



Anekant Education Society's

Tuljaram Chaturchand College
of Arts, Science & Commerce, Baramati
(Autonomous)

Four Year B.Sc. Degree Program in Zoology
(Faculty of Science & Technology)

CBCS Syllabus

F.Y. B.Sc. (Zoology) Semester -I

For Department of Zoology

Tuljaram Chaturchand College of Arts, Science & Commerce, Baramati

Choice Based Credit System Syllabus (2023 Pattern)

(As Per NEP 2020)

To be implemented from Academic Year 2023-2024

(Eligibility : 12th Science)

Title of the Programme: F.Y. B. Sc. (Zoology)**Preamble**

AES's Tuljaram Chaturchand College has made the decision to change the syllabus of across various faculties from June, 2023 by incorporating the guidelines and provisions outlined in the National Education Policy (NEP), 2020. The NEP envisions making education more holistic and effective and to lay emphasis on the integration of general (academic) education, vocational education and experiential learning. The NEP introduces holistic and multidisciplinary education that would help to develop intellectual, scientific, social, physical, emotional, ethical and moral capacities of the students. The NEP 2020 envisages flexible curricular structures and learning based outcome approach for the development of the students. By establishing a nationally accepted and internationally comparable credit structure and courses framework, the NEP 2020 aims to promote educational excellence, facilitate seamless academic mobility, and enhance the global competitiveness of Indian students. It fosters a system where educational achievements can be recognized and valued not only within the country but also in the international arena, expanding opportunities and opening doors for students to pursue their aspirations on a global scale.

In response to the rapid advancements in science and technology and the evolving approaches in various domains of Zoology and related subjects, the Board of Studies in Zoology at Tuljaram Chaturchand College, Baramati - Pune, has developed the curriculum for the first semester of **F. Y. B. Sc. Zoology**, which goes beyond traditional academic boundaries. The syllabus is aligned with the NEP 2020 guidelines to ensure that students receive an education that prepares them for the challenges and opportunities of the 21st century. This syllabus has been designed under the framework of the Choice Based Credit System (CBCS), taking into consideration the guidelines set forth by the National Education Policy (NEP) 2020, LOCF (UGC), NCrF, NHEQF, Prof. R.D. Kulkarni's Report, Government of Maharashtra's General Resolution dated 20th April and 16th May 2023, and the Circular issued by SPPU, Pune on 31st May 2023.

After completion of B.Sc. in Zoology enrolled students will acquire complete disciplinary knowledge as well as allied branches of Zoology. At the end of programme, students may possess expertise which will provide them competitive advantage in pursuing higher studies within India or abroad; and seek jobs in academia, civil administration, research or industries. Students will be able to define and explain major concepts in the

biological sciences. They will be able to correctly use biological instrumentation and proper laboratory techniques; to communicate biological knowledge in oral and written form; to identify the relationship between structure and function at all levels: molecular, cellular, tissue, organ, system and organismal.

Students should be able to identify, classify and differentiate diverse non-chordates and chordates based on their basic morphological, anatomical biochemical and molecular characters. They will also be able to describe economic, ecological and medical significance of various animals in human life. This programme will create a curiosity and awareness among students to explore the animal diversity and take up wild life photography or wild life exploration as a career option. The procedural knowledge about identification and classification of animals will provide students professional advantages in seeking the jobs in fields of teaching, research and taxonomy in various private & public organizations; including Zoological Survey of India and National Parks/Sanctuaries. Students will be able to apply the scientific methods to answer questions in biology by formulating testable hypotheses, gathering data that address these hypotheses, and analyzing those data to assess the degree to which their scientific work supports their hypotheses. Students will be able to present scientific hypotheses and data both orally and in writing in the conventional formats that are in practice. Students will be able to access the primary literature, identify relevant works for a particular topic, and evaluate the scientific content of these works. Acquired practical skills in biotechnology, biostatistics, bioinformatics and molecular biology can be used to pursue career as a scientist in drug development industry in India or abroad. The students will be acquiring basic experimental skills in various techniques in the fields of genetics; molecular biology; biotechnology; entomology, physiology, qualitative and quantitative microscopy; and analytical biochemistry. These methodologies will provide an extra edge to our students, who wish to undertake higher studies. Students will be able to use the evidence of comparative biology to explain how the theory of evolution offers the only scientific explanation for the unity and diversity of life on earth. They will be able to use specific examples to explicate how descent with modification has shaped animal morphology, physiology, life history, and behaviour. Students will be able to explain how organisms function at the level of the gene, genome, cell, tissue, organ and organ-system. Drawing upon this knowledge, they will be able to give specific examples of the physiological adaptations, development, reproduction and behaviour of different animals. Students will be able to analyse the ecological relationships of life on earth by tracing energy and nutrient flows through the ecosystems. They will be able to establish the relationship between the physical

features of the environment and the structure of populations, communities, and ecosystems. Students undertaking skill enhancement courses like aquaculture, sericulture and apiculture will inculcate skills involved in rearing fish, bees and silk moth which would help them to generate self-employment making them successful entrepreneurs. Acquired skills in diagnostic testing, haematology, histopathology, staining procedures etc. used in clinical and research laboratories will make them eligible to work in diagnostic or research laboratories. B.Sc. Zoology graduates will find opportunities in public services departments, NGOs, environmental agencies, universities, colleges, biotechnological, pharmaceutical, environmental / ecological fields. There are numerous career opportunities for candidates completing their B.Sc, M.Sc and Ph.D. in Zoology in public and private sector. Candidates may find jobs as Animal Behaviourist, Conservationist, Wildlife Biologist, Zoo Curator, Wildlife Educator, Zoology teacher, Forensic experts, Lab technicians, Veterinarians, etc.

Overall, revising the Zoology syllabus in accordance with the NEP 2020 ensures that students receive an education that is relevant, comprehensive, and prepares them to navigate the dynamic and interconnected world of today. It equips them with the knowledge, skills, and competencies needed to contribute meaningfully to society and pursue their academic and professional goals in a rapidly changing global landscape.

Programme Specific Outcomes (PSOs)

- PSO1. *Disciplinary Knowledge:*** Understand the basic concepts of various branches of Zoology like Cell Biology, Genetics, Taxonomy, Physiology, Biochemistry, Molecular Biology, Embryology, Developmental Biology, Immunology, Ecology and Applied Zoology.
- PSO2. *Critical thinking and problem solving:*** Analyse the relationships of animals with abiotic factors and different biotic factors like plants and microbes. They will be able to interpret the pathogen based upon symptoms of disease.
- PSO3. *Individual and Teamwork:*** Sets up the experiments and performs the same as per laboratory standards in different fields of Zoology like Taxonomy, Physiology, Ecology, Cell biology, Genetics, Applied Zoology, Clinical science, tools and techniques of Zoology, Toxicology, Entomology, Nematology, Sericulture, Biochemistry, Ichthyology, Animal biotechnology, Immunology, Physiology and research methodology.
- PSO4. *Research related skills and scientific temper:*** Propose hypothesis, formulate tests, use various modern instruments for biological analysis, data collection and field surveys and interpret the data and find answers.
- PSO5. *Critical Thinking:*** Recognizes the relationships between structure and functions at different levels of biological organization (e.g., molecules, cells, organs, organisms, populations, and species) for animals.
- PSO6. *Development of Observation Skills:*** Distinguishes different ecosystems (e.g., terrestrial, freshwater, marine) based on biological, chemical, and physical features; Correlates the morphology, physiology, behaviour with the properties of habitat.
- PSO7. *Ethics and Effective Citizenship:*** Contributes the knowledge for sustainable development and nation building.
- PSO8. *Management Skills:*** Exhibits management skills in applied branches of Zoology like Apiculture, Sericulture, Aquaculture and Agriculture.
- PSO9. *Environmental Ethics and Sustainability:*** Explains the broad understanding of ecosystems, biodiversity and their conservation.
- PSO10. *Identification of critical problems and issues:*** Detect the causes and consequences of biodiversity depletion.

Anekant Education Society's
Tuljaram Chaturchand College
of Arts, Science & Commerce, Baramati
(Autonomous)

Board of Studies (BoS) in Zoology

From 2022-23 to 2024-25

Sr.No.	Name	Designation
1.	Mr. Sandip P. Chordiya	Chairman
2.	Dr. Vitthal B. Nale	Member
3.	Dr. Deepali M. Sangale	Member
4.	Dr. Sunil N. Pokale	Vice-Chancellor Nominee
5.	Dr. Gulab D. Khedkar	Expert from other University
6.	Dr. Sanjay K. Gaikwad	Expert from other University
7.	Dr. Yogesh A. Karpe	Industry Expert
8.	Mr. Kishor U. More	Invitee member
9.	Mr. Mayur S. Shitole	Invitee member
10.	Mr. BipinB. Jagtap	Meritorious Alumni
11.	Ms. Rutuja R. Chavan	Student Representative
12.	Mr. Subodh M. Nikam	Student Representative
13.	Mr. Shubham R. Ghadage	Student Representative
14.	Ms. Tamanna S. Tamboli	Student Representative

Credit Distribution Structure for F.Y.B.Sc.-2023-2024 (Zoology)

Level	Semester	Major		Minor	GE/OE	VSC, SEC (VSEC)	AEC, VEC, IKS	OJT, FP, CEP, CC, RP	Cum. Cr./ Sem.	Degree/ Cum. Cr.
		Mandatory	Electives							
4.5	I	<p>ZOO-101-MJM: Animal Systematics & Diversity-I</p> <p>ZOO-102-MJM: Fundamentals of Cell Biology</p> <p>ZOO-103-MJM: Zoology Practical – I</p> <p>Credits-2+2+2</p>		--	<p>ZOO-116-OE: Fresh Water Fishery (□□□□□□□□□□□□□□□□)</p> <p>ZOO-117-OE: Fresh Water Fishery(Practical) □□□□□□□□□□□□□□□□ (□□□□□□□□□□□□□□□□)</p> <p>Credit- 2+2</p>	<p>ZOO-121-VSC:- Biological Techniques-I</p> <p>ZOO-126-SEC: Medical Laboratory Technology-I</p> <p>Credit- 2+2</p>	<p>ENG-131-AEC: Functional English-I</p> <p>ZOO-135-VEC : Environmental Science</p> <p>ZOO-137-IKS:Animal Diversity & Conservation in Indian Culture</p> <p>Credit- 2+2+2</p>	<p>US--CC1: NSS/NCC/Yoga/ Cultural Activity/Sports</p> <p>Credit- 2</p>	22	UG Certificate 44
	II	<p>ZOO-151-MJM: Animal Systematics & Diversity-II</p> <p>ZOO-152-MJM: Genetics</p> <p>ZOO-153-MJM: Zoology Practical – II</p> <p>Credits-2+2+2</p>		ZOO-161-MN:Apiculture	<p>ZOO-166-OE: Crop pests: Types & management (□□□□□□□□□□□□□□□□□□□□)</p> <p>ZOO-167-OE: Crop pests: Types & management (□□□□□□□□□□□□□□□□□□□□)</p> <p>Credit- 2+2</p>	<p>ZOO-176-SEC: Medical Laboratory Technology -II</p> <p>ZOO-171-VSC: Biological Techniques-I</p> <p>Credit- 2+2</p>	<p>ENG-181-AEC: English – II</p> <p>ZOO-185-VEC: Digital and Technological Solutions</p> <p>Credit- 2+2</p>	<p>US--CC2: NSS/NCC/Yoga/ Cultural Activity/Sports</p> <p>Credit- 2 * 1 Credit = 15hr</p>	22	

	Cum Cr.	12	-	2	8	8	10	4	44	
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Course Structure for F.Y.B.Sc.Zoology(2023 Pattern)

Sem	Course Type	Course Code	Course Name	Theory / Practical	Credits
I	Major Mandatory	ZOO-101-MJM	Animal Systematics & Diversity – I	Theory	02
	Major Mandatory	ZOO-102-MJM	Fundamentals of Cell Biology	Theory	02
	Major Mandatory	ZOO-103-MJM	Zoology Practical – I	Practical	02
	Open Elective (OE)	ZOO-116-OE	Fresh Water Fishery (□□□□□□□□□□□□□□□□□□□□)	Theory	02
	Open Elective (OE)	ZOO-117-OE	Fresh Water Fishery (Practical) □□□□□□□□□□□□□□□□□□□□ (□□□□□□□□□□)	Practical	02
	Vocational Skill Course (VSC)	ZOO-121-VSC	Biological Techniques-I	Theory	02
	Skill Enhancement Course (SEC)	ZOO-126-SEC	Medical Laboratory Technology-I	Practical	02
	Ability Enhancement Course (AEC)	ENG-131-AEC	Functional English-I	Theory	02
	Value Education Course (VEC)	ZOO-135-VEC	Environmental Science	Theory	02
	Indian Knowledge System (IKS)	ZOO-137-IKS	Animal Diversity & Conservation in Indian Culture	Theory	02
	Co-curricular Course (CC)	--	To be selected from the Basket	Theory	02
Total Credits Semester-I					22
II	Major Mandatory	ZOO-151-MJM	Animal Systematics & Diversity – II	Theory	02
	Major Mandatory	ZOO-152-MJM	Genetics	Theory	02
	Major Mandatory	ZOO-153-MJM	Zoology Practical – II	Practical	02
	Minor	ZOO-161-MN	Apiculture	Theory	02
	Open Elective (OE)	ZOO-166-OE	Crop pests: Types & management (□□□□□□□□□□□□□□□□□□□□)	Theory	02
	Open Elective (OE)	ZOO-167-OE	Crop pests: Types & management (Practical) □□□□□□□□□□□□□□□□□□□□ (□□□□□□□□□□)	Practical	02
	Vocational Skill Course (VSC)	ZOO-171-VSC	Biological Techniques-I	Practical	02
	Skill Enhancement Course (SEC)	ZOO-176-SEC	Medical Laboratory Technology -II	Practical	02
	Ability Enhancement Course (AEC)	ENG-181-AEC	Functional English-II	Theory	02
	Value Education Course (VEC)	ZOO-185-VEC	Digital and Technological Solutions	Theory	02
	Co-curricular Course (CC)	--	To be selected from the Basket	Theory	02
Total Credits Semester-II					22

**SYLLABUS (CBCS) FOR F. Y. B. Sc. ZOOLOGY as per NEP 2020
(w. e. f. June, 2023)**

Name of the Program: B.Sc. Zoology

Program Code: USZOO

Class: F.Y. B.Sc.

Semester: I

Course Type: Major (Mandatory) Theory

Course Code: ZOO-101-MJM

Course Name: Animal Systematics & Diversity-I

Number of Credits: 02

Number of Teaching hours: 30

Course Objectives:-

- Principles of systematics.
- Systems of animal classification.
- Basic characteristics of the non-chordates.
- Evolution and development of systems and animals.
- Habitat diversity of animals.
- Morphology and anatomy of non-chordate.
- Economic importance of animals.

Course Outcomes:-

Student will be able to-

CO1: Define principles of systematics

CO2: Classify animals according to different systems of classification.

CO3: Identify non-chordate animals with the help of distinguishing characters.

CO4: Explain evolution and development of animals.

CO5: Identify the habitat diversity and role of animals in ecosystem.

CO6: Explain the body plan / organization of non-chordate animals.

CO7: Explore ethical use of animal abilities for environmental sustainability own economic benefits.

TOPICS:

Unit No.	Subunit No	Details	Teaching Hours
1. Principles of animal classification	1.1	Introduction to invertebrates, Three Domain & Six kingdom classification system	06
	1.2	Importance of animal classification.	
	1.3	Systematics-Linnaean hierarchy (Phylum, Class, Order, Family, Genus and Species)	
	1.4	Taxonomy-Basic terminology and Introduction : Alpha, Beta and Gamma levels of	

		taxonomy, Micro-taxonomy	
2. Classification with salient features (Up to class level with minimum one example of each class)	2.1	Protozoa	06
	2.2	Porifera	
	2.3	Coelenterata (Cnidaria)	
	2.4	Platyhelminthes	
	2.5	Aschelminthes	
	2.6	Annelida	
3. General topics	3.1	Porifera: Skeleton	04
	3.2	Cnidaria: Coral reefs & Its importance	
4. Type study: <i>Pheretimaposthuma</i>	4.1	Systematic position, Habits and habitat	14
	4.2	Morphology & Hydrostatic skeleton	
	4.3	Digestive system	
	4.4	Circulatory system	
	4.5	Excretory system.	
	4.6	Reproductive system	
	4.7	Nervous system and sense organs.	
	4.9	Economic importance	

REFERENCES

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2. Kotpal, R. L. (1970). Protozoa. Rastogi Publications.
3. Kotpal, R. L. (1990). Porifera. Rastogi Publications.
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5. Kotpal, R. L. (1967). Annelida. Rastogi Publications.
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7. Kotpal, R. L. (2003). Zoology phylum 8, Echinodermata.
8. Kotpal, R. L. (2012). Modern text book of Zoology: Invertebrates. Rastogi Publications.
9. Jordan, E. L., & Verma, P. S. (1996). Invertebrate Zoology sixth revised and Enlarged edition. S. Chand and Company, Ltd. 857pp.
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11. Pechenik, J. A. (2010). Biology of the Invertebrates (No. 592 P3).
12. Bhat, J. V., & Khambata, S. R. (1959). Role of earth worms in agriculture. Indian Council of Agricultural Research.

**SYLLABUS (CBCS) FOR F. Y. B. Sc. ZOOLOGY as per NEP 2020
(w. e. f. June, 2023)**

Name of the Program: B.Sc. Zoology

Program Code: USZOO

Class: F.Y. B.Sc.

Semester: I

Course Type: Major (Mandatory) Theory

Course Code: ZOO-102-MJM

Course Name: Fundamentals of Cell Biology

Number of Credits: 02

Number of Teaching hours: 30

Course Objectives:-

- Identification of cell types based on structural peculiarities.
- Comparison of structural properties of the cells.
- Functions of cell organelles.
- Facts & definitions of cytology, mitosis, meiosis, etc.
- Concept of cell division.
- Interpretation of the cell division stages with the help of pictures.
- Construction the models of types of cells, cell organelles, and stages of cell division.

Course Outcomes:-

Student will be able to-

CO1: Identify cell types based on structural peculiarities.

CO2: Compare structural properties of the cells.

CO3: Explain the functions of cell organelles.

CO4: Recall the facts & definitions of cytology, mitosis, meiosis, etc.

CO5: Explain the concept of cell division.

CO6: Interpret the stage of cell division with the help of pictures.

CO7: Create the models of types of cells, cell organelles, and stages of cell division.

TOPICS:

Unit	Subunit No	Content	Teaching Hours
01. Introduction to Cell Biology	1.1	Definition and brief history	02
	1.2	Introduction to cell theory	
02. Study of Prokaryotic cell and Eukaryotic cell	2.1	Comparative study of Prokaryotic cell and Eukaryotic cell	01
	2.2	Comparative study of plant and animal cell	
03. Structure	3.1	Chemical composition	04

and functions of cell membrane	3.2	Fluid mosaic model	
	3.3	Functions of cell membrane	
04. Cytoplasm	4.1	Physical Organization	02
	4.2	Chemical Composition & Biological Properties	
05. Study of cell organelles and their functions	5.1	Endoplasmic reticulum	10
	5.2	Golgi complex	
	5.3	Lysosomes & Peroxisomes	
	5.4	Ribosomes	
	5.5	Mitochondria	
06. Nucleus	6.1	Ultrastructure of nucleus	04
	6.2	Functions of nucleus	
07. Cell cycle	7.1	Cell cycle in brief	07
	7.2	Cell division: 1. Mitosis, 2. Meiosis	
	7.3	Significance of cell division	

REFERENCES

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2. DuPraw, E. J. (1968). Cell and molecular biology (No. QH581 D83).
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7. Gupta, P. K. (2005). Cytology Genetics and Evolution. Rastogi Publications.
8. Johnson, A., Lewis, J., & ALBERTS, B. (2002). Molecular biology of the cell.
9. Lohar, P. S. (2019). Cell and Molecular Biology. MJP Publisher. Chennai

**SYLLABUS (CBCS) FOR F. Y. B. Sc. ZOOLOGY as per NEP 2020
(w. e. f. June, 2023)**

Name of the Program: B.Sc. Zoology

Program Code: USZOO

Class: F.Y. B.Sc.

Semester: I

Course Type: Major (Mandatory) Practical

Course Code: ZOO-103-MJM

Course Name: Zoology Practical-I

Number of Credits: 02

Number of Teaching hours: 60

Course Objectives:-

- Taxonomic classification of invertebrate animals.
- Culturing of animals.
- Preparation of vermiculture unit.
- Use of dissecting instruments.
- Working of microscope.
- Mountings of prokaryotic and eukaryotic cells.
- Demonstration of mitochondria and bar body with suitable experiment.

Course Outcomes:-

Students will be able to-

CO1: Classify the invertebrate animals.

CO2: Culture the animals.

CO3: Apply known procedures to solve the problem of biodegradable waste.

CO4: Acquire the skills in handling and dissecting the earthworm.

CO5: Explain handling, principle and working of microscope.

CO6: Compare the mounting types of cells.

CO7: Plan the experiment for demonstration of mitochondria and bar body.

Sr. No.	Name of the practical	E/D	Teaching Hours
1.	Microscopy: Study of standard operating procedure of a simple and compound microscope.(Activity based)	E	04
2.	Title: Taxonomic classification up to class level 1. Phylum: Protozoa: <i>Paramecium</i> , <i>Euglena</i> 2. Phylum: Porifera: <i>Sycon</i> , <i>Euspongia</i>	D	04
3.	Title: Taxonomic classification up to class level 1. Phylum: Coelenterata: <i>Hydra</i> , Jelly fish 2. Phylum: Platyhelminthes- <i>Taenia</i> , <i>Planaria</i> .	D	04
4.	Title: Taxonomic classification up to class level 1. Phylum: Aschelminthes- <i>Ascaris</i> , <i>Wuchereriabancrofti</i> .(Filarial worm)	D	04

	2. Phylum: Annelida- <i>Nereis</i> , <i>Leech</i> .		
5.	Culturing of freshwater animals (<i>Acanthamoeba</i> / <i>Hydra</i> / <i>Paramecium</i>)	E	04
6.	Preparation of small scale vermiculture bed (Activity based)	E	04
7.	Dissection of earthworm so as to expose its digestive system	E/D	04
8.	Dissection of earthworm so as to expose its nervous system	E/D	04
9.	Make scientific drawings of 5 locally available invertebrate specimens belonging to different phyla	D/E	04
10.	Temporary preparation of a bacterial and protozoans on a slide and its observations under the microscope.	E	04
11.	Ultrastructure study of: a. Mitochondria, b. Nucleus, c. Endoplasmic Reticulum, d. Golgi complex (With Picture/Model/Chart)	D	04
12.	Study of mitotic cell division using onion root tips	E	04
13.	Demonstration of mitochondria using Janus Green B stain	E	04
14.	Demonstration of Barr Body	E	04
15.	Study Tour: Visit to established aquatic ecosystem / functional commercial vermicompost unit and submission of detailed tour report		
E: Experimental, D: Demonstrative			

**SYLLABUS (CBCS) FOR F. Y. B. Sc. ZOOLOGY as per NEP 2020
(w. e. f. June, 2023)**

Name of the Program: B.Sc. Zoology

Program Code: USZOO

Class: F.Y. B.Sc.

Semester: I

Course Type: Open Elective (Theory)

Course Code: ZOO-116-OE

Course Name: Fresh Water Fishery()

Number of Credits: 02

Number of Teaching hours: 30

Course Objectives:-

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Course Outcomes:-

- ()-
- CO1: ().
- CO2: ().
- CO3: ().
- CO4: ().
- CO5: ().
- CO6: ().
- CO7: ().

Topics

Unit	Content	No. of Teaching hours
1	()	02
2	()	02
3	()	05
4	()	06
5	()	03

Name of the Program: B.Sc. Zoology

Program Code: USZOO

Class: F.Y. B.Sc.

Semester: I

Course Type: Open Elective (Practical)

Course Code: ZOO-117-OE

Course Name: Fresh Water Fishery ()

Number of Credits: 02

Number of Teaching hours: 60

Course Objectives:-

-
-
-
-
-
-
-
-

Course Outcomes:-

- CO1:
- CO2:
- CO3:
- CO4:
- CO5:
- CO6:
- CO7:

Topics

Sr. No.	Title of Practical	E/D	Teaching Hours
1		01 D	04
2		02 E	08
3		02 E	08
4		02 E	08
5		02 D	08
6		01 D	04

(w. e. f. June, 2023)

Name of the Program: B.Sc. Zoology**Program Code: USZOO****Class: F.Y. B.Sc.****Semester: I****Course Type: Vocational Skill Courses (Theory)****Course Code: ZOO-121-VSC****Course Name: Biological Techniques-I****Number of Credits: 02****Number of Teaching hours: 30****Course Objectives: -**

- Acquaintance with good laboratory practices.
- Working mechanism of laboratory instruments
- Instrument handling and maintenance.
- Cleaning and sterilization of glass-wares.
- Preparation of solutions.
- Principle and working of pH meter.
- Separation of biomolecules.

Course Outcomes: -

Student will be able to-

CO1: Implement good laboratory practices.

CO2: Demonstrate working mechanism of laboratory instruments.

CO3: Handle the instruments and keep its maintenance.

CO4: Clean and sterilize glass-wares for different experiments.

CO5: Prepare the solutions of different concentrations.

CO6: Measure the pH of different samples with the help of pH meter.

CO7: Separate different biomolecules.

Unit	Subunit No	Content	Teaching Hours
1. Introduction to Good Laboratory Practices	1.1	Introduction to Good Laboratory Practices	04
	1.2	History, Scope	
	1.3	Fundamental points of GLP (Resources Characterization, Rules, Results, Quality assurance)	
2. Laboratory rules and Protocols	2.1	General Rules/Protocols for Lab Safety measures	04
	2.2	Precaution and Safety in handling of chemicals	
	2.3	Laboratory tools, Glassware and instruments.	
3. Laboratory SOP	3.1	Basic SOPs for instrument handling and Maintenance	02
4. Sterilization of	4.1	Cleaning agents for glassware,	04

Laboratory Glassware and Equipment		Methods of sterilization and storage of glassware	
5.Standard system for Measurement	5.1	Units of measurements: SI system, Equivalent weight, normality, molarity	08
	5.2	Mole concept, Determination of molecular weight by gram molecular volume relationship, Calculations and related conversions of Chemical molarity, normality	
	5.3	Volumetric measure: Percent volume; ppb; ppm	
6.Microscopy	6.1	Basic understanding on principle and uses of: Simple microscope Compound microscope	04
7.Analytical technique	7.1	pH meter: principal and working of pH meter	02
8.Separation technique	8.1	Centrifugation: principal and working of Centrifugation	02

REFERENCES

1. Bhaskaran, K.K (1986) Microtechnique and Histochemistry.EvershinePress, Vellangalloor
2. Christopher.F Forster, D.A.JohnWase, (1987) Environmental Biotechnology, Ellis Harwood.
3. Arms, K. (1990)Environmental Science,Saunders College Publishing
4. Cheesbrough, M. 1998. District Laboratory Practice in Tropical Countries. Part I. Cambridge University Press, UK.
5. Cheesbrough, M. 1998. District Laboratory Practice in Tropical Countries. Part II. Cambridge University Press, UK.
6. Cappuccino, J.G. and Sherman, N. (1996) Microbiology a Laboratory Manual. The Benjamin Cummings Publishing Co. Inc., San Francisco.
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SYLLABUS (CBCS) FOR F. Y. B. Sc. ZOOLOGY as per NEP 2020

(w. e. f. June, 2023)

Name of the Program: B.Sc. Zoology**Program Code: USZOO****Class: F.Y. B.Sc.****Semester: I****Course Type: Skill Enhancement Course (Practical)****Course Code: ZOO-126-SEC****Course Name: Medical Laboratory Technology-I****Number of Credits: 02****Number of Teaching hours: 60****Course Objectives:-**

- Identification of glass-wares and instruments.
- Working of instruments.
- Identification of blood cells and blood groups.
- Estimation of hemoglobin.
- Counting of blood cells and its interpretation.
- Preparation of blood smear and measurement of blood pressure.
- Deproteinization of samples.

Course Outcomes:-

Student will be able to-

CO1: Distinguish glass-wares and identify instruments.

CO2: Demonstrate the working of instruments.

CO3: Distinguish blood cells based on morphology and identify blood groups.

CO4: Determine haemoglobin content.

CO5: Count blood cells and interpret obtained data.

CO6: Prepare blood smear and measure blood pressure.

CO7: Deproteinize blood samples.

Sr. No.	Title of the Practical	E/D	Teaching Hours
1.	Study of Microscope and its use.	(D)	04
2.	Glassware and equipments for Haematology	(D)	04
3.	Study of morphology of blood cells	(D)	04
4.	To perform bleeding & Clotting time	(E)	04
5.	Study of Stains used in Haematology	(E)	04
6.	Determination of Blood group	(E)	04
7.	Estimation of Haemoglobin by Sahli's method	(E)	04
8.	To perform Total WBC count by Haemocytometer	(E)	04
9.	To perform Total RBC count	(E)	04
10.	Preparation of blood films	(E)	04
11.	To perform Differential Leukocyte count	(E)	04
12.	Erythrocyte Indices- MCV, MCH and MCHC	(E)	04
13.	Deproteinization of blood sample	(E)	04
14.	To measure blood pressure	(E)	04
15.	Demonstration of ECG	(D)	04
*D- Demonstration; E- Experiment.			

SYLLABUS (CBCS) FOR F. Y. B. Sc. ZOOLOGY as per NEP 2020

(w. e. f. June, 2023)

Name of the Program: B.Sc. Zoology**Program Code: USZOO****Class: F.Y. B.Sc.****Semester: I****Course Type: Indian Knowledge System (Theory)****Course Code: ZOO-137-IKS****Course Name: Animal Diversity & Conservation in Indian Culture****Number of Credits: 02****Number of Teaching hours: 30****Course Objectives:-**

- Basic information on animals in Indian culture.
- Classification of some animals by Indian ascetics.
- Habitat and behavioral diversity of animals in perspective of Indian culture.
- Correlation between Indian culture and animal conservation.
- Role of animals in ecosystem.
- Domestication of animals
- Animal taming in Indian culture.

Course Outcomes:-

Student will be able to-

CO1: Recall facts about animals in Indian culture.

CO2: Classify animals as per Indian tradition.

CO3: Compare habitat and behavioral diversity of animals.

CO4: Analyze role of Indian culture in animal conservation.

CO5: Explain role of animals in ecosystem.

CO6: Predicts correlation between Indian culture and animal domestication.

CO7: Explain the concept of animal taming in Indian culture

TOPICS:

Unit No.	Subunit No	Details	Teaching Hours
1. Sacred Animals of India (Non-chordates)	1.1	Introduction	06
	1.2	Ants & Bees	
	1.3	Praying Mantis	
	1.4	Butterflies	
	1.5	Spider	
2. Sacred Animals of India (Chordates)	2.1	Fish	12
	2.2	Frog	
	2.3	Tortoise & Snakes	
	2.4	Eagle, Peacock, Owl	
	2.5	Cow, Elephant, Horse	
3. Introduction to Animal Classification in Ancient India	3.1	Eagle	12
	3.2	Owl	
	3.3	Crow	
	3.4	Cow	
	3.5	Buffalo	
	3.6	Horse	

REFERENCES

1. Nanditha Krishna, (2010). Sacred Animal of India. Penguin Books India Pvt. Ltd.
2. Krishna N., Amrithalingam M. and Godbole A., (2006). 'Sacred Animals of Maharashtra', Ecological Traditions of Maharashtra, C.P.R. Environment Education Centre, Chennai.
3. Majupuria, T.C., (2000). Sacred Animals of Nepal and India, Gwalior.
4. Ramanujam, Geetha, (2006). Environmental Awareness in Jainism, Department of Jainology, University of Madras, Chennai.
5. Chitampalli M., and Bhatkhande N., (1993). HansadevVirachitMrigaPakshi Shastra, Maharashtra RajyaSahityaAaniSanskriti Mandal, GoM, Mumbai.

Examination Pattern / Evaluation Pattern

Teaching and Evaluation (for Major, Minor, AEC, VEC, IKS courses)

Course Credits	No. of Hours per Semester	No. of Hours per Week	Maximum Marks	CE	ESE
	Theory/Practical	Theory/Practical		40 %	60%
1	15 / 30	1 / 2	25	10	15
2	30 / 60	2 / 4	50	20	30
3	45 / 90	4 / 6	75	30	45
4	60 / 120	4 / 8	100	40	60

Teaching and Evaluation (for VSC, SEC & CC courses)

- Evaluation to be done by Internal & External Experts
- No descriptive end semester written examination
- Evaluation to be done at Department level preferably prior to commencement of Theory /Practical Examinations
- Evaluation to be done on the Skills gained by student