



**SIES**

College of Arts,  
Science &  
Commerce (Autonomous)

**RISE WITH EDUCATION**

NAAC REACCREDITED - 'A' GRADE

*(Affiliated to University of Mumbai)*

**Faculty: Science**

**Program: F.Y.B.Sc**

**Subject: ZOOLOGY**

**Academic Year: 2023 – 2024**

**Revised Syllabus in Zoology under  
Choice Based Credit System (CBCS)  
Approved by the Board of Studies in Zoology  
Effective from academic year 2023-24 under the aegis of  
National Education Policy (NEP)**

### **Preamble**

*“Where the mind is without fear and the head is held high ....”*

— A poem written by Nobel Laureate Rabindranath Tagore (Nobel Prize in Literature in 1913), the poem represents Tagore’s vision of a new and awakened India (it is quoted in this preamble in the context of India’s National Education Policy – New Education Policy).

The implementation of India’s National Education Policy 2020 (NEP) in this academic year, has significant relevance, especially in the context of our institution, since, this year, our institution has been bestowed with ‘Empowered Autonomous Status’. Universal high-quality education is fundamental for achieving full human potential, besides developing an equitable and just society, and promoting national development. It is the best way forward for developing and maximizing our country’s rich talents and resources which eventually will determine the future of our country. Although, under the aegis of academic autonomy, our institution has the privilege of ‘academic freedom’, however, we are also aware of the fact that ‘freedom’ comes with ‘responsibility’ and moreover, it needs to be justified with ‘academic excellence’. Therefore, one of the ways to achieve this, is through restructuring and refining the curriculum, which is pivotal in shaping the educational outcomes of an academic institution. Thus, a modest attempt has been made to design an effective syllabus that will preserve the essence of the subject, besides inculcating critical thinking and developing analytical reasoning amongst the students.

At the undergraduate level this syllabus will enable students to have a sound foundation of the Major subject - Zoology, besides encouraging an interdisciplinary approach by integration and inclusion of a few courses under Vocational Skill Course (VSC), Skill Enhancement Course (SEC), Generic/Open Electives (GE/OE), a course related to Indian Knowledge System (IKS), Ability Enhancement Course (AEC), Value Education Course (VEC), and Co-Curricular Courses (CC). Some of the key features of this revised syllabus are as follows:-

- ✓ **Mandatory/Core Course** – A course which is aimed at understanding the fundamental concepts of Zoology by inclusion of topics such as Life Processes - vital processes that make life possible through an understanding of the adaptations animals have evolved that best suit the milieu in which they thrive; Ecology - to understand the relation between organisms and their environment through the study of “life at home”; Biodiversity - which will sensitize students about the bio wealth nature has bestowed on humans, and to treat the natural resources with humane and responsible attitude in this era of global warming Animal Biotechnology - so as to acknowledge the emerging field of Biotechnology that blends the technological advancements and the natural wealth – the living organisms, for improving human life.
- ✓ **Vocation Skill Course** – A course, which is aimed at providing hands-on training, competencies, proficiency to students to enhance their skills & employability. For example: Bioinstrumentation – to give students a hands-on experience of instrumentation used in laboratory facility which will enable them to operate instruments independently.
- ✓ **Skill Enhancement Course** – A course, which is aimed at imparting practical skills, nurturing soft skills etc., to enhance the employability of students. For example: Animal Systematics – to introduce the students to the diversity of animal life to understand that part of the world around us comprising of various life forms, besides gaining an insight into field biology which will enable them to be equipped with the skills of understanding taxonomy of animal kingdom.
- ✓ **Generic or Open Elective** – An elective course generally chosen from an unrelated subject / discipline with the intention to seek multidisciplinary exposure. For example, any one of the following elective courses such as: Understanding the History of Mumbai (Course offered by Department of History) or Basics of Banking and Finance (Course offered by Department of Economics) or Stress Management (Course offered by Department of Psychology) or Fundamentals of Advertising (Course offered by Department of Commerce).
- ✓ **Indian Knowledge System** – A course which will make students aware of the vast repositories of ancient traditional knowledge in India in fields such as Literature, Culture, Indian traditional systems of medicine, Astronomy, Yoga, Arthashastra, etc.
- ✓ **Ability Enhancement Course** – A course which is aimed at enabling the students to acquire & demonstrate the core linguistic skills, achieve competency in Modern Indian Language (such as Marathi / Hindi among others) and in English Language.
- ✓ **Value Education Course** – A course which is based upon the content that leads to knowledge enhancement through various areas of study such as Understanding India, Constitution of India, Environment studies, Sustainable Development.
- ✓ **Co-Curricular Courses** – A course which will provide student’s a sense of identity & belonging, as well as appreciation of other cultures & identities; For example: courses such as National Cadet Corps (NCC), National Service Scheme (NSS), Yoga education, Health & Wellness, Sports, Cultural activities, courses related to Fine / Applied / Performing Arts etc.

This syllabus is a collective and constructive effort of the faculty, experts from research institutions, alumni and the board members whose valuable suggestions and expertise were instrumental in materializing this syllabus. The comments and recommendations of the contributors and reviewers have been carefully considered and implemented wherever feasible.

For effective teaching-learning, teachers are advised not to follow the syllabus too rigidly, but to exercise their professional discretion and judgement in implementing it. After all teaching is about creating a conducive environment for learners to sustain enthusiasm about the subject. We sincerely hope that all stakeholders from faculty to learners exploring this course will appreciate the importance of a well-designed curricular framework in shaping educational outcomes.

In conclusion, we hope this syllabus will encourage and maximize learning among students to develop open, inquiring minds for holistic development, thereby justifying the essence and spirit of National Education Policy.

Dr. Satish Sarfare

Chairman, Board of Studies in the subject of Zoology

Email: [satishs@sies.edu.in](mailto:satishs@sies.edu.in)

***Members of the Board of Studies in the subject of Zoology and Syllabus Committee***

- ✓ *Professor (Dr.) Manisha Kulkarni – Department of Zoology, Institute of Science, Fort, Mumbai (Vice Chancellor's Nominee)*
- ✓ *Professor (Dr.) Manoj Mahinkar – Principal Investigator, Cancer Research Institute, ACTREC, Kharghar, Navi Mumbai; (Subject expert from outside the Parent University to be nominated by the Academic Council)*
- ✓ *Dr. Sasikumar Menon – Director, Institute for Advanced Training & Research in Interdisciplinary Sciences (IATRIS), (Therapeutic Drug Monitoring Lab), Sion, Mumbai; Faculty, Pharma Analytical Sciences, Ruia College, Mumbai (Subject Expert from outside college/Industry expert)*
- ✓ *Mr. Kedar Gore – Director, The Corbett Foundation (Non-profit Organization), Mumbai, (Subject expert from outside college / Representative from Corporate sector / Allied area)*
- ✓ *Ms. Uma Bandekar – Clinical Team Manager with ICON plc (Postgraduate Meritorious Alumnus)*
- ✓ *Mr. Pushparaj Shetty – Faculty, Department of Zoology, SIES College, Mumbai*
- ✓ *Dr. Rupali Vaity – Faculty, Department of Zoology, SIES College, Mumbai*
- ✓ *Dr. Madhavan Gopalan – Faculty, Department of Zoology, SIES College, Mumbai*
- ✓ *Dr. Aditya Akerkar – Faculty, Department of Zoology, SIES College, Mumbai*
- ✓ *Ms. Shraddha Patil – Faculty, Department of Zoology, SIES College, Mumbai*
- ✓ *Dr. Satish Sarfare – Head and Faculty, Department of Zoology, SIES College, Mumbai*

**F.Y.B.Sc – Zoology – Semester I (Syllabus Grid)**

Course name and code	Unit	Topic Headings	Credits
<b>SEMESTER – I</b>			
<b>Major / Subject</b>			
<b>Mandatory/Core Paper: Life Processes – I, Ecology and Animal Biotechnology – I</b>			
<b>SIUZOCC111</b> Theory	1	Life Processes - I	<b>3</b>
	2	Ecology	
	3	Animal Biotechnology	
Practical	1	Practical's based on Mandatory paper	<b>1</b>
<b>Vocational Skill Course (VSC): Bioinstrumentation (Semester I/II)</b>			
<b>SIUZOVS111</b> Theory	1	Principle, working and application of Microscope, Colorimeter, pH meter, Centrifuge, Electrophoresis and Chromatography	<b>1</b>
Practical	1	Practical's based on Vocational Skill Course	<b>1</b>
<b>Skill Enhancement Course (SEC): Animal Systematics (Semester I/II)</b>			
<b>SIUZOSE111</b> Practical	1	Conceptual understanding of systematics, taxonomy, phylogeny to inculcate and develop skills for practical's based on Skill Enhancement Course	<b>2</b>
<b>Generic or Open Elective (GE or OE) (Semester I/II)</b>			
Theory and Tutorial	1	An elective course generally chosen from an unrelated subject / discipline with the intention to seek multidisciplinary exposure. For example, any one of the following elective courses such as: Understanding the History of Mumbai (Course offered by Department of History) or Basics of Banking and Finance (Course offered by Department of Economics) or Stress Management (Course offered by Department of Psychology) or Fundamentals of Advertising (Course offered by Department of Commerce)	<b>4</b>
<b>Indian Knowledge System (IKS) (Semester I/II)</b>			
Theory	1	Course which will make students aware of the vast repositories of ancient traditional knowledge in India in fields such as Literature, Culture, Indian traditional systems of medicine, Astronomy, Yoga, Arthashastra, etc.	<b>2</b>
<b>Ability Enhancement Course (AEC) (Semester I/II)</b>			
Theory	1	Course which is aimed at enabling the students to acquire & demonstrate the core linguistic skills, achieve competency in Modern Indian Language (such as Marathi / Hindi among others) and in English Language	<b>2</b>
<b>Value Education Course (VEC) (Semester I/II)</b>			
Theory	1	Course which is based upon the content that leads to knowledge enhancement through various areas of study such as Understanding India, Constitution of India, Environment studies, Sustainable Development	<b>2</b>
<b>Co-Curricular Course (CC) (Semester I/II)</b>			
Tutorial / Participation	1	Course which will provide student's a sense of identity & belonging, as well as appreciation of other cultures & identities; Example: courses such as National Cadet Corps (NCC), National Service Scheme (NSS), Yoga education, Health & Wellness, Sports, Cultural activities, Fine/Applied/Visual/Performing Arts	<b>2</b>

**F.Y.B.Sc – Zoology – Semester II (Syllabus Grid)**

Course name and code	Unit	Topic Headings	Credits
<b>SEMESTER – II</b>			
<b>Major / Subject</b>			
<b>Mandatory/Core Paper: Life Processes – II, Biodiversity and Animal Biotechnology – II</b>			
<b>SIUZOCC121</b> Theory	1	Life Processes - II	<b>3</b>
	2	Biodiversity	
	3	Animal Biotechnology	
Practical	1	Practical's based on Mandatory paper	<b>1</b>
<b>Vocational Skill Course (VSC): Bioinstrumentation (Semester I/II)</b>			
<b>SIUZOV511</b> Theory	1	Principle, working and application of Microscope, Colorimeter, pH meter, Centrifuge, Electrophoresis and Chromatography	<b>1</b>
Practical	2	Practical's based on Vocational Skill Course	<b>1</b>
<b>Skill Enhancement Course (SEC): Animal Systematics (Semester I/II)</b>			
<b>SIUZOSE111</b> Practical	1	Conceptual understanding of systematics, taxonomy, phylogeny to inculcate and develop skills for practical's based on Skill Enhancement Course	<b>2</b>
<b>Generic or Open Elective (GE or OE) (Semester I/II)</b>			
Theory and Tutorial	1	An elective course generally chosen from an unrelated subject / discipline with the intention to seek multidisciplinary exposure. For example, any one of the following elective courses such as: An overview of cultural aspects of Maharashtra (Course offered by Department of History) or Credit and Insurance market (Course offered by Department of Economics) or Consumer Psychology (Course offered by Department of Psychology) or Introduction to e-commerce (Course offered by Department of Commerce)	<b>4</b>
<b>Indian Knowledge System (IKS) (Semester I/II)</b>			
Theory	1	Course which will make students aware of the vast repositories of ancient traditional knowledge in India in fields such as Literature, Culture, Indian traditional systems of medicine, Astronomy, Yoga, Arthashastra, etc.	<b>2</b>
<b>Ability Enhancement Course (AEC) (Semester I/II)</b>			
Theory	1	Course which is aimed at enabling the students to acquire & demonstrate the core linguistic skills, achieve competency in Modern Indian Language (such as Marathi / Hindi among others) and in English Language	<b>2</b>
<b>Value Education Course (VEC) (Semester I/II)</b>			
Theory	1	Course which is based upon the content that leads to knowledge enhancement through various areas of study such as Understanding India, Constitution of India, Environment studies, Sustainable Development	<b>2</b>
<b>Co-Curricular Course (CC) (Semester I/II)</b>			
Tutorial / Participation	1	Course which will provide student's a sense of identity & belonging, as well as appreciation of other cultures & identities; Example: courses such as National Cadet Corps (NCC), National Service Scheme (NSS), Yoga education, Health & Wellness, Sports, Cultural activities, Fine/Applied/Visual/Performing Arts	<b>2</b>

**Semester – I**  
**Mandatory/Core Paper (SIUZOCC111)**  
**Life Processes – I, Ecology and Animal Biotechnology - I**

**Learning Objectives**

- To attempt an inquiry into the vital processes that make life possible through an understanding of the adaptations animals have evolved that best suit the milieu in which they thrive.
- To understand the relation between organisms and their environment through Ecology i.e., the study of “life at home”.
- To acknowledge the emerging field of Biotechnology that blends the technological advancements and the natural wealth – the living organisms, for improving human life.

**Expected Outcomes**

- ✓ Students will be equipped knowledge of functionality of life, diversity of animals and manipulating genomes for economic and social wellbeing.
- ✓ Students will be able to apply the knowledge gained for appearing competitive examinations in future.
- ✓ Enhanced knowledge of physiology can be an excellent skill set for students pursuing career in biological sciences.

**Unit 1: Life Processes – I**

**15 Lectures**

**1.1 Movement and Locomotion**

- 1.1.1: Amoeboid movement
- 1.1.2: Ultrastructure of cilia and ciliary movements
- 1.1.3: Action of muscles (Role of muscles in movement)

**1.2 Nutrition**

- 1.2.1: Types of nutrition: Autotrophic and heterotrophic
- 1.2.2: Apparatus for nutrition:
  - a. Food vacuole: Animals without alimentary canal, ex. *Amoeba*
  - b. Animals with incomplete alimentary canal, ex. *Hydra*
  - c. Animals with complete alimentary canal, ex. Bird
- 1.2.3: Physiology of digestion in vertebrates and symbiotic digestion in ruminants

**1.3 Respiration**

- 1.3.1: Types of respiratory surfaces:
  - a. General body surface: Cell membrane, ex. *Amoeba*; Skin - ex. Earthworm and Frog
  - b. Specialized respiratory structures: trachea and spiracles, gills of fish, lungs of frog and human, air sacs of bird
- 1.3.2: External respiration and cellular respiration with reference to human

**1.4 Circulation**

- 1.4.1: Types of circulating fluids: water, coelomic fluid, lymph and blood
- 1.4.2: Types of circulation: Protoplasmic streaming, open and closed circulation, single and double circulation
- 1.4.3: Hearts: Heart in *Daphnia*, cockroach and chordates (one, two, three and four-chambered hearts)
- 1.4.4: Structure of cardiac muscle

**Unit 2: Ecology**

**15 Lectures**

- 2.1:** Concept of Ecosystem
- 2.2:** Concepts of energy flow, food chain and food web
- 2.3:** Biogeochemical cycles
  - 2.3.1: Carbon cycle, oxygen cycle, nitrogen cycle, phosphorus cycle and water cycle
  - 2.3.2: Human activities affecting biogeochemical cycles
- 2.4:** Animal interactions: Symbiosis - mutualism, commensalism, parasitism, predation and antibiosis

## Unit 3: Animal Biotechnology – I

15 Lectures

### 3.1 Biotechnology and Gene therapy

- 3.1.1: Recombinant DNA technology in production of insulin, alpha-1-antitrypsin, tissue plasminogen activator (tPA) and Human growth hormone (hGH).
- 3.1.2 : Gene therapy: *Ex vivo* and *In vitro* approach; Gene therapy for Severe Combined Immunodeficiency (SCID) and Cystic fibrosis
- 3.1.3: Ethical issues with reference to gene therapy

### 3.2 Transgenic Animals and Animal Cloning

- 3.2.1: Transgenic animals
- 3.2.2: DNA Micro injection, Retro-viral method of gene transfer
- 3.2.3: Nuclear transfer technology
- 3.2.4: Animal cloning experiments for “Dolly”

## Semester – I

### Practical's based on Mandatory/Core paper

1. Study of *Paramecium* culture to observe cyclosis, food vacuole, contractile vacuole and ciliary movement and irritability in *Paramecium* by demonstration of release of trichocysts
2. Study of effect of pH and temperature on the activity of enzyme amylase/ trypsin
3. Rate of oxygen consumption by cockroach (demonstration only)
4. Determination of rate of heartbeat in *Daphnia*
5. Study of Animal interactions: -
  - a. Mutualism: Termite and *Trichonympha*
  - b. Antibiosis: Effect of antibiotics on bacterial growth in a petriplate
  - c. Parasitism: 1. Ectoparasite – Head louse and bed bug; 2. Endoparasite – *Trichinella spiralis*
  - d. Predation: Praying mantis and spider
6. Qualitative tests for Carbohydrates proteins and Lipids

## Semester – II

### Mandatory/Core Paper (SIUZOCC121)

### Life Processes - II, Biodiversity and Animal Biotechnology – II

#### Learning Objectives

- To attempt an inquiry into the vital processes that make life possible through an understanding of the adaptations animals have evolved that best suit the milieu in which they thrive.
- To acknowledge the importance of the natural treasure – the biodiversity around us, and to be judicious in the utilization of this natural economy.
- To acknowledge the emerging field of Biotechnology that blends the technological advancements and the natural wealth – the living organisms, for improving human life.

#### Expected Outcomes

- ✓ Students will be equipped knowledge of functionality of life, diversity of animals and manipulating genomes for economic and social wellbeing.
- ✓ Students will be able to apply the knowledge gained for appearing competitive examinations in future.
- ✓ Enhanced knowledge of physiology can be an excellent skill set for students pursuing career in biological science.

## Unit 1: Life Processes – II

15 Lectures

### 1.1 Excretion and Osmoregulation

- 1.1.1: Concepts of excretion and osmoregulation
- 1.1.2: Categorization of animals on the basis of principal nitrogenous excretory products
- 1.1.3: Ornithine cycle, formation of urea; deamination and detoxification

### 1.2 Control and Coordination

- 1.2.1: Irritability
- 1.2.2: Structure of neuron; sense organs – human eye and ear
- 1.2.3: Conduction of nerve impulse: Resting potential, action potential and refractory period: Synaptic transmission
- 1.2.4: Endocrine regulation: Hormones as chemical messengers; feedback mechanisms

### 1.3 Reproduction

- 1.3.1: Gametogenesis; structure of egg and sperm of mammal
- 2.3.2: Fertilization in animals; *In vitro* fertilization
- 1.3.3: Oviparity, viviparity and ovoviviparity

## Unit 2: Biodiversity and its Conservation

15 Lectures

- 2.1: Introduction to Biodiversity - Definition, Concepts, Scope and Significance
- 2.2: Levels of Biodiversity - Introduction to Genetic, Species and Ecosystem Biodiversity
- 2.3: Introduction of Biodiversity Hotspots- (Western Ghats and IndoBurma Border)
- 2.4: Values of biodiversity - Direct and Indirect use value
- 2.5: Threats to Biodiversity - Habitat loss and Man-Wildlife conflict
- 2.6: Biodiversity conservation and management
  - 2.6.1: Conservation strategies: in situ, ex-situ, National parks, Sanctuaries and Biosphere reserves.
  - 2.6.2: Introduction to International efforts: International Union for Conservation of Nature and Natural Resources (IUCN).
  - 2.6.3: Introduction to National conservation efforts: Project Tiger, Project Rhinoceros (IVR2020)
  - 2.6.4: Introduction to Indian Wildlife (Protection) Act, 1972

## Unit 3: Animal Biotechnology – II

15 Lectures

### 3.1 Food Biotechnology

- 3.1.1: Applications of biotechnology in making bread, beer, wine, yogurt and cheese

### 3.2 Enzyme Technology

- 3.2.1: Enzymes as meat tenderizers
- 3.2.2: Biodetergents
- 3.2.3: Concept of enzyme immobilization

### 3.3 Environmental Biotechnology

- 3.3.1: Bioremediation: Concepts and applications
- 3.3.2: *Ex situ* and *In situ* Bioremediation
- 3.3.3: Case studies related to Bioremediation



**Semester – II**  
**Practical's based on Mandatory/Core paper**

1. Mounting of septal nephridium of earthworm (from preserved specimen)
2. Urine analysis for detection of normal and abnormal constituents; Detection of uric acid from excreta of bird or cockroach
3. Extraction and qualitative detection of nucleic acids: DNA (SDS-NaCl extraction) and RNA (Phenol extraction)
4. Study of bacteria using Gram stain
5. To evaluate the quality of milk by Methylene Blue Reduction Test (MBRT)
6. Preparation and assay of immobilization of enzyme amylase/ yeast cells in beads of calcium alginate (visual observation for comparing the colour intensity in test tubes)
7. To demonstrate fermentation of grape juice/ sugar cane juice or any fruit juice (Detection of alcohol generated during fermentation by benzoic acid)
8. Effect of Papain (raw papaya extract) as a meat tenderizer

**Semester I / II – Vocational Skill Course (VSC) (SIUZOVS111)**  
**Bioinstrumentation**

***Learning Objectives***

- To give students a hands-on experience of instrumentation used in laboratory facility.
- To expose students to concept in biological sciences by experiment-based learning.

***Expected Outcomes***

- ✓ Students will be able to operate instruments in laboratory facility independently.
- ✓ Students will be equipped with principle and working of instruments used in laboratory.
- ✓ Students will be gaining analytical skills based on experimental learning.

**Unit 1: Bioinstrumentation**

**15 Lectures**

- 1.1 Principle, working and application of Microscope: Simple and Compound
- 1.2 Principle, working and application of Centrifuge: High speed Centrifuge
- 1.3 Principle, working and application of Colorimeter, pH meter
- 1.4 Principle, working and application of Electrophoresis: Agarose Gel Electrophoresis (AGE) and Poly Acrylamide Gel Electrophoresis (PAGE)
- 1.5 Principle, working and application of Chromatography: Paper and Thin Layer Chromatography (TLC)

**Practical's Based on Bioinstrumentation - Vocational Skill Course (VSC)**

1. Introduction to basic laboratory safety: safety rules, safety symbols and precautions; safety practices with respect to accidents which may occur while working in a laboratory (chemical spillage, burns, etc.); principle, working and use of fire extinguishers.
2. Handling of common laboratory equipment's/ instruments: Burner, microscope, centrifuge, colorimeter, balance, homogenizer; Handling of glassware
3. Separation of amino acids by ascending paper chromatography
4. Thin layer chromatography of lipids using silica gel coated aluminium-backed TLC sheets and silica gel coated glass plates
5. Adsorption chromatography using chalk to separate plant pigments or other pigments/ dyes (Food colours)
6. Demonstrate agarose gel electrophoresis for the separation of egg white proteins and compare with a protein ladder or standard protein sample

**Semester I / II – Skill Enhancement Course (SEC) (SIUZOSE111)**  
**Animal Systematics**

**Learning Objectives**

- To do an introductory survey of the diversity of animal life to understand that part of the world around us comprising of various life forms. Also, to gain an insight into field biology.

**Expected Outcomes**

- ✓ Students will be equipped with the skill of understanding taxonomy of animal kingdom.
- ✓ Students will be able to gain and apply the practical knowledge in field studies in future.
- ✓ Enhanced knowledge of classification can be an excellent skillset for students pursuing career in field biology.

**Practical's based on Animal systematics - I**

1. Levels of Organization in Animal Kingdom
  - a. Symmetry:
    1. Asymmetric organization: *Amoeba*
    2. Radial symmetry: Sea anemone, *Aurelia*
    3. Bilateral symmetry: *Planaria*/ liver fluke
  - b. Coelom condition:
    1. Acoelomate: T.S. of *Planaria*/ liver fluke
    2. Pseudocoelomate: T.S. of *Ascaris*
    3. Coelomate: T.S. of earthworm
  - c. Metamerism: Ametamerism, Psuedometamerism and Eumetamerism
  - d. Specialization of body parts for division of labour: Insect – Head, thorax and abdomen
  - e. Cephalization:
    1. Cockroach – Head
    2. Prawn/ crab – Cephalothorax
2. Animal Diversity
  - a. Phylum Protozoa: *Amoeba*, *Paramoecium*, *Euglena*, *Plasmodium*
  - b. Phylum Porifera: *Leucosolenia*, Bath sponge
  - c. Phylum Cnidaria / Coelenterata: *Hydra*, *Obelia colony*, *Aurelia*, Sea anemone, any one coral
  - d. Phylum Platyhelminthes: *Planaria*, liver fluke and tapeworm
  - e. Phylum Nematelminthes: *Ascaris* (male and female)
  - f. Phylum Annelida: *Nereis*, earthworm and leech
  - g. Phylum Arthropoda: Crab, lobster, *Lepisma*, beetle, dragonfly, butterfly, moth, spider, centipede, millipede
  - h. Phylum Mollusca: *Chiton*, *Dentalium*, *Pila*, bivalve, *Sepia* and *Nautilus*
  - i. Phylum Echinodermata: Starfish, brittle star, sea urchin, sea cucumber, feather star
3. Field visit to Zoo / Aquarium / Museum / Natural habitats

**Practical's based on Animal systematics - II**

1. Animal Diversity
  - a. Phylum Hemichordata: *Balanoglossus*
  - b. Subphylum Urochordata: *Herdmania*
  - c. Subphylum Cephalochordata: *Amphioxus*
  - d. Division Agnatha: Class Cyclostomata: *Petromyzon*/ *Myxine*
  - e. Class Pisces: Subclass Chondrichthyes: Shark, skates, sting ray/ electric ray Subclass Osteichthyes: *Sciaena*, flying fish

- f. Class Amphibia: Frog, toad, caecilian, salamander
  - g. Class Reptilia: Chameleon, *Calotes*, turtle/ tortoise, snake, alligator/ crocodile
  - h. Class Aves: Kite, kingfisher, duck
  - i. Class Mammalia: Shrew, hedgehog, guinea pig, bat
2. Study of wheel organ of *Amphioxus*, scroll valve of shark, digestive system of pigeon, ruminant stomach
  3. Observation of sagittal section of mammalian kidney, Bowman's capsule (under high power)
  4. Observation of hen's egg with developing embryo at any stage of development
  5. Study of mammalian brain (entire and sagittal section with the help of specimen/ model); observation of T.S. of mammalian spinal cord.
  6. Geographical Mapping of National Parks and Sanctuaries
  7. Field visit to Zoo / Aquarium / Museum / Natural habitats

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  - The Cell, Alberts, Panima Publications
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- Additional reading:**
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- Documentaries:**
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  - ✓ Life on our Planet; A Perfect Planet – Sir David Attenborough

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