

**Tribhuvan University**  
**Institute of Science and Technology**  
**Four Years B. Sc. Zoology Course of Study**

**Course Title: Chordata, Comparative Anatomy and Evolution Full Marks: 100**

**Course No. :B.Sc. Zool.201**

**Pass Marks: 35**

**Nature of Course: Theory**

**Year: II**

**Instruction Lectures: 150**

**Objectives of the Course:**

At the end of course students will be able to:

- Classify various species of Chordates based on important characteristics.
- Understand the origin, evolution and adaptive radiation of various classes.
- Be familiar with the fauna of Nepal and their status.
- Understand fundamental aspects of animal behaviours.
- Know the functional anatomy of each class.
- Be familiar with concepts and principles of evolution and biogeography.

**Group A1: Chordata**

**Agnatha:** Characteristics and classification. Salient features of *Petromyzon* and *Myxine*.

**(3 lec.)**

**Pisces:** Characteristics and classification. Origin and evolution. Adaptive radiation. Scales and Fins. Parental care. Migration. Fish identification techniques. Endemic species, diversity and distribution of fishes in Nepal.

**(12 lec.)**

**Amphibia:** Characteristics and classification. Origin and evolution. Adaptive radiation. Metamorphosis and neoteny. Parental care. Endemic species, diversity and distribution of amphibians in Nepal.

**(12 lec.)**

**Reptilia:** Characteristics and classification. Origin and evolution. Adaptive radiation. Affinities of *Sphenodon*. Poisonous and non-poisonous snakes. Biting mechanism of snakes. Nature of snake's venom and its action. First-aid treatment on snake bite. Endemic species, diversity and distribution of reptiles in Nepal.

**(12 lec.)**

**Aves:** Characteristics and classification. Origin and evolution. Adaptive radiation. Feathers. Flight and perching mechanism. Migration. Palate. Endemic species, diversity and distribution of birds in Nepal. Pheasants of Nepal. Important bird areas of Nepal.

**(15 lec.)**

**Mammalia:** Characteristics and classification. Origin and evolution. Adaptive radiation. Stomach. Dentition. Endemic species, diversity and distribution of mammals in Nepal.

**(12 lec.)**

**Group A2: Ethology**

Introduction to Ethology. Development of behavior. Social behavior. Courtship and Mating. Learning behavior. Communication in animals.

**(10 lec.)**

### **Group B1: Comparative Anatomy of Chordata**

<b>Exoskeleton-</b> Integument and its derivatives.	(5 lec.)
<b>Endoskeleton:</b> Axial and appendicular skeleton.	(9 lec.)
<b>Digestive organs:</b> Alimentary canal and associated glands .	(6 lec.)
<b>Respiratory organs:</b> Skin, gills and lungs. Air sacs.	(6 lec.)
<b>Circulatory organs:</b> Hearts and aortic arches. Portal systems.	(8 lec.)
<b>Urinogenital organs:</b> Kidney and its ducts, gonads and their ducts.	(8 lec.)
<b>Brain and sense organs:</b> Vertebrate brain, ear and eye.	(8 lec.)

### **Group B2: Evolution and Biogeography**

**Evolution:** Principles of organic evolution. Basic patterns of evolution- sequential and divergent evolution, micro, macro, mega and quantum evolution. Modern synthetic theory of evolution. Variation- Types and causes. Speciation - types and modes. Isolation- mechanism, types and origin. Population genetics and evolution– population, gene pool and gene frequency, Hardy-Weinberg Law, genetic equilibrium and genetic drift. (12 lec.)

**Biogeography:** Concept of biogeography and distribution- geographic, bathymetric and geological distribution. Biogeographic patterns: Animal distribution - cosmopolitan, endemic, disjunct /discontinuous, bipolar distribution, factors affecting distribution. Biogeographic process: Dispersal- modes, means and barriers of dispersal, and vicariance. Zoogeographic realms: Geographic range, sub realms, physical features and representative fauna of major realms. Theory of Island biogeography. Zoogeographic affinities of fauna of Nepal.

(12 lec.)

#### **Text Books** (latest eds.):

Alcock, J. *Animal Behavior: An Evolutionary Approach*. Sinauer Associates.

Drickamer, L.C., Vessey, S.H. and Jakob, E. *Animal Behavior: Mechanisms, Ecology, and Evolution*. Fifth edition. McGraw-Hill Publishers.

Jordan, E.L. and Verma, P.S. *Chordate Zoology & Animal Physiology*. S. Chand, New Delhi.

Kardong, K.V. *Vertebrates: Comparative Anatomy, Function and Evolution*. McGraw-Hill Higher Education.

Kent, G.C. and Carr, R.K. *Comparative Anatomy of the Vertebrates*. The McGraw-Hill Companies.

Kotpal, R.L. *Modern Text book of Zoology: Vertebrates*. Rostogi Pub., Meerut India.

Lomolino, M.V., Riddle, B.R. and Brown, J.H. 2006. *Biogeography*. 3rd edition. Sinauer, Sunderland, MA.

Parker, T.J. & Haswell, W.A. *A Text Book of Zoology, Vol. 2*. The McMillan Press Ltd. London, U.K.

Verma, P.S. and Agrawal, V.K. *Cell Biology, Evolution and Ecology*. S. Chand, New Delhi.

Young, J.Z. *The Life of Vertebrates*. The Oxford University Press.

#### **Suggested Readings:**

Baral, H.S. and Shah, K.B. 2008. *Wild Mammals of Nepal*. Himalayan Nature, Kathmandu.

Darlington, P.J. Jr. 1952. *Zoogeography: The Geographical Distribution of Animals*. John Willey & Sons, New York.

- Darwin, C. 1859. On the Origin of Life by means of Natural Selection. John Murray, London.
- Dhami, P.S. and Dhami, J.K. A Textbook of Zoology, vol. II & III. Pradeep Pub., New Delhi.
- Grimmett, R., Inskipp, C. and Inskipp, T. 2000. Birds of Nepal. Christopher Helm.
- Jnawali, S.R. et al. 2011. The Status of Nepal's Mammal: The National Red List Series. DNPWC, Kathmandu.
- Lull, R.S. 1926. Organic Evolution. Macmillan, New York.
- Manning, A. An Introduction to Animal Behaviour. Arrol, London.
- Romer, A.S. 1970. The Vertebrate Body, 4<sup>th</sup> ed. W.B. Saunders, Philadelphia.
- Schleich, H.H. and Kastle, W. (editors). 2002. Amphibians and Reptiles of Nepal: Biology, Systematics, Field Guide. A.R.G. Gantner Verlag, Germany.
- Shah, K.B. and Tiwari, S. 2004. Herpetofauna of Nepal: A Conservation Companion. IUCN Nepal.
- Shah, K.B. et al. 2003. Snakebite Management Guidelines. Min. of Health, Dept. of Health Services, EDCD, Nepal.
- Shrestha, J. 1981. Fishes of Nepal. CDC, Tribhuvan University, Kathmandu, Nepal.
- Shrestha, T.K. 1997. Mammals of Nepal. B. Shrestha, Kathmandu.
- Shrestha, T.K. 2001. Birds of Nepal. Vol.I & II, B.Shrestha, Kathmandu.
- Shrestha, T.K. 2008. Ichthyology of Nepal. Himalayan Ecosphere, Kathmandu.

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**Course Title: Chordata, Comparative Anatomy and Evolution**

**Full Marks: 50**

**Course No.: B.Sc. Zool.202**

**Pass Marks: 20**

**Nature of Course: Practical**

**Year: II**

**Objective of the Course:** For better understanding of the topics of Zool.201.

1. **Study of museum specimens:** Identification, classification, sketches, general characters and biological importance.
2. **Methods of studying vertebrates:** Sampling, collection, transportation, preservation, identification and tagging.
3. **Dissection of fish** (*Scoliodon* or *Labeo* sp. or locally available fish): General anatomy, digestive organ, afferent and efferent branchial arteries, brain and cranial nerves. Eye muscles.
4. **Dissection (amphibia/reptile/bird/mammal):** General anatomy, digestive organ, urinogenital organ, arterial and venous systems, brain and cranial nerves.
5. **Mounting:** Scales – placoid, cycloid and ctenoid/ampulla of lorenzini, weberian ossicle of any fish, pecten of bird.
6. **Study of followings** based on original, models and charts- Scales of reptiles; Feathers of birds; Gills of fishes; Lungs of amphibians, reptiles, birds and mammals; Heart and Brain of vertebrates.
7. **Histology:** Study of permanent slides of TS/VS of skin, liver, intestine, pancreas, kidney, ovary, testis, stomach, lung and spinal cord.
8. **Osteology:** Comparative study of axial and appendicular skeleton of vertebrates (frog, *Varanus*, fowl and rabbit).
9. Study of any two fossils (if available).

**Practical note book preparation as regular study.**

**Report writing:** Survey of any locality regarding any topic of Zool. 201 (visit to zoological museum/zoo/protected areas/natural habits- forest/lake or river), writing and submission of a report on fauna (of about 5 -10 pages).

**Practical Books:**

Verma, P.S. A Manual of Practical Vertebrate Zoology. S. Chand and Co. Ltd., New Delhi, India.

Lal, S.S. A Text Book of Practical Zoology: Vertebrate. Rastogi Pub., Meerut, India.

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