p> <p>3 Study of ABO blood group system from given blood sample .</p> <p>4 Total count of WBC from a given blood sample by using Neubauer chamber.</p> <p>5 Study of following abnormal urine constituents: Glucose, Bile, Blood and Albumin</p> <p>6 Microtomy: Study of principle , procedure and mechanism of micro-technique for the preparation of permanent slides:</p> <p>a) Fixation of tissue</p> <p>b) Embedding wax and Preparation of blocks</p> <p>c) Gradient hydration and dehydration and staining with HE</p> <p>7 Study of contraceptives : Oral contraceptives (pills), Intra -uterine device, Condom using chart/Photographs.</p> <p>8 Study of the permanent slides/charts of endocrine glands: Pineal, Pituitary, Thyroid, Parathyroid, Pancreas, Adrenal.</p> <p>9. Erythrocyte sedimentation rate.(ESR)</p> <p>10. Study visit: Preparation of models, Visit to wetlands, R&D labs, medical college, pathology laboratory and blood bank OR Preparation and submission of small project/ review on topics related to ecology, cell biology, biochemistry and physiology/Visit to IVF center.</p> |
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| References list |
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| 8. Principles of Anatomy & Physiology. Tortora, G.J. & Grabowski, S. (2006). XI Edition John Wiley & sons |
| 9. De Fiore's Atlas of Histology with Functional correlations. Victor P. Eroschenko. (2008). XII Edition. Lippincott W. & Wilkins |
| 10. .Randall, D. et al. (2002) Eckert Animal Physiology (5th edition) Freeman. |
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| 12. Prosser C. L. and F. A. Brown – Comparative Animal Physiology; Saunders |
| 13. Randall D ,Burggren W. 2001. Eckert Animal Physiology by. 4th edition. W. H. Freeman. |
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|  <p>पुण्यश्लोक अहिल्यादेवी होळकर सोलापूर विद्यापीठ ॥ विद्यया संपन्नता ॥ NAAC Accredited-2022 "B++" Grade (CGPA-2.96)</p> | Punyashlok Ahilyadevi Holkar Solapur University, Solapur Second Year B.Sc.(Zoology) Semester- IV Course Code :DSC2-5 (Theory) (Practical) Course Code : Biological Pest Management |
| Teaching Scheme Lectures:04 Hours/ week, 04 Credits- 2 OR Practical: 02 Hours/ week, 01 Credit- 2 | *Examination Scheme UA: Marks CA: Marks |

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| Program Specific Outcome (PSOs) : PSO1:- Deep Introduction to Entomology PSO2 :- Role of Insects in Agriculture PSO3 :- Study of Pest Management PSO4:- Study of different types of Pests and their Habitat. |
| Program outcome : PO1:- To study Taxonomy of Insects. PO2:- To study Advance technique of Pest control. PO3:- Importance of Evaluation of Pest Management. PO4:- Study of Pesticides and their Effects on Human Health. |
| Course Objectives: CO1:- Study of different categories of Pests. CO 2:- Study of Pest control Strategies. CO 3:- Sustainable development of Pest Management. CO 4:- Awareness of Biological Pest Control. |

Section I

| Unit 1 | Number of Marks | Weightage |
|---|-----------------|-----------|
| Definition of Pest Management Study of different categories of Pests. Pest of Crop, Pest of Vegetable, Pest of Pulses, Pest of Oilseed crop. Pest of forage crop- Sugarcane, Lucerne. | 02 to 06 | 04 |
| Unit 2 | Number of Marks | Weightage |

| | | |
|---|-----------------|-----------|
| A-Study of Biological pest control strategies- Importation, Augmentation and Conservation. Biological control Agents- Predators, Parasitoids, Pathogen, Bacteria, Fungi, Virus , Competitors. B-Chemical Pest Control – Pesticides -Penetration and Dislocation of Pesticides and their effect on Human Health | 02 to 06 | 04 |
|---|-----------------|-----------|

| Unit 3 | Number of Marks | Weightage |
|---|------------------------|------------------|
| Bioefficiency of Pesticides -Evaluation of toxicity of Insecticides. Bioassay Method | 02 to 06 | 04 |

| Unit 4 | Number of Marks | Weightage |
|--|------------------------|------------------|
| A -Methods of Pest Control Natural and Applied, Prophylactic and Curative Cultural and Mechanical, Physical, legal and Biological B- Principals of Pest Control- Prevention, Identification, Monitoring, Injury and Action decision, Treatment, Evaluation. Elements of Pest Control | 02 to 06 | 04 |

Section II

| Unit 1 | Number of Marks | Weightage |
|---|------------------------|------------------|
| Pesticide in Atmosphere Transport of Vapors, Action of Pesticides and their effects on Human Life., Air pollution | 02 to 06 | 04 |

| Unit 2 | Number of Marks | Weightage |
|---|------------------------|------------------|
| Pesticide in Water Ecosystem Dynamics of Pesticide in Aquatic Environment. Nature and Origin of Pollution of Aquatic System. | 02 to 06 | 03 |


| Unit 3 | Number of Marks | Weightage |
|---------------|------------------------|------------------|
| | | |

| | | |
|--|-----------------|-----------|
| Penetration and distribution of Pesticide and their effects on Human Life. Effect of Pesticide on Life in general. Consequent effects of Pesticide on Human life. | 02 to 06 | 03 |
|--|-----------------|-----------|

| Unit 4 | Number of Marks | Weightage |
|---|------------------------|------------------|
| Introduction to Toxicology Introduction, General account Definition of Toxicology, History of Toxicology Detail account of Forensic Toxicology Definition of Poison, Classification of Poison Concept and scope of Toxicology. Mode of action of Toxicant Mechanism of action of Insecticides.- Pyrethroids, Organochlorine, Organophosphate, Carbonate Insecticide | 02 to 06 | 03 |

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| College Level Assessment (CA) Activities: Home assignment, Review article, Class test, Field visit, Seminar |
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|--|
| Reference list |
| 1. Biopesticides and Pest Management - G S Dahiwal and O.Koul 2. Handbook of Agriculture - ICAR Publication 3. Handbook of Pest Management in Agriculture - A.Pinrental 4. Principles of Insect Pests - Dahiwal and Arora 5. Agricultural Pests of India - A A Satwal 6. Alternatives to chemical pesticides in pest management - C L Gupta , Ashok Kumar |
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|  | Punyashlok Ahilyadevi Holkar Solapur University, Solapur Second Year B. Sc. (Zoology) Semester-IV Course Code: DSC 2-6 (2+1) (Theory) (Practical) Course Code: Endocrinology |
| *Teaching Scheme Lectures: 04 Hours/week, 04 Credits -2 OR Practical: 02 Hours/week, 01 Credit-2 | *Examination Scheme UA: Marks CA: Marks |
| Program Specific Outcome (PSOs): PSO1 Students perform and analyze endocrine biochemical tests. PSO2 Students understand endocrine physiology. PSO3 Students learn how to perform research in endocrinology. PSO4 Enhance general medical knowledge. | |
| Program Outcome: PO1 PO2 PO3 PO4 | |
| Course Objectives: 1 The course will provide information about diagnosis and management of endocrine disorders. 2 The course will provide information in endocrine biochemistry. 3 Students learn about Hormonal Replacement Therapy. 4 Course provide knowledge in the field of endocrine research and development. | |
| Course Outcomes: 1 Students learn about endocrine glands and their functions. 2 Students learn about action and mechanism of different hormones. 3 Students learn about endocrine disorders. 4 Students will analyze metabolic laboratory data. | |

Section I

| Unit 1 | Number of Marks | Weightage |
|---|-----------------|-----------|
| Introduction of hormones - Definition of Hormone - Classification of Hormones, Protein hormones and steroid hormones | | |
| | | |
| Unit 2 | Number of Marks | Weightage |
| Pituitary gland hormones – chemical composition and functions of pituitary gland hormones | | |
| | | |
| Unit 3 | Number of Marks | Weightage |
| Male sex hormones and female sex hormones – chemical composition and functions | | |

| | | |
|---|------------------------|------------------|
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| Unit 4 | Number of Marks | Weightage |
| Role of hormones in digestion - Hormonal regulation of carbohydrate, Lipid and Protein metabolism | | |
| | | |

Section II

| | | |
|--|------------------------|------------------|
| Unit 1 | Number of Marks | Weightage |
| Hormone action mechanism – Hormone action at cellular level Hormone action at genetic level | | |
| | | |

| | | |
|---|------------------------|------------------|
| Unit 2 | Number of Marks | Weightage |
| Hormones in Reproductive physiology – Hormonal control of pregnancy, parturition and lactation; Hormonal regulation of Growth and Reproduction | | |
| | | |

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|---|------------------------|------------------|
| Unit 3 | Number of Marks | Weightage |
| Hormonal Disorders – Thyroid hormones and disorders Pituitary hormones and major Disorders Adrenal Gland hormones and Disorders | | |
| | | |

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|--|------------------------|------------------|
| Unit 4 | Number of Marks | Weightage |
| Hormones therapy and general – Hormone replacement therapy Risks and benefits of Hormone replacement therapy Other hormones: Rennin, angiotensin, cytokines, ANF, Erythropoietin | | |
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|--|--|--|
| College Level Assessment (CA) Activities: Home assignment, Review article, Class test, Field visit, Seminar | | |
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Practical's

- 1 Identification of hormone secreting glands, write its location, hormones secreted and write its function
- 2 Qualitative urine hcg test
- 3 Analytical determination of presence of glucose in urine
- 4 Study hormonal disorders of – Pancreas, Thyroid, adrenal gland
- 5 Detection of hormone from immunoassay kit/ Detection kit
- 6 Study hormones and their functions – any five hormones
- 7 Qualitative determination of glucose in urine Benedict's reagent
- 8 Cortisol saliva test by using kit

References list

1. Human Physiology- C. C. Chatterji Vol. I and II
2. Comparative Vertebrate Endocrinology, Bentley: Cambridge University Press, 1998
3. Fundamentals of Comparative Endocrinology, Chester-Jones et al.: Plenum Press, New York, London, 1987.
4. Comparative Endocrinology, Gorbman et al.: John Wiley & Sons, New York, 1983
5. Vertebrate Endocrinology, Norris: (2nd ed.), Lea & Febiger, 1997.
6. Vertebrate Endocrinology Schreibman & Pang: Vol. I-IV, Fundamentals & Biomedical Implications, Academic Press, 1985 & onwards
7. Endocrinology, Hadley: Prentice hall. International Edition. 2000
8. Human Physiology- C. C. Chatterji Vol. I and II
9. Textbook of Endocrinology, 2013: Buy Textbook of Endocrinology, 2013 by N. K. Pandey, R. Radheshyam

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|---|--|---------------------------|
|  | PunyashlokAhilyadevi Holkar Solapur University, Solapur First Year BSc (Zoology) Semester-I Vertical :Open Elective-I / General Elective -I Course Code:GO4-GE-OE- (Theory) Course Code: OE / GE :Wild life photography | |
| Teaching Scheme Lectures:04 Hours/week, 04 Credits | *Examination Scheme UA:60 Marks CA: 40 Marks | |
| Program Specific Outcome (PSOs): PSO 1: Technical Proficiency: Students will develop advanced skills in using photography equipment, including cameras, lenses, and lighting, to capture high-quality wildlife images. PSO 2: Fieldwork Expertise: Students will gain hands-on experience in conducting fieldwork, including tracking, observing, and photographing wildlife in their natural habitats. PSO 3: Ethical Practices: Students will understand and apply ethical guidelines for wildlife photography, ensuring minimal disturbance to animals and their environments. PSO 4: Post-Processing Skills: Students will learn techniques for editing and enhancing wildlife photographs using software tools to produce professional-quality images. PSO 5: Ecological Knowledge: Students will acquire knowledge of animal behavior, ecology, and conservation, which will inform their photographic practices and storytelling. | | |
| Program Outcome: PO1: Comprehensive Knowledge: Understand avian biology, ecology, behavior, and evolution. PO2: Field Research: Conduct and design bird surveys and habitat assessments. PO3: Data Analysis: Analyze ecological data using statistical and GIS tools. PO4: Ethical Awareness: Understand and uphold ethical standards in ornithological research and conservation practices | | |
| Course Objectives: The students will be able: COs 1 - To understand the concept, scope and significance of Photography. COs 2 - To distinguish between various types of photography. COs 3 - To demonstrate lighting techniques for different photographic scenarios. COs 4 - To understand the concept the techniques of Photo Journalism and provide an Opportunity to pursue their areas of interest | | |
| Course Outcomes: CO 1: Proficiency in using photography equipment to capture high-quality wildlife images. CO 2: Effective planning and conducting of fieldwork for wildlife observation and photography. CO 3: Application of ethical guidelines to minimize disturbance to wildlife. CO 4: Skills in editing and processing wildlife photographs using industry-standard software. CO 5: Understanding animal behavior and ecology to enhance photographic practices. | | |
| Unit 1: History pf photography and equipment’s of photography. | No. of lectures-08 | Weightage of Marks |
| 1.1 Brief history of photography. | 3 | 2-4 |
| 1.2 Types of photographic cameras and their applications. | 3 | 2-6 |
| 1.3 Understanding various functions of camera. | 2 | 2-4 |
| Unit 2: Equipment’s used in photography No. of lectures -07 | | |
| 2.1 Types of lenses and their Use. | 3 | 2-6 |
| 2.2 Lighting equipment three-point lighting technique | 2 | 2-4 |

| | | |
|---|----------|------------|
| and metering for light, filters and use of a flash unit. | | |
| 2.3 Optional Accessories like recording media, filters, tripods, cards, etc. | 3 | 2-6 |

| Unit 3: Techniques in photography | No. of lectures- 07 | Weightage of Marks |
|--|----------------------------|---------------------------|
| 3.1 Study about the right Exposure. Controlling Light with Shutter Speed, Aperture and ISO. Adjusting Light and Colors, Auto, Aperture, Shutter Speed and Manual Modes. | 4 | 2-4 |
| 3.2 Significance of ISO, Correct Focus and suitable White Balance Using right ISO in various conditions. | 3 | 2-6 |
| Unit 4: Photo editing and Maintenance of camera | No. of lectures- 08 | Weightage of Marks |
| 4.1 Understanding Photo Editing and video Editing Software and Installation: a. Photo Editing: Adobe Photoshop, Picasso, Coral draw, Photo editor, Mobile phone apps, etc. b. Video Editing: Adobe Primer Pro, Kinemaster, Filmora, mobile phone apps, etc | 4 | 2-6 |
| 4.2 Care and maintenance of camera. | 2 | 3 |
| 4.3 Requirements of wildlife photography | 2 | 3-6 |

Suggested Reading:

1. Anderson, Grey H (1993). Video Editing and Post Production London: Focal Press
2. Gupta, R. G(2000). Audio and Video System, New Delhi: Tata Mc Graw – Hill
3. Millerson, Gerald(2003) Video Camera Techniques (Media Manuals), Focal Press: London
4. Musberger, Robert B(2008). Single-Camera Video Production, New Delhi: Tata Mcgraw

Field project - Shooting Flowers, trees and other steady things. Shooting Insects, birds wildlife and moving objects.



**Punyashlok Ahilyadevi Holkar Solapur University,
Solapur**

Second Year B. Sc. (Zoology) Semester-III/IV

Subject code:

Course Code: VSC-3 (2) Ornithology (Practical Course)

Practical: 02 Hours/week, 01 Credit- 2

***Examination Scheme UA: Marks CA: Marks**

Program Specific Outcome (PSOs):

PSO1: Species Identification and Classification: Identify and classify bird species using various characteristics and tools.

PSO2: Habitat and Conservation Management: Understand and manage avian habitats and conservation strategies.

PSO3: Research and Data Analysis: Conduct, analyze, and publish ornithological research using statistical and GIS tools.

PSO4: Public Awareness and Education: Engage with the public and policymakers to promote bird conservation through educational programs and outreach.

Program Outcome:

PO1: Comprehensive Knowledge: Understand avian biology, ecology, behavior, and evolution.

PO2: Field Research: Conduct and design bird surveys and habitat assessments.

PO3: Data Analysis: Analyze ecological data using statistical and GIS tools.

PO4: Ethical Awareness: Understand and uphold ethical standards in ornithological research and conservation practices

Course Objectives:

CO1: To Develop a comprehensive understanding of bird anatomy, physiology, and behavior.

CO2: To Gain practical skills in bird identification, surveying, and habitat assessment.

CO3: To Develop skills to educate and involve the community in bird conservation efforts.

CO4: Understand the principles of bird conservation and apply them in real-world scenarios.

Course Outcomes:

CO1: Understanding Avian Diversity: Gain knowledge of the diversity of bird species, their taxonomy, and evolutionary relationships.

CO2: Field Identification Skills: Develop the ability to identify birds by sight and sound, using field guides and other resources.

CO3: Ecological Roles of Birds: Understand the roles birds play in various ecosystems, including their interactions with other species and their environments.

CO4: Bird Behavior: Learn about the behavior of birds, including migration patterns, mating rituals, and feeding habits.


VSC Practical course (Any 6 to 8 practical's)

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|--|
| 1. Study of external morphology of birds |
| 2. Types of beak and feet in birds |
| 3. Avian Diversity and Classification |
| 4. Study of Internal anatomy of bird |
| 5. Study of Archeopteryx |
| 6. Study of mating and breeding behaviors in bird (Display) |
| 7. Study of Types of birds' nests in the college campus |
| 8. Identification of Birds, Calls and songs. (Using prerecorded sound / call of birds) |
| 9. Equipment's required for bird watching. |
| 10. Survey of campus or visit to water reservoir for bird watching. (Student should submit album of photograph captured by camera or mobile phone at the time of examination). |

(When studying bird habitats or nests, it's important to take steps to avoid disturbing the birds and to ensure their safety).

Suggested reading

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| 1. "The Book of Indian Birds" by Dr. Sálim Ali - This classic book has been a companion for birdwatchers and ornithologists in India for nearly fifty years. It provides detailed descriptions and illustrations of Indian bird species ¹ . |
| 2. "Indian Birds: A Photo Guide" by Bikram Grewal - This book is filled with stunning photographs and information on the birds of India, making it a great resource for both beginners and experienced birdwatchers. |
| 3. "Birds of India" by Richard Grimmett, Carol Inskipp, and Tim Inskipp - Although not exclusively by Indian authors, this book is highly regarded for its comprehensive coverage of Indian bird species. |
| 4. "The Birds of India Volume 1: Habitats" by K.S. Rasmussen and H. C. Jackson - This book focuses on the habitats of Indian birds and is an essential read for understanding the ecological aspects of bird life in India. |

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|  | <p align="center">Punyashlok Ahilyadevi Holkar Solapur University, Solapur Second Year B. Sc. (Zoology) Semester-IV Course Code: VEC-4 Sericulture (Practical)</p> |
| <p>*Teaching Scheme Lectures: 04 Hours/week, 04 Credits -2 OR Practical: 02 Hours/week, 01 Credit-2</p> | <p>*Examination Scheme UA: Marks CA: Marks</p> |

| Practical's |
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| <ol style="list-style-type: none"> External morphology of Silkmoth – Mulberry silkmoth, Tassar Silkmoth, Eri Silkmoth, Muga Silkmoth. Life Cycle of Mulberry silkmoth, Tassar Silkmoth, Eri Silkmoth, Muga Silkmoth. Handling of different larval stages of silkworms. Economic importance of Mulberry silkworms, Tassar silkworms, Eri silkworms, Muga silkworms. Moriculture - Cultivation of mulberry plant in college campus – Plantation, Pruning of mulberry. Harvesting of mulberry – Individual leaf feeding method, shoot feeding method. Study of ideal rearing house. Study of rearing of apparatus. Mulberry Silkworm Diseases- Grasserie, Flacherie, Pebrine and Muscardine. Handlings of Cocoons. |

| References list |
|--|
| <p>23. Sericulture and Rural Development by G. Sandhya Rani: This book discusses silk farming and its impact on rural areas, particularly in India.</p> |
| <p>24. Sericulture and Silk Production: A Handbook (Small-Scale Textiles Series)" by Prabha Shekar and Martin Hardingham: This handbook provides detailed information on silk farming and production.</p> |
| <p>25. Sericulture and Pest Management by A. Jadhav and T. V. Sathe: This book covers developments in sericulture, including pest management.</p> |
| <p>26. Sericulture Extension by Amardev Singh: A guide for extension personnel, students, and sericulturists.</p> |
| <p>27. Sericulture Manual by R. K. Patnaik: This manual offers insights into various aspects of sericulture, from mulberry cultivation to silk processing.</p> |

Punyashlok Ahilyadevi Holkar Solapur University, Solapur
Guidelines for : Field Project (FP)
B.Sc.-Part-II; Semester-IV

Credits: 2

Marks: 50

Contact Hours: 60

1) Nature of Course

| | |
|-------------------------|---|
| 1) Name of the Course: | Field Project (FP) |
| 2) Class: | Second Year of UG |
| 3) Semester: | UG-Third Semester |
| 4) No. of Credits: | UG 02 Credits |
| 5) Total Contact Hours: | UG (60 Hours) |
| 6) Nature: | Field Based Learning/Project |
| 7) Type: | Compulsory Course |
| 8) Total Marks: | Under Graduation: 50 (20 for IE + 30 for ESE) |
| 9) Credit: | Total Credits = 2 (1 Credit = 30 Contact Hours) |

2) Course Outcomes (COs):

CO-1: Understanding the different socio-economic contexts and observe situation in urban and rural contexts.

CO-2: Fostering the capability to identify and address scientific problems or challenges at the local, regional and national level.

CO-3 Acquiring themethodical research skills to innovatively address the issue based problems and give solutions for long-term benefits of the society.

CO-4: Improvement in scientific communication through literature survey, technical writing, publication and presentation skills.

CO-5: Developing the power of critical& logical thinking skills, analysis and ability to present data as policy document.

CO-6: Enhancing the employability through acquisition of practical knowledge and experiences.

3) Objectives:

- 1) To develop ability to identify real life challenges faced by society and devise hypothesis to answer these challenges.
- 2) To prepare methodology to explicitly work on the identified problems in scientific way.
- 3) To collect field and laboratory based data, compile, organize, analyze and interpret the data
- 4) To prepare a scientific document as a policy document based on primary field generated data for innovative solutions.

4) Learning Outcomes: After completing this course, student will be able:

- 1) PSO-1: Understand methodology for field based research work.
- 2) PSO-2: Develop core skills to work with local community.
- 3) PSO-3: Contribute towards national development through community engagement.
- 4) PSO-4: Learn to link and extend research problems and share the knowledge for the benefit of society.
- 5) PSO-5: Gaining mutual learning and respect about community and fostering social responsibility and community engagement, promoting deeper interactions with locals, extending higher education skills for the benefit of local communities and catalysing acquisition of values of public service and active citizenship to evolve into responsible citizens.

5) Credit Guidelines for Field Project:

The field-based learning/project attempts to provide opportunities for students to understand the different socio-economic contexts and observe situation in rural, urban, sub-urban and peri-urban locales. The students is supposed to identify local and regional problems in their respective areas of subject and work under the supervision of faculty mentor to grasp the issues, challenges of the question in a scientific manner.

| Total Credits | Classroom and Tutorial | Field Engagement |
|---------------|------------------------|------------------|
| 02 | 01 Credit | 01 Credit |

6) Evaluation of Field Project / Regional Case Study:

| Module | Unit | IE (20) | ESE (30) |
|--------|--|---------|----------|
| 1 | Basic structure of field/society,: key definitions of problem area, analysis of preliminary data | 5 | ----- |
| 2 | Classroom work: Correspondence (if any), formats for data collection, interactions and liaising | 5 | ----- |
| 3 | Field-work and data collection | 5 | 10 |
| 4 | Field Report: 1) Data organization, analysis and report preparation 2) Preparation and Presentation of Outcome in Examination 3) Feedback to Community | 5 | 20 |

7) Steps for the Implementation Field Project under the Mentorship of Faculty:

- 1) **Classroom Discussion:** Making students aware on the various topics that can be explored for Field Project on various topics related to subject and its extension to society
- 2) **Assignments:** Giving assignments to students on Field Project related topics
- 3) **Group Discussion:** Discussion with students in classroom to finalize tentative topics for Filed Project
- 4) **Field Visit:** Understanding the topic through field visit. Giving an integrated approach to the topic related to subject so that science, community, research and policy can be studied together.

5) Classroom and Field Assignments: Distribution of field based topics to students either in group or individually.

6) Field Visits, Data Collection: Regular field visits for collection of data on selected topic

7) Finalization of FP Report: Data organization, data analysis and preparation of report based on the data consisting of:

- a) Title Page
- b) Certificate
- c) Acknowledgement
- d) Index
- e) Introduction
- f) Literature Review
- g) Methodology
- h) Result
- i) Discussion and Conclusion
- j) References

OR

Punyashlok Ahilyadevi Holkar Solapur University, Solapur
Guidelines for: Community Engagement Services (CEP)
B.Sc.-Part-II; Semester: IV

Credits: 2

Marks: 50

Contact Hours: 60

1) Nature of Course

- | | |
|-------------------------|-----------------------------------|
| 1) Name of the Course: | Community Engagement and Services |
| 2) Class: | Second Year of B.Sc. |
| 3) Semester: | IV |
| 4) No. of Credits: | 02 (1 Credit = 30 contact hours) |
| 6) Nature: | Field Based Learning/Project |
| 5) Total Contact Hours: | 60 Hours |

| Total Credits | Classroom and Tutorial | Field Engagement |
|---------------|------------------------|----------------------|
| 02 | 01 Credit (30 Hours) | 01 Credit (30 Hours) |

2) Course Outcomes (COs):

- CO-1: Contributing to socio-economic development of India through active community engagement.
CO-2: Enabling students to become socially productive.
CO-3: Make students understand India's rural society, rural development schemes and contribute to the betterment of the same.
CO-4: Provide community engagement to all Undergraduate & Post Graduate students

3) Objectives:

- 1) To develop an appreciation of rural culture, life-style and wisdom amongst students
- 2) To learn about the status of various agricultural and development programmes
- 3) To understand causes for distress and poverty faced by vulnerable households and explore solutions for the same
- 4) To apply classroom knowledge of courses to field realities and thereby improve quality of learning

4) Learning Outcomes: After completing this course, student will be able:

- PSO-1: To Gain an understanding of rural life, Indian culture & ethos and social realities
PSO-2: Develop a sense of empathy and bonds of mutuality with local community
PSO-3: Appreciate significant contributions of local communities to Indian society and economy
PSO-4: Learn to value the local knowledge and wisdom of the community
PSO-5: Identify opportunities for contributing to community's socio-economic improvements

5) Evaluation Pattern: Total Marks: 50

| Internal Evaluation (IE): 20 Marks | |
|---|----------|
| 1) Participation in CEP | 10 Marks |
| 2) Group Discussion/Assignments on CEP related activities/Seminar etc. | 10 Marks |
| 3) Group Discussion Involves both field based discussions and classroom discussions | |
| End Semester Examination: 30 Marks | |
| 1) Overall Participatory Performance | 10 Marks |
| 2) Preparation and presentation of Report in Standard Format Consisting of: | 20 Marks |
| i) Title Page | |
| ii) Certificate | |
| iii) Acknowledgement | |
| iv) Index | |
| v) Introduction | |
| vi) Literature Review | |
| vii) Methodology | |
| viii) Result | |
| ix) Discussion and Conclusion | |
| x) References | |

6) Examples of Recommended Field Based Activities under Zoology Subject or Any other Topics of Significance to Community Can be Selected

| Teaching Learning Methods | |
|----------------------------------|--|
| 1 | Available on-line modules for self paced learning on UGCs platform |
| 2 | Classroom Discussions |
| 3 | Reading |
| 4 | Participatory Research Methods & Tools |
| 5 | Community Dialogues |
| 6 | Oral History |
| 7 | Social & institutional Mapping |
| 8 | Interactions with elected Panchayat Leaders & Govt. officers |
| 9 | Observation of Gram Sabha |
| 10 | Field visits to various village institutions |
| Recommended Activities | |
| | <ul style="list-style-type: none"> • Environment awareness camp; • Conservation of biodiversity; • Significance of green spaces; • Awareness on health & hygiene; • Applied component of agriculture such as apiculture, sericulture, pisciculture & dairy; • Awareness camps in sustainability and development; • Promotion of practices for sustainable development through management of ecosystem |

| | |
|--|--|
| | <p>services of local forest & wildlife;</p> <ul style="list-style-type: none"> • Awareness of locals on pollution and its impact; • Organization of camps on role of biological control agents for pest control & aspects of organic farming/IPM; • Collaborating with government and Forest Department for Survey of animals and other species etc.; • Awareness drive on ecotourism potential of villages for green economy; • Implementation of SDGs at the local level; Solutions to human-wildlife conflict etc... |
| | <ul style="list-style-type: none"> • SHG Women Members • MGNREGS project • Swachh Bharat project • Rural Schools / mid-day meal centres • Schemes for urban informal workers and migrants and • Other similar Governmental & Non-governmental Social and Extension Projects for the benefit of rural society |

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| Punyashlok Ahilyadevi Holkar Solapur University, Solapur |
| B.Sc. II year Zoology, Semester Pattern NEP 2020 |

University Assessment Theory - 30 Marks

Question Paper Pattern

College Assessment Theory - Marks

Punyashlok Ahilyadevi Holkar Solapur University, Solapur
B.Sc. II year Zoology, Semester Pattern

University Assessment Practical – 30 Marks

Question Paper Pattern

Q.1. 10 Marks

Q.2. 05 Marks

Q.3. 05 Marks

Q.5. Certified Journal 05 Marks

Q.6. Viva voce / Field visit report / Visit report - 05 Marks

College Assessment Practical - 20 Marks

Any two questions from the list of practical's, each for 10 Marks