



GOVERNMENT OF KARNATAKA

**Curriculum Framework for Three-Year  
Undergraduate Program in Colleges and Universities  
of Karnataka State.**



***5<sup>th</sup> Semester  
Model Syllabus  
for BSc. In  
Zoology***

*Submitted to*

**VICE CHAIRMAN**

**Karnataka State Higher Education Council 30,  
Prasanna Kumar Block, Bengaluru City  
University Campus, Bengaluru, Karnataka–  
560009**

## COMPOSITION OF SUBJECT EXPERT COMMITTEE MEMBERS

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4	Prof. S. Basavarajappa, Mysore University, Mysuru.9449203241 E-mail:ornithoraj11@gmail.com	Member
5	Prof. Nagaraj, Department of Zoology, Kuvempu University, Shivamogga. 9620485338	Member
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7	Prof .B.Vasanthkumar, Department of Zoology, Sir M V Govt. College, Bhadravathi, Shimoga	Member
8	Prof. B .K.Meera,Professor, Maharani Cluster University, Bengaluru (98 86409382)	Member
9	Dr. Gangadhara Rao ,Professor ,Govt. Women's College, Kolar.9448984956	Member
10	Prof. Shankarappa S.Hatti,Govt. College, Dept. of Zoology, Sedam Road, Kalaburagi.9980391964	Member
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12	Dr. Asiya Nuzhath F.B, Associate Professor ,Dept. of Zoology, Tumkur University, Tumakuru.9844029441	Member
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## COMPOSITION OF BOS (U.G) MEMBERS, KUVEMPU UNIVERSITY

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1.	Prof. Nagaraja, Department of Applied Zoology, Kuvempu University, Shankaraghatta
<b>INTERNAL MEMBERS</b>	
1.	Dr. Vasanthkumar B, Sir. M.V. Government Science College, Bhadravathi
2.	Dr. K.L. Naik, Sahyadri Science College Shivamogga.
3.	Smt. Arpitha Patil, Smt. Indira Gandhi First Grade Women's College, Sagara.
<b>EXTERNAL MEMBER</b>	
4.	Mahadevaswamy M., Professor, Department of Zoology, Yuvaraja's College, Mysore

**Government of Karnataka**



**Model Curriculum**

Programe Name	<b>B.Sc. Zoology</b>	V Semester	
Course Title	<b>Non-Chordates and Economic Zoology (Theory)</b>		
Course Code:		No. of Credits	<b>4</b>
Contact hours	<b>60 Hours</b>	Duration of SEA/Exam	<b>3 hours</b>
Formative Assessment Marks	<b>40</b>	Summative Assessment Marks	<b>60</b>

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

**Course Out comes (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.

CO5. Examine the diversity and evolutionary history of a taxon through the construction of a basic phylogenetic/cladistics tree.

**Content of Theory**

**60Hrs**

**Pedagogy:** Lecturers, Seminars, Field Visits and Assignment.

<b>Formative Assessment for Theory</b>	
<b>Assessment Occasion/type</b>	<b>Marks</b>
House Examination/ Test	20
Written Assessment/ Presentation/ Project/Term Papers	10
Classroom Performance/ Participation/Seminars	10
<b>Total</b>	<b>40Marks</b>
<i>Formative Assessment as per NEP guidelines are compulsory</i>	

<b>UNIT-I</b>	
<p><b>1. Protozoa to Coelenterate</b></p> <ul style="list-style-type: none"> <li>• <b>Protozoa</b> - General characters and classification upto classes with examples; <i>Paramecium</i> (Morphology and Reproduction)</li> <li>• <b>Porifera</b>- General Characters and classification upto classes with examples. Canal system in porifera ( <i>Ascon, Sycon, Leucon and Rhagon type</i>)</li> <li>• <b>Coelenterata</b> – General characters and classification upto classes with examples; <i>Obelia</i> (Structure, Life Cycle and Polymorphism in obelia)</li> </ul> <p><b>2. Ctenophora to Nematheiminthes</b></p> <ul style="list-style-type: none"> <li>• <b>Ctenophora</b> –Salient feature</li> <li>• <b>Platyhelminthes</b> - General characters and classification upto classes with examples; <i>Taenia solium</i> (Morphology and Reproduction); Parasitic adaptations in Platyhelminthes</li> <li>• <b>Nemathelminthes</b> - General characters and classification upto classes with examples; <i>Ascaris lumbricoides</i> (Morphology and Reproduction)</li> </ul>	<b>15 HOURS</b>
<b>UNIT-2</b>	
<p><b>3. Annelida</b></p> <ul style="list-style-type: none"> <li>• General characters and classification upto classes with examples; <i>Hirudinaria granulosa</i> (Morphology, Digestive system, Excretory system, Reproductive system and Parasitic Adaptation)</li> </ul> <p><b>4. Arthropoda</b></p> <ul style="list-style-type: none"> <li>• <b>Arthropoda</b>– General Characters and classification upto classes with examples; <i>Palaemon</i> (Prawn), (Morphology, appendages, nervous system and reproduction). A brief account on metamorphism in insects.</li> </ul>	<b>15 HOURS</b>
<b>UNIT-3</b>	
<p><b>5. Mollusca and Echinodermata:</b></p> <ul style="list-style-type: none"> <li>• <b>Mollusca</b>– General characters and classification upto classes with examples; <i>Unio</i> (Morphology, Respiratory system, Nervous System and Reproduction); Foot and shell modifications in Mollusca.</li> </ul>	<b>15 HOURS</b>

<ul style="list-style-type: none"> <li>• <b>Echinodermata</b>– General characters and classification upto classes with examples; <i>Asterias</i> (Star Fish) (Morphology and Water Vascular System) Larval forms of echinodermata (Bipinneria, Auricularia, ophioplatus)</li> </ul>	
<b>UNIT-4</b>	
<p><b>6. Economic Zoology: Vectors and Pests :</b> Types of vectors, Life cycle and their control of following pests: Gundhi Bug, Termites and Mosquitoes (Anopheles), Ticks, Mites and their control.</p>	
<p><b>7. Economic Zoology: Apiculture, Poultry, Aquaculture, Vermiculture and Sericulture,</b></p> <ul style="list-style-type: none"> <li>• <b>Apiculture:</b> General Introduction, Different species of Honey Bee, Honey Bee morphology, Modern method of Bee Keeping, Economic Importance of honey, wax and Chemical composition of Honey.</li> <li>• <b>Poultry:</b> General Introduction, Poultry breeds, Poultry diseases (Viral, Bacterial and Protozoan), Symptoms, Remedies and their control.</li> <li>• <b>Aquaculture:</b> General Introduction, A Brief account on Inland fisheries – Induced Breeding of major Carps, Fish rearing techniques.</li> <li>• <b>Vermiculture:</b> General Introduction, Types of Earthworm, preparation of Compost and its importance.</li> <li>• <b>Sericulture:</b> General Introduction, Life cycle of <i>Bombyx mori</i>, Silkworm rearing, Silkworm diseases and Economic Importance of Sericulture.</li> </ul>	<b>15 HOURS</b>

<b>References</b>	
1	Barnes, R.S.K.; Calow, P.; Olive,P.J.W.; Golding, D.W.; Spicer, J.I.(2002)The Invertebrates: Synthesis, Black well 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.

## Model Curriculum

Course Title	<b>Non-Chordates and Economic Zoology (Practical)</b>	Practical Credits	<b>2</b>
Course Code		Contact Hours	
Formative Assessment	<b>25 Marks</b>	Summative Assessment	<b>25 Marks</b>
<b>Course Pre-requisite(s):</b>			
<b>Course Outcomes (COs):</b>			
<p>At the end of the course the student should be able to:</p> <ol style="list-style-type: none"> <li>1. Understand basics of classification of non-chordates.</li> <li>2. Learn the diversity of habit and habitat of the species.</li> <li>3. Develop the skills to identify different classes and species of animals.</li> <li>4. Know uniqueness of a particular animal and its importance</li> </ol>			
<b>Formative Assessment for Practical</b>			
<b>Assessment Occasion / type</b>		<b>Marks</b>	
Test		10	
Class Record		10	
Attendance		5	
<b>Total</b>		<b>25 Marks</b>	
<i>Formative Assessment as per NEP guidelines are compulsory</i>			
<b>Practical Content</b>			
<ol style="list-style-type: none"> <li>1. Preparation and observation of protozoan culture.</li> <li>2. <b>Protozoa:</b> Systematics of <i>Amoeba</i>, <i>Euglena</i>, <i>Noctiluca</i>, <i>Paramecium</i> and <i>Vorticella</i> (Permanent slides).</li> </ol>			



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*, *Sabella*, *Aphrodite* and Leech (Specimens) Slide of T.S. of Earthworm 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 and 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*, Cuttlebone. (Any four)
  
11. **Echinodermata:** Systematics of Seastar, Brittlestar, Sea Urchin, Sea cucumber, Sea lilly (Specimens). Slides of Bipinnaria larva, Echinopluteus larva and Pedicellaria.

12. **Harmful Non chordates:** Soil Nematodes. Agricultural, veterinary pests of Arthropoda and Human pest of Arachnida.

13. **Beneficial Non-chordates:**

- **Sericulture:** Lifecycle of *Bombyx mori*, Cocoons, Mulberry and Non- Mulberry silkworms.
- **Apiculture:** Any 2 Species of honeybee.

14. **Virtual Dissection/Cultured specimens:**

- **Cockroach** – Mouth Parts, Salivary Gland, Digestive System and Reproductive system
- **Earthworm** – Nervous system, Digestive System, Setae, Nephridia
- **Prawn** – Appendage, Nervous System
- **Silkworm** – Silk Gland

**15. Educational tour with report is compulsory.**

**STUDY TOUR:** A study tour accompanied by teachers should be arranged during V Semester for on-the-spot study of Apiculture farm/ Poultry/ Sericulture rearing center/ Fisheries/ Sanctuaries/ National Parks and Seashores. Submission of the tour report by each student is compulsory and the report may be treated as one practical unit and it should be valued as part of practical record. Actual T.A and D.A for accompanying staff should be borne by the college from development funds or other heads.

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**Model Curriculum**

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

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

**Course Outcomes (COs):** 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.

**Formative Assessment for Theory**

<b>Assessment Occasion/type</b>	<b>Marks</b>
House Examination/ Test	20
Written Assessment/ Presentation/ Project/Term Papers	10
Classroom Performance/ Participation/Seminars	10
<b>Total</b>	<b>40Marks</b>

*Formative Assessment as per NEP guidelines are compulsory*

<b>Contents</b>	<b>60Hrs</b>
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<b>UNIT 1</b>	
<p><b>1. Chordates:</b> Distinctive characters and outline classification upto classes with examples.</p> <p><b>2. Hemichordata:</b> Salient features; Type Study of <i>Balanoglossus</i> (Morphology; Coelom). Tornaria larva and its affinities.</p> <p><b>3. Urochordata:</b> Salient features; Type Study of <i>Herdmania</i>-Morphology; Ascidian Tadpole larva- structure and retrogressive metamorphosis.</p> <p><b>4. Cephalochordata:</b> Salient features; Type Study of <i>Branchiostoma (Amphioxus)</i>, (Morphology, Digestive system, Feeding mechanism and excretory system).</p> <p><b>5. Agnatha :</b> Salient features of Agnatha and classification upto classes; Salient features of Cyclostomata and Ostracodermi with examples; Ammocoete larva and its significance.</p>	<b>15 HOURS</b>
<b>UNIT-2</b>	
<p><b>6. Vertebrates:</b></p> <ul style="list-style-type: none"> <li>• General characters and Classification of different classes of vertebrates (Pisces, Amphibia, Reptilia, Aves, Mammalia) upto the order with five characters for each order citing examples.</li> <li>• Comparative Account of Chondrichthyes and Osteichthyes.</li> <li>• Unique features and evolutionary significance of Dipnoi; Salient features of Placodermi with examples.</li> <li>• Unique features of <i>Sphenodon</i>, crocodile and <i>Archaeopteryx</i>; Salient features of Ratitae and Carinatae with examples.</li> <li>• Unique features of mammalian orders (Insectivora, Carnivora, Chiroptera, Cetacea, Proboscidea, Ungulata–Perissodactyla and Artiodactyla, and Primates–Platyrrhini and Catarrhini) with examples.</li> </ul>	<b>15 HOURS</b>

<b>UNIT-3</b>	
<p><b>7. General account of Chordates:</b></p> <ul style="list-style-type: none"> <li>• Types of caudal fins, scales and accessory respiratory organs.</li> <li>• Neoteny and Paedogenesis.</li> <li>• Temporal fossae in reptiles; Poison apparatus and biting mechanism in snakes and First aid Treatment</li> <li>• Parental care in Pisces (Hippocampus, Bettasplendens) and Amphibians (Ichthyophis and Rhacophorus).</li> <li>• Flight adaptations in birds.</li> <li>• Dentition in mammals and Dental formula of Rabbit, Cow, Dog and Man.</li> <li>• Migration in Pisces- Catadromous and Anadromous Migration.</li> <li>• Migration in Birds- Types and Causes of Bird Migration.</li> </ul>	<b>15 HOURS</b>
<b>UNIT-4</b>	
<p><b>Comparative Anatomy of Vertebrates:</b></p> <p><b>8. Evolution of Aortic arches in Vertebrates-</b> Comparative account on Pisces, Amphibia, Reptilia, Aves and Mammalia.</p> <p><b>9. Evolution of heart in Vertebrates-</b> Comparative account on Pisces(Shark), Amphibia(frog), Reptilia(lizard), Aves(pigeon) and Mammalia(Man).</p> <p><b>10. Nervous System- Evolution of Brain in Vertebrates -</b> Comparative account on fish, frog, Calotes, Pigeon and Rabbit.</p> <p><b>11. Urinogenital System-</b> Evolution of Kidney in Vertebrates- Comparative account on Pronephrous, mesonephrous and metanephrous kidney.</p>	<b>15 HOURS</b>

<b>References</b>	
1	Colbert <i>et al.</i> : Colbert's Evolution of the Vertebrates: A history of the back boned animals through time. (5 <sup>th</sup> ed 2002, Wiley–Liss).
2	Hildebrand: Analysis of vertebrate Structure (4 <sup>th</sup> ed1995, John Wiley)
3	Kenneth V. Kardong (2015) vertebrates: Comparative Anatomy, Function, Evolution McGraw Hill
4	Mc Farland <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 William Presch (1970). Elements of Chordate Anatomy, Tata McGraw Hills

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**Model Curriculum**

Course Title	<b>Chordates and Comparative Anatomy (Practical)</b>	Practical Credits	<b>2</b>
Course Code		Contact Hours	
Formative Assessment	<b>25 Marks</b>	Summative Assessment	<b>25 Marks</b>

<b>Formative Assessment for Practical</b>	
<b>Assessment Occasion / type</b>	<b>Marks</b>
Test	10
Class Record	10
Attendance	5
<b>Total</b>	<b>25 Marks</b>
<i>Formative Assessment as per NEP guidelines are compulsory</i>	

**1. Protochordata:**

**[13 UNITS]**

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*.

**PISCES:**

**3. Cartilaginous Fishes** – *Narcine*, *Trygon*, *Pristis*, *Mylobaties*

**4. Bony Fishes**–Zebrafish, Hippocampus, Muraena, Ostracion, Tetradon, Pleuronectus, Diodon, Echeneis. (Any Six) – (Locally available).

**5. Ornamental fishes:** Siamese, Koi, Oscar, Betta Sp., Neon tetra, Guppies, Goldfish, Angle fish, Rainbow fish, Mollies (Locally available any four aquarium fishes).

**6. Accessory respiratory organs** – *Sacco branchus*, *Clarias* and *Anabas*.

**7. Amphibia:** *Rana*, *Bufo*, *Ambystoma*, *Axolotllarva*, *Necturus* and *Ichthyophis*.

**8. Reptilia:** Turtle, Tortoise, *Mabuya*, *Calotes*, Chameleon, *Varanus*. snakes–*Dryophis*, Rat snake, Brahmini, Cobra, Krait, Russell’s viper and *Hydrophis* (Any Four)

**9. Aves:** Beak and feet modifications in the following examples: Duck, Crow, Sparrow, Parrot, Kingfisher, Eagle or Hawk. (Any four)

**10. Mammalia:** Mongoose, Squirrel, Pangolin, Hedge Hog, Rat and Loris. (Any four)

**11. Virtual Dissection/Cultured specimens:**

Shark/Bony fish: Afferent and efferent branchial systems, Mounting of Scales

( Placoid, Ctenoid and Cycloid)

**12. Virtual Dissection/Cultured specimens:**

**Rat:** Dissection (only demonstration)– Circulatory system (arterial and venous), Urinogenital system.

**13- Skeletal System in Man/Rabbit:** Skull, vertebrae, girdles and limb bones (Except hands and feet).





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**Curriculum Framework for Three-Year  
Undergraduate Program in Colleges and Universities  
of Karnataka State.**



**Model Syllabus for  
6<sup>th</sup> Semester**

**Submitted to Vice-Chairman**

**Karnataka State Higher Educational Council**

**30, Prasanna Kumar, Bangalore City University**

**Campus, Bangalore, Karnataka- 560009**



Government of Karnataka

## Model Curriculum

Program Name	<b>B.Sc. Zoology</b>	Semester	<b>VI</b>
Course Title	<b>Evolutionary &amp; Developmental Biology (Theory)</b>		
Course Code:		No. of Credits	<b>4</b>
Contact hours	<b>60 Hours</b>	Duration of SEA/Exam	<b>3 hours</b>
Formative Assessment Marks	<b>40</b>	Summative Assessment Marks	<b>60</b>

### Course Pre-requisite(s):

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

- Understand that by biological evolution we mean that many of the organisms that inhabit the earth today are different from those that inhabited it in the past.
- Understand that natural selection is one of several processes that can bring about evolution, although it can also promote stability rather than change.
- Understand how the single cell formed at fertilization forms an embryo and then a full adult organism.
- Integrate genetics, molecular biology, biochemistry, cell biology, anatomy and physiology during embryonic development.
- Understand a variety of interacting processes, which generate an organism's heterogeneous shapes, size, and structural features.
- Understand how a cell behaves in response to an autonomous determinant or an external signal, and the scientific reasoning exhibited in experimental life science.

### Formative Assessment for Theory

Assessment Occasion/type	Marks
House Examination/ Test	20
Written Assessment/ Presentation/ Project/Term Papers	10
Classroom Performance/ Participation/Seminars	10
<b>Total</b>	<b>40Marks</b>

*Formative Assessment as per NEP guidelines are compulsory*

**Pedagogy:** Lecturers, Seminars, Field Visits and Assignment.

Theory Contents	60Hrs
<b>Unit-I</b>	
<p><b>1.Theories of Evolution:</b></p> <ul style="list-style-type: none"> <li>• Origin of Life, Historical review of evolutionary concept.</li> <li>• Lamarckism, Darwinism (Natural, Sexual and Artificial selection).</li> <li>• Modern synthetic theory of evolution (Gene pool, Gene flow, Gene Mutation, Variation, Heredity, Natural Selection and Isolation)</li> <li>• Adaptive radiations: Patterns of evolution (Divergence, Convergence, Parallel, Co-evolution)</li> </ul>	
<p><b>2.Population Genetics:</b></p> <ul style="list-style-type: none"> <li>• Micro evolution and Macro evolution: allele frequencies, genotype frequencies.</li> <li>• Hardy-Weinberg equilibrium and conditions for its maintenance.</li> <li>• Forces of evolution: mutation, selection, genetic drift</li> </ul>	
<b>Unit-II</b>	
<p><b>3. Evidences of Evolution:</b></p> <ul style="list-style-type: none"> <li>• Evidences from Comparative Morphology, Anatomy, Embryology and Biochemistry.</li> <li>• <b>Types of fossils</b>, Incompleteness of fossil record, Dating of Fossils.</li> <li>• <b>Origin and evolution</b> of horse and Man</li> </ul>	
<p><b>4. Species Concept and Extinction:</b></p> <ul style="list-style-type: none"> <li>• Biological species concept (Advantages and Limitations).</li> <li>• Modes of speciation (Allopatric, Sympatric) Pre and post Zygotic Isolation Mechanism.</li> <li>• Mass extinction (Causes, Names of five major extinctions).</li> </ul>	
<b>Unit-III</b>	
<p><b>5.Gamete Fertilization and Early Development:</b></p> <ul style="list-style-type: none"> <li>• Gametogenesis (Spermatogenesis, Spermiogenesis and Oogenesis in Mammals). Differences between Spermatogenesis and Oogenesis.</li> <li>• Fertilization (Types, Mechanism and significance). Monospermy and Polyspermy.</li> <li>• Early Development of Frog (Structure of Egg, Cleavage, Blastula, Fate Map of Blastula and Gastrulation).</li> <li>• Early Development of chick: Structure of Hen's Egg, Blastula, Gastrulation, Origin of Primitive streak</li> </ul>	

<ul style="list-style-type: none"> <li>• Development, Structure and function of Yolk sac, Amnion, Chorion and Allantois.</li> </ul>	
<b>6.Developmental Genetics:</b> <ul style="list-style-type: none"> <li>• General concepts of organogenesis,</li> <li>• Introduction to genetic basis of Embryonic development and Developmental control genes (Homeobox genes) in Drosophila.</li> </ul>	
<b>Unit-IV</b>	
<b>7.Early Vertebrate Development:</b>  Metamorphosis, regeneration, Early development of mammals including placentation Environmental regulation of development	
<b>8.Late Developmental Processes:</b> <ul style="list-style-type: none"> <li>• Development of eye, kidney, limb in amphibian.</li> <li>• Mammalian Female reproductive cycles estrous cycle and menstrual cycle in mammals.</li> <li>• Aging: the biology of senescence</li> </ul>	

<b>References</b>	
1	Ridley, M(2004) Evolution (3 <sup>rd</sup> edition) Blackwell Publishing
2	Hall, B.K. and Hallgrimson, B(2008)Evolution(4 <sup>th</sup> edition)Jones and Barlett Publishers
3	Barton, N.H., Briggs, D.E.G., Eisen, J.A., Goldstein, D.B. and Patel,N.H. (2007). Evolution. Cold Spring, Harbour Laboratory Press.
4	Campbell, N.A. and Reece J.B. (2011). Biology. IX Edition, Pearson, Benjamin, Cummings.
5	Douglas, J. Futuyma (1997). Evolutionary Biology. Sinauer Associates.
6	Developmental Biology: T. Subramaniam, (Reprint), Narosa Publishing House Pvt. Ltd., New Delhi
7	Developmental biology: Werner A. Müller, Springer Science & amp; Business Media. (2012).
8	Human Embryology and Developmental Biology E-Book: Bruce M. Carlson, Elsevier Health Sciences.
9	Developmental Biology: Michael J.F. Barresi, Scott F. Gilbert, Oxford University Press.(2019).



**Government of Karnataka**  
**Model Curriculum**

Course Title	<b>Evolutionary &amp; Developmental Biology (Practical)</b>	Practical Credits	<b>2</b>
Course Code		Contact Hours	<b>4 Hours</b>
Formative Assessment	<b>25 Marks</b>	Summative Assessment	<b>25 Marks</b>

<b>Formative Assessment for Practical</b>	
<b>Assessment Occasion / type</b>	<b>Marks</b>
Test	10
Class Record	10
Attendance	5
<b>Total</b>	<b>25 Marks</b>
<i>Formative Assessment as per NEP guidelines are compulsory</i>	

**Practical  
Content**

1. Study of fossils from models / pictures (Cast and Moulds).
2. Study of Homologus, Analogus and Vestigial organs from suitable specimens
3. Study and verification of Hardy-Weinberg Law by chi square analysis. (Any three problems)
4. Types of eggs based on quantity and distribution of yolk: Sea urchin, insect, frog, Chick.
5. Study of Aquatic, arboreal and Volant adaptations examples: Shark, Turtle, cammalion, loris, Bat, Pigeon and Broco.
6. Study of development of Chick Embryo at Various Stages of Incubation in-Vivo by making a Window in the Egg Shell (Window Technique Method).
7. Frog Embryology-Early Cleavage Stages (2 celled, 4 celled, 8 celled, 16 celled), Blastula, Gastrula and Neurula
8. Chick Embryology- Study and development of Chick with the help of Whole Mount – Primitive streak, 24, 36, 48, 72, 96 hours of Incubation Period embryos.
9. Study of adaptive radiations in feet of birds and mouth parts of insects.
10. Study of Dinosaurs – Trynosaurus, Brontosaurus, Pterosaurs and Ichthyosaurs



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## Model Curriculum

Program Name	<b>B.Sc. Zoology</b>	Semester	<b>VI</b>
Course Title	<b>Environmental Biology, Wildlife Management &amp; Conservations (Theory)</b>		
Course Code:		No. of Credits	<b>4</b>
Contact hours	<b>60Hours</b>	Duration of SEA/Exam	<b>Hours</b>
Formative Assessment Marks	<b>40</b>	Summative Assessment Marks	<b>60</b>

### Course Pre-requisite(s):

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

CO1.Develop an understanding of how animals interact with each other and their natural environment.

CO2.Developthe ability to use the fundamental principles of wildlife ecology to solve local, regional and National conservation and management issues.

CO3.Develop the ability to work collaborative team-based projects.

CO4.Gain an appreciation for the modern scope of scientific inquiry in the field of wildlife conservation management.

CO5.Develop an ability to analyze, present and interpret wildlife conservation Management information.

### Formative Assessment for Theory

Assessment Occasion/type	Marks
House Examination/ Test	20
Written Assessment/ Presentation/ Project/Term Papers	10
Classroom Performance/ Participation/Seminars	10
<b>Total</b>	<b>40Marks</b>

*Formative Assessment as per NEP guidelines are compulsory*

		60Hrs
<b>Contents</b>		
<b>Unit-I</b>		<b>15</b>
1	<p><b>Ecology:</b> Introduction to ecology, Definition, ecosystem, types of ecosystem, food chain and food web, trophic levels.</p> <p><b>Environment:</b> Definition, types of environment, terrestrial, aquatic, desert, grassland and aerial environment.</p> <p><b>Environmental Biology:</b> Adaptive features of animals to different Environmental factors (Temperature, light, salinity, altitude). Ecological factors, weather, climate, ozone layer.</p>	
<b>Unit-II</b>		<b>15</b>
1.	Definition, types of pollutants, air, soil, water and thermal pollution, ozone layer depletion, Green house effect. biomagnifications, bio accumulation and bioremediation. Effects of pollution on plants and animals.	
<b>Unit-III</b>		<b>15</b>
4.	<p><b>Wildlife Management :</b> Importance and Values of wildlife (IUCN) – Wildlife categories Endangered, Threatened, Vulnerable, Rare, Red data Book, Causes and depletion of wildlife (Direct, Indirect destruction), Inventory and classification of wetlands and their biotic components, RAMSAR convention. General strategies and issues, concept of home range, wildlife corridors and territory, animal census, tracing movement and remote sensing and GIS.</p>	
<b>Unit-IV</b>		<b>15</b>
3.	<p><b>Wildlife Conservation:</b> Conservation strategies - Ex-situ and in-situ conservation (Bio-reservoirs, National parks, Wild life sanctuaries), Ex-situ (Zoo, Captive breeding, Cryopreservation) biosphere reserve. Project tiger. Project Elephant. Habitat preservation, breeding in captivity.</p> <p>Wildlife Protection Act - 1972</p>	

<b>References</b>	
1	Colinvaux, P. A. (1993) Ecology (2 <sup>nd</sup> edition) Wiley, John and Sons, Inc.
2	Krebs, C.J. (2001) Ecology (6 <sup>th</sup> edition) Benjamin Cummings.
3	Odum, E.P., (2008) Fundamentals of Ecology. Indian Edition. Brooks/Cole. (3 <sup>rd</sup> Edition) Blackwell Sci.
4	Kendeigh, F.C.(1984) Ecology with Special Reference to Animal and Man. Prentice Hall Inc.
5	Caughley, G. and Sinclair, A. R. E. (1994) Wildlife Ecology and Management. Blackwell Science.
6	Woodroffe, R., Thirgood, S. and Rabino witz, A. (2005) People and Wildlife, Conflict Or Co-existence? Cambridge University.
7	Bookhout, T.A.(1996) Research and Management Techniques for Wildlife and Habitats(5 <sup>th</sup> edition)The Wildlife Society, Allen Press.
8	Sutherland, W.J.(2000)The Conservation Handbook: Research, Management and Policy. Blackwell Sciences
9	Hunter M.L., Gibbs, J.B. and Sterling, E.J.(2008)Problem solving in Conservation Biology and Wildlife Management: Exercises for Class, Field, and Laboratory. Blackwell Publishing

Course Title	<b>Environmental Biology, Wildlife Management &amp; Conservation (Practicals)</b>	Practical Credits	2
Course Code		Contact Hours	<b>4Hours</b>
Formative Assessment	<b>25Marks</b>	Summative Assessment	<b>25Marks</b>

<b>Formative Assessment for Practical</b>	
<b>Assessment Occasion / type</b>	<b>Marks</b>
Test	10
Class Record	10
Attendance	5
<b>Total</b>	<b>25 Marks</b>
<i>Formative Assessment as per NEP guidelines are compulsory</i>	

#### **Practical Content**

**1. Water quality parameters assessment:** Collection of water sample, Dissolved Oxygen(O<sub>2</sub>), Carbon dioxide (CO<sub>2</sub>), chlorides, Hardness and salinity estimation in water.

**2. Analysis of physico-chemical parameters of soil:** pH, soil moisture, soil temperature,

**3.** Determination of organic matter in soil sample

**4. Visit to pond and lakes:** Collection and identification of flora and fauna of selected Ecosystems. Collection, preservation and estimation of phytoplankton's, zooplanktons and insect larva.

**5.** Demonstration of field equipment's used in wildlife census: Compass, Binoculars, Spotting scope, Range Finders, Global Positioning System, Various types of cameras and lenses.(Charts)

**6. Identification wild animals:** Wild animal's pugmarks, hoof marks scats, pellet groups, nest, antlers. Demonstration of field techniques for wild flora and fauna.(Charts/pictures)

**7.** Collection, Preservation and Estimation of Zoo planktons

**8.** Location of Tiger Reserves, National Parks, Biosphere reserves, Wildlife sanctuaries of India on Map.



