



Rayat Shikshan Sanstha's

**Yashavantrao Chavan Institute of Science,
Satara**

(Autonomous)

Department of Zoology & Fisheries

Revised Syllabus under Autonomy

B. Sc. III

Zoology

(Academic year 2023-24)

REVISED Syllabus for B.Sc. III (Zoology)

1. **TITLE: Zoology**

2. **YEAR OF IMPLEMENTATION:** Revised Syllabus will be implemented from June 2023 onwards.

3. **PREAMBLE:**

This syllabus is framed to give sound knowledge with understanding of Zoology to undergraduate students at third year of B.Sc. degree course.

The goal of the syllabus is to make the study of Zoology popular, interesting and encouraging to the students for higher studies including research.

The new syllabus is based on a basic and applied approach with vigor and depth. At the same time precaution is taken to make the syllabus comparable to the syllabi of other universities and the needs of industries and research.

The syllabus is prepared after discussion at length with number of faculty members of the subject and experts from industries and research fields.

The units of the syllabus are well defined, taking into consideration the level and capacity of students.

4. **GENERAL OBJECTIVES OF THE PROGRAM:**

1. To nurture academicians with focus and commitment to their subject.
2. To shape good and informed citizens from the students entering into the program.
3. To create a skilled workforce to match the requirements of the society.
4. To impart knowledge of Science is the basic objective of education.
5. To develop scientific attitude is the major objective to make the students open minded, Critical, curious.
6. To develop skill in practical work, experiments and laboratory materials and equipments along with the collection and interpretation of scientific data to contribute the science.

5. **PROGRAM OUTCOMES:**

1. The student will graduate with proficiency in the subject of his choice.
2. The student will be eligible to continue higher studies in his subject.
3. The student will be eligible to pursue higher studies abroad.
4. The student will be eligible to appear for the examinations for jobs in government Organizations.
5. The student will be eligible to appear for jobs with minimum requirement of B. Sc. Program.

6. PROGRAM SPECIFIC OBJECTIVES:

- ❖ The students are expected to understand the fundamentals, principles, concepts and recent developments in the Zoology.
- ❖ The practical course is framed in relevance with the theory courses to improve the understanding of the various concepts in Zoology.
- ❖ It is expected to inspire and boost interest of the students in Zoology.
- ❖ To develop the power of appreciations, the achievements in science and role in nature and society.
- ❖ To enhance student sense of enthusiasm for science and to involve them in an intellectually stimulating experience of Course in a supportive environment.

7. PROGRAM SPECIFIC OUTCOMES:

1. Understand the basics of Zoology.
 2. Learn, design and perform experiments in the labs to demonstrate the concepts, principles and theories learned in the classrooms.
 3. Develop the ability to apply the knowledge acquired in the classroom and laboratories to specific problems in theoretical and experimental Zoology.
 4. Identify their area of interest in academic, research and development.
 5. Perform job in various fields' like science, environment, education, banking, business and public service, etc. or be an entrepreneur with precision, analytical mind, innovative thinking, clarity of thought, expression, and systematic approach.
- 8. DURATION:** The Course shall be a full time course.
- 9. PATTERN:** Pattern of Examination will be Semester.
- 10. MEDIUM OF INSTRUCTION:** The medium of instruction shall be in English.

Rayat Shikshan Sanstha's
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Department of Zoology & Fisheries
2023-24

Syllabus for B.Sc. III (Zoology)

B.Sc. III Zoology Semester V

Paper Code	Paper Title	Lecture per week	Credits	Practical Papers	Lecture per week	Credits
BZT501	Comparative Anatomy of Vertebrates	3	2	BZP 508: Comparative Anatomy of Vertebrates AND Aquatic Biology	05	2
BZT503	Biotechniques and Biostatistics	3	2	BZP 509: Biotechniques and Biostatistics AND Molecular Cell Biology and Animal Biotechnology + project:	05	2
BZT504	Molecular Cell Biology and Animal Biotechnology	3	2			
BSCE521	English	3	2			
Elective Paper (Any One)						
BZT502	Aquatic Biology	3	2			
BZT 505	Animal Behaviour	3	2			
BZT 506	Wildlife conservation and Management	3	2			
Skill Enhancement Course						
SECCZT 507	Numerical Skill	2	1	SECCZP 510: Numerical Skill	4	1

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Syllabus for B.Sc. III (Zoology)

B.Sc. III Zoology Semester VI

Paper Code	Paper Title	Lecture per week	Credits	Practical Papers	Lecture per week	Credits
BZT 601	Developmental Biology of Vertebrates	3	2	BZP 608: Developmental Biology And Insect vectors & Diseases	5	2
BZT 603	Immunology	3	2	BZP 609: Applied Zoology & Immunology + Project	5	2
BZT 604	Applied Zoology -II	3	2			
BSCE 621	English	3	2			
Elective Paper (Any One)						
BZT 602	Insect Vectors and Histology	3	2			
BZT 605	Oceanography	3	2			
BZT 606	Biotechniques	3	2			
Skill Enhancement Course						
SECCZT 607	Entrepreneurship Development (EDP)	2	1	SECCZP 610: Practical: Entrepreneurship Development (EDP)	4	1

STRUCTURE OF COURSE: 1) FIFTH SEMESTER ----- (NO. OF PAPERS 4)

1. Comparative Anatomy of Vertebrates (BZT 501) – 40 Marks
2. Biotechniques and Biostatistics (BZT 503) – 40 Marks
3. Molecular Cell Biology and Animal Biotechnology (BZT 504) – 40 Marks
Compulsory English (BSCE521)-40 Marks
4. Aquatic Biology (BZT 502) – 40 Marks (Elective paper)
Animal Behaviour (BZT 505) – 40 Marks (Elective paper)
Wildlife conservation and Management (BZT 506) – 40 Marks (Elective paper)

Internal examination (ISE-I, ISE-II) will be conducted for 10 marks for each paper.

Paper SECC: Paper I (SECCZT 507) – 20 Marks

Practical V: (BZP 508) Comparative Anatomy of Vertebrates AND Aquatic Biology
Practical VI: (BZP 509) + project: Biotechniques & Biostatistics AND Molecular Cell Biology
& Animal Biotechnology

Practical exam is Semester wise and is of 100 Marks

SECC Practical (SECCZP 510) -30 Marks

2) SIXTH SEMESTER ----- (NO. OF PAPERS 4)

1. Developmental Biology of Vertebrates (BZT 601) – 40 Marks
2. Immunology (BZT 603)– 40 Marks
3. Applied Zoology – II (BZT 604)– 40 Marks
Compulsory English (BSCE621)- 40 Marks
4. Insect Vectors and Histology (BZT 602) – 40 Marks (Elective paper)
Oceanography (BZT 605) – 40 Marks (Elective paper)
Biotechniques (BZT 606) – 40 Marks (Elective paper)

Internal semester examination (ISE-I, ISE-II) will be conducted for 10 marks for each paper.

SECC Paper II: SECCZT 607– 20 Marks

Practical VII: BZP 608: Developmental Biology And Insect vectors & Diseases

Practical VIII: BZP 609 + Project: Applied Zoology & Immunology

Practical SECCZP 610 - 30 Marks

Practical examination is semester wise and is of 100 Marks.

Evaluation structure Class B. Sc. III SEM-V

Paper Code	ESE	Internal Exam		Practical		Submission			Total
		ISE-I	ISE-II	Practical Course	Exam (Pract+ Oral+ Journal)	Student Performance	Seminar / educational Tour	Project (Part I)	
BZT501	40	5	5	BZP 508	40	5	5	--	50
BZT502	40	5	5						
BZT503	40	5	5	BZP 509	40			10	50
BZT504	40	5	5						
SECCZ T 507	20	--	--	BZP 510	30				30

B.Sc. III Zoology Semester V

BZT -501 COMPARATIVE ANATOMY OF VERTEBRATES

Theory: 45 hrs. (Credits 2)

Course Objectives: Students should be able to

1. Summarize the knowledge of number of systems in animals.
2. Contrast the comparative aspects of systems in animals.
3. Determine the generalized structure and evolution of organs.
4. Acquire the knowledge of animal adaptations.
5. Compare complexity of organs and organ systems, and their interrelationships.

Unit no	Content	Hours
Unit 1:	Integumentary System 1. Generalized structure of integument 2. Functions of Integument 3. Soft and Hard epidermal derivatives 4. Hard epidermal derivatives	6
Unit 2:	Habitat and anatomical adaptations	6
Unit3:	Digestive System Brief account of alimentary canal and digestive glands	6
Unit 4:	Respiratory System Brief account of Gills, lungs, air sacs	6
Unit 5:	Circulatory System Evolution of heart and aortic arches	6
Unit 6:	Evolution of Kidney Succession of kidney	5
Unit 7:	Nervous System Comparative account of brain	5
Unit 8:	Sense Organs Comparative account of ear and eye of vertebrates	5

Course Outcomes: Students will be able to-

1. Compare and Contrast between different systems of animals.

2. Illustrate and describe the no. of system in animals.
3. Conclude the interrelation in between the organs and organ system in different animals.
4. Justify and explain the evolutionary trail in different organs and systems in animals.

REFERENCES:

1. Kardong, K.V. (2005) Vertebrates' Comparative Anatomy, Function and Evolution. IV Edition. McGraw-Hill Higher Education. Kent, G.C. and Carr R.K. (2000). Comparative Anatomy of the Vertebrates. IX Edition
2. The McGraw-Hill Companies. Hilderbrand, M and Gaslow G.E. Analysis of Vertebrate Structure, John Wiley and Sons Walter, H.E. and Sayles, L.P; Biology of Vertebrates, Khosla Publishing House.
3. Outlines of comparative anatomy, Romer & Parsons, Central Book Depot, The Vertebrate Body (Saunders).
4. Biology of Vertebrates Walter & Sayles; (McMillan).
5. Chordate Zoology, P.S. Dhami & J. K. Dhami - R. Chand & Co., New Delhi.
6. Modern Textbook of Zoology, R. L. Kotpal, Rastogi Publications, Meerut.
7. The Life of Vertebrates, 3rd Edition, 1993, J. Z. Young E. L. B.S. Oxford.
8. Chordate Zoology - E.L. Jordan, S. Chand & Co., New Delhi.
9. The Phylum Chordata - 1987, H.H. Newman, Distributor Satish Book Enterprise, Agra. 8. Comparative Anatomy of the Vertebrates G. C. Kent.

BZT 502: AQUATIC BIOLOGY

Theory: 45 hrs. (Credits 2)

Course Objectives: Students should be able to

1. Classify the different concepts of Freshwater Biology.
2. Compare aspects of different Aquatic biomes
3. Interpret the histology and function of endocrine glands.
4. Determine the knowledge of animal adaptations
5. Conclude the effects of pesticides and aquaculture drugs on the fishes.

Unit no	Content	Hours
Unit 1:	Aquatic Biomes a. Freshwater ecosystem (pond, wetlands, streams and rivers), b. Estuaries c. Marine i) Intertidal zones ii) pelagic zone iii) Marine benthic zone d. Coral reefs	14
Unit 2:	Freshwater Ecology 1. Lakes a. Lake as an Ecosystem b. Lake Morphometry c. Physico-chemical characteristics i. Light ii. Temperature iii. Thermal Stratification iv. Dissolved solids v. Carbonates vi. Bicarbonates vii. Phosphates and Nitrates viii. Turbidity ix. Dissolved gases (Oxygen Carbon dioxide) x. Nutrient Cycle – (Nitrogen, Sulphur and Phosphorus) 2. Streams a. Different stages of stream development b. Physico-chemical Environment c. Adaptation of hill stream fishes	14
Unit 3:	Endocrinology	12

	<p>a. Study of endocrine glands – Anatomy and histology</p> <p>b. Hormones- Nature, role, regulation and disorders with reference to the following: Thyroid gland, parathyroid gland, adrenal gland and islets of Langerhans</p>	
Unit 4:	<p>Fish Toxicology</p> <p>a. Pesticide effects</p> <p>b. Aquaculture drugs</p>	5

Course Outcomes: Students will be able to-

1. Compare and contrast between different aquatic biomes.
2. Evaluate aspects of lakes and streams.
3. Criticize the interrelation in between the endocrine glands, their hormone and effects.
4. Justify and explain the hazardous effects of pesticides on freshwater ecology.

REFERENCES:

1. Anathakrishnan : Bioresources Ecology 3rdEdition
2. Goldman : Limnology, 2ndEdition
3. Odum and Barrett : Fundamentals of Ecology, 5thEdition
4. Pawlowski : Physicochemical Methods for Water and Wastewater Treatment, 1st Edition
Wetzel : Limnology, 3rdedition
5. Trivedi and Goyal : Chemical and biological methods for water pollutionstudies
Welch : Limnology Vols. I-II
6. Animal Physiology – Nelson (Cambridge)
7. Endocrinology – Hadely
8. General Endocrinology – Bangara and Turner (W.B. Saunders)
9. Reproductive Physiology – Nalbandov A. V.

BZT503: BIOTECHNIQUES AND BIOSTATISTICS

Theory: 45 hrs. (Credits 2)

Course Objectives: Students should be able to-

1. Categorized the different Biotechniques
2. Outline the culture Techniques and Applications in daily life.
3. Interpret the process and applications of Genetically Modified Organisms.
4. Acquire the knowledge of biostatistics.

Unit no	Content	Hours
Unit I:	Genetically Modified Organisms <ol style="list-style-type: none">1. Production of cloned and transgenic animals:<ol style="list-style-type: none">a. Nuclear Transplantationb. Retroviral Methodc. DNA microinjection2. Applications of transgenic animals:<ol style="list-style-type: none">a. Productions of pharmaceuticalsb. Production of donor organs3. Knockout mice.	12
Unit II:	Culture Techniques and Applications <ol style="list-style-type: none">a. Animal cell culture: Introduction, principle and applicationsb. Stem Cells: Introduction to stem cells<ol style="list-style-type: none">i) Potency of stem cells: Totipotency, Pleurepotency, Multipotency, Unipotencyii) Sources of stem cells-Embryo, Fetal, Adult, Bone marrow	10
Unit III:	Biostatistics <ol style="list-style-type: none">a. Classification of Biological datab. Frequency distributionc. Tabulationd. Graphical representation of datae. Measures of central tendency (Mean, Median, Mode)f. Dispersion – Mean deviation & standard deviationg. Correlation – Scattered diagram, Karl Pearson's correlation coefficient and Spearman's rank correlation coefficient.	15

Unit IV:	Statistical Tools for research <ol style="list-style-type: none"> a. ANOVA b. Chi square test c. Student t test d. Probability 	8
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Course Outcomes: Students will be able to-

1. Interpret Genetically Modified Organisms and their application in the society.
2. Understand animal cell culture and its applications.
3. Apply the knowledge of Biostatistics and its application in research field.

REFERENCES:

1. Brown, T.A. (1998). Molecular Biology Labfax II: Gene Cloning and DNA Analysis. I Edition, Academic Press, California, USA. Glick, B.R. and Pasternak, J.J. (2009). Molecular Biotechnology – Principles and Applications of Recombinant DNA. IV Edition, ASM press, Washington, USA. Griffiths, A.J.F., J.H. Miller, Suzuki, D.T., Lewontin, R.C. and Gelbart, W.M. (2009)
2. An Introduction to Genetic Analysis. IX Edition. Freeman and Co., N.Y., USA. Snustad, D.P. and Simmons, M.J. (2009).
3. Principles of Genetics. V Edition, John Wiley and Sons Inc. Watson, J.D., Myers, R.M., Caudy, A. and Witkowski, J.K. (2007).
4. Recombinant DNA Genes and Genomes- A Short Course. III Edition, Freeman and Co., N.Y., USA. Beauchamp, T.I. and Childress, J.F. (2008).
5. Principles of Biomedical Ethics. VI Edition Oxford University Press.
6. Elements of Biotechnology - P. K. Gupta, Rastogi Publications.
7. Gene V & VI, 1994, Lewin B., Oxford University Press, Oxford.
8. Concept of Genes- Pearson Edition 9. Cell and Molecular Biology

**BZT504: MOLECULAR CELL BIOLOGY AND
ANIMAL BIOTECHNOLOGY**

Theory: 45 hrs. (Credits 2)

Course Objectives: Students should be able to-

1. Paraphrase the undergraduate level knowledge of basic Molecular Techniques.
2. Extrapolate the various terms and concepts of Molecular Biology.
3. determine basic and fundamental processes in Gene manipulations.
4. Apply the principles, practices and application of animal biotechnology.

Unit no	Content	Hours
Unit 1:	<p>Molecular Biology</p> <ol style="list-style-type: none"> 1) DNA Replication (Semiconservative mode) 2) DNA Damage and Repair mechanism 3) Regulation of gene expression- Operon concept 4) Genetic Code: <ol style="list-style-type: none"> i) Properties of Genetic code ii) Codon assignment iii) Wobble hypothesis 	12
Unit 2:	<p>Protein synthesis</p> <ol style="list-style-type: none"> A) Transcription Process in prokaryotes and eukaryotes <ol style="list-style-type: none"> i) Initiation ii) elongation iii) termination B) Translation in prokaryotes and eukaryotes <ol style="list-style-type: none"> i) Initiation ii) Elongation iii) Termination 	12
Unit 3 :	<p>Gene manipulation processes</p> <ol style="list-style-type: none"> 1. Restriction enzymes: Nomenclature, detailed study of Type II. 2. Characteristics of Cloning vectors: Plasmids, Cosmids, Phagemids, Lambda Bacteriophages 3. Gene cloning: Transformation techniques by Calcium chloride method and electroporation 4. Construction of genomic and cDNA libraries 	12
Unit 4:	<p>Molecular Techniques</p> <ol style="list-style-type: none"> 1. Southern, Northern and Western blotting 2. DNA sequencing: Sangers method 3. Polymerase Chain Reaction, 	9

	4. DNA Finger Printing	
	5. DNA microarray	

Course Outcomes: Students will be able to-

1. Analyze the fundamental knowledge in Molecular Biology;
2. Examine molecular basis of various Techniques used in Molecular biology and biotechnology.
3. Contrast advanced techniques and instruments used in gene manipulations.

REFERENCES:

1. Brown, T.A. (1998). Molecular Biology Labfax II: Gene Cloning and DNA Analysis.II Edition, Academic Press, California, USA. Glick, B.R. and Pasternak, J.J.(2009).
2. Molecular Biotechnology - Principles and Applications of Recombinant DNA.IV Edition, ASM press, Washington, USA. Griffiths, A.J.F., J.H. Miller, Suzuki, D.T., Lewontin, R.C. and Gelbart, W.M.(2009).
3. An Introduction to Genetic Analysis. IX Edition. Freeman and Co., N.Y., USA.Snustad, D.P. and Simmons, M.J. (2009).
4. Principles of Genetics. V Edition, John Wiley and Sons Inc. Watson, J.D., Myers, R.M., Caudy, A. and Witkowski, J.K.(2007).
5. Recombinant DNAGenes and Genomes- A Short Course. III Edition, Freeman andCo., N.Y., USA. Beauchamp, T.I. and Childress, J.F.(2008).
6. Principles of Biomedical Ethics. VI Edition, Oxford UniversityPress.
7. Cell and Molecular Biology, 8th Edition, De. Robertis EDP and De RobertisJr.EMF, Lippincott Williams andWilkins,Philadelphia.
8. Cell Biology, C.B. Powar, Himalaya PublicationHouse.
9. Cell and Molecular Biology, E.J. Dupraw, Academic Press,NewYork.
10. Cell Structure and Function - A. G. Loewy, P. Siekevitz, J. R. Meninger& J. A.N. Gallant, SaunderCollege,Philadelphia.
11. Molecular Biology of the Cell - 3rd Edition, Bruce Alberts, Dennis Bray, JulianLewis, Martin Raff, K. Roberts & James D. Watson, Garian Publishing, NewYork

BZT 505 ANIMAL BEHAVIOUR (Elective paper)

Theory: 45 hrs. (Credits 2)

Course Objectives: Students should be able to-

1. Recite the key concepts and principles in animal behavior.
2. Recognize the animal behavior and response of animals to different instincts.
3. Interpret the various animal behavior patterns.
4. Discuss the importance of the animal behavioral study.
5. Summarize the factors affecting the behavior of animals.

Unit no	Content	Hours
Unit 1:	Introduction and mechanisms of behavior <ol style="list-style-type: none">1. Origin and history2. Objective3. Sign stimuli4. Code breakers	5
Unit 2:	Unit 2: Patterns of Behavior <ol style="list-style-type: none">1. Reflexes: Types of reflexes, reflex path, characteristics of reflexes and its comparison with complex behavior2. Orientation: Learning: Associative learning, classical and operant conditioning, Habituation, Imprinting3. Social Behavior : Insects' society; Honey bee	10
Unit 3 :	Unit 3: Altruism <ol style="list-style-type: none">1. Reciprocal altruism2. Hamilton's rule3. Inclusive fitness with suitable examples4. Sexual Behaviour	10
Unit 4:	Unit 4: Biological Clocks <ol style="list-style-type: none">1. Circadian rhythms2. Tidal rhythms3. Lunar rhythms4. Advantages of biological clocks5. Jet lag	10
Unit 5 :	Skill based <ol style="list-style-type: none">1. Foundations of Research:	10

	<p>Meaning, Objectives, Motivation: Research Methods vs Methodology, Types of Research:</p> <p>Analytical vs Descriptive, Quantitative vs Qualitative, Basic vs Applied</p> <p>2. Research Design</p> <p> Need for research design: Features of good design, Important concepts related to good design- Observation and Facts, Prediction and Explanation, Development of Models.</p> <p> Developing a research plan: Problem identification, Experimentation, Determining experimental and sample designs.</p> <p>3. Teaching Methodology</p> <p> Materials development and syllabus design, Teacher education and critical pedagogy,</p> <p> Technology and language teaching, Socio-cultural Theory of language learning, Classroom management</p>	
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Course Outcomes: Students will be able to-

- 1) Demonstrate the knowledge of key concepts in animal behavior.
- 2) Recognize the importance of studying animal behavior.
- 3) understand the complex evolutionary processes and behavior of animals.
- 4) Connect with communication between animals from different communities.

REFERENCES:

1. David McFarland, Animal Behaviour, Pitman Publishing Limited, London, UK.
2. Manning, A. and Dawkins, M. S, An Introduction to Animal Behaviour, Cambridge University Press, UK.
3. John Alcock, Animal Behaviour, Sinauer Associate Inc., USA.
4. Paul W. Sherman and John Alcock, Exploring Animal Behaviour, Sinauer Associate Inc., Massachusetts, USA

**BZT 506 WILD LIFE CONSERVATION AND
MANAGEMENT (Elective paper)**

Theory: 45 hrs. (Credits 2)

Course Objectives: Students should be able to-

1. Outline the principles of evolution, wildlife and conservation biology.
2. Criticize the knowledge on modern concepts in wildlife management.
3. Demonstrate the conservation policies and legislations and their enforcement mechanism.
4. Develop scientific skills for resolving human wildlife conflicts.

Unit no	Content	Hours
Unit 1:	Wild life - Values of wild life conservation ethics, Importance, Habitat analysis, Evaluation and management of wild life - Physical parameters, Biological Parameters and Standard evaluation procedures	10
Unit 2:	Management of habitats Population estimation: Faecal analysis of ungulates and carnivores Pug marks and census method.	5
Unit 3 :	National Organizations, Wild life Legislation, Management planning of wild life in protected areas; Estimation of carrying capacity; Eco tourism in forests; Concept of climax persistence; Ecology of perturbation.	08
Unit 4:	Management of excess population & translocation; Bio-telemetry; Care of injured and diseased animal; Quarantine; Common diseases of wild animal, Protected areas, Community reserve; Important features of protected areas in India; Tiger reserves in India; Management challenges	12
Unit 5 :	Skill based (20%) 1. Foundations of Research Meaning, Objectives, Motivation: Research Methods vs Methodology, Types of Research: Analytical vs Descriptive, Quantitative vs Qualitative, Basic vs Applied	10

	<p>2. Research Design</p> <p>Need for research design: Features of good design, Important concepts related to good design- Observation and Facts, Prediction and Explanation, Development of Models. Developing a research plan: Problem identification, Experimentation, Determining experimental and sample designs.</p> <p>3. Teaching Methodology</p> <p>Materials development and syllabus design, Teacher education and critical pedagogy, Technology and language teaching, Sociocultural Theory of language learning, Classroom Management</p>	
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Course Outcomes: Students will be able to-

1. Recite the conservation strategies that will help protection of wildlife.
2. Analyze the wildlife legislation will systematically organize the understanding of wildlife conservation, trade and management.
3. Enumerate the Knowledge of the ecology and behavior of wild animals.
4. Analyze the critical evaluation of existing wildlife management practice and options for the future.

REFERENCES:

1. Usher, M. B. (1986). Wildlife conservation evaluation: attributes, criteria and values. London, New York: Chapman and Hall.
2. Harris, J. D.; Brown, P. L. (2009). Wildlife: Destruction, Conservation and Biodiversity. Nova Science Publishers
3. Wildlife Habitat Management: Concept and application in forestry; Brenda C. McCom); taylor & Franscis group (2015)
4. Text Book of Wildlife Management; by S K Singh; Publisher : IBDC (1 January 2009)

SECCZT 507: Numerical Skills

Lecture: 30 Credits: 01

Course Objectives: Students should be able to-

1. Restate Mathematical Reasoning and Aptitude
2. Convince some tricks in mathematics.
3. Discuss the basic concepts of reasoning.

Unit no	Content	Hours
Unit 1:	Mathematical Reasoning and Aptitude: Mathematical Aptitude: Fraction, Time & Distance, Ratio, Proportion and Percentage, Profit and Loss, Interest and Discounting, Averages etc. Number series, Letter series, Codes and Relationships. Mathematical Aptitude (Fraction, Time & Distance, Ratio.	12
Unit 2:	Logical Reasoning: Understanding the structure of arguments: argument forms, structure of categorical propositions, Mood and Figure, Formal and Informal fallacies, Uses of language, Connotations and denotations of terms, Classical Square of opposition. Analogies, Venn diagram: Simple and multiple use for establishing validity of arguments, Graphical representation (Bar-chart, Histograms, Pie-chart, Table-chart and Line-chart) and mapping of Data. Probability: concept, types, application in biological sciences.	18

Course Outcomes: Students will be able to-

1. Reproduce the fundamentals of basics of Maths and Reasoning
2. Infer an insight in the fascinating topics like Graphical representation

REFERENCES:

1. Quantitative Aptitude for Competitive Examinations by Dr. R. S. Agarwal.
2. NTA UGC - NET/SET/ JRF Paper I - Sikshan Evam Shodh Abhiyogita, second Edition
3. Vidyabhartee SET/NET Anivarya Paper Margadarshak 2017 by Brijmohan Dayma
4. UGC NET Mathematical Sciences 2018 by Pawan Sharma

B.Sc. III SEM- V
BZP 508: Zoology Practical – I
Practical Hours: 45 (Credits-02)

BZP 508: Based on Comparative Anatomy and Aquatic Biology

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.

Unit no	Content	Hours
Part 1:	<p>1. Part-I Comparative Study of following</p> <ol style="list-style-type: none"> 2. V.S. of skin of vertebrates 3. Digestive system of vertebrates 4. Respiratory system of vertebrates 5. Heart of vertebrates 6. Brain of vertebrates 7. Osteology <p>a) The skeleton fowl (Disarticulated) and rabbit (Disarticulated)</p> <p>b) Mammalian skull's – (any one herbivorous and one carnivorous animal)</p>	18
Unit 2:	<p>Part- II Aquatic Biology.</p> <ol style="list-style-type: none"> 1. Determination of area of a lake using Graphimetric & Gravimetric method 2. Identify the zooplanktons present in lake ecosystem 3. Determination of turbidity or transparency from nearby lake or water body 4. Determination of Dissolved oxygen 5. Determination of free CO₂ 6. Determination of alkalinity (Carbonates & bicarbonates) from water collected from nearby lake or water body 7. Estimation of total hardness of water 8. Instruments used in limnology & their significance <ol style="list-style-type: none"> a) Secchi disc b) Van Dorn bottle c) Conductivity meter d) Turbidity meter e) PONAR grabs ampler 9. Endocrine Glands (Anatomy & Histology)- Thyroid, 	18

	Parathyroid, Adrenal and Pancreas.	
	<p>10. Study of ecological adaptations</p> <ul style="list-style-type: none"> ○ Lotic ○ Lentic ○ Benthic ○ Pelagic ○ Grassland ○ Desert <p>Visit to seashore/water reservoir/animal sanctuary to study animal diversity. Report of tour should be submitted at the time of practical examination</p>	9

Course Outcomes: Students will be able to-

1. Summarized the importance of comparative vertebrate biology in understanding our own biology.
2. Illustrate an insight in the fascinating topics like ecological adaptations in animals.
3. Relate the dynamics of aquatic ecosystems and their potential response to changes.
4. Demonstrate skills at identifying organisms found in different aquatic ecosystems.

REFERENCES:

1. The McGraw-Hill Companies. Hilderbrand, M and Gaslow G.E. Analysis of Vertebrate Structure, John Wiley and Sons; Walter, H.E. and Sayles, L.P; Biology of Vertebrates, Khosla Publishing House.
2. Outlines of comparative anatomy, Romer & Parsons, Central Book Depot, The Vertebrate Body (Saunders).
3. Kardong, K.V. (2005) Vertebrates' Comparative Anatomy, Function and Evolution. IV Edition. McGraw-Hill Higher Education. Kent, G.C. and Carr R.K. (2000). Comparative Anatomy of the Vertebrates. IX Edition
4. Chordate Zoology, P.S. Dhami & J. K. Dhami - R. Chand & Co., New Delhi.
5. Chordate Zoology - E.L. Jordan, S. Chand & Co., New Delhi.
6. Odum and Barrett : Fundamentals of Ecology, 5th Edition
7. Pawlowski : Physicochemical Methods for Water and Wastewater Treatment, 1st Edition; Wetzel : Limnology, 3rd Edition

Zoology Practical –II
BZP 509: Based on Molecular Biology, Animal Biotechnology, AND
Biostatistics & Biotechniques
Practical Hours: 45 (Credits-02)

Course Objectives: Students should be able to-

1. Restate the concept and application of Micro techniques and different biotechniques.
2. Evaluate the best data analysis methods in their research projects.
3. Contrast the different blotting techniques.

Unit no	Content	Hours
Part- I	<p style="text-align: center;">Molecular Biology, Animal Biotechnology, Biostatistics & Biotechniques</p> <p>Part- I Micro technique</p> <ol style="list-style-type: none"> 1. Preparation of permanent histological slides by H-E technique 2. Histochemical technique <ol style="list-style-type: none"> i. AB PH 1 technique ii. AB PH 2.5 technique iii. PAS technique 	15
Part- II	<p>Biotechniques</p> <ol style="list-style-type: none"> 1. Chromatography – Separation of amino acid by paper chromatography 2. Isolation of DNA using any suitable material 3. Demonstration of DNA by Feulgen technique 4. To study the following technique (photographs) <ol style="list-style-type: none"> 1. Southern blotting 2. Northern blotting 3. Western blotting 4. DNA sequencing (Sanger’s method) 5. PCR 6. DNA fingerprinting 	15
Part- III	<p>Biostatistics</p> <p>Any 10 example based on theory</p>	3
	<p>Project (any suitable work possible in local area or from the syllabus) Report of the same to be submitted at the time of practical examination.</p>	12

Course Outcomes: Students will be able to-

1. Apply the knowledge of skills in histological, immunological and physiological techniques.
2. Administer the skills in application of micro techniques and different biotechniques.
3. Demonstrate the application of internet and statistical bioinformatics in research.

REFERENCES:

1. Cell and Molecular Biology, 8th Edition, De. Robertis EDP and De Robertis Jr. EMF, Lippincott Williams and Wilkins, Philadelphia.
2. Cell Biology, C.B. Powar, Himalaya PublicationHouse.
3. Molecular Biology of the Cell - 3rd Edition, Bruce Alberts, Dennis Bray, JulianLewis, Martin Raff, K. Roberts & James D. Watson, Garian Publishing, NewYork
4. Molecular Biotechnology - Principles and Applications of Recombinant DNA.IV Edition, ASM press, Washington, USA. Griffiths, A.J.F., J.H. Miller, Suzuki, D.T., Lewontin, R.C. and Gelbart, W.M.(2009).
5. Elements of Biotechnology - P. K. Gupta, RastogiPublications.

SECCZP 510: Numerical Skills Practical

Practical Hours: 30 (Credits-01)

Course Objectives: Students should be able to-

1. Apply the Mathematical Reasoning and Aptitude using short cut key.
2. Apply basic formula of reasoning.
3. Aware about competitive exams syllabus like SET/NET/JNU/IIT.

Unit no	Content	Hours
1.	To calculate Time & Distance, Ratio, Proportion and Percentage, Profit and Loss, Interest and Discounting, Averages etc. (give three examples of each)	8
2.	Identify Number series and Letter series of given example.	3
3.	To understanding the structure of arguments: argument forms, structure of categorical propositions, Mood and Figure, Formal and Informal fallacies.	8
4.	Uses of language, Connotations and denotations of terms	4
5.	Draw Venn diagram using given information.	3
6.	Show the Graphical representation and mapping from given Data.	4

Course Outcomes: Students will be able to-

1. Deduce the basics of Reasoning
2. Collaborate the knowledge with the Entrance exam and competitive exams.

REFERENCES:

1. Quantitative Aptitude for Competitive Examinations by Dr. R. S. Agarwal.
2. Vidyabhartee SET/NET Anivarya Paper Margadarshak 2017by BrijmohanDayma
3. UGC NET Mathematical Sciences 2018 by Pawan Sharma.

Rayat Shikshan Sanstha's
Yashwantrao Chavan Institute of Science, Satara (Autonomous)
Department of Zoology & Fisheries
2023-24
B.Sc. III Zoology Semester - VI

Paper Code	Paper Title	Lecture per week	Credits	Practical Papers	Lecture per week	Credits
BZT 601	Developmental Biology of Vertebrates	3	2	BZP 608: Developmental Biology And Insect vectors & Diseases	05	2
BZT 603	Immunology	3	2	BZP 609 + Project: Applied Zoology & Immunology	05	2
BZT 604	Applied Zoology -II	3	2			
BSCE 621	English	3	2			
Elective Paper (Any One)						
BZT 602	Insect Vectors and Histology	3	2			
BZT 605	Oceanography	3	2			
BZT 606	Biotechniques	3	2			
Skill Enhancement Course						
SECCZT 607	Entrepreneurship Development (EDP)	2	1	SECCZP 610: Practical: Entrepreneurship Development (EDP)	4	1

Evaluation structure Class B. Sc. III SEM-VI

Paper Code	ESE	Internal Exam		Practical		Submission			Total
		ISE - I	ISE - II	Practical Course	Exam (Pract+ Oral+ Journal)	Student Performance	Seminar / educational Tour	Project (Part II)	
BZT601	40	5	5	BZP 608	40	5	5	--	50
BZT602	40	5	5						
BZT603	40	5	5	BZP 609	40			10	50
BZT604	40	5	5						
SECCZ T 607	20	--	--	BZP 610	30				30

BZT 601: Developmental Biology of Vertebrates

Theory: 45 hrs. (Credits 2)

Course Objectives: Students should be able to-

1. Compare various types of fertilization and process of fertilization.
2. Discuss concept of fertilization and cleavage.
3. Recognize early development of frog.
4. Explain the organogenesis.

Unit no	Content	Hours
Unit 1:	Unit 1: Gametogenesis: 1. Types of Eggs 2. Fertilization – Types and Process of Fertilization 3. Types of Cleavages	08
Unit 2:	Unit 2: Early Development of Frog a) Structure of mature egg and its membranes b) Cleavage c) Blastula and its fate map d) Process of gastrulation e) Types of Morphogenic Movements f) Fate of three germinal layers g) Neurulation Metamorphosis in frog and its hormonal regulation	12
Unit 3:	Chick Embryology a. Structure of sperm b. Structure of egg and vitellogenesis c. Fertilization and cleavage d. Blastula and its fate map e. Process of gastrulation f. Organogenesis 1. Development of neural tube and brain up to 72 hours of incubation 2. Development of gut up to 72 hours of incubation 3. Development of blood and heart up to 72 hours of incubation Foetal membranes and significance	15

Unit 4:	<p>Late Embryonic Development</p> <p>a. Implantation of embryo in human being</p> <p>b. Placenta – Formation, types and significance</p> <p>c. Fetal membranes and their importance in humans</p>	10
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Course Outcomes: Students will be able to-

1. Recite the basic concepts of developmental biology.
2. Enumerate the main anatomical changes that occur during development.
3. Outline and compare the developmental stages which occur in a variety of animals.
4. Identify the cellular behavior that led to morphological change during development.

REFERENCES:

1. A Introduction to Embryology 1981, Balinnsky B.L., Saunders College, Philadelphia.
2. Developmental biology; Patterns/ Principles/ Problems., 1982, Saunders J. wW. Collier MacMillan Publishers, London.
3. Developmental biology;1997, 3rd Edition, Gilbert S.F. saunders associates Inc. U.S.A.
4. Developmental biology; 1992, 3rd Edition Browder L.W. Erickson C.A & Williams, R.J. Saunders College, Publications, London.
5. A textbook of Embryology, Dr. Puranik P.G; S. Chands & Co.
6. Development of Chick Embryo, 1972, Lillie
7. Developmental biology; 1991, 3rd Edition, Sinaur Associates Inc U.S.A. Gilbert, S.F. (2006)
8. Developmental biology; VIIIth Edition, Sinaur Associates, Inc Publishers, Sunderland, Massachusetts, U.S.A. Balinsky, B.I (2008)

BZT 602: Insect Vectors and Histology

Theory: 45 hrs. (Credits 2)

Course Objectives: Students should be able to-

1. Paraphrase the insect vectors.
2. Criticize the mosquito born disease and their control measures.
3. Interpret the microscopic structure of cells of mammalian organs.
4. Summarize the fly born disease and their control measures.

Unit no	Content	Hours
Unit 1:	Insect Vectors 1. insect vectors a. Sand fly b. Horse fly c. Black fly d. Ticks and Mites 2. Study of mosquito born diseases– a. Malaria b. Dengue c. Chikungunya d. Viralencephalitis e. Filariasis 3. Control measures of Mosquitoes 4 . Study of house fly as important mechanical vector, Myiasis, Control of housefly	20
Unit 2:	Unit II: Siphonaptera as Disease Vectors 1. Fleas an important insect vector 2. Host-specificity 3. Study of Flea-borne diseases • Plague • Typhus fever 4. Control of fleas	12
Unit 3:	Unit III: Histology of mammalian organs Tooth, tongue, Salivary glands, Stomach, Duodenum, Ileum, Liver, Pancreas, Kidney	13

Course Outcomes: Students will be able to-

1. Relate the knowledge about insect vectors.

2. Correlate the mosquito borne diseases and their control measures.
3. Recognize the microscopic structure of cells of mammalian organs and their functions.
4. Correlate the fly borne diseases and their control measures.

REFERENCES:

9. Imms, A.D. (1977). A General Text Book of Entomology. Chapman & Hall, UK Chapman, R.F.(1998).
10. The Insects: Structure and Function. IV Edition, Cambridge University Press, UK Pedigo L.P.(2002).
11. Entomology and Pest Management. Prentice Hall Publication Mathews, G.(2011).
12. Integrated Vector Management: Controlling Vectors of Malaria
13. Insect Vector Borne Diseases. Wiley-Blackwell
14. Textbook of Histology: Bloom W and Fawcett D.W.
15. Histology: Lippincott. Ham, A.W.
16. Histology: Greep, R.O and well, L.
17. An Atlas of Histology. Heinemann Educational Book Ltd. London and ELBS: Freeman. W.H. and Bracegirdle, B.
18. Microscopic Anatomy of vertebrates, Lea and Febigen. Philadelphia: Kendall, J.I.
19. Histology of Mammals: Athavale, M.V and Latey, A. N.

BZT 603: Immunology

Theory: 45 hrs. (Credits 2)

Course Objectives: Students should be able to-

1. Recite the basic concepts in immunology.
2. Restate about vaccination.
3. Classify the cells and organs of immune system.
4. Analyze the structure and function of antibody.
5. Restate the antigen-antibody interactions.
6. Explain the Hybridoma technology.

Unit no	Content	Hours
Unit 1:	Overview of the Immune System Introduction to basic concept in immunology Principles of innate and adaptive immune system Immuno-therapeutic strategies against pathogens vaccination	10
Unit 2:	Cells and Organs of the immune system 1.Cells of immune system : Synthesis of different human blood cells. Immune Cells – Stem cell, T cell, B cell, NK cell, Macrophage, Neutrophil, Eosinophil, Basophil, Mast cell, Dendritic cell; 2. Organs and tissues of immune system : Primary and secondary lymphoid organs Bone Marrow, Thymus, Lymph Node, Spleen, GALT, MALT, SALT.	12
Unit 3:	Antigens 1. Classification of antigens – chemical and molecular nature; 2. Characteristics of an antigen (Foreignness, Molecular size and Heterogeneity); 3. haptens, epitopes ,adjuvants; cytokines; Superantigens ,complement pathway, antigen presenting cells; major histocompatibility complex 4. B and T cell biology.	13
Unit 4:	Immunoglobulin/Antibodies 1.Structure, Classes and Functions of Antibodies	12

	<p>2. Antigen – Antibody interactions</p> <p>3. Hybridoma Technology: Monoclonal Antibodies in diagnosis and therapeutics</p> <p>4. Immunodiagnostic methods (Immuno- diffusion ELISA, FACS), immune modulatory drugs.</p>	
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Course Outcomes: Students will be able to-

1. Enumerate the knowledge about basic concepts in immunology.
2. Discuss the concept of vaccination.
3. Interpret the knowledge about cells and organs of immune system.
4. Infer the structure and function of antibody.
5. Discuss the antigen-antibody interactions.

REFERENCES:

1. Kindt, T. J., Goldsby, R.A., Osborne, B. A. and Kuby, J (2006). Immunology, VI Edition.
W.H. Freeman and Company. David, M., Jonathan, B., David, R. B. and Ivan R.(2006).
2. Immunology, VII Edition, Mosby, Elsevier Publication. Abbas, K. Abul and Lichtman
H. Andrew (2003.) Cellular and Molecular
3. Immunology. V Edition. Saunders Publication

BZT 604: Applied Zoology – II

Theory: 45 hrs. (Credits 2)

Course Objectives: Students should be able to-

1. Design the small apiaries for demonstration, pollination, extraction and by-product of beekeeping.
2. Determine the proper management of the domestic animals.
3. Contrast the indigenous and exotic breeds of domestic animals.

Unit no	Content	Hours
Unit 1:	Apiculture a. Types and casts of honeybee b. Honey Comb c. Bee Keeping <ol style="list-style-type: none">i. Artificial models of bee hive – Newton and Langstroth modelsii. Bee keeping Equipmentsiii. Extraction of Honeyiv. Medicinal Value of Honey	14
Unit 2:	Animal Husbandry <ol style="list-style-type: none">1. Indigenous and exotic breeds of cattle2. Preservation and artificial insemination in cattle3. Induction of early puberty4. Synchronization of estrus in cattle5. Commercial importance of dairy farming	8
Unit 3:	Pearl culture <ol style="list-style-type: none">1. Species of oyster2. Process of Pearl formation: natural and artificial3. Maintenance of oysters4. Harvesting5. Importance of Pearl	8
Unit 4:	Freshwater prawn culture <ol style="list-style-type: none">1. Species of Prawn2. Sites election3. Farm Construction4. Production system: fertilization, Larval Development, Food and feeding Harvesting	5
Unit 5:	Fish Technology Genetic improvements in aquaculture industry: <ol style="list-style-type: none">1. Induced breeding2. Transportation of fish seed	5

	3. Feeding and development 4. Harvesting and Marketing	
Unit 6:	Production and marketing of milk products	5

Course Outcomes: Students will be able to-

1. Set up bee keeping system and bee keeping management.
2. Apply the knowledge about bee colony management.
3. Develop the management for the production of the domestic animals.
4. Correlate the nutrition of domestic animals to increase the milk production.
5. Manipulate the process of pearl formation.

REFERENCES:

1. Mollusca -Hyman.
2. Prawn and Prawn Fishery of India -Kurian.
3. Fish Culture - K. H.Alikuhni.
4. Fish Culture -Lagter.
5. Fishes of India. -Khanna.
6. Hand Book of Animal Husbandary and Dairy -Mudlyer.
7. Bee keeping in India - SardarSing.
8. Bee Keeping in India- M. G.Smith.
9. Poultry keeping in India - NaiduP.N.M.
10. Poultry Husbandary - M. A. Jule. 18. Poultry Husbandary -Moarthy.
11. Outlines of Dairy Technology - SukumarDe.
12. Milk and milk products - Clarence Henry Eckles,Willes Barnes Combs, HaroldMa

BZT 605 OCEANOGRAPHY

Theory: 45 hrs. (Credits 2)

Course Objectives: Students should be able to-

1. Recall the basic concepts of Oceanography.
2. Discuss the science of Oceanography and how it is practiced.
3. Integrate all specific concepts of Oceanography into multidisciplinary analysis of the earth.
4. Criticize the interest and curiosity in the many and varied science used in the study of the oceans.

Unit no	Content	Hours
Unit 1:	Geologic history of the oceans - Early history of Oceanography and World exploration - Modern Technology in Oceanography - Seas - Oceans - Ocean floor - Continental shelf - Continental slope - Abyssal basin - Introduction to hydrographic surveying; Marine instrumentation - Echo sounder - Side Scanning Sonar - marine navigator (GPS) – underwater camera, etc., - Marine structures - vehicles - long term geologic history of oceans.	10
Unit 2:	Sea as a biological environment - Plankton, classification of plankton based on size, mode of life and habitat. Phytoplankton and zooplankton - methods of collection, plankton volume, settling and displacement methods; Adaptations of plankton; Phytoplankton and zooplankton interrelations	10
Unit 3:	Unit 3: Organic production - primary and secondary productions, methods of estimation of primary production, factors affecting primary production, regional differences production (in primary and secondary), red tide phenomenon - its causes and effects	10

Unit 4:	<p>Unit 4: Introduction to marine life - Life process in the marine environment - Ocean's Food web</p> <p>Fish in Schools- Sharks - Lobsters - Marine flora - sea weeds and sea grass; Mangroves and salt marshes - distribution - adaptations (morphological, anatomical and physiological), ecological role, uses, need for conservation</p>	10
Unit 5:	<p>Unit 5 : Skill based</p> <p>1. Data Collection, Analysis and Report Writing Observation and Collection of Data-Methods of data collection- Sampling Methods, Data Processing and Analysis Strategies, Technical Reports and Thesis</p> <p>2. Ethical Issues Intellectual property Rights, Commercialization, Copy Right, Royalty, Patent law, Plagiarism, Citation, Acknowledgement</p> <p>3. Teaching Methodology English for Specific Purposes (ESP)/ English for Academic Purposes (EAP), Strategies-based instruction, integrated language skills, Reflective language teaching, Needs Analysis.</p>	5

Course Outcomes: Students will be able to-

1. Demonstrate understanding of fundamentals of Oceanography.
2. Apply the principles of scientific methodology to test hypothesis as to how earths ocean work as an integrated system.
3. Analyze the impact of the ocean system on humanity.
4. Examine critical issues facing the marine environment.

REFERENCES:

1. Physical oceanography A Short Course of Beginners Y. D. Afanasyev
2. Descriptive Physical Oceanography, Sixth Edition, Lynne D. Talley
3. Introduction to oceanography Harold V. Thurman.
4. Oceanography for geographers By R. C. Sharma & M. Vatal

BZT 606 BIOTECHNIQUES

Theory: 45 hrs. (Credits 2)

Course Objectives: Students should be able to-

1. Acquaint with various techniques used in biological sciences.
2. Develop competencies in biotechniques and its applications in a technology-rich, interactive environment.
3. Explain the mechanics of common laboratory assays and how they can be applied to research.
4. Discuss about modern instruments for various analytical works.

Unit no	Content	Hours
Unit 1:	<p>1. Assays –Definition and criteria of reliability; Chemical assays; Biological assays – <i>invivo and vitro assays</i>.</p> <p>2. Principles and uses of analytical instruments – Balances, pH meter, calorimeter, spectrophotometer, centrifuge, ultracentrifuge.</p> <p>3. Microscopy – Principle of light transmission, electron, phase-contrast, fluorescence, electron, confocal, scanning electron microscopes. Microphotography. Image analysers.</p>	10
Unit 2:	<p>4. Microbiological techniques –Media preparation and sterilization; Inoculation and growth monitoring; Use of fermenters; Microbial assays.</p> <p>5. Cell culture techniques –Design and functioning of tissue culture laboratory; Cell viability testing; Culture media preparation and cell harvesting methods.</p> <p>6. Separation techniques in biology –Molecular separations by chromatography, electrophoresis, precipitation etc.</p>	10
Unit 3:	<p>7. Computer aided techniques for data presentation, data analyses, statistical techniques, special software for specific tasks.</p> <p>8. Radioisotope and mass isotope techniques in biology – Autoradiography; Magnetic Resonance Imaging.</p>	10

	<p>9. Immunological techniques based on antigen - antibody interactions.</p> <p>10. Surgical techniques –Organ ablutions (eg; ovariectomy, adrenaletomy etc.); Perfusion techniques.</p>	
Unit 4:	<p>Unit 5 : Skill based 20%</p> <p>1. Data Collection, Analysis and Report Writing</p> <p>Observation and Collection of Data-Methods of data collection- Sampling Methods, Data Processing and Analysis Strategies, Technical Reports and Thesis</p> <p>2. Ethical Issues</p> <p>Intellectual property Rights, Commercialization, Copy Right, Royalty, Patent law, Plagiarism, Citation, Acknowledgement</p>	10
Unit 5:	<p>3. Teaching Methodology</p> <p>English for Specific Purposes (ESP)/ English for Academic Purposes (EAP), Strategies-based instruction, Integrated language skills, Reflective language teaching, Needs Analysis.</p>	5

Course Outcomes: Students will be able to-

1. State the principles and applications of different assays.
2. Summarized the principles and applications of Microscopy
3. Contrast the principles of different spectroscopic techniques in biology.
4. Apply the knowledge of electrophoresis and blotting.
5. Discuss the nature and types of radiations and their applications in structural and functional analysis of biological samples.

REFERENCES:

1. Handbook of Analytical Instruments, Second Edition; Dr R S Khandpur, 2006 McGraw-Hill Education Private Limited.
2. Basic Methods in Microscopy: Protocols and Concepts from "Cells: a Laboratory Manual"; David Spector, Robert Goldman; Cold Spring Harbor Laboratory Press,U.S.; 1st edition (15 October 2005)

3. Lodish, Harvey; Berk, Arnold; Zipursky, S. Lawrence; Matsudaira, Paul; Baltimore, David; Darnell, James (2000). ["Microscopy and Cell Architecture"](#). Molecular Cell Biology. 4th Edition.
4. Alberts B et al (2008), Molecular Biology of the Cell, 5th ed. Garland Science Publishing.
5. Becker WM, Kleinsmith LJ and Hardin J (2006), The world of the cell, 6th ed. Pearson Education Inc.
6. Bozzola JJ and Russell LD (1998), Electron Microscopy: Principles and Techniques for Biologists, 2nd ed. Jones and Bartlett Publishers, Inc.
7. Hoppert M (2003), Microscopic Techniques in Biotechnology, Wiley-VCH Verlag.
8. Lodish H, Berk A, Kaiser CA et al (2008), Molecular Cell Biology, 6th ed. W.H. Freeman and Company.
9. Pawley J (2006), Handbook of Biological Confocal Microscopy, 3rd ed. Springer.

B.Sc. III Zoology
Semester-VI
SCCCZT607: Entrepreneurship Development (EDP)

Theory: 30 hrs. (Credits 1)

Course Objectives: Students should be able to-

1. Predict the opportunities for development.
2. Restate the mechanism of finance and fund raising.
3. Determine the importance of marketing for better business opportunities.
4. To understand the Entrepreneurship Development skill in Apiculture & Sericulture.

Unit no	Content	Hours
Unit 1:	<p>Unit I: Entrepreneurship Development.</p> <p>Introduction to entrepreneurship, Identification of opportunities for entrepreneurship, Concept of different occupations: business, employment and profession, Function of an Entrepreneur, Business idea plan, Types of businesses/ ownership- Sole proprietorship, Partnership, Private limited company, Public limited company, Joint stock Company, Co-operative society.</p>	05
Unit 2:	<p>Unit II: Sources of finance.</p> <p>Preparation of project report for business, Sources of finance- government and non government agencies, working capital, Cash flow, Fund flow, preparation of basics of financial statements, costing and pricing, Policies and incentives.</p>	03
Unit 3:	<p>Unit III: Marketing management.</p> <p>Small business management and entrepreneurship, Woman Entrepreneurship, Features of small business firms, Process of management in small business, Concept of data and information, Information as a commodity, Study of marketing strategy and marketing mix, decision- making models, Types of decisions, Decision support systems, Introduction to e-commerce, Types- B2B, B2C, C2B, C2C, Case study on small scale industries in India.</p>	05
Unit 4:	<p>1. Entrepreneurship Development in Sericulture:</p> <p>Emergence and objectives of EDP, essential qualities to become an entrepreneur; selection of a potential entrepreneur. Central government Schemes for the promotion of sericulture in India, State</p>	10

	<p>Government schemes for the promotion of sericulture in Maharashtra. Policies for bank loan for sericulture. Export policies of cocoon.</p> <p>2. Entrepreneurship Development in Apiculture:</p> <p>Emergence and objectives of EDP, essential qualities to become an entrepreneur; selection of a potential entrepreneur. Government Schemes for the promotion of Apiculture. Policies for bank loan for Apiculture. Export policies of Bee products</p>	7
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Course Outcomes: Students will be able to-

1. Contrast the Entrepreneurship, Creativity & Opportunities.
2. Discover the financial and marketing skills.
3. Prepare the proposal for small scale industry.
4. Apply Entrepreneurship Development skill in Apiculture & Sericulture

REFERENCES:

1. Energy management, W.R. Murphy, G. Mckay, Butterworth- Heinemann Ltd., 1981.
2. Energy management principles, Craig Smith Kelly Parmenter, Elsevier Publishers., 2015
3. Efficient Use of energy, I.G.C, Dryden, Elsevier Publishers. (2nd Ed.) 1982
4. Energy Economics, A.V. Desai, New age publishers, 1996.
5. Entrepreneurship, Alpana Trehan, Wiley India publishers, . (1st Ed.) 2011.
6. Complete guide to successful Entrepreneurship, G.N. Pande, S. Chand (G/L) & Company Ltd., 1994.

B.Sc. III Zoology
Semester-VI
ZOOLOGY PRACTICAL – I
Practical: 45 hrs. (Credits 2)

BZP 608: Based on Developmental biology of vertebrates AND Insect Vectors & Diseases

Course Objectives: Students should be able to-

1. Summarize the different developmental stages of frog.
2. Explain the concept of fertilization and cleavage.
3. Identify the early development of Chick embryo.
4. Recall the basics of arthropods of public health importance.
5. Restate the Histology and functions of mammalian organs

Unit no	Content	Hours
Part A)	<p style="text-align: center;">1) DEVELOPMENTAL BIOLOGY OF VERTEBRATES:</p> <p>A) Study of developmental stages of frog.</p> <ul style="list-style-type: none"> i) Cleavage ii) Blastulation iii) Gastrulation iv) Neurulation v) Stages of metamorphosis in frog <ul style="list-style-type: none"> 1. External gill stage 2. Internal gill stage 3. Forelimb stage 4. Hind limb stage 5. Tail bud stage 6. Juvenile stage 	10
Part B)	<p style="text-align: center;">B) Study of Chick Embryo</p> <p>1. Whole mount of chick embryo – 18, 24, 33, 48 and 72hours.</p> <p>T.S. of chick embryo – 18, 24, 33, 48 and 72hours.</p> <p>III. Preparation of whole mount chick embryo.</p> <p>IV. Study of Histological structures of placenta (permanent slide or microphotographs)</p> <ul style="list-style-type: none"> a. Epitheliochorial b. Endotheliochorial c. Hemochorial d. Syndesmochorial e. Hemoendothelial <p>2. Examination of Gametes – Frog or Rat sperm & ovum through slides or microphotographs.</p>	14

Part C)	<p>2) INSECT VECTORS & DISEASES:</p> <p>I. Study of different kinds of mouthparts of insects</p> <ol style="list-style-type: none"> i) Chewing & biting ii) Chewing & lapping iii) Piercing & sucking iv) Sponging v) Siphoning <p>II. Study of following insect vectors through permanent slides or photograph</p> <ol style="list-style-type: none"> 1. Insect vector – Mosquito, sand fly housefly 2. Study of mosquito born diseases – Malaria, dengue, chikungunya, encephalitis, filariasis 3. Study of sand fly born diseases – Visceral leishmanians, Cutaneous leishmanians, Phlebotomus fever 4. Study of housefly born diseases – Myiasis 5. Study of flea born diseases – Plague, typhus 	14
Part D)	. Histology of following mammalian organs- a) Tooth (V.S.) b) Tongue c) Salivary gland d) Stomach e) Duodenum f) Ileum g) Liver h) Pancreas i) Kidneys	07

Course Outcomes: Students will be able to-

1. Recognize the developmental stages of frog.
2. Differentiate the early development of Chick embryo.
3. Correlate the Insect vectors, their mode of transmission and preventive measures.

REFERENCES:

1. Developmental biology; 1997, 3rd Edition, Gilbert S.F. saunders associates Inc. U.S.A.
2. Developmental biology; 1992, 3rd Edition Browder L.W. Erickson C.A & Williams, R.J. Saunders College, Publications, London.
3. A textbook of Embryology, Dr. Puranik P.G; S. Chands & Co.
4. An Introduction to Embryology 1981, Balinnsky B.L., Saunders College, Philadelphia.
5. Insect Vector Borne Diseases. Wiley-Blackwell
6. Textbook of Histology: Bloom W and Fawcett D.W.
7. Histology: Lippincott. Ham, A.W.
8. Histology: Greep, R.O and well, L.
9. An Atlas of Histology. Heinemann Educational Book Ltd. London and ELBS: Freeman. W.H. and Bracegirdle, B.
10. Histology of Mammals: Athavale, M.V and Latey, A. N.

B.Sc. III Zoology
Semester-VI
ZOOLOGY PRACTICAL – II (CREDITS-02)

Practical: 45 hrs. (Credits 2)

BZP 609: Based on Applied Zoology – II and Immunology

Course Objectives: Students should be able to-

1. Recite the concepts of Apiculture, bee keeping equipment.
2. Outline the pearl culture and fresh water prawn culture.
3. Recall the basic histology of glands related to immunity.
4. Explain the concept of Goat farming.

Unit no	Content	Hours
Part A)	1)APPLIED ZOOLOGY	8
	1) Apiculture: <ol style="list-style-type: none"> a. Casts of Honey Bees b. Bee Hive (Photographs or models) c. Pollen Basket d. Sting Apparatus e. Honey f. Newton’s model of Bee Hive (Photographs or models) g. Bee keeping Equipments (Photographs or models) 	
	2) Preservation & Artificial insemination in cattles	2
	3) Pearl culture <ul style="list-style-type: none"> • Species of oyster • Process of Pearl formation: natural and artificial • Importance of Pearl 	3
	4) Freshwater prawn culture <ol style="list-style-type: none"> a. Species of Prawn b. Site selection c. Farm Construction d. Production system e. Harvesting 	4
	5) Goat farming <ol style="list-style-type: none"> a. Breeds (any four = 2 Indigenous and 2Exotic) b. Housing c. Feeding 	4
	6) Economic importance of Milk and Milk byproducts	2
Part B)	2)IMMUNOLOGY	10
	1) Study of lymphoid organ’s (Photograph, Models, Videos) 2) Histological study of (slides or photographs) <ul style="list-style-type: none"> • Spleen • Thymus 	

	<ul style="list-style-type: none"> • Lymph nodes 3) Preparation of stained blood smears to study various types of blood cells 4) Determination of ABO blood groups. 5) Demonstration of <ul style="list-style-type: none"> • ELISA • Immuno-electrophoresis 6. Cell counting and viability test from splenocytes of farm breed animals / cell line	
Part C)	3)PROJECT	12

Course Outcomes: Students will be able to-

1. Demonstrate knowledge of Apiculture, Prawn culture and goat farming.
2. Set up their own Apiculture, Prawn culture and goat farming unit.
3. Illustrate the use of different immunohistochemical instruments.
4. State the role of the immune system.

REFERENCES:

1. Bee keeping in India - SardarSing.
2. Bee Keeping in India- M. G.Smith.
3. Kindt, T. J., Goldsby, R.A., Osborne, B. A. and Kuby, J (2006).
4. Immunology VI Edition. W.H. Freeman and Company. David, M., Jonathan, B., David, R. B. and Ivan R.(2006).
5. Poultry keeping in India - NaiduP.N.M.
6. Prawn and Prawn Fishery of India -Kurian.
7. Immunology. V Edition. SaundersPublication
8. Fish Culture - K. H.Alikuhni.
9. Fish Culture -Lagter.
10. Fishes of India. -Khanna.
11. Immunology, VII Edition, Mosby, Elsevier Publication. Abbas, K. Abul andLechtman H. Andrew (2003.) Cellular and Molecular
12. Hand Book of Animal Husbandary and Dairy -Mudlyer.
13. Poultry Husbandary - M. A. Jule. 18. Poultry Husbandary -Moarthy.
14. Milk and milk products - Clarence Henry Eckles,Willes Barnes Combs, HaroldMa