

**Academic Council Meeting No. and Date :8 / September 04, 2023**  
**Agenda Number : 2      Resolution Number : 34, 35/ 2.6, 2.7**



**Vidya Prasarak Mandal's**  
**B. N. Bhandodkar College of Science**  
**(Autonomous), Thane?**



**Syllabus for**

**Programme Code :BUZO**

**Programme : Bachelor of Science Specific Programme : Zoology**  
**(Major/Minor/Generic)**

**[F.Y.B.Sc. Zoology]**

**Level 4.5**

**CHOICE BASED GRADING SYSTEM**

**Revised under NEP**

**From academic year 2023-2024**

## **Preamble**

I am glad to introduce this modified syllabus to the Department of Zoology to pursue wise and able aspects of the subject to be instilled in the students of the semester V and semester VI under the quest of 'Autonomy' sanctioned by the University of Mumbai to VPM's B. N. Bandodkar College of Science, Thane.

It is foresighted to involve experts from all the relevant sectors of society to design this syllabus with their valued advice and suggestions. The syllabus has been finalized unanimously by the priory appointed members of the Board of Studies in Zoology Subject which includes industrial technical advice from Reliable Analytical Laboratory which practices the most advance analytical techniques in biological sciences. It gives me great pleasure to involve our meritorious alumni who have successfully made their careers in zoology in this venture.

However, with the constraint of the UGC guidelines in changing the syllabus, it was envisaged to change 20% of the syllabus at the initial phase and has been planned to migrate sly to a metamorphic pattern of the syllabus, which shall eliminate the existent short comings, during forthcoming cycles of syllabus framing.

Also, the syllabus will be framed in accordance with the PG programs of various national and international Universities so that our students will be able to avail their education in them.

Although, due to the guidelines of UGC, the use of animals is excluded from the practical, substituting the same with audiovisual instruction, simulations aids, and the use of ICT to make the syllabus more interesting and interactive. Pedagogy will guide our teachers to know content and objectives along with the desired outcome of every topic.

It is expected that the teaching process is expected to be boosted with exciting outcomes of the syllabus with further improvement and enthusiasm of the teachers. At the initiation, the department introduces the 'Choice-Based Credit System' (CBCS) of teaching-learning, under autonomy. The evaluation process involves 30-20 pattern of theory to ensure continuous learning from the academic year 2025-26, onward.

**Prof. Dr. Vinda Manjramkar**  
**Chairperson, BOS in Zoology**

## **PROGRAMME OUTCOMES (POs) OF BACHELOR OF SCIENCE (B.Sc.)**

*The Undergraduate Programmes of Science are intended to cater quality education and attain holistic development of learners through the following programme outcomes:*

### **PO1 - Disciplinary Knowledge**

Lay a strong foundation of conceptual learning in science. Instil ability to apply science in professional, social and personal life.

### **PO2 - Inculcation of Research Aptitude**

Ignite spirit of inquiry, critical thinking, analytical skills and problem-solving approach which will help learners to grasp concepts related to research methodology and execute budding research ideas.

### **PO3 - Digital Literacy**

Enhance ability to access, select and use a variety of relevant information e-resources for curricular, co-curricular and extracurricular learning processes.

### **PO4 - Sensitization towards Environment**

Build a cohesive bond with nature by respecting natural resources, encouraging eco-friendly practices and creating awareness about sustainable development.

### **PO5 - Individuality and Teamwork**

Encourage learners to work independently or in collaboration for achieving effective results through practical experiments, project work and research activities.

### **PO6 - Social and Ethical Awareness**

Foster ethical principles which will help in developing rational thinking and becoming socially aware citizens. Build an attitude of unbiased, truthful actions and avoid unethical behaviour in all aspects of life.

**Eligibility:** 12th Science Pass

**Duration:** 3 years (Syllabus for Second Year semester I & II)

**Mode of Conduct:** Offline lectures/ Online lectures

**Discipline/Subject:** Zoology

**Specific Programme:** B.Sc. Zoology

**Qualification Title:** UG certificate

<b>Program Specific Outcomes</b>		
<b>No.</b>	<b>Outcome</b>	<b>Level</b>
<b>1</b>	Describe the diversity and structural organization of animal life that govern biological systems.	L-1
<b>2</b>	Explain cellular, physiological, genetic, and biochemical processes that regulate the life.	L-2
<b>3</b>	Demonstrate laboratory skills, operate scientific instruments and analyze results.	L-3
<b>4</b>	Examine disease-causing agents, evaluate preventive and control strategies with indigenous knowledge.	L-4
<b>5</b>	Examine disease-causing agents, evaluate preventive and control strategies with indigenous knowledge.	L-5
<b>6</b>	Examine disease-causing agents, evaluate preventive and control strategies with indigenous knowledge.	L-6

<b>Specific Programme: F.Y.B.Sc. (Zoology -Major/ Minor)</b>		
<b>Assessment: Weightage for assessments (in percentage) For Major and Minor</b>		
<b>Type of Course</b>	<b>Formative Assessment / IA</b>	<b>Summative Assessment</b>
Theory	40%	60%

**Curriculum Structure for the Undergraduate Programme  
F.Y.B.c Zoology**

<b>SEMESTER – I</b>			
<b>Course Code</b>	<b>Major Course Title</b>	<b>No. of Lectures in hrs</b>	<b>Credits</b>
<b>23BUZO1T01</b>	<b>Biodiversity and its conservation</b>	<b>30</b>	<b>02</b>
<b>23BUZO1T02</b>	<b>Animal biotechnology and instrumentation</b>	<b>30</b>	<b>02</b>
<b>23BUZO1P01</b>	<b>Practical based on 23BUZO1T01 and 23BUZO1T02</b>	<b>60</b>	<b>02</b>
<b>Course Code</b>	<b>Skill enhancement courses title</b>	<b>No. of Lectures in hrs</b>	<b>Credits</b>
<b>23BU1SEC05</b>	<b>Fish dishes</b>	<b>45</b>	<b>02</b>
<b>Total</b>		<b>165</b>	<b>08</b>
<b>Course Code</b>	<b>Minor Course Title</b>	<b>No. of Lectures in hrs</b>	<b>Credits</b>
<b>23BUZO1T03</b>	<b>Biodiversity and its conservation</b>	<b>30</b>	<b>02</b>
<b>23BUZO1T04</b>	<b>Animal biotechnology and instrumentation</b>	<b>30</b>	<b>02</b>
<b>23BUZO1P02</b>	<b>Practical based on 23BUZO1T03 and 23BUZO1T04</b>	<b>60</b>	<b>02</b>
<b>Total</b>		<b>120</b>	<b>06</b>
<b>Course Code</b>	<b>Generic Course Title</b>	<b>No. of Lectures in hrs</b>	<b>Credits</b>
<b>23BUZO1T05</b>	<b>History of zoology and footsteps to follow</b>	<b>30</b>	<b>02</b>
<b>Total</b>		<b>30</b>	<b>02</b>

<b>SEMESTER – II</b>			
<b>Course Code</b>	<b>Major Course Title</b>	<b>No. of Lectures in hrs</b>	<b>Credits</b>
<b>23BUZO2T01</b>	<b>Population ecology and wildlife management</b>	<b>30</b>	<b>02</b>
<b>23BUZO2T02</b>	<b>Nutrition and public health and hygiene</b>	<b>30</b>	<b>02</b>
<b>23BUZO2P01</b>	<b>Practical based on 23BUZO2T01 and 23BUZO2T02</b>	<b>60</b>	<b>02</b>
<b>Course Code</b>	<b>Skill enhancement courses title</b>	<b>No. of Lectures in hrs</b>	<b>Credits</b>
<b>23BU2SEC05</b>	<b>Bird Identification</b>	<b>45</b>	<b>02</b>
	<b>Total</b>	<b>165</b>	<b>08</b>
<b>Course Code</b>	<b>Minor Course Title</b>	<b>No. of Lectures in hrs</b>	<b>Credits</b>
<b>23BUZO2T03</b>	<b>Population ecology and wildlife management</b>	<b>30</b>	<b>02</b>
<b>23BUZO2T04</b>	<b>Nutrition and public health and hygiene</b>	<b>30</b>	<b>02</b>
<b>23BUZO2P02</b>	<b>Practical based on 23BUZO2T03 and 23BUZO2T04</b>	<b>60</b>	<b>02</b>
	<b>Total</b>	<b>120</b>	<b>06</b>
<b>Course Code</b>	<b>Generic Course Title</b>	<b>No. of Lectures in hrs</b>	<b>Credits</b>
<b>23BUZO2T05</b>	<b>Ecosystem and common human diseases and disorders</b>	<b>30</b>	<b>02</b>
	<b>Total</b>	<b>30</b>	<b>02</b>

# **Semester - I**

<b>MAJOR COURSE CODE:</b> 23BUZO1T01		<b>(02 Credits)</b>		<b>No of lecture in Hrs. 30</b>		
<b>MINOR COURSE CODE:</b> 23BUZO1T03		<b>(02 Credits)</b>		<b>No of lecture in Hrs. 30</b>		
<b>Biodiversity and conservation</b>						
<b>COURSE OUTCOME</b>						
Students will be wanted to learn OR on completion of this course, students will be able to learn:						
CO1	Illustrate the treasure of biodiversity and its importance.					L1
CO2	Relate different conservation strategies and its management for wild animals.					L1
CO3	Compare the adaptations about the fascinating world of animals.					L2
CO4	Build up the interest and love in zoology by studying the wonderful features in animals.					L3
<b>Grading will be as 3: High(&gt;60%), 2: Moderate(40%-60%), 1: Low(&lt;40%), 0: No mapping</b>						
	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>
CO1	3	0	0	0	0	0
CO2	0	0	0	3	0	0
CO3	0	2	0	0	0	0
CO4	0	0	0	2	0	0
<b>Unit</b>	<b>Description</b>					<b>No. of Hours.</b>
<b>I</b>	<p style="text-align: center;"><b>Wonders of animal world</b></p> <p><b>Corals:</b> Types of coral reefs Mechanism of Coral formation <b>Mechanism of Pearl formation in Mollusca</b> <b>Regeneration in Animals:</b> Earthworm (Annelida)Lizard (Reptile) <b>Mimicry in Butterflies and its significance:</b> Great Egg fly and Common Crow Common Palm fly and Plain Tiger <b>Bioluminescence in Animals: Significance with examples</b> Mechanism of bioluminescence Noctiluca ,Glow worm, Firefly Angler Fish <b>Echolocation:</b> Bats <b>Cetaceans: Significance with examples</b> Dolphins, Whales</p>					<b>15</b>

	<p><b>Bird migration:</b> Types of bird migration Factors inducing bird migration</p> <p><b>Adaptive features of desert animals:</b> Reptiles (Phrynosoma)Mammals (Camel)</p> <p><b>Breeding and Parental care in:</b></p> <p><b>Pisces:</b> Ovo-viviparous (Black Molly/Guppy)Mouth brooders(Tilapia) Brood pouches (Sea horse)</p> <p><b>Amphibian</b> Mouth brooders (Darwin's Frog)Egg carriers (Midwife Toad) <b>Aves</b> Brood Parasitism (Cuckoo)</p> <p><b>Mammals:</b> Egg-laying (Duck-billed Platypus)Marsupials (Kangaroo)</p>	
<b>II</b>	<p style="text-align: center;"><b>Biodiversity and its conservation</b></p> <p><b>Introduction of Biodiversity:</b> Definition, Concepts, Scope and Significance</p> <p><b>Types of Biodiversity:</b> Genetic biodiversity,Species biodiversity Ecosystem biodiversity</p> <p><b>Biodiversity Hotspots:</b> Western Ghats Indo- Burma Border</p> <p><b>Values of biodiversity:</b> Direct and Indirect values</p> <p><b>Threats to Biodiversity:</b> Habitat loss Man-Wildlife conflict</p> <p><b>Biodiversity conservation and management:</b></p> <p><b>Conservation strategies:</b> In situ Ex-situ Biosphere reservesNational parks Sanctuaries</p> <p><b>Introduction to International efforts:</b> Convention on Biological Diversity (CBD) International Union for Conservation of Nature and Natural Resources (IUCN) Monitoring Centre (UNEP- WCMC) United Nations Environment Program - World Conservation Introduction to Indian Wildlife (Protection) Act, 1972 Convention for International Trade of endangered species National Biodiversity Action Plan, 2002</p>	<b>15</b>

<b>REFERENCES</b>	
<b>23BUZO1T01/T03</b>	
1.	Wonders of the Animal World – University Text Book of Zoology, F.Y.B.Sc. Semester I Course 1, V.V. Dalvie, G.B. Raje, P.Sardesai, N.S.Prabhu, University Press.University of Mumbai
2.	Invertebrate Zoology Volume I, Jordan and Verma, S. Chand and Co.Edition 14 <sup>th</sup> ,2009

3.	Vertebrate Zoology Volume II, Jordan and Verma, S. Chand and Co. Edition 14 <sup>th</sup> , 2009
4.	Fundamentals of Ecology, E. P. Odum, Sanders Publication
5.	Fundamentals of Ecology, M. C. Dash, Tata McGraw Hill
6.	Biodiversity, K. C. Agarwal, Agro Botanica Publications
7.	Butterflies of India, Isaac Kehimkar, BNHS Publication

<b>MAJOR COURSE</b>		<b>(02 Credits)</b>		<b>No of lecture in Hrs.</b>		
<b>CODE:23BUZO1T02</b>				<b>30</b>		
<b>MINOR COURSE</b>		<b>(02 Credits)</b>		<b>No of lecture in Hrs.</b>		
<b>CODE: 23BUZO1T04</b>				<b>30</b>		
<b>Animal Biotechnology and Instrumentation</b>						
<b>COURSE OUTCOME</b>						
Students will be wanted to learn OR on completion of this course, students will be able to learn:						
CO1	Build up the knowledge to understand the recent advances in the subject.					L3
CO2	Analyse the applications of biotechnology for the betterment of mankind.					L4
CO3	Develop the skills to select & operate suitable Instrument for the studies.					L3
CO4	Make use of different instruments & its applications.					L3
<b>Grading will be as 3: High(&gt;60%), 2: Moderate(40%-60%), 1: Low(&lt;40%), 0: No mapping</b>						
	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>
CO1	0	2	0	0	0	0
CO2	0	3	0	0	0	0
CO3	0	0	0	0	3	0
CO4	0	3	0	0	0	0
<b>Unit</b>	<b>Description</b>					<b>No. of Hours</b>

<b>I</b>	<p><b>Animal Biotechnology</b></p> <p><b>Scope and achievements of biotechnology</b>  Fishery  Animal Husbandry  Medical  <b>Transgenesis:</b>  Retro viral method  Nuclear transplantation method  DNA microinjection method  Embryonic stem cell method  <b>Cloning (Dolly)</b>  <b>Ethical issues of transgenic and cloned animals</b>  <b>Applications of biotechnology:</b>  DNA fingerprinting technique  Application in forensic science (Crime Investigation)  Recombinant DNA in medicines (recombinant insulin) <b>Gene therapy:</b>  Ex-vivo  In vivo  Severe Combined Immuno Deficiency (SCID) Cystic Fibrosis  <b>Green genes:</b>  Green Fluorescent Protein (GFP) from Jelly fish</p>	<b>15</b>
----------	--	-----------

<b>II</b>	<p><b>Instrumentation</b></p> <p><b>Microscopes Dissecting microscope</b>  Construction and Principle  Applications  <b>Compound microscope</b>  Construction and Principle  Applications  <b>Colorimeter</b>  Construction and Principle Applications  <b>Spectrophotometer:</b> Construction and Principle Applications  <b>PH meter</b>  Sorenson's pH scale Construction and Principle Applications  <b>Centrifuge</b>  Construction and Principle Applications  <b>Chromatography</b> Construction and Principle Applications  <b>Electrophoresis</b>  <b>Horizontal electrophoresis</b>  Construction, Principle and Applications  <b>Vertical electrophoresis</b>  Construction, Principle and Applications</p>	<b>15</b>
-----------	--	-----------

<b>REFERENCES</b>	
<b>23BUZO1T02/T04</b>	
1.	Introduction to Practical Biochemistry, David T. Plummer, Tata McGraw Hill Publishing Co. Ltd. Edition 3 <sup>rd</sup> , 2001
2.	A Manual of Medical Laboratory Technology, H. Patel, Navneet Prakashan Ltd.
3.	Biological instruments and methodology, Dr. P. K. Bajpai, S. Chand company Ltd
4.	Basic Laboratory Techniques, Instrumentation and Biotechnology- University Text Book of Zoology, F.Y.B.Sc. Semester I Course 2, V.V. Dalvie, R. G. Deshmukh, R. D'souza and H.U. Shingadia, University Press.
5.	Calculations in Molecular biology and Biotechnology, Frank H. Stephenson, Academic Press.
6.	Understanding biotechnology, Low price edition, Aluizio Borem, David Bowe, Pearson Publication.
7.	Principles and Techniques of Practical Biochemistry, Keith Wilson and John Walker, Cambridge University Press
8.	Biochemistry, Jeremy Berg, Lubert Stryer, W. H. Freeman and company, NY, Edition 7 <sup>th</sup> , 2012
9.	Microscopy and Cell Biology, V. K. Sharma, Tata McGraw Hill Publishing Co. Ltd.

<b>MAJOR COURSE</b>	<b>(02 Credits)</b>	<b>No of lecture in Hrs. 60</b>				
<b>CODE: 23BUZO1P01</b>						
<b>Practical based on 23BUZO1T01 and 23BUZO1T02</b>						
<b>MINOR COURSE</b>	<b>(02 Credits)</b>	<b>No of lecture in Hrs. 60</b>				
<b>CODE: 23BUZO1P02</b>						
<b>Practical based on 23BUZO1T03 and 23BUZO1T04</b>						
<b>COURSE OUTCOME</b>						
Students will be wanted to learn OR on completion of this course, students will be able to learn:						
CO1	Build up the interest in animal science by studying the different features in animals.	L3				
CO2	Compare the body organization and the morphological features of the animals.	L3				
CO3	Apply the knowledge to understand the various basic qualitative tests.	L3				
CO4	Develop the operational skills of handling the different instruments.	L3				
<b>Grading will be as 3: High(&gt;60%), 2: Moderate(40%-60%), 1: Low(&lt;40%), 0: No mapping</b>						
	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>
<b>CO 1</b>	2	0	0	0	0	0

<b>CO 2</b>	0	2	0	0	0	0
<b>CO 3</b>	0	2	0	0	0	0
<b>CO 4</b>	0	0	0	0	2	0

<b>Practical I</b>	
<b>1.</b>	Mounting of foraminifera shells from sand.
<b>2.</b>	<b>Study of types of corals:</b> Brain ,Organpipe, Stag Horn, Mushroom coral.
<b>3.</b>	<b>Mimicry in Butterflies:</b> Great Egg fly and Common Crow Common Palm fly and Plain Tiger
<b>4.</b>	<b>Mounting of scales of fish:</b> Placoid, Cycloid and Ctenoid
<b>5.</b>	<b>Breeding and parental care in Amphibians:</b> Rhacophorus ,Mid- wife toad, Darwin's frog, Caecilian.
<b>6.</b>	<b>Study of adaptive radiation in reptiles:</b> Turtle, Tortoise, Phrynosoma, Draco.
<b>7.</b>	<b>Identification and differentiation of venomous and non-venomous snakes:</b> Scales, Fangs and Bite marks
<b>8.</b>	<b>Study of types of feathers in birds:</b> Contour, Filoplume, Down. <b>Study of types of Claws in birds:</b> Perching ,Wading ,Swimming,Hopping
<b>9.</b>	<b>Study of types of beaks and feeding in birds:</b> Nectar feeding Insect Catching ,Fruit eating, Scavenging
<b>10.</b>	<b>Identification of birds:</b> Coppersmith Barbet, Bulbul ,Rose ringed Parakeet, Magpie Robin Two local birds
<b>11.</b>	<b>Study of camouflage:</b> Leaf insect, Chameleon <b>Study of Bioluminescence:</b> Noctiluca Glow worm Fire fly Angler fish
<b>12.</b>	<b>Study of Cannibalistic mate-eating animals:</b> Spider Praying Mantis
<b>13.</b>	<b>Study of Symbiosis association:</b> Termite and Trychonympha Hermit crab and sea anemone
<b>14.</b>	<b>Study of animal architects:</b> Termites Harvester ant Baya weaverbird
<b>15.</b>	<b>Study Biodiversity hotspots using world map:</b> Western Ghats Indo-Burma

<b>Practical II</b>	
<b>1.</b>	Estimation of moisture content of biscuits.
<b>2.</b>	Extraction of fruit juice with pectinase from Apple/Guava or any other suitable fruit.
<b>3.</b>	Estimation of protein content from the variety of eggs.
<b>4.</b>	Testing of adulterants in milk using Methylene Blue Reduction Test (MBRT).
<b>5.</b>	Food adulteration test to check adulterants in: Cheese Butter Ghee
<b>6.</b>	Food adulteration test to check adulterants in: Jaggery Honey Iodized Salt.
<b>7.</b>	Identification of transgenic fish and cloned animals.
<b>8.</b>	Application of DNA fingerprinting in criminology.
<b>9.</b>	Identification of green genes.
<b>10.</b>	Study of microscope.
<b>11.</b>	Working of pH meter.
<b>12.</b>	Study of colorimeter.
<b>13.</b>	Separation of amino acids from the mixture by paper chromatography.
<b>14.</b>	Separation of pigments from the mixture by chalk chromatography.
<b>15.</b>	Study of electrophoresis.

<b>MAJOR COURSE</b>	<b>(02 Credits)</b>	<b>No of lecture in Hrs.</b>
<b>CODE: 23BU1SEC05</b>		<b>15</b>
<b>Fish Dishes</b>		
<b>COURSE OUTCOME</b>		
Students will be wanted to learn OR on completion of this course, students will be able to learn:		
CO 1	Importance of nutrients in fish in human diet.	L5
CO 2	Develop small scale business skill.	L3
CO 3	Build up the skills for entrepreneurship.	L3
CO 4	Take part in cooking innovative fish dishes.	L4
<b>Grading will be as 3: High(&gt;60%), 2: Moderate(40%-60%), 1: Low(&lt;40%), 0: No mapping</b>		

	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>
<b>CO 1</b>	3	0	0	0	0	0
<b>CO 2</b>	0	0	0	0	3	0
<b>CO 3</b>	0	0	0	0	2	0
<b>CO 4</b>	0	0	0	0	2	0

<b>Unit</b>	<b>Description</b>	<b>No. of Hours</b>
<b>I</b>	1. Selection of fish for dishes 2. Various types of ingredients 3. Methods for preparation 4. Nutritional value 5. To Study Processed(Salting, Drying, Frozen ,Canning fish 6. Healthy ways to cook fish	

**SEC- PRACTICAL**

<b>1</b>	Fish Burger
<b>2</b>	Fish Noodles
<b>3</b>	Fish Curry
<b>4</b>	Fish Cutlet
<b>5</b>	Fish Sandwich
<b>6</b>	Fish Pickles
<b>7</b>	Fish Samosa

**REFERENCES**

<b>23BU1SEC05</b>	
<b>1.</b>	Indian Fish Recipes, Abdul Riaz, Amazon digital Publisher, Edition 1,2001
<b>2.</b>	Fish The Indian Way, Prasenjit Kumar, Edition 1,2005
<b>3.</b>	Fish In Nutrition, Nimish Mol Stephen, S Balasundari,S Felix, Astral, Edition 1, 2018
<b>4.</b>	Fish Indian Style, Atul Kochhar, Bloomsbury Publishing, Edition 1,2016

	<b>Generic 1</b>				<b>Credits 02</b>	
<b>Course code 23BUZO1T05:</b>	<b>Course title - History of Zoology &amp; Footsteps to follow</b>				<b>No of lectures in hrs 30</b>	
<b>COURSE OUTCOME</b>						
Students will be wanted to learn OR on completion of this course, students will be able to learn:						
CO 1	Interpret the Value of history of science.				L2	
CO 2	Recall the efforts made by earlier Scientist to develop today's Science.				L1	
CO 3	List of work of achievements of various leaders and social workers in the field of biological Science.				L1	
CO 4	Recall & encourage their original crude Ideas of various leaders from the field of biological science.				L2	
<b>Grading will be as 3: High(&gt;60%), 2: Moderate(40%-60%), 1: Low(&lt;40%), 0: No mapping</b>						
	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>
<b>CO 1</b>	2	0	0	0	0	0
<b>CO 2</b>	2	0	0	0	0	0
<b>CO 3</b>	2	0	0	0	0	0
<b>CO 4</b>	2	0	0	0	0	0

	<b>Course: Generic – I</b>	
<b>Unit I</b>	<b>History of Zoology &amp; Footsteps to follow</b>	<b>No. of Lectures</b>
<b>I</b>	<p style="text-align: center;"><b>History of Zoology</b></p> <p><b>Introduction to the History of Science</b> Some ancient records of scientific discoveries and inventions</p> <p><b>Historical advances of World Zoology</b> Ancient Zoology Medieval Zoology Modern Zoology</p> <p><b>Notable Scientist of Zoology</b> Aristotle (382 BC – 322 BC) Robert Hooke (1635 – 1703) Carl Linnaeus (1707 – 1778) Charles Darwin (1809 – 1882) Alfred Russell Wallace (1823 – 1931)</p> <p><b>History of Zoology in India</b> Ancient Indian Zoology Veda to Mrig-pakshi Shastra</p> <p><b>Indian Zoologists</b> Varahamihira (505 AD) Ram Brahma Sanyal (1858–1908) Salim Ali (1896–1987) C. R. Narayan Rao (1882 –1960)</p>	<b>15</b>

	Sunder Lal Hora (1896 –1955)	
<b>II</b>	<p style="text-align: center;"><b>Footsteps to follow</b></p> <p><b>Dr. Hargobind Khorana</b> (Genetic code)</p> <p><b>Dr. Varghese Kurian</b> (Amul –White revolution)</p> <p><b>Anna Hazare</b>(Water Conservation-Ralegaon Siddhi)</p> <p><b>Baba Amte</b> (Anandvan)</p> <p><b>Kiran Mazumdar Shaw</b> (Biocon)</p> <p><b>Gadre Fisheries</b> (Surimi)</p> <p><b>Rajendra Singh</b> (Water man of India)</p>	<b>15</b>

<b>REFERENCES</b>	
<b>23BUZO1T05</b>	
1.	"The Unsung Man of Science – Ram Brahma Sanyal" Pandey, Shakunt, Science Reporter. 51 (8): 53–55,2014
2.	Zoo and Aquarium History: Ancient Animal Collections to Zoological, Kisling, V. N. CRC Press. ISBN 0- 8493- 2100-X Google Books, 2001
3.	"The Late Dr. Sunder Lal Hora (1896- 1955): an appreciation, together with a complete list of his scientific writings" Roonwal, M.L.1956
4.	"Sunder Lal Hora" (PDF), Silas, E.G. Copeia (2):134–136. JSTOR 1440452, 1956
5.	Natural history paintings. In Indian painting for the British, Archer Mildred & W.G. Archer, Oxford, Oxford University Press, 1770–1880,pp. 91– 98,1955
6.	Bird study in India: its history and its importance, Ali, S. ICCR, New Delhi,1979

## **Semester - II**

<b>MAJOR COURSE CODE:</b> <b>23BUZO2T01</b>	<b>CREDIT -02</b>	<b>NO OF LECTURES IN HRS. 30</b>				
<b>MINOR COURSE CODE:</b> <b>23BUZO2T03</b>	<b>CREDIT -02</b>	<b>NO OF LECTURES IN HRS. 30</b>				
<b>Population Ecology and Wildlife management</b>						
<b>COURSE OUTCOME</b>						
Students will be wanted to learn OR on completion of this course, students will be able to learn:						
CO 1	Compare the intrinsic & Extrinsic Mechanism in population	L2				
CO 2	Relate different population interaction and human census	L1				
CO 3	Compare different national parks and sanctuaries with its flora and fauna	L2				
CO 4	Relate management strategies of wild animals in India	L1				
<b>Grading will be as 3: High(&gt;60%), 2: Moderate(40%-60%), 1: Low(&lt;40%), 0: No mapping</b>						
	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>
<b>CO 1</b>	0	2	0	0	0	0
<b>CO 2</b>	0	3	0	0	0	0
<b>CO 3</b>	0	0	0	3	0	0
<b>CO 4</b>	0	0	0	0	0	2

<b>MAJOR COURSE CODE:</b> <b>23BUZO2T01</b>	<b>CREDIT -02</b>	<b>NO . OF LECTURES IN HRS. 30</b>
--	-------------------	--

<b>MINOR COURSE CODE</b> <b>:23BUZO2T03</b>	<b>CREDIT -02</b>	<b>NO . OF LECTURES IN HRS. 30</b>
<b>Unit</b>	<b>Description</b>	<b>No. of Hours.</b>
<b>I</b>	<b>Population Ecology</b>  Population dynamics Population density Natality Mortality Fecundity Age structureSex ratio Life tables Survivorship curves	<b>15</b>

	<p>Population dispersal and distribution patterns  Niche concept  <b>Population growth regulation</b>  <b>Intrinsic mechanism:</b>  Density dependent fluctuations and oscillations  <b>Extrinsic mechanism:</b>  Density independent environmental and climatic factors  <b>Population interactions</b>  Population growth pattern  S-shaped or Sigmoid growth form  J – Shaped growth form  <b>Human census (India)</b>  Concept Mechanism Significance</p>	
<p><b>II</b></p>	<p><b>Wildlife management</b>  <b>National parks and sanctuaries</b>  Sanjay Gandhi National Park Tadoba  National Park  Corbett National Park  Kaziranga National Park  Gir National Park  Silent Valley National Park  Pirotan Island Marine Park  Keoladeo Ghana National Park  Bandipur Sanctuary  <b>Wildlife Management strategies in India</b>  Project Tiger Project Rhinoceros  <b>Ecotourism Biopiracy</b></p>	<p><b>15</b></p>

<b>REFERENCES</b>		
<b>23BUZO2T01/23BUZO2T03</b>		
1.	Introduction to Ecology and Wildlife - University Text Book of Zoology, F.Y.B.Sc. Semester II Course 3 2018	
2.	Fundamentals of Ecology, Eugene P. Odum and Grey W. Barrett, Brook Cole/ Cengage learning	
3.	Fundamentals of Ecology, Brook Cole/ Cengage learning, M. C. Dash, McGraw Hill company Ltd, New Delhi	
4.	Field Biology and Ecology, Alen H. Benton and William E. Werner, McGraw Hill company Ltd, New Delhi	
5.	Economic Zoology, Biostatistics and Animal Behaviour, Shukla, Mathur, Upadhyay, Prasad, Rastogi Publications.	
<b>MAJOR COURSE CODE: 23BUZO2T02</b>	<b>(02 CREDITS)</b>	<b>No of lectures in hrs. 30</b>
<b>MINOR COURSE CODE: 23BUZO2T04</b>	<b>(02 CREDITS)</b>	<b>No of lectures in hrs. 30</b>
<b>Nutrition and Public health and hygiene</b>		
<b>COURSE OUTCOME</b>		
Students will be wanted to learn OR on completion of this course, students will be able to learn:		
CO 1	Construct a balanced diet with respect to different age groups.	L3
CO 2	Importance of dietary component to avoid different malnutrition disorders.	L5
CO 3	Importance of health and it's issue.	L5
CO 4	Categories contagious and non-contagious diseases by using WHO guidelines.	L4

<b>Grading will be as 3: High(&gt;60%), 2: Moderate(40%-60%), 1: Low(&lt;40%), 0: No mapping</b>						
	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>
<b>CO 1</b>	2	0	0	0	0	0
<b>CO 2</b>	2	0	0	0	0	0
<b>CO 3</b>	0	0	0	0	0	2
<b>CO 4</b>	0	0	0	0	0	3

<b>MAJOR COURSE CODE:</b> 23BUZO2T02	<b>(02 CREDITS)</b>	<b>No of lectures in hrs. 30</b>
<b>MINOR COURSE CODE:</b> 23BUZO2T04	<b>(02 CREDITS)</b>	<b>No of lectures in hrs. 30</b>
<b>Unit</b>	<b>Description</b>	<b>No. of Hours.</b>
<b>I</b>	<p align="center"><b>Nutrition and health</b></p> <p><b>Concept of balanced diet: Dietary recommendations</b>  Normal adult  Infant  Pregnant woman  Aged</p> <p><b>Malnutrition disorders:</b>  Causes, symptoms, precaution and remedy  Anemia (B12 and Iron deficiency) Rickets  Marasmus  Goiter  Kwashiorkor</p> <p><b>Medical conditions:</b>  causes, symptoms, precaution and remedy Constipation  Piles Starvation  Acidity  Flatulence  Peptic ulcers  Obesity</p> <p><b>Importance of fibers in food</b>  <b>Significance of breast feeding</b>  <b>Swine flu</b>  <b>BMI calculation and its significance</b></p>	<b>15</b>

<b>II</b>	<b>Public health and hygiene</b>	<b>15</b>
	<p><b>Health</b> Factors that influence health Health education Health goal</p> <p><b>Health issues</b> Physical Psychological Social</p> <p><b>WHO and its Programmes in India</b> (Concept and outcome) Polio Small pox Malaria Leprosy</p> <p><b>Ill effects of self-medication</b></p> <p><b>Water</b> Sources Properties Purification of water Small scale Medium scale Large scale</p> <p><b>Water footprint (concept and significance)</b> Hygiene Basic hygiene Hygiene practices</p> <p><b>Radiation risk:</b> Mobile Cell tower</p>	
	<p>Electronic gadgets</p> <p><b>Blood bank</b> Concept and significance</p>	

<b>REFERENCES</b>	
<b>23BUZO2T02/23BUZO2T04</b>	
1.	Common Diseases, Health and Hygiene - University Text Book of Zoology, F.Y.B.Sc. Semester II Course 4, Ramesh Gaonkar, University Press.Mumbai, Edition 3, 2018
2.	Clinical Dietetics and Nutrition, F. P. Antia and Philip, Oxford,University Press,
3.	A Complete Handbook of Nature Cure, Dr. H. K. Bakru,, Jaico Publishing House
4.	Textbook of Medical Parasitology, C. K. Jayaram Paniker, Jaypee Brothers.
5.	Nutrition: Principles and Application in Health Promotion, J. B. Lippincott Company Philadelphia
6.	A Treatise on Hygiene and Public health, B. N. Ghosh, Calcutta Scientific Publishing Company
7.	Are You Healing Yourself Mr. Executive? Dr. R. H.Dastur, IBH Publishing Company
8.	Public Health Nutrition. Edited, Michael J. Gidney, Barrie,M. Margetts, John Kearney and Lenore Arab, Willey Blackwell Publication

<b>MAJOR COURSE CODE: 23BUZO2P01</b>		<b>(02 CREDITS)</b>			<b>No of lecture in Hrs. 60</b>	
<b>Practical based on 23BUZO2T01 and 23BUZO2T02</b>						
<b>MINOR COURSE CODE: 23BUZO2P02</b>		<b>(02 CREDITS)</b>			<b>No of lecture in Hrs. 60</b>	
<b>Practical based on 23BUZO2T03 and 23BU402T04</b>						
<b>COURSE OUTCOME</b>						
Students will be wanted to learn OR on completion of this course, students will be able to learn:						
CO 1	Apply knowledge to understand the population ecology and its dynamics and regulatory factors.					L3
CO 2	List the current status of wildlife conservation in India.					L4
CO 3	Examine the various malnutritional disorders and understand the importance of healthy dietary habits.					L4
CO 4	Identify the major lifestyle diseases and understand the role of diet, exercise and behavioural changes.					L3
<b>Grading will be as 3: High(&gt;60%), 2: Moderate(40%-60%), 1: Low(&lt;40%), 0: No mapping</b>						
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	2	0	0	0	0	0
CO 2	0	0	0	2	0	0
CO 3	2	0	0	0	0	0
CO 4	2	0	0	0	0	0
<b>Practical I</b>						
1	<b>Interpretation of the given graphs/ tables and comment on pattern of population nature:</b> Survivorship curve, Life tables					
2	<b>Interpretation of the given graphs/ tables and comment on pattern of population nature:</b> Fecundity tables Age structure Sex ratio					
3	<b>Calculation of:</b> Natality, Mortality					
4	Estimation of population density by capture recapture method.					
5	<b>Interpretation of growth curves:</b> S-shaped or Sigmoid growth form J shaped growth form					
6	Human census (India)					
7	<b>Endangered species: State reasons for their decline</b> Great Indian Bustard Asiatic lion					

	Blackbuck Olive Ridley sea turtle
8	<b>Critically endangered species: State reasons for their decline</b> Slender-billed vulture Gharial Malabar civet
9	<b>Study of National parks and sanctuaries</b> Sanjay Gandhi National Park Tadoba National Park
10	<b>Study of National parks and sanctuaries</b> Gir National Park Pirotan Island Marine Park
11	<b>Study of National parks and sanctuaries</b> Silent Valley National Park Keoladeo Ghana National Park
12	Prepare a report on Project Tiger.
13	Prepare a report on Project Rhinoceros.
14	Prepare a report on Ecotourism.
15	Prepare a report on Biopiracy.
	<b>Practical II</b>
1	Qualitative estimation of Vitamin C by Iodometric method.
2	Study of microscopic structure of starch granules of different cereals.
3	Estimation of maltose from brown/white bread.
4	Screening of anemic/non-anemic persons.
5	Study of efficacy of antacids.
6	<b>Study of malnutrition disorders.</b> Rickets, Marasmus
7	<b>Study of malnutrition disorders.</b> Goiter, Kwashiorkor
8	<b>Study of blood groups.</b>
9	<b>Study of human diseases.</b> Polio, Small pox
10	<b>Study of human diseases.</b> Malaria, Leprosy
11	<b>Study of lifestyle disease:</b> Obesity
12	Estimation of sugar from two different samples of aerated drinks.
13	BMI analysis - Measurement of Height/ Weight and calculation of BMI using formula.

14	Estimation of hardness from given water sample (tap water v/s well water)
15	Estimation of Free carbon dioxide (Free CO <sub>2</sub> ) from two different samples-aerated drinks(diluted) v/s tap water

<b>MAJOR COURSE CODE:23BU2SEC05</b>		<b>(02 Credits)</b>			<b>No of lecture in Hrs. 15</b>	
<b>Bird Identification</b>						
<b>COURSE OUTCOME</b>						
Students will be wanted to learn OR on completion of this course, students will be able to learn:						
CO 1	Identify birds by their morphological characters.					L5
CO 2	Examine the habit and habitat of birds					L3
CO 3	List the birds according to their habitat.					L1
CO 4	Identify the characters of birds.					L3
<b>Grading will be as 3: High(&gt;60%), 2: Moderate(40%-60%), 1: Low(&lt;40%), 0: No mapping</b>						
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	0	2	0	0	0	0
CO 2	0	0	0	1	0	0
CO 3	0	0	0	2	0	0
CO 4	0	2	0	0	0	0
<b>Unit</b>	<b>Description</b>					<b>No. of Hours</b>
<b>I</b>	1. Habit and habitat study of birds 2. Morphological keys of identification (head, beak, neck, feathers, tail, feet, color) 3. Bird calls /Songs 4. Bird nesting					<b>05</b>
<b>SEC- PRACTICAL</b>						

1	Bird habitat
2	Bird watching
3	Bird Photography
4	Bird Survey
5	Mimicry



<b>Course: Generic – II</b>		
<b>Unit</b>	<b>Topics: Ecosystem and Common human diseases and disorders</b>	<b>No. of Lectures</b>
<b>I</b>	<p align="center"><b>Ecosystem</b></p> <p><b>Introduction to ecology Concepts of ecology</b> Environment Population Community Ecosystem Biosphere Ecosystem</p> <p><b>Types of ecosystems:</b> Aquatic: Freshwater Estuarine Marine Terrestrial: Forest Grassland Desert</p> <p><b>Structure and composition of ecosystem:</b> Abiotic components Biotic components</p> <p><b>Food chain:</b> Detritus food chain Grazing food chain</p> <p><b>Food web:</b> Fresh waterGrass land</p> <p><b>Energy flow through the ecosystem</b></p> <p><b>Ecological pyramids:</b> Number, Biomass, Energy</p> <p><b>Concept of eutrophication in lakes and rivers</b></p>	<b>15</b>

<b>II</b>	<p align="center"><b>Common human diseases and disorders</b></p> <p><b>Stress related disorders:</b> Cause, symptoms, precaution and remedy Hypertension, Diabetes type II ,Anxiety, Insomnia Migraine Depression</p> <p><b>Communicable and non-communicable diseases</b> Tuberculosis, Typhoid, Dengue Hepatitis (A and B), AIDS Gonorrhea, Syphilis</p> <p><b>Diseases of respiratory system:</b> Cause/causative agents, symptoms, diagnostics, precaution /prevention and remedy Asthma, Bronchitis and Oral Cancer</p>	<b>15</b>
-----------	--	-----------

<b>REFERENCES</b>	
<b>23BUZO2T05</b>	
1.	Fundamentals of Ecology, E. P. Odum, Sanders Publication
2.	Fundamentals of Ecology, M. C. Dash, Tata McGraw Hill
3	Common Diseases, Health and Hygiene - University Text Book of Zoology, F.Y.B.Sc. Semester II Course 4, Ramesh Gaonkar, University Press.Mumbai, Edition 3, 2018
4	A Complete Handbook of Nature Cure, Dr. H. K. Bakru,, Jaico Publishing House.

**VPM's B.N. Bandodkar College of Science (Autonomous), Thane**

Curriculum Structure for the Undergraduate Degree Programme F.Y.B.Sc Botany

	<b>SEMESTER – I</b>	<b>Course imparts Employability (EM), Entrepreneurship (EN), Skill Development (SD)</b>			<b>Course integrates with Professional Ethics (PE), Gender Equity (GE), Human Value (HV), Environmental Sustainability (ES)</b>			
<b>Course Code</b>	<b>Major Course Title</b>	<b>EM</b>	<b>EN</b>	<b>SD</b>	<b>PE</b>	<b>GE</b>	<b>HV</b>	<b>ES</b>
<b>23BUZO1T01</b>	Biodiversity and its conservation	--	--	--	--	--	--	√
<b>23BUZO1T02</b>	Animal Biotechnology and instrumentation	√	√	√	√	--	√	--
<b>23BUZO1P01</b>	Zoology Practicals based on 23BUZO1T01 and 23BUZO1T02	√	√	√	√	--	√	√
<b>23BU1SEC05</b>	Fish Dishes (SEC)	√	√	√	√	--	--	--
	<b>Minor Course Title</b>							
<b>23BUZO1T03</b>	Biodiversity and its conservation	--	--	--	--	--	--	√
<b>23BUZO1T04</b>	Animal Biotechnology and instrumentation	√	√	√	√	--	√	--
<b>23BUZO1P02</b>	Zoology Practicals based on 23BUZO1T03 and 23BUZO1T04	√	√	√	√	--	√	√
<b>Course Code</b>	<b>Generic - Course Title</b>							
<b>23BUZO2T05</b>	History of Zoology & Footsteps to follow (GE)	--	--	--	--	--	√	--
	<b>Total</b>	<b>05</b>	<b>05</b>	<b>05</b>	<b>05</b>	<b>00</b>	<b>05</b>	<b>04</b>

	<b>SEMESTER – II</b>	<b>Course imparts Employability (EM), Entrepreneurship (EN), Skill Development (SD)</b>			<b>Course integrates with Professional Ethics (PE), Gender Equity (GE), Human Value (HV), Environmental Sustainability (ES)</b>			
<b>Course Code</b>	<b>Major Course Title</b>	<b>EM</b>	<b>EN</b>	<b>SD</b>	<b>PE</b>	<b>GE</b>	<b>HV</b>	<b>ES</b>
<b>23BUZO2T01</b>	Population Ecology and Wildlife management	--	--	--	--	√	√	√
<b>23BUZO2T02</b>	Nutrition and public health and hygiene	--	--	--	--	--	√	--
<b>23BUZO2P01</b>	Zoology Practicals based on 23BUZO2T01 and 23BUZO2T02	--	--	√	--	√	√	√
<b>23BU2SEC05</b>	Bird Identification (SEC)	√	√	√	√	--	--	√
	<b>Minor Course Title</b>							
<b>23BUZO2T03</b>	Population Ecology and Wildlife management	--	--	--	--	√	√	√
<b>23BUZO2T04</b>	Nutrition and public health and hygiene	--	--	--	--	--	√	--
<b>23BUZO2P02</b>	Zoology Practicals based on 23BUZO2T03 and 23BUZO2T04	--	--	√	--	√	√	√
<b>Course Code</b>	<b>Generic - Course Title</b>							
<b>23BUZO2T05</b>	Ecosystem Common Human Disease and disorders (GE)	--	--	--	--	--	√	√
	<b>Total</b>	<b>01</b>	<b>01</b>	<b>03</b>	<b>01</b>	<b>04</b>	<b>07</b>	<b>06</b>

