



**Karmaveer Bhaurao Patil University, Satara**

**Syllabus for  
B. Sc. III Zoology**

**Under  
Faculty of Science and Technology  
(As per NEP 2020)**

**With effect from Academic Year 2026-2027**

# 1.STRUCTURE OF COURSE:

As per NEP-2020 (2.0)

| Sem<br>(Level)  | Courses                                                               |                                                           |            | OE | VSC/ SEC                                                       | AEC/ VEC/<br>IKS         | OJT/ FP/<br>CEP/ CC/<br>RP | Total<br>Credits |
|-----------------|-----------------------------------------------------------------------|-----------------------------------------------------------|------------|----|----------------------------------------------------------------|--------------------------|----------------------------|------------------|
|                 | Course I                                                              | Course II                                                 | Course III |    |                                                                |                          |                            |                  |
|                 | Major<br>Mandatory                                                    | Major<br>Elective                                         | --         |    |                                                                |                          |                            |                  |
| Sem V<br>(5.5)  | Major IX (2)<br>Major X (2)<br>Major XI (2)<br>Major P V (2)          | Major XII<br>(Elect.) (2)<br>Major P VI<br>(Elect.) (2)   | -          | -  | VSC III (2)<br>(P) Major<br>specific)                          | AEC III (2)<br>(English) | OJT (4)<br>CEP (2)         | 22               |
| Sem VI<br>(5.5) | Major XIII (2)<br>Major XIV (2)<br>Major XV (2)<br>Major P VII<br>(2) | Major XVI<br>(Elect.) (2)<br>Major P VIII<br>(Elect.) (2) | -          | -  | VSC IV (2)<br>(P) Major<br>specific)<br>SEC III (2)<br>(T + P) | AEC III (2)<br>(English) | FP (2)<br>CC (2)           | 22               |
| Credits         | 16                                                                    | 08                                                        | -          | -  | 06                                                             | 04                       | 10                         | 44               |

## 14.COURSE TITLE

### 1) Semester-V (5.5)

| Sr. No. | Theory             |                          |                                                 |                          |         | Sr. No | Practical                      |                           |         |
|---------|--------------------|--------------------------|-------------------------------------------------|--------------------------|---------|--------|--------------------------------|---------------------------|---------|
|         | Subject            | Course No. & Course Code | Title of Paper                                  | No. of lectures per week | Credits |        | Course No. & Course Code       | No. of Practical Per week | Credits |
| 1.      | Major IX           | BZT351                   | Comparative anatomy of vertebrates              | 2                        | 2       | 6.     | Major P V<br>BZP 356           | 1                         | 2       |
| 2.      | Major X            | BZT 352                  | Aquatic Biology                                 | 2                        | 2       |        |                                |                           |         |
| 3.      | Major XI           | BZT 353                  | Biotechniques and Biostatistics                 | 2                        | 2       |        |                                |                           |         |
| 4.      | Major XII (Elect.) | BZT 354                  | Molecular Cell Biology and Animal Biotechnology | 2                        | 2       | 7.     | Major P VI (Elect.)<br>BZP 357 | 1                         | 2       |
|         |                    | BZT 355                  | Wildlife Conservation and Management            |                          |         |        |                                |                           |         |
| 5.      | AEC                | AEC III                  | English                                         | 2                        | 2       | 8.     | BZPVSC III (Major specific)    | 1                         | 2       |
|         |                    |                          |                                                 |                          |         | 9      | On Job Training                | 2                         | 4       |
|         |                    |                          |                                                 |                          |         | 10     | CEP                            | 1                         | 2       |

## 2) Semester-VI (5.5)

| Sr. No. | Theory                |                          |                                      |                          |         | Sr. No | Practical                           |                           |         |
|---------|-----------------------|--------------------------|--------------------------------------|--------------------------|---------|--------|-------------------------------------|---------------------------|---------|
|         | Subject               | Course No. & Course Code | Title of Paper                       | No. of lectures per week | Credits |        | Course No. & Course Code            | No. of Practical Per week | Credits |
| 1.      | Major XIII            | BZT 361                  | Developmental Biology of Vertebrates | 2                        | 2       | 7.     | BZP 366<br>Major P VII              | 1                         | 2       |
| 2.      | Major XIV             | BZT 362                  | Vector Biology                       | 2                        | 2       |        |                                     |                           |         |
| 3.      | Major XV              | BZT 363                  | Immunology                           | 2                        | 2       |        |                                     |                           |         |
| 4.      | Major XVI<br>(Elect.) | BZT 364                  | Applied Zoology -II                  | 2                        | 2       | 8.     | BZP 367<br>Major P VIII<br>(Elect.) | 1                         | 2       |
|         |                       | BZT365                   | Endocrinology                        |                          |         |        |                                     |                           |         |
| 5.      | AEC                   | AEC-IV                   | English                              | 2                        | 2       | 9.     | BZPVSC-IV<br>(Major specific)       | 1                         | 2       |
| 6.      | CC                    | CC                       |                                      | 1                        | 1       | 10.    | BZPSEC III                          | 1                         | 2       |
|         |                       |                          |                                      |                          |         | 11.    | BZPFP-I                             | 1                         | 2       |

## Evaluation Structure: 2025-26

### ➤ B.Sc. III NEP 2.0

#### Semester V (5.5)

| Vertical                                | Course Category | Course Code | Internal Evaluation |        |         | ESE | Total Marks | Credits |
|-----------------------------------------|-----------------|-------------|---------------------|--------|---------|-----|-------------|---------|
|                                         |                 |             | CCE-I               | CCE-II | CCE-III |     |             |         |
| DSC                                     | T               | BZT 351     | 10                  | 10     | 10      | 30  | 50          | 02      |
|                                         | T               | BZT 352     | 10                  | 10     | 10      | 30  | 50          | 02      |
|                                         | T               | BZT 353     | 10                  | 10     | 10      | 30  | 50          | 02      |
|                                         | P               | BZP 356     | 25                  |        |         | 25  | 50          | 02      |
| DSE<br>(1 Theory<br>Papers Out<br>of 2) | T               | BZT 354     | 10                  | 10     | 10      | 30  | 50          | 02      |
|                                         | T               | BZT 355     | 10                  | 10     | 10      | 30  | 50          | 02      |
|                                         | P               | BZP 357     | 25                  |        |         | 25  | 50          | 02      |
| AEC                                     | T               | AEC III     | 10                  | 10     | 10      | 30  | 50          | 02      |
| VSC                                     | P               | BZPVSC III  | 25                  |        |         | 25  | 50          | 02      |
| CEP                                     | P               | BZPCEP I    | 25                  |        |         | 25  | 50          | 02      |
| OJT                                     | P               | BZPOJT I    | 50                  |        |         | 50  | 100         | 04      |
| Total                                   |                 |             |                     |        |         |     | 550         | 22      |

#### Semester VI

| Vertical                                | Course Category | Course Code | Internal Evaluation |        |         | ESE | Total Marks | Credits |
|-----------------------------------------|-----------------|-------------|---------------------|--------|---------|-----|-------------|---------|
|                                         |                 |             | CCE-I               | CCE-II | CCE-III |     |             |         |
| DSC                                     | T               | BZT 361     | 10                  | 10     | 10      | 30  | 50          | 02      |
|                                         | T               | BZT 362     | 10                  | 10     | 10      | 30  | 50          | 02      |
|                                         | T               | BZT 363     | 10                  | 10     | 10      | 30  | 50          | 02      |
|                                         | P               | BZP 366     | 25                  |        |         | 25  | 50          | 02      |
| DSE<br>(1 Theory<br>Papers<br>Out of 2) | T               | BZT 364     | 10                  | 10     | 10      | 30  | 50          | 02      |
|                                         | T               | BZT 365     | 10                  | 10     | 10      | 30  | 50          | 02      |
|                                         | P               | BZP 367     | 25                  |        |         | 25  | 50          | 02      |
| AEC                                     | T               | AEC IV      | 10                  | 10     | 10      | 30  | 50          | 02      |
| VSC                                     | P               | BZPVSC IV   | 25                  |        |         | 25  | 50          | 02      |
| SEC                                     | P               | BZPSEC III  | 25                  |        |         | 25  | 50          | 02      |
| CC                                      | T               | BZPCC I     | 10                  | 10     | 10      | 30  | 50          | 02      |
| FP                                      | P               | BZPFP I     | 25                  |        |         | 25  | 50          | 02      |
| Total                                   |                 |             |                     |        |         |     | 550         | 22      |

**Abbreviations:** DSC: Discipline Specific Course; DSE: Discipline Specific Elective; CCE: Continuous Comprehensive Examination; AEC: Ability Enhancement Course; VSC: Vocational Skill Course; SEC: Skill Enhancement Course; OJT: On Job Training; FP: Field Project; CEP: Community Engagement Program; CC: Co-curricular Course; T: Theory; P: Practical

### NEP-2020 (2.0): Credit Framework for B. Sc. III

#### Semester –V

| Sr.                   | Components                          | Course code | Course (Subject)                                | Credits   |
|-----------------------|-------------------------------------|-------------|-------------------------------------------------|-----------|
| 1.                    | Major IX                            | BZT351      | Comparative anatomy of vertebrates              | 2         |
| 2.                    | Major X                             | BZT 352     | Aquatic Biology                                 | 2         |
| 3.                    | Major XI                            | BZT 353     | Biotechniques and Biostatistics                 | 2         |
| 4.                    | Major Practical- V                  | BZP 356     | Major Practical based on subject specific paper | 2         |
| 5.                    | Major XII (Elect.)<br>(Any 1 paper) | BZT 354     | Molecular Cell Biology and Animal Biotechnology | 2         |
|                       |                                     | BZT 355     | Wildlife Conservation and Management            |           |
| 6.                    | Major Practical VIII<br>(Elect.)    | BZP 357     | Major Practical based on elective paper         | 2         |
| 7.                    | AEC                                 | AEC III     | English                                         | 2         |
| 8.                    | VSC Practical                       | BZPVSC-III  | VSC III Practical (Major specific)              | 2         |
| 9.                    | CEP                                 | CEP         | Community Engagement Programme                  | 2         |
| 10.                   | OJT                                 | OJT         | On Job Training                                 | 4         |
| 11.                   |                                     |             |                                                 |           |
| <b>Total credits:</b> |                                     |             |                                                 | <b>22</b> |

#### Semester –VI

| Sr.                   | Components                          | Course code | Course (Subject)                                 | Credits   |
|-----------------------|-------------------------------------|-------------|--------------------------------------------------|-----------|
| 1.                    | Major XIII                          | BZT 361     | Developmental Biology of Vertebrates             | 2         |
| 2.                    | Major XIV                           | BZT 362     | Vector Biology                                   | 2         |
| 3.                    | Major XV                            | BZT 363     | Immunology                                       | 2         |
|                       | Major P VII                         | BZP366      | Major practical based on subject specific papers | 2         |
| 4.                    | Major XVI (Elect.)<br>(Any 1 Paper) | BZT 364     | Applied Zoology -II                              | 2         |
|                       |                                     | BZT365      | Endocrinology                                    |           |
| 5.                    | Major P VIII (Elect.)               | BZP367      | Major practical based on elective paper          | 2         |
| 6.                    | AEC                                 | AEC-IV      | English                                          | 2         |
| 8.                    | VSC IV<br>(Major specific)          | BZPVSC-IV   | VSC practical                                    | 2         |
| 9.                    | SEC                                 | BZPSEC III  | Practical                                        | 2         |
| 10.                   | CC                                  | BZPCC-I     |                                                  | 2         |
| 11.                   | FP                                  | BZPFP-I     |                                                  | 2         |
| <b>Total credits:</b> |                                     |             |                                                  | <b>22</b> |

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|                                                                                                                                                                                                                                                                                                                                                                                      | <b>Karmaveer Bhaurao Patil University, Satara</b><br>(A State Public University Est. u/s 3(6) of MPUA 2016)<br><b>Faculty of Science &amp; Technology</b>                                                                                                                                                                        |                            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | <b>Yashavantrao Chavan Institute of Science, Satara</b>                                                                                                                                                                                                                                                                          |                            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | <b>Board of Studies in Zoology</b>                                                                                                                                                                                                                                                                                               |                            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | <b>Programme: B.Sc. Zoology</b>                                                                                                                                                                                                                                                                                                  | <b>Semester - V</b>        |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | <b>Type : Major</b>                                                                                                                                                                                                                                                                                                              | <b>Marks: 50</b>           |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | <b>Credits: 2 (30Hrs)</b>                                                                                                                                                                                                                                                                                                        | <b>From: A. Y. 2026-27</b> |
| <b>Name of the Course: BZT 351: Comparative Anatomy of Vertebrate (Major IX)</b>                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                  |                            |
| <b>Course Objectives: Students should be able to...</b> <ol style="list-style-type: none"> <li>1) summarize the knowledge of number of systems in animals.</li> <li>2) contrast the comparative aspects of systems in animals.</li> <li>3) determine the generalized structure and evolution of organs.</li> <li>4) acquire the knowledge of animal adaptations.</li> <li>5) compare complexity of organs and organ systems, and their interrelationships.</li> </ol> |                                                                                                                                                                                                                                                                                                                                  |                            |
| <b>Course Outcomes: Students will be able to...</b> <ol style="list-style-type: none"> <li>1) compare and contrast between different systems of animals.</li> <li>2) illustrate and describe the no. of system in animals.</li> <li>3) conclude the interrelation in between the organs and organ system in different animals.</li> <li>4) justify and explain the evolutionary trail in different organs and systems in animals.</li> </ol>                          |                                                                                                                                                                                                                                                                                                                                  |                            |
| <b>Module</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                         | <b>Title and Contents</b>                                                                                                                                                                                                                                                                                                        | <b>Hrs</b>                 |
| <b>Module -1:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                     | <b>1.1 Integumentary System</b><br>1.1.1 Generalized structure of integument<br>1.1.2 Functions of Integument<br>1.1.3 Soft and Hard epidermal derivative<br><b>1.2 Adaptive modifications of skin &amp; its derivatives:</b><br>1.2.1 Protective adaptations<br>1.2.2 Thermoregulatory adaptations<br>1.2.3 Sensory adaptations | <b>6</b>                   |
| <b>Module -2:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                     | <b>2.1 Digestive System</b><br>Brief account of alimentary canal and digestive glands<br><b>2.2 Respiratory System</b><br>Brief account of Gills, lungs, air sacs                                                                                                                                                                | <b>10</b>                  |
| <b>Module -3:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                     | <b>3.1 Circulatory System</b><br>Evolution of heart and aortic arches<br><b>3.2 Evolution of excretory system</b><br>Succession of kidney                                                                                                                                                                                        | <b>8</b>                   |
| <b>Module -4:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                     | <b>4.1 Nervous System</b><br>Comparative account of brain<br><b>4.2 Sense Organs</b><br>Comparative account of ear and eye of vertebrates                                                                                                                                                                                        | <b>6</b>                   |
| <b>Reference Books:-</b> <ol style="list-style-type: none"> <li>1. Arey, Leslie Brainerd. Developmental Anatomy: A Textbook and Laboratory Manual of Embryology. 7th ed. Philadelphia: W.B. Saunders. 1965.</li> <li>2. Ekambaranatha Ayyar, M., and T. N. Ananthakrishnan. Manual of Zoology, Vol. II:</li> </ol>                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                  |                            |

Vertebrata. 4th ed. Chennai: S. Viswanathan Pvt. Ltd. 1995.

3. Hildebrand, Milton, and George E. Goslow. Analysis of Vertebrate Structure. 5th ed. New York: John Wiley & Sons. 2001.
4. Kardong, Kenneth V. Vertebrates: Comparative Anatomy, Function, Evolution. 8th ed. New York: McGraw-Hill Education. 2018.
5. Kent, George C., and Robert K. Carr. Comparative Anatomy of the Vertebrates. 9th ed. New York: McGraw-Hill. 2001.
6. Moyes, Christopher D., and Patricia M. Schulte. Principles of Animal Physiology. 3rd ed. Boston: Pearson. 2016.
7. Pough, F. Harvey, Christine M. Janis, and John B. Heiser. Vertebrate Life. 9th ed. San Francisco: Pearson Education. 2012.
8. Rastogi, S. C. Essentials of Animal Physiology. 4th ed. New Delhi: New Age International Publishers. 2014.
9. Romer, Alfred S., and Thomas S. Parsons. The Vertebrate Body. 6th ed. Philadelphia: Saunders College Publishing. 1986.
10. Young, J. Z. The Life of Vertebrates. 3rd ed. Oxford: Oxford University Press. 2000.

**Evaluation Pattern:**

**Total Marks: 50**

**Internal Continuous Evaluation:**

- CCE-I: 10 M
- Mid-semester: 20 M
- CCE-II: 10 M

**End Semester Examination:**

- Question -1: 10 M
- Question -2: 20 M
- Question -3: 20 M

|                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                            |  |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|--|
|                                                                                                                                                                                                                                                                                                                                                            | <b>Karmaveer Bhaurao Patil University, Satara</b><br>(A State Public University Est. u/s 3(6) of MPUA 2016)<br><b>Faculty of Science &amp; Technology</b>                                                                                                                                                                                                                                                                                                                                                                                          |                            |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                             | <b>Yashavantrao Chavan Institute of Science, Satara</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                            |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                             | <b>Board of Studies in Zoology</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                            |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                             | <b>Programme: B.Sc. Zoology</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | <b>Semester - V</b>        |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                             | <b>Type : Major</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | <b>Marks: 50</b>           |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                             | <b>Credits : 2 (30Hrs)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | <b>From: A. Y. 2026-27</b> |  |
| <b>Name of the Course: BZT 352: Aquatic Biology (Major X)</b>                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                            |  |
| <b>Course Objectives: Students should be able to...</b> <ol style="list-style-type: none"><li>1) classify the different concepts of Freshwater Biology.</li><li>2) compare aspects of different Aquatic biomes.</li><li>3) interpret the histology and function of endocrine glands.</li><li>4) determine the knowledge of animal adaptations.</li><li>5) conclude the effects of pesticides and aquaculture drugs on the fishes.</li></ol> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                            |  |
| <b>Course Outcomes: Students will be able to...</b> <ol style="list-style-type: none"><li>1) compare and contrast between different aquatic biomes.</li><li>2) evaluate aspects of lakes and streams.</li><li>3) criticize the interrelation in between the endocrine glands, their hormone and effects.</li><li>4) justify and explain the hazardous effects of pesticides on freshwater ecology.</li></ol>                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                            |  |
| <b>Module</b>                                                                                                                                                                                                                                                                                                                                                                                                                               | <b>Title and Contents</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | <b>Hrs</b>                 |  |
| <b>Module -1:</b>                                                                                                                                                                                                                                                                                                                                                                                                                           | <b>Types of Aquatic Biomes</b><br>1.1. Freshwater ecosystem (pond, wetlands, streams and rivers),<br>1.2. Estuaries<br>1.3. Marine <ol style="list-style-type: none"><li>i. Intertidal zones</li><li>ii. pelagic zone</li><li>iii. Marine benthic zone</li><li>iv. Coral reefs</li></ol>                                                                                                                                                                                                                                                           | <b>8</b>                   |  |
| <b>Module -2:</b>                                                                                                                                                                                                                                                                                                                                                                                                                           | <b>Freshwater Ecology</b><br><b>2.1 Lentic ecosystem</b><br>2.1.1 Lake as an Ecosystem<br>2.1.2 Lake Morphometry<br>2.1.3 Physico-chemical characteristics: Light, Temperature, Thermal Stratification, Dissolved solids, Carbonates, Bicarbonates, Phosphates and Nitrates, Turbidity, Dissolved gases (Oxygen Carbon dioxide), Nutrient Cycle – (Nitrogen, Sulphur and Phosphorus)<br><b>2.2 Lotic ecosystem</b><br>2.2.1 Different stages of stream development<br>2.2.2 Physico-chemical Environment<br>2.2.3 Adaptation of hill stream fishes | <b>10</b>                  |  |
| <b>Module -3:</b>                                                                                                                                                                                                                                                                                                                                                                                                                           | <b>Aquatic Organisms:</b><br>3.1 Classification of aquatic organisms: Plankton (Phytoplankton & Zooplankton), Nekton and Benthos                                                                                                                                                                                                                                                                                                                                                                                                                   | <b>8</b>                   |  |

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|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 3.2 Adaptations of aquatic organisms<br>3.3 Life cycles and reproductive methods of aquatic organisms.                                                                  |                                                                                                                                                                  |
| <b>Module -4:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <b>Aquatic Toxicology</b><br>4.1 Introduction and need to study aquatic toxicology.<br>4.2 Types of aquatic toxicants<br>4.3 Toxicity tests: Acute, sub -acute, chronic | <b>4</b>                                                                                                                                                         |
| <b>Reference Books:-</b> <ol style="list-style-type: none"> <li>1. Boyd, Claude E. Water Quality: An Introduction. 2nd ed. Cham: Springer International Publishing. 2017.</li> <li>2. Dutta Munshi, J. S., and H. M. Dutta. Fish Morphology: Horizon of New Research. Enfield, NH: Science Publishers. 1996.</li> <li>3. Evans, David H., and James B. Claiborne. 2 The Physiology of Fishes. 3rd ed. Boca Raton, FL: CRC Press. 2006.</li> <li>4. Goldman, Charles R., and Alexander J. Horne. Limnology. 2nd ed. New York: McGraw- Hill. 1983.</li> <li>5. Jobling, Susan. Endocrine Disruption in Wildlife. Cambridge: Cambridge University Press. 2015.</li> <li>6. Norris, David O., and James A. Carr. Vertebrate Endocrinology. 5th ed. London: Academic Press. 2013.</li> <li>7. Odum, Eugene P., and Gary W. Barrett. 2005. Fundamentals of Ecology. 5th ed. Belmont, CA: Brooks/Cole.</li> <li>8. Rand, Gary M., ed. Fundamentals of Aquatic Toxicology: Effects, Environmental Fate, and Risk Assessment. 2nd ed. Washington, DC: Taylor &amp; Francis. 1995.</li> <li>9. Santhakumar, M., and A. Senthil Kumar. Aquatic Toxicology and Environmental Safety. New Delhi: Daya Publishing House. 2010.</li> <li>10. Wetzel, Robert G. Limnology: Lake and River Ecosystems. 3rd ed. San Diego: Academic Press. 2001</li> </ol> |                                                                                                                                                                         |                                                                                                                                                                  |
| <b>Evaluation Pattern:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                         |                                                                                                                                                                  |
| <b>Total Marks: 50</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                         |                                                                                                                                                                  |
| <b>Internal Continuous Evaluation:</b> <ul style="list-style-type: none"> <li>• CCE-I: 10 M</li> <li>• Mid-semester: 20 M</li> <li>• CCE-II: 10 M</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                         | <b>End Semester Examination:</b> <ul style="list-style-type: none"> <li>• Question -1: 10 M</li> <li>• Question -2: 20 M</li> <li>• Question -3: 20 M</li> </ul> |

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|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|
|                                                                                                                                                                                                                                     | <b>Karmaveer Bhaurao Patil University, Satara</b><br>(A State Public University Est. u/s 3(6) of MPUA 2016)<br><b>Faculty of Science &amp; Technology</b>                                                                                                                                                  |                            |
|                                                                                                                                                                                                                                                                                                                      | <b>Yashavantrao Chavan Institute of Science, Satara</b>                                                                                                                                                                                                                                                    |                            |
|                                                                                                                                                                                                                                                                                                                      | <b>Board of Studies in Zoology</b>                                                                                                                                                                                                                                                                         |                            |
|                                                                                                                                                                                                                                                                                                                      | <b>Programme: B.Sc. Zoology</b>                                                                                                                                                                                                                                                                            | <b>Semester - V</b>        |
|                                                                                                                                                                                                                                                                                                                      | <b>Type : Major</b>                                                                                                                                                                                                                                                                                        | <b>Marks: 50</b>           |
|                                                                                                                                                                                                                                                                                                                      | <b>Credits : 2 (30 Hrs.)</b>                                                                                                                                                                                                                                                                               | <b>From: A. Y. 2026-27</b> |
| <b>Name of the Course: BZT353: Biotechniques and Biostatistics (Major XI)</b>                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                            |                            |
| <b>Course Objectives: Students should be able to...</b><br>1) understand the different Biotechniques<br>2) remember the culture Techniques and Applications in daily life.<br>3) learn the process and applications of Genetically Modified Organisms.<br>4) acquire the knowledge of biostatistics.                 |                                                                                                                                                                                                                                                                                                            |                            |
| <b>Course Outcomes: Students will be able to...</b><br>1) apply the knowledge of transgenic techniques in the society.<br>2) analyze the animal cell culture and its applications.<br>3) apply the knowledge of Biostatistics and its application in research field.<br>4) Evaluate various biostatistical analysis. |                                                                                                                                                                                                                                                                                                            |                            |
| <b>Module</b>                                                                                                                                                                                                                                                                                                        | <b>Title and Contents</b>                                                                                                                                                                                                                                                                                  | <b>Hrs</b>                 |
| <b>Module -1:</b>                                                                                                                                                                                                                                                                                                    | <b>Transgenic techniques.</b><br>1.1 Production of cloned and transgenic animals:<br>a. Nuclear Transplantation<br>b. Retroviral Method<br>c. DNA microinjection<br>1.2 Applications of transgenic animals:<br>a. Productions of pharmaceuticals<br>b. Production of donor organs<br>1.3 Knockout mice.    | <b>8</b>                   |
| <b>Module -2:</b>                                                                                                                                                                                                                                                                                                    | <b>Culture Techniques and Applications</b><br>2.1 Animal cell culture: Introduction, principle and applications<br>2.2 Stem Cells: Introduction to stem cells<br>Potency of stem cells: Totipotency, Pluripotency, Multipotency, Unipotency<br>2.3 Sources of stem cells-Embryo, Fetal, Adult, Bone marrow | <b>8</b>                   |
| <b>Module -3:</b>                                                                                                                                                                                                                                                                                                    | <b>Biostatistics</b><br>3.1 Introduction, scope & importance of biostatistics.<br>3.2 Measures of central tendency (Mean, Median, Mode)<br>3.3 Dispersion – Mean deviation & standard deviation<br>3.4 Frequency distribution<br>3.5 Graphical representation of data<br>3.6 Probability                   | <b>8</b>                   |
| <b>Module -4:</b>                                                                                                                                                                                                                                                                                                    | <b>Statistical Tools for research</b><br>3.1 Introduction to Statistical software: SPSS<br>3.2 ANOVA (Analysis of variance)                                                                                                                                                                                | <b>6</b>                   |

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|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 3.3 Duncan's test                                                                                                        |                                                                                                                                 |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 3.4 Correlation – Scattered diagram, Karl Pearson's correlation coefficient and Spearman's rank correlation coefficient. |                                                                                                                                 |
| <b>Reference Books:-</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                          |                                                                                                                                 |
| <ol style="list-style-type: none"> <li>1. Alberts, Bruce, Alexander D. Johnson, Julian Lewis, David Morgan, Martin Raff, Keith Roberts, and Peter Walter. Molecular Biology of the Cell. 6th ed. New York: Garland Science, 2014.</li> <li>2. Das, Mukund. Biostatistics: A Textbook for the Health Sciences. New Delhi: Academic Publishers, 2018.</li> <li>3. Freshney, R. Ian. Culture of Animal Cells: A Manual of Basic Technique and Specialized Applications. 7th ed. Hoboken, NJ: Wiley-Blackwell, 2016.</li> <li>4. Griffiths, Anthony J. F., Susan R. Wessler, Richard C. Lewontin, Sean B. Carroll, and John Doebley. Introduction to Genetic Analysis. 12th ed. New York: W.H. Freeman, 2020.</li> <li>5. Lodish, Harvey, Arnold Berk, Chris A. Kaiser, Monty Krieger, Anthony Bretscher, Hidde Ploegh, and Angelika Amon. Molecular Cell Biology. 8th ed. New York: W.H. Freeman, 2016.</li> <li>6. Slack, Jonathan M. W. Stem Cells: A Very Short Introduction. Oxford: Oxford University Press, 2021.</li> <li>7. Sokal, Robert R., and F. James Rohlf. Biometry: The Principles and Practice of Statistics in Biological Research. 4th ed. New York: W.H. Freeman, 2012.</li> <li>8. Turksen, Kursad. Stem Cells: Basics and Clinical Translation. New York: Springer, 2015.</li> <li>9. Watson, James D., Tania A. Baker, Stephen P. Bell, Alexander Gann, Michael Levine, and Richard Losick. Molecular Biology of the Gene. 7th ed. Boston: Pearson, 2014.</li> <li>10. Zar, Jerrold H. Biostatistical Analysis. 5th ed. Upper Saddle River, NJ: Pearson Prentice Hall, 2010.</li> </ol> |                                                                                                                          |                                                                                                                                 |
| <b>Evaluation Pattern:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                          |                                                                                                                                 |
| <b>Total Marks: 50</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                          |                                                                                                                                 |
| <b>Internal Continuous Evaluation:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                          | <b>End Semester Examination:</b>                                                                                                |
| <ul style="list-style-type: none"> <li>• CCE-I: 10 M</li> <li>• Mid-semester: 20 M</li> <li>• CCE-II: 10 M</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                          | <ul style="list-style-type: none"> <li>• Question -1: 10 M</li> <li>• Question -2: 20 M</li> <li>• Question -3: 20 M</li> </ul> |

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|                                                                                                                                                                                                                                                                                       | <b>Karmaveer Bhaurao Patil University, Satara</b><br>(A State Public University Est. u/s 3(6) of MPUA 2016)<br><b>Faculty of Science &amp; Technology</b>                                                                                                                                                                                                                                                                                         |                            |  |
|                                                                                                                                                                                                                                                                                                                                                                        | <b>Yashavantrao Chavan Institute of Science, Satara</b>                                                                                                                                                                                                                                                                                                                                                                                           |                            |  |
|                                                                                                                                                                                                                                                                                                                                                                        | <b>Board of Studies in Zoology</b>                                                                                                                                                                                                                                                                                                                                                                                                                |                            |  |
|                                                                                                                                                                                                                                                                                                                                                                        | <b>Programme: B.Sc. Zoology</b>                                                                                                                                                                                                                                                                                                                                                                                                                   | <b>Semester - V</b>        |  |
|                                                                                                                                                                                                                                                                                                                                                                        | <b>Type : Major</b>                                                                                                                                                                                                                                                                                                                                                                                                                               | <b>Marks: 50</b>           |  |
|                                                                                                                                                                                                                                                                                                                                                                        | <b>Credits : 2 (30 Hrs.)</b>                                                                                                                                                                                                                                                                                                                                                                                                                      | <b>From: A. Y. 2026-27</b> |  |
|                                                                                                                                                                                                                                                                                                                                                                        | <b>Name of the Course: BZT354: Molecular Cell Biology and Animal Biotechnology (Elective Major- XII)</b>                                                                                                                                                                                                                                                                                                                                          |                            |  |
| <b>Course Objectives: Students should be able to...</b><br>1) paraphrase the undergraduate level knowledge of basic Molecular Techniques.<br>2) extrapolate the various terms and concepts of Molecular Biology.<br>3) determine basic and fundamental processes in Gene manipulations.<br>4) apply the principles, practices and application of animal biotechnology. |                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                            |  |
| <b>Course Outcomes: Students will be able to...</b><br>1) analyze the fundamental knowledge in Molecular Biology;<br>2) examine molecular basis of various Techniques used in Molecular biology and biotechnology.<br>3) contrast advanced techniques and instruments used in gene manipulations.<br>4) Analyze the various molecular techniques.                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                            |  |
| <b>Module</b>                                                                                                                                                                                                                                                                                                                                                          | <b>Title and Contents</b>                                                                                                                                                                                                                                                                                                                                                                                                                         | <b>Hrs.</b>                |  |
| <b>Module -1:</b>                                                                                                                                                                                                                                                                                                                                                      | <b>DNA replication</b><br>1.1. Definition, types of DNA Replication (Conservative, Semiconservative & Dispersive)<br>1.2. Mechanism of prokaryotic DNA replication<br>1.3. Enzymes involved in the process of prokaryotic DNA replication.<br>1.4. DNA Damage and Repair mechanism<br>1.5. Regulation of gene expression- Operon concept<br>1.6. Genetic Code:<br>i) Properties of Genetic code<br>ii) Codon assignment<br>iii) Wobble hypothesis | <b>10</b>                  |  |
| <b>Module -2:</b>                                                                                                                                                                                                                                                                                                                                                      | <b>Protein synthesis</b><br>2.1 Transcription Process in prokaryotes and eukaryotes<br>i) Initiation<br>ii) elongation<br>iii) termination<br>2.2 Translation in prokaryotes and eukaryotes<br>i) Initiation<br>ii) Elongation<br>iii) Termination                                                                                                                                                                                                | <b>8</b>                   |  |
| <b>Module -3:</b>                                                                                                                                                                                                                                                                                                                                                      | <b>Gene manipulation processes</b><br>3.1 Restriction enzymes: Nomenclature, detailed study of Type II.<br>3.2 Characteristics of Cloning vectors: Plasmids, Cosmids, Phagemids, Lambda Bacteriophages                                                                                                                                                                                                                                            |                            |  |

|                   |                                                                                                                                                                                                              |          |
|-------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
|                   | 3.3 Gene cloning: Transformation techniques by Calcium chloride method and electroporation<br>3.4 Construction of genomic and cDNA libraries                                                                 | <b>6</b> |
| <b>Module -4:</b> | <b>Molecular Techniques</b><br>4.1 Southern, Northern and Western blotting<br>4.2 DNA sequencing: Sangers method<br>4.3 Polymerase Chain Reaction,<br>4.4 DNA Finger Printing<br>4.5 Maxam-Gilbert technique | <b>6</b> |

**Reference Books:-**

1. Alberts, Bruce, Alexander D. Johnson, Julian Lewis, David Morgan, Martin Raff, Keith Roberts, and Peter Walter. Molecular Biology of the Cell. 6th ed. New York: Garland Science, 2014.
2. Brown, Terence A. Genomes. 4th ed. New York: Garland Science, 2017.
3. Glick, Bernard R., and Jack J. Pasternak. Molecular Biotechnology: Principles and Applications of Recombinant DNA. 5th ed. Washington, DC: ASM Press, 2010.
4. Krebs, Jocelyn E., Elliott S. Goldstein, and Stephen T. Kilpatrick. Lewin's Genes XII. Burlington, MA: Jones & Bartlett Learning, 2017.
5. Lodish, Harvey, Arnold Berk, Chris A. Kaiser, Monty Krieger, Anthony Bretscher, Hidde Ploegh, and Angelika Amon. Molecular Cell Biology. 9th ed. New York: W. H. Freeman, 2021.
6. Nelson, David L., and Michael M. Cox. Lehninger Principles of Biochemistry. 8th ed. New York: W. H. Freeman, 2021.
7. Nicholl, Desmond S. T. An Introduction to Genetic Engineering. 3rd ed. Cambridge: Cambridge University Press, 2008.
8. Primrose, Sandy B., and Richard Twyman. Principles of Gene Manipulation and Genomics. 7th ed. Malden, MA: Blackwell Publishing, 2006.
9. Watson, James D., Tania A. Baker, Stephen P. Bell, Alexander Gann, Michael Levine, and Richard Losick. Molecular Biology of the Gene. 7th ed. Boston: Pearson Education, 2014.
10. Weaver, Robert F. Molecular Biology. 5th ed. New York: McGraw-Hill, 2011.

**Evaluation Pattern:**

**Total Marks: 50**

|                                                                                                                       |                                                                                                                                 |
|-----------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|
| <b>Internal Continuous Evaluation:</b>                                                                                | <b>End Semester Examination:</b>                                                                                                |
| <ul style="list-style-type: none"> <li>• CCE-I: 10 M</li> <li>• Mid-semester: 20 M</li> <li>• CCE-II: 10 M</li> </ul> | <ul style="list-style-type: none"> <li>• Question -1: 10 M</li> <li>• Question -2: 20 M</li> <li>• Question -3: 20 M</li> </ul> |

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|                                                                                                                                                                                                                                                                                                                                                                                | <b>Karmaveer Bhaurao Patil University, Satara</b><br>(A State Public University Est. u/s 3(6) of MPUA 2016)<br><b>Faculty of Science &amp; Technology</b>                                                                                                                                                 |                            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <b>Yashavantrao Chavan Institute of Science, Satara</b>                                                                                                                                                                                                                                                   |                            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <b>Board of Studies in Zoology</b>                                                                                                                                                                                                                                                                        |                            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <b>Programme: B.Sc. Zoology</b>                                                                                                                                                                                                                                                                           | <b>Semester - V</b>        |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <b>Type : Major</b>                                                                                                                                                                                                                                                                                       | <b>Marks: 50</b>           |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <b>Credits : 2 (30 Hrs.)</b>                                                                                                                                                                                                                                                                              | <b>From: A. Y. 2025-26</b> |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <b>Name of the Course: BZT 355: Wild Life Conservation and Management (Elective- XII)</b>                                                                                                                                                                                                                 |                            |
| <b>Course Objectives: Students should be able to...</b><br>1) outline the principles of evolution, wildlife and conservation biology.<br>2) criticize the knowledge on modern concepts in wildlife management.<br>3) demonstrate the conservation policies and legislations and their enforcement mechanism.<br>4) develop scientific skills for resolving human wildlife conflicts.                                                                            |                                                                                                                                                                                                                                                                                                           |                            |
| <b>Course Outcomes: Students will be able to...</b><br>1) recite the conservation strategies that will help protection of wildlife.<br>2) analyze the wildlife legislation will systematically organize the understanding of wildlife conservation, trade and management.<br>3) enumerate the Knowledge of the ecology and behavior of wild animals.<br>4) analyze the critical evaluation of existing wildlife management practice and options for the future. |                                                                                                                                                                                                                                                                                                           |                            |
| <b>Module</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                   | <b>Title and Contents</b>                                                                                                                                                                                                                                                                                 | <b>Hrs</b>                 |
| <b>Module -1:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                               | <b>Introduction to wildlife:</b><br>1.1 Wild life - Values of wild life conservation ethics,<br>1.2 Importance,<br>1.3 Habitat analysis,<br>1.4 Evaluation and management of wild life –<br>1.5 Parameters of water & soil: Physical parameters, Biological Parameters and Standard evaluation procedures | <b>08</b>                  |
| <b>Module -2:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                               | <b>Importance of wildlife conservation:</b><br>2.1 National parks, wildlife sanctuary<br>2.2 Wild life Legislation,<br>2.3 Estimation of carrying capacity;<br>2.4 Eco tourism in forests;<br>2.5 Concept of climax persistence<br>2.6 Ecology of perturbation.                                           | <b>08</b>                  |
| <b>Module -3:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                               | <b>Management of habitats &amp; Population estimation:</b><br>3.1 Fecal analysis of ungulates and carnivores<br>3.2 Pug marks and census method.<br>3.3 Management of excess population & translocation<br>3.4 Bio- telemetry                                                                             | <b>06</b>                  |
| <b>Module -4:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                               | <b>Management of wildlife:</b><br>4.1 Care of injured and diseased animal<br>4.2 Quarantine<br>4.3 Common diseases of wild animal<br>4.4 Protected areas, Community reserve<br>4.5 Important features of protected areas in India<br>4.6 Tiger reserves in India; Management challenges                   | <b>08</b>                  |

**Reference Books:-**

1. Bookhout, Theodore A., ed. Research and Management Techniques for Wildlife and Habitats. 5th ed. Bethesda, MD: The Wildlife Society. 1994.
2. Knight, Richard L., and Kevin J. Gutzwiller, eds. Wildlife and Recreationists: Coexistence through Management and Research. Washington, DC: Island Press. 1995.
3. Kothari, Ashish, Neema Pathak, and Bina Agarwal. Communities and Conservation: Natural Resource Management in South and Central Asia. New Delhi: Sage Publications. 2006.
4. Kumar, U. Wildlife Management and Conservation. New Delhi: Anmol Publications Pvt Ltd. 2006.
5. Prater, S. H. The Book of Indian Animals. 3rd ed. Bombay: Bombay Natural History Society. 1971.
6. Ramakrishnan, P. S. Ecology and Sustainable Development. New Delhi: National Book Trust. 2001.
7. Rodgers, W. A., H. S. Panwar, and V. B. Mathur. Wildlife Protected Area Network in India: A Review (Executive Summary). Wildlife Institute of India, Dehradun. 2000.
8. Sharma, B. D. Wildlife in India: Conservation and Management. New Delhi: APH Publishing Corporation. 2013.
9. Sinclair, A. R. E., John M. Fryxell, and Graeme Caughley. Wildlife Ecology, Conservation, and Management. 2nd ed. Oxford: Blackwell Publishing. 2006.
10. Sutherland, William J. The Conservation Handbook: Research, Management and Policy. Oxford: Blackwell Science. 2000.

**Evaluation Pattern:****Total Marks: 50****Internal Continuous Evaluation:**

- CCE-I: 10 M
- Mid-semester: 20 M
- CCE-II: 10 M

**End Semester Examination:**

- Question -1: 10 M
- Question -2: 20 M
- Question -3: 20 M

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|  | <b>Karmaveer Bhaurao Patil University, Satara</b><br>(A State Public University Est. u/s 3(6) of MPUA 2016)<br><b>Faculty of Science &amp; Technology</b> |                            |
|                                                                                   | <b>Yashavantrao Chavan Institute of Science, Satara</b>                                                                                                   |                            |
|                                                                                   | <b>Board of Studies in Zoology</b>                                                                                                                        |                            |
|                                                                                   | <b>Programme: B.Sc. Zoology</b>                                                                                                                           | <b>Semester - V</b>        |
|                                                                                   | <b>Type : Major</b>                                                                                                                                       | <b>Marks: 50</b>           |
|                                                                                   | <b>Credits : 2 (30 Hrs.)</b>                                                                                                                              | <b>From: A. Y. 2026-27</b> |
|                                                                                   | <b>Name of the Course:</b><br><b>BZP 356: Major Practical-V</b>                                                                                           |                            |

**Course Objectives: Students should be able to...**

- 1) identify all organs and organ systems of vertebrates.
- 2) compare the study of different organ systems of vertebrates.
- 3) determine the diversity of aquatic life and to understand various aspects of living systems of aquatic biology.
- 4) apply scientific methodologies such as experimentation and data analysis in the area of aquatic biology.

**Course Outcomes: Students will be able to...**

- 1) Understand the structure and function of vertebrate integument and its derivatives.
- 2) Compare major organ systems (digestive, respiratory, circulatory, nervous) across vertebrates.
- 3) Identify and differentiate soft and hard epidermal derivatives in vertebrates.
- 4) Interpret histological sections and anatomical features of various vertebrates

| Module | Title and Contents                                                                                                                                     | Hrs |
|--------|--------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| 1.     | To study soft and hard epidermal derivatives in vertebrates                                                                                            | 30  |
| 2.     | Study of V.S. of skin of vertebrates: Fish, frog, <i>Calotes</i> , Bird, Mammals                                                                       |     |
| 3.     | Comparative study of Digestive system of following vertebrates: <i>Scoliodon</i> , <i>Frog</i> , <i>Calotes</i> , Pigeon, Rat                          |     |
| 4.     | To study the heart of the following vertebrates: Fishes, Amphibian, Aves, Mammal.                                                                      |     |
| 5.     | To study the respiratory organs of the following vertebrates: Fishes, Amphibian, Aves, Mammal.                                                         |     |
| 6.     | Comparative study of brain of following vertebrates: Fishes, Amphibian, Aves, Mammal.                                                                  |     |
| 7.     | To study Freshwater ecosystem: pond ecosystem, wetlands ecosystem.                                                                                     |     |
| 8.     | Identification of phytoplankton and zooplankton from given pond water sample.                                                                          |     |
| 9.     | Determination of Dissolved oxygen in given water sample.                                                                                               |     |
| 10.    | Determination of free CO <sub>2</sub> from given water sample.                                                                                         |     |
| 11.    | Determination of alkalinity (Carbonates & bicarbonates) from water collected from nearby lake or water body                                            |     |
| 12.    | Estimation of total hardness of water                                                                                                                  |     |
| 13.    | To study ecological adaptation of the following: <ol style="list-style-type: none"> <li>a. Pelagic</li> <li>b. Grassland</li> <li>c. Desert</li> </ol> |     |

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| <b>14.</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Instruments used in limnology & their significance of the following:<br>Secchi disc, Van Dorn bottle, Conductivity meter, Turbidity meter, PONAR grab sampler |                                                                                                                                                                                                                                                                                                                                                |
| <b>15.</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Visit to seashore/water reservoir/animal sanctuary to study animal diversity. Report of tour should be submitted at the time of practical examination         |                                                                                                                                                                                                                                                                                                                                                |
| <b>Reference Books:-</b> <ol style="list-style-type: none"> <li>1. Bhatia, Hans Raj. 2014. A Textbook of Animal Physiology. 4th ed. New Delhi: Atlantic Publishers &amp; Distributors.</li> <li>2. Khitoliya, R. K. 2004. Environmental Pollution: Management and Control for Sustainable Development. New Delhi: S. Chand &amp; Company Ltd.</li> <li>3. Hilderbrand, Milton, and Gasper A. Goslow.. Analysis of Vertebrate Structure. 5th ed. New York: John Wiley &amp; Sons. 2001</li> <li>4. Kent, George C., and Robert K. Carr. Comparative Anatomy of the Vertebrates. 9th ed. Boston: McGraw-Hill. 2000</li> <li>5. Allan, J. David, and María M. Castillo. 2007. Stream Ecology: Structure and Function of Running Waters. 2nd ed. Dordrecht: Springer.</li> <li>6. Goldman, Charles R., and Alexander J. Horne. 1983. Limnology. 2nd ed. New York: McGraw-Hill.</li> </ol> |                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                |
| <b>Evaluation Pattern:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                |
| <b>Total Marks: 50</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                |
| <b>Internal Continuous Evaluation:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                               | <b>End Semester Examination:</b> <ul style="list-style-type: none"> <li>• Question -1: Experiment 1- 10 M</li> <li>• Question -2: Experiment 1- 10 M</li> <li>• Question -2: Experiment 1- 10 M</li> <li>• Question -3: Identification- 10 M</li> <li>• Question -4: Student's performance- 5 M</li> <li>• Question -5: Journal-5 M</li> </ul> |

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|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | <b>Karmaveer Bhaurao Patil University, Satara</b><br>(A State Public University Est. u/s 3(6) of MPUA 2016)<br><b>Faculty of Science &amp; Technology</b> |                            |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <b>Yashavantrao Chavan Institute of Science, Satara</b>                                                                                                   |                            |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <b>Board of Studies in Zoology</b>                                                                                                                        |                            |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <b>Programme: B.Sc.</b>                                                                                                                                   | <b>Semester - V</b>        |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <b>Type : Major</b>                                                                                                                                       | <b>Marks: 50</b>           |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <b>Credits : 2 (30 Hrs.)</b>                                                                                                                              | <b>From: A. Y. 2026-27</b> |  |
| <b>Name of the Course: BZP 357: Major Practical- VI (Elective)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                           |                            |  |
| <b>Course Objectives: Students should be able to...</b> <ol style="list-style-type: none"><li>1) provide hands-on experience in tissue collection, fixation, and preparation for microscopic examination.</li><li>2) train students in advanced staining techniques such as Hematoxylin-Eosin, Alcian Blue (AB pH 1 &amp; 2.5), and PAS for histochemical analysis.</li><li>3) develop students' skills in tissue dehydration, clearing, embedding, section cutting, and mounting techniques.</li><li>4) introduce the fundamental concepts of molecular biotechnology, including cloning and the production of transgenic animals.</li><li>5) familiarize students with basic and applied biostatistical tools relevant to biological and medical research.</li></ol> |                                                                                                                                                           |                            |  |
| <b>Course Outcomes: Students will be able to...</b> <ol style="list-style-type: none"><li>1) collect, fix, and process biological tissues using standard histological protocols.</li><li>2) demonstrate proficiency in embedding, sectioning, and mounting tissues using microtomy.</li><li>3) interpret histological sections based on results obtained from various staining techniques.</li><li>4) understand the principles and applications of transgenic and cloned animal models in biomedical research.</li><li>5) apply biostatistical methods to analyze and interpret biological data accurately.</li></ol>                                                                                                                                                 |                                                                                                                                                           |                            |  |
| <b>Module</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | <b>Title and Contents</b>                                                                                                                                 | <b>Hrs</b>                 |  |
| 1.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Microtomy: Demonstration of tissue collection, fixation, Dehydration and Clearing using suitable biological material.                                     | 30                         |  |
| 2.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Microtomy: Embedding, block preparation                                                                                                                   |                            |  |
| 3.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Sectioning and mounting of tissue.                                                                                                                        |                            |  |
| 4.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Demonstration of Hematoxylin- eosin staining                                                                                                              |                            |  |
| 5.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | AB PH 1 technique                                                                                                                                         |                            |  |
| 6.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | AB PH 2.5 technique                                                                                                                                       |                            |  |
| 7.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | PAS technique                                                                                                                                             |                            |  |
| 8.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | To study the methods of cloned and transgenic animals                                                                                                     |                            |  |
| 9.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | To study Physical Parameters – Measurement of soil, water, and climatic conditions in a forest ecosystem.                                                 |                            |  |
| 10.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Use of line transects and quadrats for vegetation sampling.                                                                                               |                            |  |
| 11.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | To study Faecal Analysis of Herbivores and Carnivores animals.                                                                                            |                            |  |
| 12.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Study of Pugmark & Identification of carnivorous animals.                                                                                                 |                            |  |
| 13.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Study of ecological succession in forest.                                                                                                                 |                            |  |

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| <b>14.</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Mapping and studying major national parks, reserves, and sanctuaries                                                                                                                                                                                                                                                                           |  |
| <b>15.</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | To study any 10 biostatistics examples-based on theory.                                                                                                                                                                                                                                                                                        |  |
| <b>Reference Books:-</b> <ol style="list-style-type: none"> <li>1. Alberts, Bruce, et al. Molecular Biology of the Cell. 7th ed. Garland Science, 2022.</li> <li>2. Bancroft, John D., and Marilyn Gamble. Theory and Practice of Histological Techniques. 7th ed. Elsevier Health Sciences, 2008.</li> <li>3. Carson, Freida L., and Christa Hladik Cappellano. Histotechnology: A Self-Instructional Text. 4th ed. ASCP Press, 2014.</li> <li>4. Daniel, Wayne W. Biostatistics: A Foundation for Analysis in the Health Sciences. 10th ed. Wiley, 2013.</li> <li>5. Kiernan, J. A. Histological and Histochemical Methods: Theory and Practice. 4th ed. Scion Publishing, 2008</li> <li>6. Auerbeck, Caroline, and Urs Breitenmoser. Field and Laboratory Methods for General Ecology. New York: McGraw-Hill, 2009.</li> <li>7. Fowler, Murray E., and Susan K. Mikota. Biology, Medicine, and Surgery of Elephants. Ames, IA: Blackwell Publishing, 2006. (Relevant for wildlife diseases and rehabilitation)</li> <li>8. Hunter Jr., Malcolm L., and James P. Gibbs. Fundamentals of Conservation Biology. 4th ed. Hoboken, NJ: Wiley-Blackwell, 2021.</li> <li>9. Jacobson, Susan K. Communication Skills for Conservation Professionals. 2nd ed. Washington, DC: Island Press, 2009. (Useful for rescue, rehabilitation, and public ethics education)</li> <li>10. Macdonald, David, and Katrina Service, eds. Key Topics in Conservation Biology. Malden, MA: Blackwell Publishing, 2007.</li> </ol> |                                                                                                                                                                                                                                                                                                                                                |  |
| <b>Evaluation Pattern:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                |  |
| <b>Total Marks: 50</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                |  |
| <b>Internal Continuous Evaluation:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | <b>End Semester Examination:</b> <ul style="list-style-type: none"> <li>• Question -1: Experiment 1- 10 M</li> <li>• Question -2: Experiment 1- 10 M</li> <li>• Question -2: Experiment 1- 10 M</li> <li>• Question -3: Identification- 10 M</li> <li>• Question -4: Student's performance- 5 M</li> <li>• Question -5: Journal-5 M</li> </ul> |  |

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|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | <b>Karmaveer Bhaurao Patil University, Satara</b><br>(A State Public University Est. u/s 3(6) of MPUA 2016)<br><b>Faculty of Science &amp; Technology</b> |                            |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <b>Yashavantrao Chavan Institute of Science, Satara</b>                                                                                                   |                            |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <b>Board of Studies in Zoology</b>                                                                                                                        |                            |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <b>Programme: B.Sc.</b>                                                                                                                                   | <b>Semester - V</b>        |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <b>Type : Major</b>                                                                                                                                       | <b>Marks: 50</b>           |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <b>Credits : 2 (30 Hrs.)</b>                                                                                                                              | <b>From: A. Y. 2026-27</b> |  |
| <b>Name of the Course: BZP 357: Major Practical- VI (Elective)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                           |                            |  |
| <b>Course Objectives: Students should be able to...</b> <ol style="list-style-type: none"><li>1) provide hands-on experience in tissue collection, fixation, and preparation for microscopic examination.</li><li>2) train students in advanced staining techniques such as Hematoxylin-Eosin, Alcian Blue (AB pH 1 &amp; 2.5), and PAS for histochemical analysis.</li><li>3) develop students' skills in tissue dehydration, clearing, embedding, section cutting, and mounting techniques.</li><li>4) introduce the fundamental concepts of molecular biotechnology, including cloning and the production of transgenic animals.</li><li>5) familiarize students with basic and applied biostatistical tools relevant to biological and medical research.</li></ol> |                                                                                                                                                           |                            |  |
| <b>Course Outcomes: Students will be able to...</b> <ol style="list-style-type: none"><li>1) collect, fix, and process biological tissues using standard histological protocols.</li><li>2) demonstrate proficiency in embedding, sectioning, and mounting tissues using microtomy.</li><li>3) interpret histological sections based on results obtained from various staining techniques.</li><li>4) understand the principles and applications of transgenic and cloned animal models in biomedical research.</li><li>5) apply biostatistical methods to analyze and interpret biological data accurately.</li></ol>                                                                                                                                                 |                                                                                                                                                           |                            |  |
| <b>Module</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | <b>Title and Contents</b>                                                                                                                                 | <b>Hrs</b>                 |  |
| 1.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Microtomy: Demonstration of tissue collection, fixation, Dehydration and Clearing using suitable biological material.                                     | 30                         |  |
| 2.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Microtomy: Embedding, block preparation                                                                                                                   |                            |  |
| 3.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Sectioning and mounting of tissue.                                                                                                                        |                            |  |
| 4.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Demonstration of Hematoxylin- eosin staining                                                                                                              |                            |  |
| 5.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | AB PH 1 technique                                                                                                                                         |                            |  |
| 6.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | AB PH 2.5 technique                                                                                                                                       |                            |  |
| 7.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | PAS technique                                                                                                                                             |                            |  |
| 8.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | To study the methods of cloned and transgenic animals                                                                                                     |                            |  |
| 9.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Chromatography – Separation of amino acid by paper chromatography                                                                                         |                            |  |
| 10.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Isolation of DNA using any suitable material                                                                                                              |                            |  |
| 11.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Cell Counting Using Hemocytometer                                                                                                                         |                            |  |
| 12.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Study of different mitotic stages in plants using Onion root tip cells.                                                                                   |                            |  |

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| 13. | Demonstration of DNA by Feulgen technique                                                                        |  |
| 14. | To study the following blotting techniques-<br>i. Southern blotting<br>ii. Northern blotting<br>Western blotting |  |
| 15. | Demonstration of Polymerase chain reaction (PCR)                                                                 |  |

**Reference Books:-**

1. Alberts, Bruce, et al. Molecular Biology of the Cell. 7th ed. Garland Science, 2022.
2. Bancroft, John D., and Marilyn Gamble. Theory and Practice of Histological Techniques. 7th ed. Elsevier Health Sciences, 2008.
3. Carson, Freida L., and Christa Hladik Cappellano. Histotechnology: A Self-Instructional Text. 4th ed. ASCP Press, 2014.
4. Daniel, Wayne W. Biostatistics: A Foundation for Analysis in the Health Sciences. 10th ed. Wiley, 2013.
5. Kiernan, J. A. Histological and Histochemical Methods: Theory and Practice. 4th ed. Scion Publishing, 2008
6. Alberts, Bruce, Alexander Johnson, Julian Lewis, David Morgan, Martin Raff, Keith Roberts, and Peter Walter. Molecular Biology of the Cell. 6th ed. New York: Garland Science, 2015.
7. Brown, T. A. Genomes. 4th ed. New York: Garland Science, 2017.
8. Cooper, Geoffrey M., and Robert E. Hausman. The Cell: A Molecular Approach. 7th ed. Sunderland, MA: Sinauer Associates, 2019.
9. Gupta, P. K. A Textbook of Cell and Molecular Biology. Meerut: Rastogi Publications, 2020.
10. Karp, Gerald. Cell and Molecular Biology: Concepts and Experiments. 8th ed. Hoboken, NJ: John Wiley & Sons, 2018.

**Evaluation Pattern:**

**Total Marks: 50**

|                                        |                                                                                                                                                                                                                                                                                                                                                |
|----------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Internal Continuous Evaluation:</b> | <b>End Semester Examination:</b> <ul style="list-style-type: none"> <li>• Question -1: Experiment 1- 10 M</li> <li>• Question -2: Experiment 1- 10 M</li> <li>• Question -2: Experiment 1- 10 M</li> <li>• Question -3: Identification- 10 M</li> <li>• Question -4: Student's performance- 5 M</li> <li>• Question -5: Journal-5 M</li> </ul> |
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|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | <b>Karmaveer Bhaurao Patil University, Satara</b><br>(A State Public University Est. u/s 3(6) of MPUA 2016)<br><b>Faculty of Science &amp; Technology</b> |                            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | <b>Yashavantrao Chavan Institute of Science, Satara</b>                                                                                                   |                            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | <b>Board of Studies in Zoology</b>                                                                                                                        |                            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | <b>Programme: B.Sc. Zoology</b>                                                                                                                           | <b>Semester - V</b>        |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | <b>Type : Vocational Skill Course (VSC)</b>                                                                                                               | <b>Marks: 50</b>           |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | <b>Credits : 2 (30 Hrs.)</b>                                                                                                                              | <b>From: A. Y. 2026-27</b> |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | <b>Name of the Course: BZPVSC-III: Advances in Wildlife Photography-I</b>                                                                                 |                            |
| <b>Course Objectives: Students should be able to...</b> <ol style="list-style-type: none"><li>1) develop technical proficiency in diverse wildlife photography techniques, including high- speed, low-light, macro, and underwater photography.</li><li>2) train students in using specialized equipment and technologies such as drones, camera traps, thermal/infrared cameras, and 360° systems.</li><li>3) enable students to capture and analyze wildlife behavior in various environmental conditions, including nocturnal, aquatic, and fast-motion settings.</li><li>4) introduce post-processing and computational tools, including AI, HDR, focus stacking, and time-lapse techniques, for enhancing wildlife imagery.</li><li>5) foster storytelling and conservation awareness through visual narratives, emphasizing ethical practices and environmental sensitivity.</li></ol>                 |                                                                                                                                                           |                            |
| <b>Course Outcomes: Students will be able to...</b> <ol style="list-style-type: none"><li>1) demonstrate the ability to operate and apply advanced photographic tools and settings (e.g., burst mode, high ISO, manual focus, drone navigation) in various wildlife environments.</li><li>2) capture high-quality wildlife images under diverse conditions, including underwater, nocturnal, and macro contexts.</li><li>3) use AI tools, remote traps, and time-lapse sequences to document and study wildlife behavior with minimal disturbance.</li><li>4) produce professional-level wildlife images and videos with enhanced clarity, depth, and dynamic range using techniques like HDR, focus stacking, and multi-exposure.</li><li>5) create compelling wildlife photo stories or virtual experiences, integrating ethical considerations, conservation messages, and creative expression.</li></ol> |                                                                                                                                                           |                            |
| <b>Module</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | <b>Title and Contents</b>                                                                                                                                 | <b>Hrs</b>                 |
| 1.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | High-Speed Photography – Capturing fast-moving wildlife using high shutter speeds and burst mode.                                                         | 30                         |
| 2.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Low-Light and Night Photography – Using high ISO, long exposure, and artificial lighting for nocturnal wildlife.                                          |                            |
| 3.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Infrared and Thermal Imaging – Exploring the use of infrared cameras for studying wildlife in the dark.                                                   |                            |
| 4.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Aerial Wildlife Photography with Drones – Learning drone operation for capturing wildlife from a bird’s-eye view.                                         |                            |
| 5.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Underwater Wildlife Photography – Techniques for shooting marine life using underwater housing and lighting.                                              |                            |
| 6.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Macro Wildlife Photography – Capturing intricate details of small creatures like insects and amphibians.                                                  |                            |
| 7.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Focus Stacking for Enhanced Depth – Combining multiple images to achieve sharpness throughout the subject.                                                |                            |
| 8.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | motion Blur & Panning Effects – Creating artistic effects with controlled motion blur.                                                                    |                            |

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| 9.  | Remote Camera Trapping – Using motion-sensitive camera traps for capturing elusive wildlife         |
| 10. | Time-Lapse Photography – Documenting wildlife behavior changes over time                            |
| 11. | Artificial Intelligence in Wildlife Photography –Exploring AI-based tracking and autofocus systems. |
| 12. | 360° Wildlife Photography & VR – Creating immersive wildlife experiences using 360° cameras.        |
| 13. | Multi-Exposure & HDR Photography – Enhancing dynamic range in extreme lighting conditions.          |
| 14. | Camouflage & Concealment Techniques – Blending into environments for close-range wildlife shots.    |
| 15. | Storytelling through Wildlife Photography – Crafting impactful visual narratives.                   |

#### Reference Books:-

1. Sartore, Joel. Photographing National Parks: A Guide for Scouting and Shooting America's Most Cherished Lands. New York: National Geographic, 2019.
2. Hedgecoe, John. The Art of Digital Photography: A Step-by-Step Guide to Creating Dynamic Images. New York: DK Publishing, 2010.
3. Shaw, John. John Shaw's Guide to Digital Nature Photography. New York: Amphoto Books, 2015.
4. Hein, Richard. Drone Photography Basics: Your Guide to the Art and Technology of Aerial Imaging. London: Routledge, 2021.
5. Kelsey, Elin R., and Christian Ziegler. Watching Wildlife: A Photographer's Guide. London: Smithsonian Books, 2020.
6. Freeman, Michael. The Photographer's Eye: Composition and Design for Better Digital Photos. Oxford: Focal Press, 2020.
7. Meeks, Andrew. Infrared Photography: Artistic Techniques for Brilliant Images. Boston: Cengage Learning, 2017.
8. Rowlands, Tim. Wildlife Photography: From Snapshots to Great Shots. San Francisco: Peachpit Press, 2016.
9. Arnold, Bruce. Macro Photography: From Snapshots to Great Shots. San Francisco: Peachpit Press, 2018.
10. Bloom, Peter. The Science of Wildlife Sound and Image: Techniques and Technology for Nature Recordists. Cambridge: Cambridge University Press, 2022.

#### Evaluation Pattern:

**Total Marks: 50**

|                                        |                                                                                                                                                                                                                                                                                                                                                |
|----------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Internal Continuous Evaluation:</b> | <b>End Semester Examination:</b> <ul style="list-style-type: none"> <li>• Question -1: Experiment 1- 10 M</li> <li>• Question -2: Experiment 1- 10 M</li> <li>• Question -2: Experiment 1- 10 M</li> <li>• Question -3: Identification- 10 M</li> <li>• Question -4: Student's performance- 5 M</li> <li>• Question -5: Journal-5 M</li> </ul> |
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|                                                                                                                                                                                                                                                                                                                                     | <b>Karmaveer Bhaurao Patil University, Satara</b><br>(A State Public University Est. u/s 3(6) of MPUA 2016)<br><b>Faculty of Science &amp; Technology</b> |                            |
|                                                                                                                                                                                                                                                                                                                                                                                                                      | <b>Yashavantrao Chavan Institute of Science, Satara</b>                                                                                                   |                            |
|                                                                                                                                                                                                                                                                                                                                                                                                                      | <b>Board of Studies in Zoology</b>                                                                                                                        |                            |
|                                                                                                                                                                                                                                                                                                                                                                                                                      | <b>Programme: B.Sc.</b>                                                                                                                                   | <b>Semester - V</b>        |
|                                                                                                                                                                                                                                                                                                                                                                                                                      | <b>Type : On Job Training (OJT)</b>                                                                                                                       | <b>Marks: 100</b>          |
|                                                                                                                                                                                                                                                                                                                                                                                                                      | <b>Credits : 4 (60 Hrs.)</b>                                                                                                                              | <b>From: A. Y. 2026-27</b> |
| <b>Name of the Course: BZPOJT-I: On-Job Training</b>                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                           |                            |
| <b>Course Objectives: Students should be able to...</b> <ol style="list-style-type: none"> <li>1. Understand the functioning of zoology-related workplaces.</li> <li>2. Apply zoological knowledge in real-world situations.</li> <li>3. Develop laboratory, field, and professional skills.</li> <li>4. Analyze biological data and observations.</li> <li>5. Practice professional ethics and teamwork.</li> </ol> |                                                                                                                                                           |                            |
| <b>Course Outcomes: Students will be able to...</b> <ol style="list-style-type: none"> <li>1. Explain workplace practices in zoology</li> <li>2. Apply zoological techniques in professional settings.</li> <li>3. Analyze biological data and field observations.</li> <li>4. Evaluate scientific procedures and outcomes.</li> <li>5. Demonstrate professional ethics, communication, and teamwork.</li> </ol>     |                                                                                                                                                           |                            |

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|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <b>Karmaveer Bhaurao Patil University, Satara</b><br>(A State Public University Est. u/s 3(6) of MPUA 2016)<br><b>Faculty of Science &amp; Technology</b> |                            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | <b>Yashavantrao Chavan Institute of Science, Satara</b>                                                                                                   |                            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | <b>Board of Studies in Zoology</b>                                                                                                                        |                            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | <b>Programme: B.Sc.</b>                                                                                                                                   | <b>Semester - V</b>        |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | <b>Type : Community Engagement programme (CEP)</b>                                                                                                        | <b>Marks: 50</b>           |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | <b>Credits : 2 (30 Hrs.)</b>                                                                                                                              | <b>From: A. Y. 2026-27</b> |
| <b>Name of the Course: BZPCEP-I: Community Engagement programme in Zoology</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                           |                            |
| <b>Course Objectives: Students should be able to...</b> <ol style="list-style-type: none"> <li>1. Remember the basic concepts of biodiversity, environmental conservation, public health, and community ecology.</li> <li>2. Understand the role of zoological knowledge in addressing community and environmental issues.</li> <li>3. Apply zoological principles and scientific methods during community-based activities and field surveys.</li> <li>4. Analyze ecological and social challenges affecting local communities and ecosystems.</li> <li>5. Create awareness programmes and sustainable solutions for community welfare and environmental conservation.</li> </ol> |                                                                                                                                                           |                            |
| <b>Course Outcomes: Students will be able to...</b> <ol style="list-style-type: none"> <li>1. Explain the importance of zoology in community development, environmental protection, and public health.</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                           |                            |

2. Conduct community surveys, biodiversity assessments, and awareness campaigns using appropriate scientific approaches.
3. Demonstrate effective communication, teamwork, and leadership skills while working with community stakeholders.
4. Evaluate local environmental and health-related issues and propose evidence-based interventions.
5. Design and implement community engagement projects that promote biodiversity conservation, sustainability, and social responsibility.

## Sixth Semester

### 1) Semester-VI (5.5)

| Sr. No. | Theory             |                          |                                      |                          |         | Sr. No | Practical                        |                           |         |
|---------|--------------------|--------------------------|--------------------------------------|--------------------------|---------|--------|----------------------------------|---------------------------|---------|
|         | Subject            | Course No. & Course Code | Title of Paper                       | No. of lectures per week | Credits |        | Course No. & Course Code         | No. of Practical Per week | Credits |
| 1.      | Major XIII         | BZT 361                  | Developmental Biology of Vertebrates | 2                        | 2       | 7.     | BZP 366<br>Major P VII           | 1                         | 2       |
| 2.      | Major XIV          | BZT 362                  | Vector Biology and Histology         | 2                        | 2       |        |                                  |                           |         |
| 3.      | Major XV           | BZT 363                  | Immunology                           | 2                        | 2       |        |                                  |                           |         |
| 4.      | Major XVI (Elect.) | BZT 364                  | Applied Zoology -II                  | 2                        | 2       | 8.     | BZP 367<br>Major P VIII (Elect.) | 1                         | 2       |
|         |                    | BZT365                   | Endocrinology                        |                          |         |        |                                  |                           |         |
| 5.      | AEC                | AEC-IV                   | English                              | 2                        | 2       | 9.     | BZPVSC-IV (Major specific)       | 1                         | 2       |
| 6.      | CC                 | CC                       |                                      | 1                        | 1       | 10.    | BZPSEC III                       | 1                         | 2       |
|         |                    |                          |                                      |                          |         | 11.    | BZPFP-I                          | 1                         | 2       |

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|                                                                                                                                                                                                                                                                                           | <b>Karmaveer Bhaurao Patil University, Satara</b><br>(A State Public University Est. u/s 3(6) of MPUA 2016)<br><b>Faculty of Science &amp; Technology</b>                                                                                                                                                                                                                                                              |                            |
|                                                                                                                                                                                                                                                                                                                                                                            | <b>Yashavantrao Chavan Institute of Science, Satara</b>                                                                                                                                                                                                                                                                                                                                                                |                            |
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|                                                                                                                                                                                                                                                                                                                                                                            | <b>Programme: B.Sc. Zoology</b>                                                                                                                                                                                                                                                                                                                                                                                        | <b>Semester - VI</b>       |
|                                                                                                                                                                                                                                                                                                                                                                            | <b>Type : Major</b>                                                                                                                                                                                                                                                                                                                                                                                                    | <b>Marks: 50</b>           |
|                                                                                                                                                                                                                                                                                                                                                                            | <b>Credits : 2 (30 Hrs.)</b>                                                                                                                                                                                                                                                                                                                                                                                           | <b>From: A. Y. 2026-27</b> |
|                                                                                                                                                                                                                                                                                                                                                                            | <b>Name of the Course: BZT 361: Developmental Biology of Vertebrates (Major XIII)</b>                                                                                                                                                                                                                                                                                                                                  |                            |
| <b>Course Objectives: Students should be able to...</b><br>1) compare various types of fertilization and process of fertilization.<br>2) discuss concept of fertilization and cleavage.<br>3) recognize early development of frog.<br>4) explain the organogenesis.                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                        |                            |
| <b>Course Outcomes: Students will be able to...</b><br>1) recite the basic concepts of developmental biology.<br>2) enumerate the main anatomical changes that occur during development.<br>3) outline and compare the developmental stages which occur in a variety of animals.<br>4) identify the cellular behavior that led to morphological change during development. |                                                                                                                                                                                                                                                                                                                                                                                                                        |                            |
| <b>Module</b>                                                                                                                                                                                                                                                                                                                                                              | <b>Title and Contents</b>                                                                                                                                                                                                                                                                                                                                                                                              | <b>Hrs.</b>                |
| <b>Module -1:</b>                                                                                                                                                                                                                                                                                                                                                          | <b>Unit 1: Gametogenesis:</b><br>1.1 Introduction, Types of Eggs<br>1.2 Process of Fertilization, types of fertilization.<br>1.3 Cleavages-Types of Cleavages                                                                                                                                                                                                                                                          | <b>5</b>                   |
| <b>Module -2:</b>                                                                                                                                                                                                                                                                                                                                                          | <b>Unit 2: Early Development of Frog</b><br>2.1 Structure of mature egg and its membranes<br>2.2 Cleavage<br>2.3 Blastula and its fate map<br>2.4 Process of gastrulation<br>2.5 Types of Morphogenic Movements<br>2.6 Fate of three germinal layers<br>2.7 Neurulation<br>2.8 Metamorphosis in frog and its hormonal regulation                                                                                       | <b>8</b>                   |
| <b>Module -3:</b>                                                                                                                                                                                                                                                                                                                                                          | <b>Chick Embryology</b><br>3.1 Structure of sperm<br>3.2 Structure of egg and vitellogenesis<br>3.3 Fertilization and cleavage<br>3.4 Blastula and its fate map<br>3.5 Process of gastrulation<br>3.6 Organogenesis<br>i) Development of neural tube and brain up to 72 hours of incubation<br>ii) Development of gut up to 72 hours of incubation<br>iii) Development of blood and heart up to 72 hours of incubation | <b>10</b>                  |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                             |                                                                                                                                                                  |
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|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | iv) Fetal membranes and significance                                                                                                                        |                                                                                                                                                                  |
| <b>Module -4:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <b>Embryonic Development</b><br>4.1 Placenta – Formation, types and significance<br>4.2 Fetal membranes and their importance in humans<br>4.3 IVF technique | <b>7</b>                                                                                                                                                         |
| <b>Reference Books:-</b> <ol style="list-style-type: none"> <li>1. Arora, M. P. Embryology. Meerut: Himalaya Publishing House. 2010.</li> <li>2. Balinsky, B. I., and Fabian, B. C. An Introduction to Embryology. 5th ed. Boston: Cengage Learning. 2012.</li> <li>3. Carlson, Bruce M. Human Embryology and Developmental Biology. 5th ed. Philadelphia: Elsevier. 2014</li> <li>4. Gilbert, Scott F. Developmental Biology. 11th ed. Sunderland, MA: Sinauer Associates. 2016.</li> <li>5. Kalthoff, Kurt. Analysis of Biological Development. 2nd ed. New York: McGraw-Hill. 2000.</li> <li>6. Langman, Jan. Medical Embryology. 13th ed. Philadelphia: Wolters Kluwer. 2015.</li> <li>7. Larsen, William J. Human Embryology. 3rd ed. Philadelphia: Churchill Livingstone. 2001.</li> <li>8. Rai, U. N. Developmental Biology. Allahabad: Rastogi Publications. 2011.</li> <li>9. Verma, P. S., and V. K. Agarwal. Chick Embryology. New Delhi: S. Chand &amp; Company. 2009.</li> <li>10. Wolpert, Lewis, and Cheryll Tickle. Principles of Development. 4th ed. Oxford: Oxford University Press. 2011.</li> </ol> |                                                                                                                                                             |                                                                                                                                                                  |
| <b>Evaluation Pattern:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                             |                                                                                                                                                                  |
| <b>Total Marks: 50</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                             |                                                                                                                                                                  |
| <b>Internal Continuous Evaluation:</b> <ul style="list-style-type: none"> <li>• CCE-I: 10 M</li> <li>• Mid-semester: 20 M</li> <li>• CCE-II: 10 M</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                             | <b>End Semester Examination:</b> <ul style="list-style-type: none"> <li>• Question -1: 10 M</li> <li>• Question -2: 20 M</li> <li>• Question -3: 20 M</li> </ul> |

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|                                                                                                                                                                                                                                                                                                                           | <b>Karmaveer Bhaurao Patil University, Satara</b><br>(A State Public University Est. u/s 3(6) of MPUA 2016)<br><b>Faculty of Science &amp; Technology</b>                                                                                                                                                                                                                                                       |                            |
|                                                                                                                                                                                                                                                                                                                                                                                                            | <b>Yashavantrao Chavan Institute of Science, Satara</b>                                                                                                                                                                                                                                                                                                                                                         |                            |
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|                                                                                                                                                                                                                                                                                                                                                                                                            | <b>Type : Major</b>                                                                                                                                                                                                                                                                                                                                                                                             | <b>Marks: 50</b>           |
|                                                                                                                                                                                                                                                                                                                                                                                                            | <b>Credits : 2 (30 Hrs.)</b>                                                                                                                                                                                                                                                                                                                                                                                    | <b>From: A. Y. 2026-27</b> |
| <b>Name of the Course: BZT 362: Vector Biology (Major XIV)</b>                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                 |                            |
| <b>Course Objectives: Students should be able to...</b> <ol style="list-style-type: none"> <li>1) paraphrase the insect vectors.</li> <li>2) criticize the mosquito born disease and their control measures.</li> <li>3) interpret the microscopic structure of cells of mammalian organs.</li> <li>4) summarize the fly born disease and their control measures.</li> </ol>                               |                                                                                                                                                                                                                                                                                                                                                                                                                 |                            |
| <b>Course Outcomes: Students will be able to...</b> <ol style="list-style-type: none"> <li>1) relate the knowledge about insect vectors.</li> <li>2) corelate the mosquito borne diseases and their control measures.</li> <li>3) recognize the microscopic structure of cells of mammalian organs and their functions.</li> <li>4) corelate the fly borne diseases and their control measures.</li> </ol> |                                                                                                                                                                                                                                                                                                                                                                                                                 |                            |
| <b>Module</b>                                                                                                                                                                                                                                                                                                                                                                                              | <b>Title and Contents</b>                                                                                                                                                                                                                                                                                                                                                                                       | <b>Hrs</b>                 |
| <b>Module -1:</b>                                                                                                                                                                                                                                                                                                                                                                                          | <b>Study of following insect vectors with reference to disease:</b> <ol style="list-style-type: none"> <li>1.1 Tse-Tse fly</li> <li>1.2 Sand fly</li> <li>1.3 Horse fly</li> <li>1.4 Black fly</li> <li>1.5 Arachnid vectors: Ticks and Mites</li> </ol>                                                                                                                                                        | 8                          |
| <b>Module -2:</b>                                                                                                                                                                                                                                                                                                                                                                                          | <b>2.1 Study of mosquito borne diseases–</b> <ol style="list-style-type: none"> <li>i. Important mosquito species: Culex, Anopheles</li> <li>ii. Malaria</li> <li>iii. Dengue</li> <li>iv. Chikungunya</li> <li>v. Virulencephalitis</li> <li>vi. Filariasis</li> </ol> <b>2.2 Control measures of Mosquitoes</b><br><b>2.3 Study of house fly as important mechanical vector, Myiasis, Control of housefly</b> | 8                          |
| <b>Module -3:</b>                                                                                                                                                                                                                                                                                                                                                                                          | <b>Siphonaptera as Disease Vectors</b> <ol style="list-style-type: none"> <li>3.1 Fleas an important insect vector (Morphology, life cycle)</li> <li>3.2 Host-specificity</li> <li>3.3 Study of Flea-borne diseases (Plague, Typhus fever)</li> <li>3.4 Control of fleas</li> </ol>                                                                                                                             | 8                          |
| <b>Module -4:</b>                                                                                                                                                                                                                                                                                                                                                                                          | <b>Emerging vector borne diseases:</b> <ol style="list-style-type: none"> <li>4.1 Zika virus disease</li> <li>4.2 West Nile fever</li> <li>4.3 Nipah virus disease</li> </ol>                                                                                                                                                                                                                                   | 6                          |

**Reference Books:-**

1. Clements, Alan N. The Biology of Mosquitoes: Volume 1: Development, Nutrition and Reproduction. London: Chapman & Hall, 1992.
2. Eldridge, Bruce F., and John D. Edman, eds. Medical Entomology: A Textbook on Public Health and Veterinary Problems Caused by Arthropods. Dordrecht: Springer, 2004.
3. Gartner, Leslie P., and James L. Hiatt. Color Textbook of Histology. 4th ed. Philadelphia: Elsevier Saunders, 2014.
4. James, Maurice T., and Roy F. Harwood. Herm's Medical Entomology: Entomology in Human and Animal Health. 7th ed. New York: Macmillan, 1969.
5. Lane, R. P., and R. W. Crosskey, eds. Medical Insects and Arachnids. London: Chapman & Hall, 1993.
6. Lehane, Michael J. The Biology of Blood-Sucking in Insects. 2nd ed. Cambridge: Cambridge University Press, 2005.
7. Marquardt, William C., ed. Biology of Disease Vectors. 2nd ed. Burlington, MA: Elsevier Academic Press, 2004.
8. Ross, Michael H., and Wojciech Pawlina. Histology: A Text and Atlas: With Correlated Cell and Molecular Biology. 8th ed. Philadelphia: Wolters Kluwer, 2020.
9. Service, M. W. Medical Entomology for Students. 5th ed. Cambridge: Cambridge University Press, 2012.
10. Snodgrass, R. E. Principles of Insect Morphology. New York: McGraw-Hill Book Company, 1935.

**Evaluation Pattern:****Total Marks: 50****Internal Continuous Evaluation:**

- CCE-I: 10 M
- Mid-semester: 20 M
- CCE-II: 10 M

**End Semester Examination:**

- Question -1: 10 M
- Question -2: 20 M
- Question -3: 20 M

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|                                                                                                                                                                                                                                                                                                                                   | <b>Karmaveer Bhaurao Patil University, Satara</b><br>(A State Public University Est. u/s 3(6) of MPUA 2016)<br><b>Faculty of Science &amp; Technology</b>                                                                                                                                                                                                                                                                                                                       |                            |
|                                                                                                                                                                                                                                                                                                                                                                                                                    | <b>Yashavantrao Chavan Institute of Science, Satara</b>                                                                                                                                                                                                                                                                                                                                                                                                                         |                            |
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|                                                                                                                                                                                                                                                                                                                                                                                                                    | <b>Programme: B.Sc. Zoology</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <b>Semester - VI</b>       |
|                                                                                                                                                                                                                                                                                                                                                                                                                    | <b>Type : Major</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                             | <b>Marks: 50</b>           |
|                                                                                                                                                                                                                                                                                                                                                                                                                    | <b>Credits : 2 (30 Hrs.)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                    | <b>From: A. Y. 2026-27</b> |
| <b>Name of the Course: BZT 363: Immunology (Major XV)</b>                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                            |
| <b>Course Objectives: Students should be able to...</b> <ol style="list-style-type: none"> <li>1) recite the basic concepts in immunology.</li> <li>2) restate about vaccination.</li> <li>3) classify the cells and organs of immune system.</li> <li>4) analyze the structure and function of antibody.</li> <li>5) restate the antigen-antibody interactions.</li> </ol>                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                            |
| <b>Course Outcomes: Students will be able to...</b> <ol style="list-style-type: none"> <li>1) enumerate the knowledge about basic concepts in immunology.</li> <li>2) discuss the concept of vaccination.</li> <li>3) interpret the knowledge about cells and organs of immune system.</li> <li>4) infer the structure and function of antibody.</li> <li>5) discuss the antigen-antibody interactions.</li> </ol> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                            |
| <b>Module</b>                                                                                                                                                                                                                                                                                                                                                                                                      | <b>Title and Contents</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                       | <b>Hrs</b>                 |
| <b>Module -1:</b>                                                                                                                                                                                                                                                                                                                                                                                                  | <b>1.1 Introduction to Immune system</b><br><b>1.2 Classification of immune system</b> <ol style="list-style-type: none"> <li>i. Innate (Specific and non-specific)</li> <li>ii. Acquired (Active and Passive)</li> <li>iii. -Non -specific defense mechanism of body -</li> <li>iv. First line of defense</li> <li>v. Second Line of defense</li> <li>vi. Third line of defense</li> </ol>                                                                                     | <b>5</b>                   |
| <b>Module -2:</b>                                                                                                                                                                                                                                                                                                                                                                                                  | <b>Introduction to Cells and organs of immune system</b><br><b>2.1 Cells of immune system:</b> Synthesis of different human blood cells. Immune Cells – Stem cell, T cell, B cell, NK cell, Macrophage, Neutrophil, Eosinophil, Basophil, Mast cell, Dendritic cell. (Structure and their role)<br><b>2.2 Organs and tissues of immune system:</b> Primary and secondary lymphoid organs Bone Marrow, Thymus, Lymph Node, Spleen, GALT, MALT, SALT. (Structure and their role.) | <b>8</b>                   |
| <b>Module -3:</b>                                                                                                                                                                                                                                                                                                                                                                                                  | <b>Antigen and Antibody</b><br>3.1 Antigen- Definition, Nature, Characteristics and types of antigens, factors affecting Antigenicity<br>3.2 Antibody-Definition, Nature, Basic structure of immunoglobulins, major human immunoglobulin classes (Their properties and functions).<br>3.3 Hybridoma Technology: Monoclonal Antibodies in diagnosis and therapeutics                                                                                                             | <b>7</b>                   |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                            |
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| <b>Module -4:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | <b>Immune Response and Antigen- antibody interactions:</b><br>4.1 Immune response- Primary and secondary immune response.<br>4.2 Antigen Antibody reactions –Principle and applications of --<br>i. agglutination,<br>ii. precipitation, flocculation<br>iii. complement fixation<br>iv. ELISA<br>v. neutralization<br>vi. fluorescence antibody test<br>4.3 Parasitic immunology: - Immune response against Bacterial /viral infection with reference to suitable examples. | <b>10</b>                                                                                                                                                  |
| <b>Reference Books:-</b> <ol style="list-style-type: none"> <li>Owen, Judith A., Jenni Punt, and Sharon A. Stranford. <i>Kuby Immunology</i>. 8th ed. New York: W. H. Freeman, 2017.</li> <li>Janeway, Charles A., Paul Travers, Mark Walport, and Mark J. Shlomchik. <i>Janeway's Immunobiology</i>. 9th ed. New York: Garland Science, 2016.</li> <li>Abbas, Abul K., Andrew H. Lichtman, and Shiv Pillai. <i>Basic Immunology: Functions and Disorders of the Immune System</i>. 7th ed. Philadelphia: Elsevier, 2023.</li> <li>Coico, Richard, and Geoffrey Sunshine. <i>Immunology: A Short Course</i>. 8th ed. Hoboken, NJ: Wiley-Blackwell, 2021.</li> <li>Delves, Peter J., Seamus J. Martin, Dennis R. Burton, and Ivan M. Roitt. <i>Roitt's Essential Immunology</i>. 14th ed. Hoboken, NJ: Wiley-Blackwell, 2017.</li> <li>Kindt, Thomas J., Richard A. Goldsby, Barbara A. Osborne, and Janis Kuby. <i>Kuby Immunology</i>. 7th ed. New York: W.H. Freeman, 2013.</li> <li>Owen, Judith A., Jenni Punt, and Sharon A. Stranford. <i>Immunology</i>. 9th ed. New York: W.H. Freeman, 2022.</li> <li>Parham, Peter. <i>The Immune System</i>. 5th ed. New York: Garland Science, 2020.</li> <li>Tizard, Ian R. <i>Veterinary Immunology: An Introduction</i>. 11th ed. St. Louis, MO: Elsevier, 2021.</li> </ol> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                            |
| <b>Evaluation Pattern:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                            |
| <b>Total Marks: 50</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                            |
| <b>Internal Continuous Evaluation:</b> <ul style="list-style-type: none"> <li>CCE-I: 10 M</li> <li>Mid-semester: 20 M</li> <li>CCE-II: 10 M</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | <b>End Semester Examination:</b> <ul style="list-style-type: none"> <li>Question -1: 10 M</li> <li>Question -2: 20 M</li> <li>Question -3: 20 M</li> </ul> |

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|                                                                                                                                                                                                                                                                                                                                                                                                                                                            | <b>Programme: B.Sc. Zoology</b>                                                                                                                                                                                                                                                                                                                                                                                                                                        | <b>Semester - VI</b>       |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                            | <b>Type : Major</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                    | <b>Marks: 50</b>           |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                            | <b>Credits : 2 (30 Hrs.)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                           | <b>From: A. Y. 2026-27</b> |
| <b>Name of the Course: BZT 364: Applied Zoology – II (Major XVI) (Elective)</b>                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                            |
| <b>Course Objectives: Students should be able to...</b> <ol style="list-style-type: none"> <li>1) design the small apiaries for demonstration, pollination, extraction and by-product of beekeeping.</li> <li>2) determine the proper management of the domestic animals.</li> <li>3) contrast the indigenous and exotic breeds of domestic animals.</li> </ol>                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                            |
| <b>Course Outcomes: Students will be able to...</b> <ol style="list-style-type: none"> <li>1) set up bee keeping system and bee keeping management.</li> <li>2) apply the knowledge about bee colony management.</li> <li>3) develop the management for the production of the domestic animals.</li> <li>4) correlate the nutrition of domestic animals to increase the milk production.</li> <li>5) manipulate the process of pearl formation.</li> </ol> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                            |
| Module                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Title and Contents                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Hrs                        |
| <b>Module -1:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                          | <b>Apiculture</b> <ol style="list-style-type: none"> <li>1.1 Life Cycle of honey bee</li> <li>1.2 Types and casts of honeybee</li> <li>1.3 Honey Comb: structural study</li> <li>1.4 Bee Keeping               <ol style="list-style-type: none"> <li>i. Artificial models of bee hive – Newton and Langstroth models</li> <li>ii. Bee keeping Equipment</li> <li>iii. Extraction of Honey</li> <li>iv. Medicinal Value of Honey</li> </ol> </li> </ol>                | <b>10</b>                  |
| <b>Module -2:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                          | <b>Animal Husbandry</b> <ol style="list-style-type: none"> <li>2.1 Indigenous and exotic breeds of cattle</li> <li>2.2 Preservation and artificial insemination in cattle</li> <li>2.3 Induction of early puberty</li> <li>2.4 Synchronization of estrus in cattle</li> <li>2.5 Commercial importance of dairy farming</li> <li>2.6 Ethical consideration in India: Committee for the Purpose of Control and Supervision of Experiments on Animals (CPCSEA)</li> </ol> | <b>5</b>                   |
| <b>Module -3:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                          | <b>Freshwater Pearl culture</b> <ol style="list-style-type: none"> <li>3.1 Species of oyster</li> <li>3.2 Process of Pearl formation: natural and artificial</li> <li>3.3 Maintenance of oysters</li> <li>3.4 Harvesting</li> <li>3.5 Importance of Pearl</li> </ol>                                                                                                                                                                                                   | <b>5</b>                   |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |           |
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| <b>Module -4:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | <p><b>4.1 Freshwater prawn culture</b></p> <ol style="list-style-type: none"> <li>Species of Prawn</li> <li>Sites election</li> <li>Farm Construction</li> <li>Production system: fertilization, Larval Development, Food and feeding Harvesting</li> </ol> <p><b>4.2 Fish Technology</b><br/>Genetic improvements in aquaculture industry:</p> <ol style="list-style-type: none"> <li>Induced breeding</li> <li>Transportation of fish seed</li> <li>Feeding and development</li> <li>Harvesting and Marketing</li> </ol> | <b>10</b> |
| <p><b>Reference Books:-</b></p> <ol style="list-style-type: none"> <li>Banerjee, G. C. A Textbook of Animal Husbandry. 8th ed. New Delhi: Oxford &amp; IBH Publishing Co., 2016.</li> <li>Ghosh, A. K., and C. V. Rao. Pearl Culture. New Delhi: APH Publishing, 2001.</li> <li>Graham, Joe M., ed. The Hive and the Honey Bee. Hamilton, IL: Dadant &amp; Sons, 2015.</li> <li>Jhingran, V. G. Fish and Fisheries of India. 3rd ed. Delhi: Hindustan Publishing Corporation, 1991.</li> <li>Pandey, K., and J. P. Shukla. Fish and Fisheries. 4th ed. Meerut: Rastogi Publications, 2012.</li> <li>Pillay, T. V. R., and M. N. Kuttu. Aquaculture: Principles and Practices. 2nd ed. Oxford: Blackwell Publishing, 2005.</li> <li>Prasad, Jagdish. Principles and Practices of Dairy Farm Management. New Delhi: Kalyani Publishers, 2014.</li> <li>Ruttner, Friedrich. Biology and Breeding of Honeybees. New York: McGraw-Hill, 1988.</li> <li>Santhana Krishnan, M. Aquaculture: Freshwater Prawn Culture. New Delhi: Narendra Publishing House, 2012.</li> <li>Singh, Harbans. Beekeeping in India. New Delhi: Indian Council of Agricultural Research, 2013.</li> </ol> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |           |
| <b>Evaluation Pattern:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |           |
| <b>Total Marks: 50</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |           |
| <p><b>Internal Continuous Evaluation:</b></p> <ul style="list-style-type: none"> <li>CCE-I: 10 M</li> <li>Mid-semester: 20 M</li> <li>CCE-II: 10 M</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <p><b>End Semester Examination:</b></p> <ul style="list-style-type: none"> <li>Question -1: 10 M</li> <li>Question -2: 20 M</li> <li>Question -3: 20 M</li> </ul>                                                                                                                                                                                                                                                                                                                                                          |           |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | <b>Karmaveer Bhaurao Patil University, Satara</b><br>(A State Public University Est. u/s 3(6) of MPUA 2016)<br><b>Faculty of Science &amp; Technology</b>                                                                                                                                                                                                                                                                                                                                            |                            |
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|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | <b>Yashavantrao Chavan Institute of Science, Satara</b>                                                                                                                                                                                                                                                                                                                                                                                                                                              |                            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | <b>Board of Studies in Zoology</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | <b>Programme: B.Sc. Zoology</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | <b>Semester - VI</b>       |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | <b>Type : Major</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | <b>Marks: 50</b>           |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | <b>Credits : 2 (30 Hrs.)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | <b>From: A. Y. 2025-26</b> |
| <b>Name of the Course: BZT 365: Endocrinology (Major XIV) (Elective)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                            |
| <b>Course Objectives: Students should be able to...</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                            |
| <ol style="list-style-type: none"> <li>1) introduce the fundamental concepts and scope of endocrinology, including the structure and function of endocrine glands.</li> <li>2) explain the classification, synthesis, and mechanisms of hormone action and regulation.</li> <li>3) describe the anatomical and physiological aspects of the hypothalamic-pituitary axis.</li> <li>4) explore the structure, secretions, and disorders of major endocrine glands such as thyroid, adrenal, pancreas, and gonads.</li> <li>5) examine emerging areas in endocrinology, including gastrointestinal hormones, melatonin, and metabolic regulation.</li> </ol> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                            |
| <b>Course Outcomes: Students will be able to...</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                            |
| <ol style="list-style-type: none"> <li>1) define endocrinology and explain its scope and relevance in biological and medical sciences.</li> <li>2) demonstrate understanding of hormone types, their biochemical nature, modes of action, and regulatory mechanisms.</li> <li>3) analyze the functional coordination between the hypothalamus and pituitary gland in endocrine control.</li> <li>4) identify the structure, hormones, and common disorders associated with thyroid, adrenal, pancreatic, and gonadal glands</li> </ol>                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                            |
| Module                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Title and Contents                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Hrs                        |
| <b>Module -1:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | <b>1.1 Overview of Endocrinology</b><br>Definition, scope, and importance of endocrinology<br><b>1.2 Endocrine Glands and Hormones</b> <ol style="list-style-type: none"> <li>i. Classification of hormones: Peptides, steroids, and amines</li> <li>ii. General characteristics of hormones</li> <li>iii. Mechanisms of hormone action: Receptors, signal transduction, and second messengers</li> </ol> <b>1.3 Regulation of Hormonal Secretion</b><br>Feedback mechanisms (positive and negative) | <b>6</b>                   |
| <b>Module -2:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | <b>Hypothalamic-Pituitary Axis</b><br><b>2.1 Hypothalamus</b><br>Neurosecretory cells<br><b>2.2 Pituitary Gland</b> <ol style="list-style-type: none"> <li>i. Structure and functional divisions (anterior and posterior pituitary)</li> <li>ii. Hormones of the anterior pituitary: Growth hormone (GH), prolactin (PRL), TSH, ACTH, FSH, and LH</li> </ol>                                                                                                                                         | <b>8</b>                   |

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|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | iii. Hormones of the posterior pituitary: Vasopressin (ADH) and oxytocin                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                  |
| <b>Module -3:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <b>Endocrine Glands: Structure, Hormones and disorders of the following-</b> <ol style="list-style-type: none"> <li>1. Thyroid Gland</li> <li>2. Adrenal Gland</li> <li>3. Pancreas</li> <li>4. Gonads (Ovaries and Testes)</li> </ol>                                                                                                                                         | <b>8</b>                                                                                                                                                         |
| <b>Module -4:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <b>Emerging Trends in Endocrinology</b> <p><b>4.1 Pineal Gland and Melatonin</b><br/>Role in biological rhythms and sleep-wake cycles</p> <p><b>4.2 Endocrine Regulation of Metabolism</b><br/>Hormonal control of carbohydrate, protein, and lipid metabolism</p> <p><b>4.3 Endocrinological diseases: Acromegaly, Gigantism, Hyperparathyroidism, Hypoparathyroidism</b></p> | <b>8</b>                                                                                                                                                         |
| <b>Reference Books:-</b> <ol style="list-style-type: none"> <li>1. Barrett, Kim E., Susan M. Barman, Scott Boitano, and Heddwen L. Brooks. Ganong's Review of Medical Physiology. 26th ed. New York: McGraw-Hill Education, 2019.</li> <li>2. Griffin, John E., and Sergio R. Ojeda. Textbook of Endocrine Physiology. 6th ed. Oxford: Oxford University Press, 2012.</li> <li>3. Hadley, Mac E., and Jon E. Levine. Endocrinology. 6th ed. San Francisco: Pearson Benjamin Cummings, 2006.</li> <li>4. Hall, John E. Guyton and Hall Textbook of Medical Physiology. 14th ed. Philadelphia: Elsevier, 2021.</li> <li>5. Larsen, P. Reed, ed. Williams Manual of Endocrinology. 2nd ed. Philadelphia: Lippincott Williams &amp; Wilkins, 2007.</li> <li>6. Martin, Carol A. Concise Medical Physiology. 8th ed. Kolkata: New Central Book Agency, 2022.</li> <li>7. Melmed, Shlomo, Kenneth S. Polonsky, P. Reed Larsen, and Henry M. Kronenberg, eds. Williams Textbook of Endocrinology. 14th ed. Philadelphia: Elsevier, 2020.</li> <li>8. Norman, Anthony W., and Helen L. Henry. Hormones. 3rd ed. San Diego: Academic Press, 2002.</li> <li>9. Nussey, Stephen S., and Saffron A. Whitehead. Endocrinology: An Integrated Approach. Oxford: BIOS Scientific Publishers, 2001.</li> <li>10. Turner, C. D., and J. T. Bagnara. General Endocrinology. 6th ed. Philadelphia: W.B. Saunders, 1984.</li> </ol> |                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                  |
| <b>Evaluation Pattern:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                  |
| <b>Total Marks: 50</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                  |
| <b>Internal Continuous Evaluation:</b> <ul style="list-style-type: none"> <li>• CCE-I: 10 M</li> <li>• Mid-semester: 20 M</li> <li>• CCE-II: 10 M</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                | <b>End Semester Examination:</b> <ul style="list-style-type: none"> <li>• Question -1: 10 M</li> <li>• Question -2: 20 M</li> <li>• Question -3: 20 M</li> </ul> |

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|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | <b>Karmaveer Bhaurao Patil University, Satara</b><br>(A State Public University Est. u/s 3(6) of MPUA 2016)<br><b>Faculty of Science &amp; Technology</b>                                                                                                    |                            |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | <b>Yashavantrao Chavan Institute of Science, Satara</b>                                                                                                                                                                                                      |                            |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | <b>Board of Studies in Zoology</b>                                                                                                                                                                                                                           |                            |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | <b>Programme: B.Sc. Zoology</b>                                                                                                                                                                                                                              | <b>Semester - VI</b>       |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | <b>Type : Major</b>                                                                                                                                                                                                                                          | <b>Marks: 50</b>           |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | <b>Credits : 2 (30 Hrs.)</b>                                                                                                                                                                                                                                 | <b>From: A. Y. 2026-27</b> |  |
| <b>Name of the Course: BZP 366: Major Practical VII</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                              |                            |  |
| <b>Course Objectives: Students should be able to...</b> <ol style="list-style-type: none"><li>1) To understand the structure and function of gametes and reproductive organs across vertebrate species.</li><li>2) To observe and analyze the process of fertilization, cleavage, and early embryonic development in vertebrates.</li><li>3) To examine stages of embryogenesis, including gastrulation and neurulation, through microscopic and video demonstrations.</li><li>4) To compare metamorphic stages in amphibians and embryonic development stages in avians.</li><li>5) To study advanced embryological concepts such as organizer activity, placental types, and teratogenic effects using case studies and photomicrographs.</li></ol>                                                                                                    |                                                                                                                                                                                                                                                              |                            |  |
| <b>Course Outcomes: Students will be able to...</b> <ol style="list-style-type: none"><li>1) Students will be able to identify and differentiate gametes and gonadal structures in various vertebrate species using permanent slides.</li><li>2) Students will gain the ability to describe and interpret cleavage patterns and early embryonic development in frogs and chicks.</li><li>3) Students will demonstrate understanding of neurulation and morphogenesis through slide observation and model analysis.</li><li>4) Students will be able to trace the metamorphic stages in amphibians and developmental timelines in chick embryos with accuracy.</li><li>5) Students will analyze and evaluate the role of embryological phenomena such as organizer regions, placental types, and developmental disorders induced by teratogens.</li></ol> |                                                                                                                                                                                                                                                              |                            |  |
| <b>Module</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | <b>Title and Contents</b>                                                                                                                                                                                                                                    | <b>Hrs</b>                 |  |
| 1.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Microscopic examination of sperm and ova from different species.                                                                                                                                                                                             | 30                         |  |
| 2.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | To study different types of cleavages in animals.                                                                                                                                                                                                            |                            |  |
| 3.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Studying early embryonic development in frog- Blastula & Gastrula through permanent slides.                                                                                                                                                                  |                            |  |
| 4.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Comparison of meroblastic vs holoblastic cleavage patterns using microphotographs or diagram.                                                                                                                                                                |                            |  |
| 5.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Study of neurulation in frog embryo.                                                                                                                                                                                                                         |                            |  |
| 6.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | To study Stages of metamorphosis in frog <ol style="list-style-type: none"><li>i. External gill stage</li><li>ii. Internal gill stage</li><li>iii. Forelimb stage</li><li>iv. Hind limb stage</li><li>v. Tail bud stage</li><li>vi. Juvenile stage</li></ol> |                            |  |
| 7.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Preparation and Study of Whole mount of chick embryo – 18, 24, 33, 48 and 72 hours.                                                                                                                                                                          |                            |  |

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| 8.  | Microscopic examination of somite formation in chick embryo (whole mount or permanent slides).                                                                                                                                                  |
| 9.  | Study of different kinds of mouthparts of insects<br>a. Chewing & biting<br>b. Chewing & lapping<br>c. Piercing & sucking<br>d. Sponging<br>e. Siphoning                                                                                        |
| 10. | Study of following insect vectors: Mosquito, sand fly, housefly                                                                                                                                                                                 |
| 11. | Demonstration of breeding habitats of mosquito vectors – stagnant water, water tanks, flower pots, etc.                                                                                                                                         |
| 12. | Study of mosquito borne diseases – Malaria, dengue, chikungunya.                                                                                                                                                                                |
| 13. | Study of housefly borne diseases and flea borne diseases – Plague, typhus                                                                                                                                                                       |
| 14. | Study of Zika virus disease and West Nile fever.                                                                                                                                                                                                |
| 15. | Case study- Submission of any 5 insect vector photographs and their role as a disease vector.<br><br><b>OR</b><br>Visit to sea shore/ large water body/ research Centre related to insect vector disease control and submission of visit report |

#### Reference Books:-

1. Gilbert, Scott F. Developmental Biology. 12th ed. Sunderland, MA: Sinauer Associates, 2020.
2. Wolpert, Lewis, Cheryll Tickle, and Alfonso Martinez Arias. Principles of Development. 6th ed. Oxford: Oxford University Press, 2019.
3. Carlson, Bruce M. Human Embryology and Developmental Biology. 6th ed. Philadelphia: Elsevier, 2018.
4. Balinsky, B. I. An Introduction to Embryology. 5th ed. New York: Holt-Saunders International, 2012.
5. Browder, Leon W., Donald R. Erickson, and William R. Jeffery. Developmental Biology: A Comprehensive Synthesis. New York: Springer-Verlag, 1991.
6. Service, M. W. Medical Entomology for Students. 5th ed. Cambridge: Cambridge University Press, 2012.
7. Clements, Alan N. The Biology of Mosquitoes. Vol. 1–3. Wallingford: CABI Publishing, 1992–2012.
8. Eldridge, Bruce F., and John D. Edman. Medical Entomology: A Textbook on Public Health and Veterinary Problems Caused by Arthropods. Dordrecht: Springer, 2004.
9. Lehane, Michael J. The Biology of Blood-Sucking in Insects. 2nd ed. Cambridge: Cambridge University Press, 2005.
10. Paniker, C. K. Jayaram, and Ananthanarayan. Textbook of Microbiology. 10th ed. Hyderabad: Universities Press, 2017.

#### Evaluation Pattern:

#### Total Marks: 50

|                                        |                                                                                                                                                                                                                                                                                                                                                |
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| <b>Internal Continuous Evaluation:</b> | <b>End Semester Examination:</b> <ul style="list-style-type: none"> <li>• Question -1: Experiment 1- 10 M</li> <li>• Question -2: Experiment 1- 10 M</li> <li>• Question -2: Experiment 1- 10 M</li> <li>• Question -3: Identification- 10 M</li> <li>• Question -4: Student's performance- 5 M</li> <li>• Question -5: Journal-5 M</li> </ul> |
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|                                                                                                                                                                                                                                                                                                     | <b>Karmaveer Bhaurao Patil University, Satara</b><br>(A State Public University Est. u/s 3(6) of MPUA 2016)<br><b>Faculty of Science &amp; Technology</b>                                                     |                            |
|                                                                                                                                                                                                                                                                                                                                                                                      | <b>Yashavantrao Chavan Institute of Science, Satara</b>                                                                                                                                                       |                            |
|                                                                                                                                                                                                                                                                                                                                                                                      | <b>Board of Studies in Zoology</b>                                                                                                                                                                            |                            |
|                                                                                                                                                                                                                                                                                                                                                                                      | <b>Programme: B.Sc. Zoology</b>                                                                                                                                                                               | <b>Semester - VI</b>       |
|                                                                                                                                                                                                                                                                                                                                                                                      | <b>Type : Major</b>                                                                                                                                                                                           | <b>Marks: 50</b>           |
|                                                                                                                                                                                                                                                                                                                                                                                      | <b>Credits : 2 (30 Hrs.)</b>                                                                                                                                                                                  | <b>From: A. Y. 2026-27</b> |
|                                                                                                                                                                                                                                                                                                                                                                                      | <b>Name of the Course: BZP 367: Major Practical- VIII (Elective)</b>                                                                                                                                          |                            |
| <b>Course Objectives: Students should be able to...</b> <ol style="list-style-type: none"><li>1) recite the concepts of Apiculture, bee keeping equipment.</li><li>2) outline the pearl culture and fresh water prawn culture.</li><li>3) recall the basic histology of glands related to immunity.</li><li>4) explain the concept of Goat farming.</li></ol>                        |                                                                                                                                                                                                               |                            |
| <b>Course Outcomes: Students will be able to...</b> <ol style="list-style-type: none"><li>1) demonstrate knowledge of apiculture, Prawn culture and goat farming.</li><li>2) set up their own Apiculture, Prawn culture and goat farming unit.</li><li>3) illustrate the use of different immunohistochemical instruments.</li><li>4) state the role of the immune system.</li></ol> |                                                                                                                                                                                                               |                            |
| <b>Module</b>                                                                                                                                                                                                                                                                                                                                                                        | <b>Title and Contents</b>                                                                                                                                                                                     | <b>Hrs</b>                 |
| 1.                                                                                                                                                                                                                                                                                                                                                                                   | Demonstration of different castes of Honey Bees (Worker, Drone, Queen) and Structure of Bee hive                                                                                                              | 30                         |
| 2.                                                                                                                                                                                                                                                                                                                                                                                   | To study the types of communication in honey bees:<br>Round Dance, Waggle Dance, Cleaning Dance, DVAV Dance – with audio-visual aids.                                                                         |                            |
| 3.                                                                                                                                                                                                                                                                                                                                                                                   | Study of bee-keeping equipment and bee products:<br>Observation through photographs/models – Newtons model of hive, smokers, hive tools, Honey extractor, Bee-veil, frames, honey, beeswax, royal jelly, etc. |                            |
| 4.                                                                                                                                                                                                                                                                                                                                                                                   | Mounting of Pollen basket and Sting Apparatus of Honey Bee.                                                                                                                                                   |                            |
| 5.                                                                                                                                                                                                                                                                                                                                                                                   | Demonstration of equipment for Preservation & Artificial insemination in cattle. (Equipment/ Photographs or Videos)                                                                                           |                            |
| 6.                                                                                                                                                                                                                                                                                                                                                                                   | To study the different species of pearl oysters and process of pearl formation.                                                                                                                               |                            |
| 7.                                                                                                                                                                                                                                                                                                                                                                                   | To study the process of induced breeding in fish with (Photographs)                                                                                                                                           |                            |
| 8.                                                                                                                                                                                                                                                                                                                                                                                   | To Study the lymphoid organs of vertebrates.                                                                                                                                                                  |                            |
| 9.                                                                                                                                                                                                                                                                                                                                                                                   | To study the histology of given human organs through permanent slides or photographs)<br>i. Spleen<br>ii. Thymus<br>iii. Lymph nodes                                                                          |                            |
| 10.                                                                                                                                                                                                                                                                                                                                                                                  | Preparation of stained blood smears to study various types of blood cells                                                                                                                                     |                            |
| 11.                                                                                                                                                                                                                                                                                                                                                                                  | Determination of ABO blood groups.                                                                                                                                                                            |                            |
| 12.                                                                                                                                                                                                                                                                                                                                                                                  | To study the Ag-Ab interactions with suitable serological techniques: To study- Widal test (Qualitative)                                                                                                      |                            |

|            |                                                      |  |
|------------|------------------------------------------------------|--|
| <b>13.</b> | Demonstration of Rapid Plasma Reagin (RPR) card test |  |
| <b>14.</b> | Demonstration of Radial Immuno-diffusion assay (RIA) |  |
| <b>15.</b> | Visit to local apiary / fishery production center.   |  |

**Reference Books:-**

1. Alagarwami, K. Pearl Culture. New Delhi: Indian Council of Agricultural Research, 1991.
2. Crane, Eva. The World History of Beekeeping and Honey Hunting. New York: Routledge, 1999.
3. Ghosh, Amal Kumar. Aquaculture: Principles and Practices. 3rd ed. New Delhi: PHI Learning, 2018.
4. Jhingran, V. G. Fish and Fisheries of India. 3rd ed. New Delhi: Hindustan Publishing Corporation, 1991.
5. Pillay, T. V. R., and M. N. Kutty. Aquaculture: Principles and Practices. 2nd ed. Oxford: Blackwell Publishing, 2005.
6. Abbas, Abul K., Andrew H. Lichtman, and Shiv Pillai. Basic Immunology: Functions and Disorders of the Immune System. 7th ed. Philadelphia: Elsevier. 2022.
7. Ananthanarayan, R., and C.K. Jayaram Paniker. Paniker's Textbook of Microbiology. 10th ed. Hyderabad: Universities Press. 2017.
8. Chatterjee, C.C. Human Physiology, Volume 2. 11th ed. Kolkata: Medical Allied Agency. 2012.
9. Delves, Peter J., Seamus J. Martin, Dennis R. Burton, and Ivan M. Roitt. Roitt's Essential Immunology. 13th ed. Chichester: Wiley-Blackwell. 2016.
10. Guyton, Arthur C., and John E. Hall. Textbook of Medical Physiology. 14th ed. Philadelphia: Elsevier. 2020.

**Evaluation Pattern:**

**Total Marks: 50**

|                                        |                                                                                                                                                                                                                                                                                                               |
|----------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Internal Continuous Evaluation:</b> | <b>End Semester Examination:</b>                                                                                                                                                                                                                                                                              |
|                                        | <ul style="list-style-type: none"> <li>• Question -1: Experiment 1- 10 M</li> <li>• Question -2: Experiment 1- 10 M</li> <li>• Question -2: Experiment 1- 10 M</li> <li>• Question -3: Identification- 10 M</li> <li>• Question -4: Student's performance- 5 M</li> <li>• Question -5: Journal-5 M</li> </ul> |

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|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | <b>Karmaveer Bhaurao Patil University, Satara</b><br>(A State Public University Est. u/s 3(6) of MPUA 2016)<br><b>Faculty of Science &amp; Technology</b>                           |                            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | <b>Yashavantrao Chavan Institute of Science, Satara</b>                                                                                                                             |                            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | <b>Board of Studies in Zoology</b>                                                                                                                                                  |                            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | <b>Programme: B.Sc. Zoology</b>                                                                                                                                                     | <b>Semester - VI</b>       |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | <b>Type : Major</b>                                                                                                                                                                 | <b>Marks: 50</b>           |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | <b>Credits : 2 (30 Hrs.)</b>                                                                                                                                                        | <b>From: A. Y. 2025-26</b> |
| <b>Name of the Course: BZP 367: Major Practical- VIII (Elective)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                     |                            |
| <b>Course Objectives: Students should be able to...</b> <ol style="list-style-type: none"> <li>1) introduce students to the fundamentals of endocrinology, including hormone types, their mechanisms, and the physiological roles of endocrine glands.</li> <li>2) explain the structure and function of the hypothalamic-pituitary axis and its regulatory mechanisms.</li> <li>3) study the anatomy, hormonal secretions, and disorders of major endocrine glands such as thyroid, adrenal, pancreas, and gonads.</li> <li>4) understand the role of emerging endocrine components such as melatonin, gastrointestinal hormones, and metabolic regulators.</li> <li>5) raise awareness about environmental endocrine disruptors and their impact on human and animal health.</li> </ol> |                                                                                                                                                                                     |                            |
| <b>Course Outcomes: Students will be able to...</b> <ol style="list-style-type: none"> <li>1) gain a comprehensive understanding of hormone classification, characteristics, and signaling mechanisms.</li> <li>2) explain the interactions between the hypothalamus and pituitary in regulating various physiological functions.</li> <li>3) demonstrate knowledge of endocrine gland disorders, including symptoms, diagnosis, and physiological implications.</li> <li>4) analyse the role of lesser-known hormones and their effects on circadian rhythms, digestion, and metabolism.</li> <li>5) equipped to evaluate environmental endocrine disruptors and their relevance to public and ecosystem health.</li> </ol>                                                              |                                                                                                                                                                                     |                            |
| <b>Module</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | <b>Title and Contents</b>                                                                                                                                                           | <b>Hrs</b>                 |
| 1.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Dissection and Identification of Endocrine Glands in a Representative Vertebrate (e.g., Rat or Frog)<br><i>Identification of pituitary, thyroid, adrenal, pancreas, and gonads.</i> | 30                         |
| 2.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Histological Study of Endocrine Glands<br><i>Microscopic examination of sections of pituitary, thyroid, adrenal, pancreas, and gonads.</i>                                          |                            |
| 3.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Demonstration of Feedback Mechanism using Models or Simulations<br><i>Negative and positive feedback loops of hormone regulation.</i>                                               |                            |
| 4.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Estimation of Blood Glucose Level (Fasting and Postprandial)<br><i>Assessment of insulin function using glucometer or spectrophotometer.</i>                                        |                            |
| 5.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Study of the Hypothalamo-Pituitary Axis using Flowcharts and Diagrams<br><i>Mapping hormone interactions and feedback control.</i>                                                  |                            |
| 6.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Demonstration of Hormone Receptor Binding through Virtual Labs/Software<br><i>Understanding receptor-ligand interaction and signal transduction.</i>                                |                            |
| 7.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Study of Hypo and hyper thyroidism.                                                                                                                                                 |                            |
| 8.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | To Study the lymphoid organs of vertebrates.                                                                                                                                        |                            |
| 9.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | To study the histology of given human organs through permanent slides or                                                                                                            |                            |

|     |                                                                                                          |  |
|-----|----------------------------------------------------------------------------------------------------------|--|
|     | photographs)<br>i. Spleen<br>ii. Thymus<br>iii. Lymph nodes                                              |  |
| 10. | Preparation of stained blood smears to study various types of blood cells                                |  |
| 11. | Determination of ABO blood groups.                                                                       |  |
| 12. | To study the Ag-Ab interactions with suitable serological techniques: To study- Widal test (Qualitative) |  |
| 13. | Demonstration of Rapid Plasma Reagin (RPR) card test                                                     |  |
| 14. | Demonstration of Radial Immuno-diffusion assay (RIA)                                                     |  |
| 15. | Disease – Introduction, Mode of Infection, Epidemiology and preventive measures etc.                     |  |

**Reference Books:-**

1. Becker, Barbara A., and Susan M. Barman. Ganong's Review of Medical Physiology. 26th ed. New York: McGraw-Hill Education, 2019.
2. Chrousos, George P., and Ashley B. Grossman. Hormones: From Molecules to Disease. Totowa, NJ: Humana Press, 2003.
3. Degroot, Leslie J., and Joseph L. Jameson, eds. Endocrinology: Adult and Pediatric. 7th ed. Philadelphia: Elsevier Saunders, 2016.
4. Guyton, Arthur C., and John E. Hall. Textbook of Medical Physiology. 13th ed. Philadelphia: Elsevier Saunders, 2015.
5. Hadley, Mac E., and Jon E. Levine. Endocrinology. 6th ed. San Francisco: Pearson Benjamin Cummings, 2007.
6. Abbas, Abul K., Andrew H. Lichtman, and Shiv Pillai. Basic Immunology: Functions and Disorders of the Immune System. 7th ed. Philadelphia: Elsevier. 2022.
7. Ananthanarayan, R., and C.K. Jayaram Paniker. Paniker's Textbook of Microbiology. 10th ed. Hyderabad: Universities Press. 2017.
8. Chatterjee, C.C. Human Physiology, Volume 2. 11th ed. Kolkata: Medical Allied Agency. 2012.
9. Delves, Peter J., Seamus J. Martin, Dennis R. Burton, and Ivan M. Roitt. Roitt's Essential Immunology. 13th ed. Chichester: Wiley-Blackwell. 2016.
10. Guyton, Arthur C., and John E. Hall. Textbook of Medical Physiology. 14th ed. Philadelphia: Elsevier. 2020

**Evaluation Pattern:**

**Total Marks: 50**

|                                        |                                                                                                                                                                                                                                                                                                               |
|----------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Internal Continuous Evaluation:</b> | <b>End Semester Examination:</b>                                                                                                                                                                                                                                                                              |
|                                        | <ul style="list-style-type: none"> <li>• Question -1: Experiment 1- 10 M</li> <li>• Question -2: Experiment 1- 10 M</li> <li>• Question -2: Experiment 1- 10 M</li> <li>• Question -3: Identification- 10 M</li> <li>• Question -4: Student's performance- 5 M</li> <li>• Question -5: Journal-5 M</li> </ul> |

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|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | <b>Karmaveer Bhaurao Patil University, Satara</b><br>(A State Public University Est. u/s 3(6) of MPUA 2016)<br><b>Faculty of Science &amp; Technology</b> |                            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | <b>Yashavantrao Chavan Institute of Science, Satara</b>                                                                                                   |                            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | <b>Board of Studies in Zoology</b>                                                                                                                        |                            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | <b>Programme: B.Sc. Zoology</b>                                                                                                                           | <b>Semester - V</b>        |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | <b>Type : Vocational Skill Course (VSC)</b>                                                                                                               | <b>Marks: 50</b>           |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | <b>Credits : 2 (30 Hrs.)</b>                                                                                                                              | <b>From: A. Y. 2026-27</b> |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | <b>Name of the Course: BZPVSC-IV: Advances in Wildlife Photography-II</b>                                                                                 |                            |
| <b>Course Objectives: Students should be able to...</b> <ul style="list-style-type: none"><li>1) train students in advanced photographic techniques such as dual ISO usage, light painting, and astrophotography in challenging environmental conditions.</li><li>2) develop ethical awareness and conservation-focused photographic practices, emphasizing minimal wildlife disturbance and responsible storytelling.</li><li>3) enhance students' proficiency in digital post-processing and metadata tools for ecological documentation and portfolio refinement.</li><li>4) encourage observational and behavioral photography skills, enabling students to capture authentic wildlife activities and interspecies interactions.</li><li>5) guide students in crafting compelling visual narratives, culminating in professional-quality photo essays and exhibition-ready portfolios.</li></ul> |                                                                                                                                                           |                            |
| <b>Course Outcomes: Students will be able to...</b> <ul style="list-style-type: none"><li>1) demonstrate mastery in advanced post-processing techniques to enhance wildlife images professionally.</li><li>2) apply ethical editing principles to maintain credibility and authenticity in wildlife photography.</li><li>3) utilize AI-driven tools for image enhancement and conservation photography.</li><li>4) develop a high-quality wildlife photography portfolio suitable for exhibitions, digital media, and professional projects.</li></ul>                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                           |                            |
| <b>Module</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <b>Title and Contents</b>                                                                                                                                 | <b>Hrs.</b>                |
| 1.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Post-Processing Workflow in Adobe Lightroom & Photoshop – Enhancing images without over-processing.                                                       | 30                         |
| 2.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Ethical Considerations & Conservation Photography –Balancing art with wildlife protection.                                                                |                            |
| 3.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Extreme Weather Wildlife Photography – Shooting in rain, snow, fog, and desert conditions.                                                                |                            |
| 4.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Night Sky & Wildlife Compositions – Combining astrophotography with nocturnal wildlife shots.                                                             |                            |
| 5.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Portfolio Development & Exhibition Preparation – Compiling and presenting advanced wildlife photography projects.                                         |                            |
| 6.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Behavioral Observation Photography – Capturing wildlife behaviors (mating, hunting, nesting) with minimal interference.                                   |                            |
| 7.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Use of Telephoto and Super-Telephoto Lenses – Mastering distant subject capture while maintaining image sharpness and detail.                             |                            |
| 8.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Sound-Triggered Wildlife Photography – Using acoustic triggers for capturing shy or fast-moving species based on sound cues.                              |                            |
| 9.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Light Painting in Wildlife Scenes – Artistic illumination of subjects and environments using controlled light sources in low-light settings.              |                            |
| 10.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Bokeh and Depth-of-Field Manipulation – Using aperture control creatively to isolate subjects and enhance visual appeal.                                  |                            |
| 11.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Using GPS and Metadata Tools for Ecological Tracking – Embedding and analyzing location data for conservation studies.                                    |                            |

|     |                                                                                                                             |  |
|-----|-----------------------------------------------------------------------------------------------------------------------------|--|
| 12. | Dual ISO and Sensor Optimization Techniques – Maximizing sensor performance for high dynamic range in challenging lighting. |  |
| 13. | Minimalist Wildlife Composition – Creating powerful imagery with limited subjects and clean framing.                        |  |
| 14. | Cross-Species Interaction Photography – Documenting interspecies behavior (e.g., predator-prey, symbiosis) ethically.       |  |
| 15. | Creating Wildlife Photo Essays – Assembling a themed collection that tells a conservation or ecological story.              |  |

#### Reference Books:-

1. Benvie, Neil. The Art of Nature Photography: A Wildlife Photographer's Handbook. London: The Crowood Press, 2012.
2. Bruton, David. Mastering Wildlife Photography: Shooting Techniques for Animal Photographers. New York: Amherst Media, 2020.
3. Dyer, Heather Angel. Digital Wildlife Photography. London: HarperCollins, 2011.
4. Kesselheim, Aaron. Drone Photography Basics: Capturing Aerial Wildlife Images Safely and Creatively. San Francisco: Rocky Nook, 2022.
5. Kneubuhler, Yves. Infrared Photography: Artistic Techniques for Wildlife and Landscapes. Munich: Rocky Nook, 2021.
6. Newton, Jim. Macro Photography for Gardeners and Nature Lovers: The Essential Guide to Digital Techniques. Portland: Timber Press, 2008.
7. Shaw, John. John Shaw's Guide to Digital Nature Photography. New York: Amphoto Books, 2015.
8. Silva, Suzi Eszterhas. A Photographer's Guide to Ethics in Wildlife Photography. London: NHPA Press, 2023.
9. Smith, Richard. The Underwater Photographer: A Guide to Capturing Marine Life with DSLR and Mirrorless Cameras. Burlington, MA: Focal Press, 2019.
10. Widstrand, Staffan. Wildlife Photojournalism: Telling Nature's Stories Through Images. Stockholm: Wild Wonders Publishing, 2020.

#### Evaluation Pattern:

**Total Marks: 50**

|                                        |                                                                                                                                                                                                                                                                                                                                                |
|----------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Internal Continuous Evaluation:</b> | <b>End Semester Examination:</b> <ul style="list-style-type: none"> <li>• Question -1: Experiment 1- 10 M</li> <li>• Question -2: Experiment 1- 10 M</li> <li>• Question -2: Experiment 1- 10 M</li> <li>• Question -3: Identification- 10 M</li> <li>• Question -4: Student's performance- 5 M</li> <li>• Question -5: Journal-5 M</li> </ul> |
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|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|
|                                                                                                                                                                                                                                                                                                                                                                                                                                             | <b>Karmaveer Bhaurao Patil University, Satara</b><br>(A State Public University Est. u/s 3(6) of MPUA 2016)<br><b>Faculty of Science and Technology</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | <b>Yashavantrao Chavan Institute of Science, Satara.</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | <b>Board of Studies in Zoology</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | <b>Programme: B. Sc. III</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | <b>Semester – VI</b>       |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | <b>Type : BZPSEC 3</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | <b>Marks: 50</b>           |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | <b>Credits : 2</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | <b>From: A. Y. 2026-27</b> |
| <b>Name of the Course: Advanced laboratory Techniques (BZPSEC-3)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                            |
| <b>Course Objectives:</b> Student should be able to<br>1) classify specimens from different classes or phylum.<br>2) categorize different types of specimens according to their classification.<br>3) analyze physicochemical parameters of water.<br>4) demonstrate difference between fresh and sewage water.                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                            |
| <b>Course Outcomes:</b> Student will be able to<br>1) classify biological specimens into appropriate phyla and classes based on their characteristics.<br>2) categorize different specimens according to taxonomic criteria and analyze their distinguishing features.<br>3) analyze physicochemical parameters of water using standard methods and interpret the results.<br>4) differentiate between fresh water and sewage water based on their physical, chemical, and biological characteristics through demonstration. |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                            |
| <b>Module</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | <b>Title and Contents</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <b>Hrs</b>                 |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 1. Basic and Advanced Sterilization techniques for Laboratory.<br>2. Media preparation and growth of microorganisms.<br>3. Demonstration of Human Electro Cardiogram (ECG)<br>4. Estimation of Hemoglobin by (Sahli’s method)<br>5. Separation of blood cells by centrifugation<br>6. Total RBC /WBC count by Heamocytometer<br>7. Determination of Differential leukocyte count (DLC)<br>8. Determination of own blood group (ABO & Rh typing)<br>9. Study of abnormal urine constituents from given sample.<br>10. Amplication of biomolecules by PCR technique.<br>11. Detection of Pregnancy from given urine sample (hCG test)<br>12. Widal test for detection of enteric fever.<br>13. Detection of syphilis Ab by RPR test.<br>14. Detection of Ag-ab by ELISA technique (Dot ELISA)<br>15. Estimation Blood glucose<br>16. Estimation of Urea,Uric acid & creatinine from serum.<br>17. To perform the Liver function tests (SGOT,SGPT) from serum<br>18. Study of Thyroid function test .<br>19. To study the diagnostic tests with computerized kit.<br>20. Visit to pathological laboratory. | 60                         |
| <b>Reference Books:-</b><br>1) Ramesh Gupta and S. Bhargava, Practical Biochemistry, Fifth Edition, (CBS Publishers & Distributors, 2013.<br>2) John Walker and Keith Wilson, Practical Biochemistry: Principles and Techniques, Cambridge University Press, 807 pp, 2005.<br>3) David Plummer, an Introduction to Practical Biochemistry, Third Edition, (McGraw Hill Education Pvt Limited, 2017.                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                            |

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| 4) Dnyaneshwar Tembhare, Techniques in Life Sciences, First Edition, (Himalaya Publishing House Pvt. Ltd.) 463 pp, 2010.<br>5) B. Antonisamy, Prasanna Premkumar and Solomon Christopher, Principles and practice of Biostatistics, (Elsevier India,) 390 pp, 2017. Laurent Hodges, Environmental pollution Half, Rinehart and Winston, New 1977 |                                                                                                                                                                 |
| <b>Evaluation Pattern:</b>                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                 |
| <b>Total Marks: 25/25</b>                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                 |
| <b>Internal Continuous Evaluation:</b> <ul style="list-style-type: none"> <li>• Question -1- 05M</li> <li>• Question -2 – 05M</li> <li>• Question -3 - 05M</li> <li>• Question -4 - 10M</li> </ul>                                                                                                                                               | <b>End Semester Examination:</b> <ul style="list-style-type: none"> <li>• Question -1- 10M</li> <li>• Question -2 – 10M</li> <li>• Question -3 - 05M</li> </ul> |

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|------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|
|  | <b>Karmaveer Bhaurao Patil University, Satara</b><br>(A State Public University Est. u/s 3(6) of MPUA 2016)<br><b>Faculty of Science &amp; Technology</b> |                            |
|                                                                                    | <b>Yashavantrao Chavan Institute of Science, Satara</b>                                                                                                   |                            |
|                                                                                    | <b>Board of Studies in Zoology</b>                                                                                                                        |                            |
|                                                                                    | <b>Programme:</b> B.Sc. Zoology                                                                                                                           | <b>Semester - VI</b>       |
|                                                                                    | <b>Type :</b> Co-curricular course (CC)                                                                                                                   | <b>Marks:</b> 50           |
|                                                                                    | <b>Credits :</b> 2 (30 Hrs.)                                                                                                                              | <b>From:</b> A. Y. 2026-27 |
|                                                                                    | <b>Name of the Course: BZPCC-I (Co-curricular course in Zoology)</b>                                                                                      |                            |

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|-------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|
|  | <b>Karmaveer Bhaurao Patil University, Satara</b><br>(A State Public University Est. u/s 3(6) of MPUA 2016)<br><b>Faculty of Science &amp; Technology</b> |                            |
|                                                                                     | <b>Yashavantrao Chavan Institute of Science, Satara</b>                                                                                                   |                            |
|                                                                                     | <b>Board of Studies in Zoology</b>                                                                                                                        |                            |
|                                                                                     | <b>Programme:</b> B.Sc. Zoology                                                                                                                           | <b>Semester - VI</b>       |
|                                                                                     | <b>Type :</b> Field Project (FP)                                                                                                                          | <b>Marks:</b> 50           |
|                                                                                     | <b>Credits :</b> 2 (30 Hrs.)                                                                                                                              | <b>From:</b> A. Y. 2025-26 |
|                                                                                     | <b>Name of the Course: BZPFP-I: Field Project in Zoology</b>                                                                                              |                            |

**Course Objectives:** Student should be able to:

1. Identify and describe animal diversity and ecological components in natural habitats.
2. Apply field sampling, observation, and data collection techniques used in zoological studies.
3. Analyze ecological and biological data collected during field investigations.
4. Evaluate the ecological significance of observed species interactions and environmental factors. .

**Course Outcomes:** Student will be able to:

1. Recognize and classify fauna and their habitats using standard zoological field methods.
2. Demonstrate proficiency in field survey, specimen documentation, and data recording techniques.
3. Interpret and analyze field data using appropriate scientific approaches.
4. Assess biodiversity status, ecological relationships, and conservation issues in the study area.

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