

"Jai Sri Gurudev"

Sri Adichunchanagiri - first Grade College

Channarayapatna 573116

Circular



Date 23/10/2023

Department of Zoology

As per the practical syllabus of V Semester NE on 26.10.2023, students of V Semester and faculties of Zoology visited to Bhadra wild life Sanctuary and near by places.

Students benefitted with the knowledge of "Environment Biology" aspects such as wild flora and fauna. Natural creatures including Monkeys, bears, tigers, bison & Spotted deer, Langur, Macca Monkeys, Bhadra Dam, bamboo forests, landscaped garden, Set against the Mullayangiri Mountain range - Kallathigiri falls, water falls etc.

Dr. Nirupama M.  
Prof. Sridhar  
Radhamma Kim

H.O.D. of Zoology  
S. A. F. G. College  
Channarayapatna-573116

Inform to V<sup>th</sup> Semester Students

|| JAI SRI GURUDEV ||

# Sri Adichunchanagiri First Grade College

Channarayapatna-573116

Department of Zoology

Date: 26.10.2023

## Report on field tour to Bhadra Wildlife Sanctuary and nearby places

The Department of Zoology arranged a trip with the permission of Principal Dr. Manjunath M. K. and HOD of Zoology Dr. Nirupama M. to visit Bhadra Wildlife Sanctuary and nearby places in Chikkamangalore along with all of the V semester students and faculties on October 26, 2023, in accordance with the syllabus pattern of the 5th semester NEP scheme BSC (Zoology), to visit any National park/Wildlife Sanctuary.

We took a bus to Mahathma Gandhi Park at 7:30 am after leaving our college at approximately 4:00 am, where we saw a variety of plant species and bamboo forests. M G Park, also known as Mahatma Gandhi Park, is a gorgeously landscaped garden set against the Mullayangiri mountain range. We visited Kalhatti Falls, which is surrounded by a wealth of lush flora, after breakfast. Along the path to the hills, we notice a variety of cardamom trees here as well as a wide selection of tropical trees, bushes, and vines. When it comes to fauna, the area is also home to a variety of natural creatures, including monkeys, bears, tigers, bison, and spotted deer. There, we saw Langur and Macca monkeys. After that, we visited Bhadra Dam, which is famous for the natural beauty of the surrounding area. Nestled amidst lush greenery, Bhadra Dam gives us a restorative experience.

We arrived at Bhadra Wildlife Sanctuary around 1:30 pm. A protected region and tiger reserve as part of Project Tiger, Bhadra Wildlife Sanctuary is located in the Chikkamagaluru district, northwest of Chikkamagaluru, 38 km from

  
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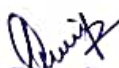
Tarikere town and 23 km south of Bhadravathi city. The Bhadra Wildlife Sanctuary's vegetation is incredibly diverse. The majority of the forest is mixed dry deciduous woodland. This forest essentially has an endless supply of green, with over 120 different varieties of trees. The sanctuary's diverse tree species, including teak, rosewood, dry bamboo, etc., are home to the distinctly unusual animals. Every form of life, from fascinating birds of every color to the dung beetle, finds refuge under the towering trees! This refuge has attracted a variety of exotic creatures, including panthers, tigers, leopards, porcupines, sloth bears, and wild boars.

After lunch we went for jeep safari. The forest department organized jeep safaris inside the Bhadra Tiger Reserve around 3:30 PM. Bhadra Wildlife Sanctuary is home to around 30 tigers and 20 leopards and there is a good chance of seeing tigers and leopards on a forest safari in Bhadra. We saw bison, rhesus macaques, peacocks, elephants, bears, spotted deer, sambar deer and various bird species in the natural habitat.

Students saw a variety of taxonomical characteristics in the flora and wildlife on our one-day excursion, and by ten o'clock at night, we arrived at the college campus safely.

#### Teachers visited to trip with students

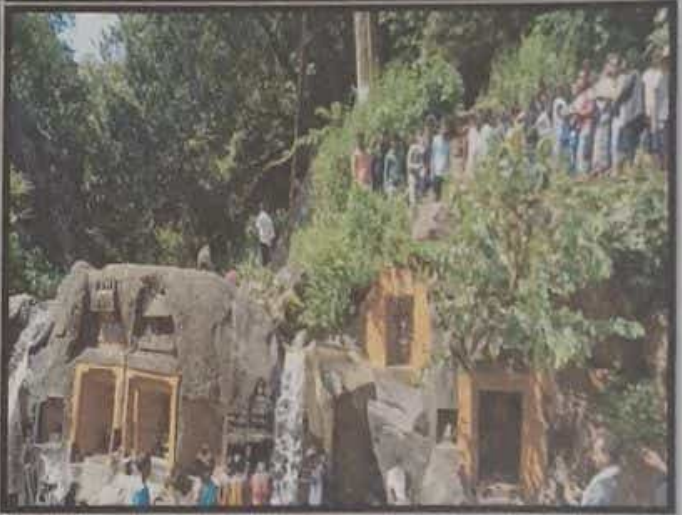
1. Dr. Nirupama M, HOD & Assistant Professor in Zoology.
2. Mrs. Radhamma K M, Assistant Professor in Zoology.
3. Mr. Shridhar A N. Assistant Professor in Commerce

  
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**Field tour to Bhadra Wildlife Sanctuary and nearby places, Date: 26.10.2023**



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**Field tour to Bhadra Wildlife Sanctuary and nearby places, Date: 26.10.2023**



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Field tour to Bhadra Wildlife Sanctuary and nearby places



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# Field Visit to Bhadra Reserve Forest

Date: / /



Sl. No.	Names	Semester	Signature	Feed back
1	Sushmitha.K.P	VI <sup>th</sup> Bsc [BZ]	Sushmitha.K.P.	V. good
2	Yogitha .P	VI <sup>th</sup> Bsc [BZ]	Yogitha .P	Good
3	Sindhuvare .S	VI <sup>th</sup> Bsc [BZ]	Sindhu	Good
4	Amrutha .H.S	VI <sup>th</sup> Bsc [BZ]	Amrutha	V. Good
5	Rohmitha.k.P	VI <sup>th</sup> Bsc [BZ]	Rashu	Good
6	Ramya .H.P	VI <sup>th</sup> Bsc [BZ]	Ram.	V. Good
7	Shubha .S.H	VI <sup>th</sup> Bsc [BZ]	Shu.	V. Good
8	Niranga'D	VI <sup>th</sup> Bsc [BZ]	Nu.	Super
9	Sona B.N	VI <sup>th</sup> Bsc (CZ)	Sona B.N	Good
10	Suchithra.k.R	VI Bsc (CZ)	Shi	Satisfactory
11	nischitha.B.S	VI Bsc (CZ)	nischitha	Good
12	Bindu.k	VI Bsc (CZ)	Bindu.k	Good
13	Sanjay B	VI Bsc (BZ)	Sanjay B	Not Bad
14	Rudra Gopada K.R	VI Bsc (CZ)	Rudra Gopada	It's Good.
15	SUMAS.S.L	VI Bsc (CZ)	S.M.	Enthusiastic
16	Komal.G.K	VI Bsc (CZ)	Komal.G.K	Good
17	Krutik Kumar	VI Bsc (CZ)	Krutik	Good
18	Abhilasha.cm	VI Bsc [CZ]	Abhilasha.cm	Not Bad
19	Shambhavi .S	VI B.sc [CZ]	Shambhavi	It's Good
20	Jayalokmi A.C	VI Bsc (CZ)	J.	Good.
21	Sahaswathi.C.N	VI Bsc (CZ)	S.	Good.
22	Swathi - M.M	VI Bsc (CZ)	Swathi	Good.
23	Niranga.M.R	VI Bsc (CZ)	Niranga	Good
24	Spandana.K.K	VI Bsc [CZ]	Spandana K.K	Good.
25	Ranjitha.C.N	VI Bsc (CZ)	Ranjitha	Good.
26	Pooja.H.K	VI Bsc [CZ]	Pooja	Good.
27	Keerthana H.S	VI Bsc [CZ]	Keerthanahs	Good.

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**Model Curriculum**

Program Name	<b>B.Sc.</b>	V Semester	
Course Title	<b>Non-Chordates and Economic Zoology (Theory)</b>		
Course Code:	<b>ZOO C-9</b>	No. of Credits	<b>4</b>
Contact hours	<b>60 Hours(4 hrs/week)</b>	Duration of SEA/Exam	<b>2 hours</b>
Formative Assessment Marks	<b>40</b>	Summative Assessment Marks	<b>60</b>

**Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)**

Course Outcomes (COs) / (POs)	ZOO C9T	ZOO C10P	ZOO C11T	ZOO C12P	ZOO C13T	ZOO C14P	ZOO C15T	ZOO C16P	ZOO C17T	ZOO C18P
I Core competency	X									
II Critical thinking	X									
III Analytical reasoning	X									
IV Research skills	X									
V Team work	X									

**Course Pre-requisite(s):**

**Course Outcomes (COs):** After the successful completion of the course, the student will be able to:

- CO1. Group animals on the basis of their morphological characteristics/ structures.
- CO2. Demonstrate comprehensive identification abilities of Non-Chordate diversity.
- CO3. Explain structural and functional diversity of Non-Chordates
- CO4. Develop understanding on the diversity of life with regard to protists, non-chordates and chordates.
- CO 5. Examine the diversity and evolutionary history of a taxon through the construction of a basic phylogenetic/ cladistics tree.



Contents	60 Hrs
<b>Unit-I</b>	<b>15</b>
<b>1. Protozoa to Coelenterate</b> <ul style="list-style-type: none"> <li>• Protozoa-<i>Paramecium</i> (Morphology and Reproduction)</li> <li>• Porifera-<i>Sycon</i> (Canal System)</li> <li>• Coelenterata – <i>Obelia</i> (Morphology and Reproduction)</li> </ul>	
<b>1. Ctenophora to Nematheiminthes</b> <ul style="list-style-type: none"> <li>• Ctenophora – Salient feature</li> <li>• Platyhelminthes- <i>Taenia</i> (Tape worm) (Morphology and Reproduction)</li> <li>• Nematelminthes-<i>Ascarislumbricoides</i> (Morphology and Reproduction)</li> </ul>	
<b>Unit-II</b>	<b>15</b>
<b>3. Annelida</b> <ul style="list-style-type: none"> <li>• Annelida – <i>Hirudinaria</i> (Leech) (Morphology and Reproduction)</li> </ul>	
<b>4. Arthropoda</b> <ul style="list-style-type: none"> <li>• Arthropoda – <i>Palaemon</i> (Prawn) Morphology, Appendages, Nervous System and Reproduction)</li> </ul>	
<b>Unit-III</b>	<b>15</b>
<b>6. Mollusca to Hemichordata</b> <ul style="list-style-type: none"> <li>• Mollusca – <i>Pila</i> (Morphology, Shell, Respiration, Nervous System and Reproduction)</li> <li>• Echinodermata – <i>Pentoceros</i> (Morphology and Water Vascular System)</li> </ul>	
<b>Unit-IV</b>	<b>15</b>
<b>7. Economic Zoology : Vectors and Pests</b> <ul style="list-style-type: none"> <li>• Life cycle and their control of following pests: Gundhi</li> <li>• Bug. Sugarcane leafhopper, Rodents. Termites and Mosquitoes and their control</li> </ul>	
<b>8. Economic Zoology: Lac-culture, Vermiculture and Poultry</b>	

<b>Formative Assessment for Theory</b>	
Assessment Occasion/ type	Marks
Attendance	10
House Examination/Test	10
Written Assessment/Presentation/Project/Term Papers/Seminars	10
Class room Performance/Participation	10
<b>Total</b>	<b>40 Marks</b>
<i>Formative Assessment as per guidelines are compulsory</i>	

Course Title	<b>Non-Chordates and Economic Zoology (Practical)</b>	Practical Credits	<b>2</b>
Course Code	<b>ZOO C10-P</b>	Contact Hours	<b>4 hrs/week</b>
Formative Assessment	<b>25 Marks</b>	Summative Assessment	<b>25 Marks</b>

**Course Outcomes (COs):**

At the end of the course the student should be able to:

1. Understand basics of classification of non-chordates.
2. Learn the diversity of habit and habitat of these species.
3. Develop the skills to identify different classes and species of animals.
4. Know uniqueness of a particular animal and its importance
5. Enhancement of basic laboratory skill like keen observation and drawing.

**Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)**

Course Outcomes (COs)/(POs)	ZOO C9T	ZOO C10P	ZOO C11T	ZOO C12 P	ZOO C13T	ZOO C14P	ZOO C15T	ZOO C16P	ZOO C17T	ZOO C18P
I Core competency		X								
II Critical thinking		X								
III Analytical reasoning		X								
IV Research skills		X								
V Team work		X								



## Practical Content

1. Preparation and observation of protozoan culture.
2. **Protozoa:** Systematics of *Amoeba*, *Euglena*, *Noctiluca*, *Paramecium* and *Vorticella* (Permanent slides).
3. **Porifera:** Systematics of *Sycon*, *Euplectella*, *Hyalonema*, *Spongilla* and *Euspongia* (Specimens). Study of permanent slides of T.S of *Sycon*, spicules and gemmules.
4. **Cnidaria:** Systematics of *Aurelia* and *Metridium* (Specimens). Slides of *Hydra*, *Obelia*-polyp and medusa, and *Ephyra* larva, T.S. of *Metridium* passing through mesenteries.
5. **Study of Corals-***Astraea*, *Fungia*, *Meandrina*, *Corallium*, *Gorgonia*, *Millepora* and *Pennatula*.
6. **Helminthes:** Systematics of *Planaria*, *Fasciola hepatica* and *Taenia solium*, *Ascaris*- Male and female (Specimens). Slides of T.S. of *Planaria*, T.S of male and female *Ascaris*.
7. **Annelida:** Systematics of *Nereis*, *Heteronereis*, *Sabella*, *Aphrodite* (Specimens). Slide of T.S. of Earth worm through typhlosole.
8. **Arthropoda:** Systematics of *Panaeus*, *Palaemon*, *Astracus*, Scorpion, Spider, *Limulus*, *Peripatus*, *Millipede*, *Centipede*, Praying mantis, Termite Queen, Moth, Butterfly, Dung beetle/Rhinoceros beetle (Any six specimens). Slide of Larvae- Nauplius, Zoea, Mysis.
9. **Mollusca:** Systematics of *Chiton*, *Mytilus*, *Aplysia*, *Pila*, *Octopus*, *Sepia* (Specimens) and Glochidium larva (Slide).
10. **Shell Pattern-***Unio*, *Ostrea*, *Cypria*, *Murex*, *Nautilus*, *Patella*, *Dentalium*, Cuttle bone.
11. **Echinodermata:** Systematics of Sea star, Brittle star, Sea Urchin, Sea cucumber, Sea lilly (Specimens). Slides of Bipinnaria larva, Echinopluteus larva and Pedicellaria.
12. **Harmful Nonchordates:** Soil Nematodes. Agricultural, veterinary and human pests of Arachnida and Arthropoda.
13. **Beneficial Nonchordates:**
  - **Sericulture:** Life cycle of *Bombyx mori*, Uzi fly, Cocoon, Raw silk.
  - **Apiculture:** Any 2 Species of honey bee and bee wax.
  - **Pearl Culture:** Pearl Oyster and Natural Pearls.
14. **Virtual Dissection/Cultured specimens:** Earthworm – Nervous system, Leech- Digestive System
15. **Virtual Dissection/Cultured specimens:** Prawn - Nervous system.  
Cockroach- Salivary Apparatus and Digestive system.

**Pedagogy:** Lectures, Presentations, Videos, Assignments and Weekly Formative Assessment Tests

<b>Formative Assessment for Practical</b>	
<b>Assessment Occasion/ type</b>	<b>Marks</b>
Attendane	05
House Examination/Test	10
Written Assessment/Presentation/Project/Term Papers/Seminars	05
Class room Performance/Participation	05
<b>Total</b>	<b>25 Marks</b>
<i>Formative Assessment as per guidelines are compulsory</i>	

<b>References</b>	
1	Barnes, R.S.K.; Calow,P.; Olive,P.J.W.; Golding,D.W.; Spicer, J.I.(2002) The Invertebrates: Synthesis, Blackwell Publishing.
2	Hickman,C.; Roberts,L.S.; Keen,S.L.; Larson, A. and Eisenhour, D. (2018) Animal Diversity, McGraw-Hill.
3	Holland, P.(2011) The Animal Kingdom: A Very Short Introduction, Oxford University Press.
4	Kardong, K.V.(2006) Vertebrates: Comparative Anatomy, Function, Evolution (4thedition), McGraw-Hill.
5	Barrington, E.J.W. (1979) Invertebrate Structure and Functions. II Edition. E.L.B.S. and Nelson.
6	Boradale, L.A. and Potts, E.A. (1961) Invertebrates: A Manual for the use of Students. Asia Publishing Home.
7	Bushbaum, R.(1964) Animals without Backbones. University of Chicago Press.



Government of Karnataka



**Model Curriculum**

Program Name	B.Sc.	Semester	V
Course Title	<b>Chordates and Comparative Anatomy (Theory)</b>		
Course Code:	ZOO C-11-T	No. of Credits	4
Contact hours	60 Hours(4 hrs/week)	Duration of SEA/Exam	2 hours
Formative Assessment Marks	40	Summative Assessment Marks	60

<b>Course Pre-requisite(s):</b>
<b>Course Outcomes (COs):</b> After the successful completion of the course, the student will be able to:
CO1. To demonstrate comprehensive identification abilities of chordate diversity
CO2. Able to explain structural and functional diversity of chordate diversity
CO3. To understand evolutionary relationship amongst chordates
CO4. To take up research in biological sciences.
CO5. To realize that very similar physiological mechanisms are used in very diverse organisms.
CO6. To Get a flavor of research by working on project besides improving their writing skills. It will further enable the students to think and interpret individually.

<b>Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)</b>										
Course Outcomes (COs)/(POs)	ZOO C9T	ZOO C10P	ZOO C11T	ZOO C12 P	ZOO C13T	ZOO C14P	ZOO C15T	ZOO C16P	ZOO C17T	ZOO C18P
I Core competency			X							
II Critical thinking			X							
III Analytical reasoning			X							
IV Research skills			X							
V Team work			X							

Contents	60 Hrs
<b>Unit-I</b>	<b>15 hrs</b>
<p><b>Chapter 1: Chordates:</b> Origin of Chordates. Basic characters of chordates and classification upto classes.</p> <p><b>Chapter 2: Hemichordata:</b> Type Study of <i>Balanoglossus</i> – Habit and Habitat, Morphology, Coelom. Tornaria larva and its affinities. Affinities and systematic position of Hemichordata.</p> <p><b>Chapter 3: Urochordata :</b> Type Study of <i>Herdmania</i>-Habit and Habitat, Morphology, Ascidian tadpole- structure and its retrogressive metamorphosis.</p> <p><b>Chapter 4: Cephalochordata :</b> Type Study of <i>Branchiostoma (Amphioxus)</i>-Habit and Habitat, Morphology, Digestive system, Feeding mechanism, excretory and circulatory system.</p> <p><b>Chapter 5: Agnatha</b> General characters of Agnatha and classification upto classes. Salient features of Cyclostomata and Ostracodermi with orders and examples. Ammocoete larva and its significance.</p>	
<b>Unit-II</b>	<b>15</b>
<p><b>Chapter 6: Vertebrates:</b> General characters and Classification of different classes of vertebrates (Pisces, Amphibia, Reptilia, Aves, Mammalia) up to the order with five characters for each order citing examples. General characters of Chondrichthyes and Osteichthyes. Interesting features and evolutionary significance of Dipnoi. Salient features of Placodermi with examples. Interesting features of <i>Sphenodon</i>, crocodile and <i>Archaeopteryx</i>. Salient features of Ratitae and Carinatae with examples. Interesting features of mammalian orders (Insectivora, Carnivora, Chiroptera, Cetacea, Proboscidea, Ungulata – Perissodactyla and Artiodactyla, and Primates –Platyrrhini and Catarrhini) with examples.</p>	
<b>Unit-III</b>	<b>15</b>
<p><b>Chapter 7. General account of Chordates:</b> Types of caudal fins, scales and swim bladder in fishes. Origin of Amphibia. Neoteny and Paedogenesis. Adaptive radiation in extinct reptiles with suitable examples. Temporal fossae in reptiles. Poison apparatus and biting mechanism in snakes. Parental care in Pisces and Amphibians. Flight adaptations in birds. Dentition in mammals. Evolution of molar tooth. Migration in Pisces, Birds and Mammals.</p>	



<b>Unit-IV</b>	15
<p><b>Comparative Anatomy of Vertebrates:</b></p> <p><b>Chapter 8. Integumentary System:</b> Structure of skin and its derivatives.</p> <p><b>Chapter 9. Skeletal System</b></p> <ul style="list-style-type: none"> <li>• Comparative account of Axial Skeletal system in vertebrates; Skull- Amphibian (Frog), Reptiles (Lizard), Aves (Pigeon) and Mammals (Man).</li> <li>• Comparative account of Appendicular skeletal system in vertebrates-Pectoral and Pelvic girdles of Amphibian (Frog), Reptiles (Lizard), Aves (Pigeon) and Mammals (Man).</li> </ul> <p><b>Chapter-7 Respiratory system</b></p> <ul style="list-style-type: none"> <li>• Comparative account of respiratory system in vertebrates: Pisces (Scoliodon), Amphibian (Frog), Reptiles (Lizard), Aves (Pigeon) and Mammals (Man).</li> </ul> <p><b>Chapter-8 Circulatory System</b></p> <ul style="list-style-type: none"> <li>• Comparative account of heart and aortic arches in vertebrates: Pisces (Scoliodon), Amphibian (Frog), Reptiles (Lizard), Aves (Pigeon) and Mammals (Man).</li> </ul> <p><b>Chapter-9 Excretory System</b></p> <ul style="list-style-type: none"> <li>• Succession of kidney in vertebrates.</li> </ul> <p><b>Chapter-9 Nervous system</b></p> <ul style="list-style-type: none"> <li>• Comparative account of brain in vertebrates: Pisces (Scoliodon), Amphibian (Frog), Reptiles (Lizard), Aves (Pigeon) and Mammals (Man).</li> </ul>	

Course Title	<b>Chordates and Comparative Anatomy Zoology (Practical)</b>	Practical Credits	<b>2</b>
Course Code	<b>ZOO C12-P</b>	Contact Hours	<b>4 hrs/week</b>
Formative Assessment	<b>25 Marks</b>	Summative Assessment	<b>25 Marks</b>

**Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)**

Course Outcomes (COs) / (POs)	ZOO C9T	ZOO C10P	ZOO C11T	ZOO C12 P	ZOO C13T	ZOO C14P	ZOO C15T	ZOO C16P	ZOO C17T	ZOO C18P
I Core competency				X						
II Critical thinking				X						
III Analytical reasoning				X						
IV Research skills				X						
V Team work				X						

## Practical Content

1. **Protochordata:**  
Balanoglossus and its T. S through proboscis  
Ascidian/ *Herdmania* and *Amphioxus*, T.S. of *Amphioxus* through pharynx and intestine.
2. **Cyclostomata:**  
-*Petromyzon*, Ammocoete larva and *Myxine*.
3. **Pisces:**
4. Cartilaginous Fishes – *Narcine*, *Trygon*, *Pristis*, *Myxobatias*
5. Bony Fishes – Zebra fish, Hippocampus, Muraena, Ostracion, Tetradon, Pleuronectus, Diodon, Echeneis. (Any six).
6. **Ornamental fishes:**  
-Siamese, Koi, Oscar, Betta Sp., Neon tetra, Guppies, Gold fish, Angle fish, Rainbow fish, Mollies (Any four).
7. **Accessory respiratory organs** – *Saccobranthus*, *Clarias* and *Anabas*.
8. **Amphibia:**  
-*Rana*, *Bufo*, *Ambystoma*, *Axolotl* larva, *Necturus* and *Ichthyophis*.
9. **Reptilia:**  
-Turtle, Tortoise, *Mabuya*, *Calotes*, Chameleon, *Varanus*.  
snakes –*Dryophis*, Rat snake, Brahmini, Cobra, Krait, Russell’s viper and *Hydrophis*;
10. **Aves:** Beak and feet modifications in the following examples: Duck, Crow, Sparrow, Parrot, King fisher, Eagle or Hawk.
11. **Mammalia:**  
Mongoose, Squirrel, Pangolin, Hedge Hog, Rat and Loris.
12. **Virtual Dissection/Cultured specimens:**  
Shark/Bony fish: Afferent and efferent branchial systems, glossopharyngeal and vagus nerves.
13. **Virtual Dissection/Cultured specimens:**  
Rat: Dissection (only demonstration) – Circulatory system (arterial and venous), urinogenital system.
14. **Skeletal System in man:** Skull, vertebrae, girdles and limb bones ( Except hands and feet)
15. **Comparative account** of skin in shark, frog, calotis, pigeon and Man.
16. **Comparative account** of heart in shark, frog, calotis, pigeon and Man.
17. **Comparative account** of brain in frog, calotis, pigeon and Man.

### Formative Assessment for Theory

Assessment Occasion/ type	Marks
Attendance	10
House Examination/Test	10
Written Assessment/Presentation/Project/Term Papers/Seminars	10
Classroom Performance/Participation	10
<b>Total</b>	<b>40 Marks</b>
<i>Formative Assessment as per guidelines are compulsory</i>	



<b>Formative Assessment for Practical</b>	
<b>Assessment Occasion/ type</b>	<b>Marks</b>
Attendane	05
House Examination/Test	10
Written Assessment/Presentation/Project/Term Papers/Seminars	05
Class room Performance/Participation	05
<b>Total</b>	<b>25 Marks</b>
<i>Formative Assessment as per guidelines are compulsory</i>	

<b>References</b>	
1	Colbert <i>et al</i> : Colbert's Evolution of the Vertebrates: A history of the backboned animals through time. (5 <sup>th</sup> ed 2002, Wiley – Liss).
2	Hildebrand: Analysis of vertebrate Structure (4 <sup>th</sup> ed 1995, John Wiley)
3	Kenneth V. Kardong (20015) vertebrates: Comparative Anatomy, Function, Evolution McGraw Hill
4	McFarland <i>et al.</i> ,: Vertebrate Life (1979, Macmillan publishing)
5	Parker and Haswell: Text Book of Zoology, Vol. II (1978, ELBS)
6	Romer and Parsons: The Vertebrate Body (6 <sup>th</sup> ed 1986, CBS Publishing Japan)
7	Young: The Life of vertebrates (3 <sup>rd</sup> ed 2006, ELBS/Oxford)
8	Weichert C.K. and Wiñiam Presch (1970). Elements of Chordate Anatomy, Tata McGraw Hills