**DEPARTMENT OF ZOOLOGY**

**NORTH LAKHIMPUR COLLEGE**

**(AUTONOMOUS)**

**UG SYLLABUS UNDER SYMESTER SYSTEM**

**ZOOLOGY ELECTIVE PROGRAMME**

**TOTAL CREDIT: 30**

**There shall be 12 (twelve) papers; 6 (six) each of theory and practical papers in zoology. The distribution of courses and marks will be as follows:**

**Semester-I Credit: 5**

**ET – 3 – Zoo – 101:** Animal diversity-I, Systematics & Evolution Credit: 3

**EP – 2 – Zoo – 102:** Based on Paper - 101 Credit: 2

 **Semester-II Credit: 5**

**ET – 3 – Zoo – 201:** Animal diversity-II and Developmental Biology Credit: 3

**EP – 2 – Zoo – 202:** Based on Paper 201 Credit: 2

**Semester-III Credit: 5**

**ET – 3 – Zoo – 301:**  Cell Biology and Biochemistry Credit: 3

**EP – 2 – Zoo – 302:** Based on Paper 301 Credit: 2

**Semester-IV Credit: 5**

**ET – 3 – Zoo – 401:** Animal Physiology and Endocrinology Credit: 3

**EP – 2 – Zoo – 402:** Based on Paper 401 Credit: 2

**Semester-V Credit: 5**

**ET – 3 – Zoo – 501:** Genetics and Molecular Biology Credit: 5

**EP – 2 – Zoo – 502:** Based on Paper 501 Credit: 2

**Semester-VI Credit: 5**

**ET – 3 – Zoo – 601:** Animal Ecology and Biostatistics Credit: 5

**EP – 2 – Zoo – 602:** Based on Paper 601 Credit: 2

**Grand Total=Semester (I+II+III+IV+V+VI) = Credit 30**

**NB: ELECTIVE PROGRAMME is the new nomenclature for the CORE COURSE of the recent**

 **syllabus of the Dibrugarh University.**

**SEMESTER-I**

**ZOOLOGY (ELECTIVE)**

**ET-3-ZOO-101**

**Animal diversity-I, Systematics & Evolution**

 **Credit: 3 L-2, T-1, P-0 Total Marks : 60**

**Objective of the course:** The main objective of this course is to introduce the students with diverse forms of invertebrate animals, their structural morphology of group level and classification; evolutionary lives and events.

**Animal diversity-I (Non-Chordates)**

Unit -1: Protozoa: General characters and classification up to class with examples Locomotion,

 nutrition and reproduction in protozoa. Life cycle of *Plasmodium* and *Entamoeba*  5 classes

Unit-2: Porifera and Coelentrata: General characters and classification up to class with examples

 Canal system in porifera, corals and coral reefs in coelenterata. 5 classes

Unit -3: General characters and classification up to class with examples. Platyhelminthes and

 Nemathelminthes: Life cycle of *Ascaris* and *Taenia*, parasitic adaptation. 7 classes

Unit-4: Annelida: General characters and classification up to class with examples Coelome and

 excretion in Annelida 5 classes

Unit -5: Arthropoda:- General characters and classification up to class with examples Mouth

 parts and legs in insects, metamorphosis in insects; crustacean larval forms, social life in

 honey bee. 7 classes

Unit-6: Mollusca: General characters and classification up to class with examples External

 morphology of Pila; respiration and economic importance of mollusca. 5 classes

Unit-7: Echinodermata:- General characters and classification up to class with examples External

 morphology, water vascular system and locomotion of starfish. 5 classes

**Systematics & Evolution**

Unit-1: Systematics- definition, classification and its hierarchy 5 class

Unit -2: Concept of evolution, evolutionary theories. 5 classes

Unit –3: Origin of life on earth. 3 classes

Unit –4: Variation, mutations, recombination, isolation and natural selection. 7 classes

Unit –5: Concept of species and speciation. 5 classes

**EP – 2 – Zoo – 102**

 **Practical - based on paper - 101**

**Paper: 102 Credit: 2 L-0,T-0,P-2**

**PRACTICAL**

**1. Dissection:** Leech – Digestive, Excretory and reproductive systems,

Prawn – Nervous system;

Grasshopper/ cockroach– Nervous system, digestive system;

*Pila* – Digestive system.

2. **Identification:**

*Trypanosoma, Leishmania, Entamoeba histolytica, Euglena, Noctiluca, Volvox, Grantia, Spongila,* Gammules of sponge, Spicules of sponge, L.S. and T.S. of Sycon, Madrepora, Porpita, Vallela, Aurelia, Sea-anemone, Corallium, Pennatula, Aleyonium, Obelia colony with medusa, *Fasciola*, *Taenia, Ascaris,* Bladder-worm, Planaria, Scolex and Proglottid of Taenia, Nereis, Aphordite, Heteronereis, Limulus, Scorpion, Spider, Centipede, Millipede, Squilla, Lobster, Crab, Balanus, Lepas, Peripatus, Locust, Mantis, Beetle, Wasp, Termite, Chiton, Dentallium, Pecten, Pearl Oyster, Loligo, Sepia, one representative from Asteroidea, Holothuroidea and Ophiurioidea.

3. Preparation of permanent slides from suitable materials from invertebrate animals.

SCHEME OF THE PRACTICAL EXAMINATION

**Time: 4 hrs.**

1. Dissection (Non Chordates)

2. Preparation of permanent slides

3. Spotting including permanent slides

(Invertebrate materials)

4. Practical record book

5. Viva voce

**Semester-II**

**Zoology Elective (General)**

**ET – 3 – Zoo - 201**

**Animal diversity-II (Chordates) and Developmental Biology**

 **Paper: 201 Credit: 3 L-2, T-1, P-0**

**Total Marks : 60**

**Objective of the course:** The main objective of this course is to introduce the students with diverse forms of vertebrate animals and the major events of embryological aspects.

**Animal diversity-II (Chordates)**

Unit –1: General characters of chordates. 4 classes

Unit –2: Protochordates – Classification upto orders, interrelationships, structural organisation of

 Balanoglossus and Ascidian, post-embryonic development of *Amphioxus*. 8 classes

Unit –3: Fishes: Classification up to orders, respiratory organs and migration. 6 classes

Unit –4: Amphibia: Classification up to orders, metamorphosis and parental care. 6 classes

Unit –5: Reptiles: Classification up to orders, extinct reptiles, poisonous snakes of India.

 6 classes

Unit –6: Aves: Classification up to super-orders, beaks and claws, perching and flight

 mechanism, bird migration. 10 classes

Unit –7: Mammals –Classification up to orders, adaptation in mammals. 6 classes

**Developmental Biology:**

Unit –1: Gametogenesis – spermatogenesis and oogenesis, vitellogenesis, egg membranes.

 6 classes

Unit –2: Fertilization –Mechanism of fertilization,; Parthenogenesis. 6 classes

Unit –3: Types of animal eggs; patterns of cleavage; germ layers, gastrulation and fate maps 6 classes

Unit –4: Extra embryonic membranes: types, structure and function of placenta. 4 classes

**EP – 2 – Zoo –202**

**Zoology Elective (General)**

 **Practical: based on Paper 201**

**Paper: 202 Credit: 2 L-0,T-0,P-2**

1. Dissection:

Scoliodon –Afferent and Efferent branchial system, internal ear.

Goroi fish – Digestive and Efferent branchial system

2. Identification:

Herdmania, Amphioxus, Doliolum, Salpa, Pristis, Chimera, Labeo, Catla, Puntius, Heteropneustes,Wallago, Cirrhinus, Exocoetus, Hippocampus, Hilsa, Electric ray, Protopterus, Lepidosiren, Ichthyophis, Cryptobranchus, Necturus, Ambystoma, Axolotol larva, Hyla, Chameleon, Gecko, Wall lizard, Flying lizard, Mabuiya, Varanus, Typhlops, Hydrophis, Banded Krait, Pit viper, Russel viper, Fowl Duck, Crow, Dove, Cuckoo, Myna, Owl, Parrot, House Sparrow, Vulture, Bulbul, Kite, Squirrel, Rat, Monkey, Hedgehog, Bat, Loris, Langur, Scaly ant-eater, Fox, Cat, Otter, Porcupine, Mouse.

3. Preparation of permanent slides from suitable materials from vertebrate animals.

4. Study of chick embryo development up to 72 hrs. by permanent slides.

**SCHEME OF THE PRACTICAL EXAMINATION**:

**Time: 4 hrs.** 1. Dissection (Chordates)

2. Spotting/Identification including vertebrate slide

3. Preparation of permanent slides using suitable chordates material

4. Practical record book

5. Viva voce

**SEMESTER-III**

**ZOOLOGY (CORE)**

**ET-3-ZOO-301**

 **Cell Biology and Biochemistry**

**Total Marks : 60**

**Credit: 3**

 **L-2, T-1, P-0**

**Objective of the course:** The main objective of this course is to introduce the students with structure and function of animal cell and biochemical aspects of macromolecules.

**Cell Biology:**

Unit –1: General structure and function of prokaryotic and eukaryotic cells. 8 classes

Unit –2: Structure and function of cell organelles (plasma, membrane, mitochondria, Golgi bodies; endoplasmic reticulum, nucleus, chromosomes). 10 classes

Unit –3: Cell cycle and cell division (mitosis & meiosis). 10 classes

**Biochemistry:**

Unit –1: Basic principles of biochemistry, acid, base, pH and buffer; Osmosis, diffusion and active transport. 10 classes

Unit –2: Classification, nature and function of enzymes; Vitamins their sources and functions. 8 classes

Unit –3: Types of carbohydrates, proteins, fats and nucleic acids. 8 classes

Unit –4: Biological oxidation, electron transport system, synthesis of ATP, glycolysis and Krebs cycle. 10 classes

**SEMESTER-III**

**ZOOLOGY (Practical)**

**EP – 2 – Zoo –302**

**Practical - based on Paper- 301**

**Total Marks : 40 Credit: 2 L-0,T-0,P-2**

1. Study of mitosis and meiosis with the help of permanent slides.

2. Preparation of slide for the study of mitosis and meiosis with suitable materials.

3. Preparation of normal and molar solution

4. Qualitative test of carbohydrate, protein and fat.

5. Qualitative test of salivary amylase.

Scheme of the practical examination

**Time: 4 hrs**

1. Cell Biology Experiment

2. Biochemical Experiment-I

3. Biochemical Experiment-II

4. Spotting

5. Practical record book

6. Viva voce

**SEMESTER-IV**

**ET – 3 – Zoo - 401**

**Animal Physiology and Endocrinology**

 **Credit: 3 Total Marks : 60 L-2, T-1, P-0**

**Zoology –VII (Th) Animal Physiology and Endocrinology**

**Objective of the course:** The main objective of this course is to introduce the students with the major events of animal physiology and endocrinology.

**Animal Physiology**

Unit –1: Digestion and absorption of carbohydrate, proteins and fats; balanced diet. 7 classes

Unit –2: Physiology of respiration and excretion in mammals. 7 classes

Unit –3: Constituents of blood ; blood groups and Rh factor,

 7 classes

Unit –4: Neurons and conduction of nerve impulse. 7 classes

Unit –5: Drug addiction and its impact on society. 5 classes

**Endocrinology**

Unit –1: A brief outline of the organization of endrocrine system in mammals; anatomy of pituitary, thyroid, pancreas and adrenal gland 10 classes

Unit –2: General character of hormones, feedback mechanism. 6 classes

Unit-3: Functions of hormones of pituitary, thyroid, pancreas and adrenal. 8 classes

Unit –4: Neuroendocrine system in insects. 7 classes

**EP – 2 – Zoo –402**

**Practical - Based on paper - 401**

**Paper: 402 Credit: 2 L-0,T-0,P-2**

**Practicals**

1. Preparation of haemin crystals.

2. R.B.C. and W.B.C. counting by haemocytometer.

3. Kymographic recording of heart beat.

4. Display pituitary and thyroid gland of frog/toad.

5. Study of permanent slides of endocrine glands

Scheme of the practical examination

**Time: 4 hrs.**

1. Physiological Experiment

2. Endocrinological Experiment

3. Spotting/Identification

4. Preparation of slide

4. Practical record book

5. Viva voce

**SEMESTER-V**

**ET – 5 – Zoo - 501**

**Genetics and Molecular Biology**

 **Paper: 501 Credit: 3 L-2, T-1, P-0**

**Objective of the course:** The main objective of this course is to introduce the students with the structure, function and transmission of genetic materials from generation to generation and the basic concepts of molecular biology.

**Genetics**

Unit –1: Principles of heredity; linkage and crossing over; non-chromosomal inheritance. 12 class

Unit –2: Concept of gene, sex chromosome and sex determination; 10class hours

Unit-3: Mutation and mutagenesis. 10 class hours

**Molecular Biology**

Unit-1: Nucleic acids, DNA as genetic material, structure of DNA, types of RNA 10 class hours

Unit-2: Genetic code, concept of central dogma, basic steps of translation 12 class hours

Unit-3: Cloning and genetic engineering. 10 class hours

**EP – 2 – Zoo –502**

**Practical - based on Paper 501**

**Paper: 502 Credit: 2 L-0,T-0,P-2**

1. Mendelian problems

2. Ball and stick model for nucleotides

3. Theoretical problems in molecular biology

4. Preparation of slides for study of meiosis using suitable material

**SCHEME OF THE PRACTICAL EXAMINATION**:

**Time: 4 hrs.**

1. Mendelian problems

2. Ball and stick model for nucleotides

3. Theoretical problems in molecular biology

4. Preparation of slides for study of meiosis

5. Practical record book

6. Viva voce

**SEMESTER- VI**

**ZOOLOGY (ELECTIVE)**

**ET-5-ZOO-601**

**Animal Ecology and Biostatistics**

**TOTAL MARKS: 100**

 **Paper: 601 Credit: 3 L-2, T-1, P-0**

**Objective of the course:** The main objective of this course is to introduce the students with the structural and functional aspects of animal communities with respect to their environment and the basic concepts of application of statistics in biology.

**Animal Ecology**

Unit –1: Basic concept of ecosystem; Brief account of abiotic and biotic factors in grassland and aquatic ecosystem 8 classes

Unit-2: Energy flow in an ecosystem, trophic level, food chain and food web.

 8 classes

Unit-3: Environmental pollution; Types, sources, causes control and prevention of air and water pollution; biogeochemical cycles (Carbon and Nitrogen) green house effect, Ozone layer depletion and its impact 13classes

Unit-4: Basic concept of wildlife and wildlife habitat, forest types of NE India, endangered fauna of NE India and its conservation. 12 classes

**Biostatistics**

Unit –1: Sampling of data; graphic presentation of data; histogram, bar diagram and oogive.

 12 classes

Unit –2: Mean, median, and mode; Mean deviation and standard deviation. 5 classes

Unit –3: Significance test (Chi-square, students’t-test, F-test). 6 classes

**EP – 2 – Zoo –602**

**Practical -based on paper 601**

**Paper: 602 Credit: 2 L-0,T-0,P-2**

1. To find out the abundance and density of soil fauna by quadrate method.

2. Biotic components of a grassland/pond ecosystem and make probable food chain and food web.

3. Simple biostatistical calculation involving mean, median, mode and standard deviation.

**SCHEME OF THE PRACTICAL EXAMINATION**:

**Time: 4 hrs.**

1. Ecological Experiment-I

2. Ecological Experiment-II

3. Biostatistical calculation

4. Practical record book

5. Viva voce

**BOOKS RECOMMENDED**:

A Text book of invertebrate Zoology: S.N. Prasad, Kitab Mahal, Allahabad, 1977.

A Manual of Zoology Part I: B. Ayyar.

Text Book of Zoology Vol. I: A. J. Marshall , S.W.D. Williams.

Fundamentals of Ecology: B.P. Odum., W.R. Saunders, Toflan co. Tokyo, 1971.

Biological Chemistry: H.F. Mahler & B.H. Cords Gapper & Raw, N.Y. 1971.

Cell Biology: B.D. Roberts, W. Newinski & F. Sacz, W.B. Saunders Co. London, 1975.

Cell Physiology: A.C. Giese, Boxwood, 1975.

Principle of Genetics: B.J.Gardener, John Willey N.Y. 1972. .

Genetics: A.M. Winestler, Oxford & IBH, Calcutta 1971.

Introduction of Evolution: P.A. Mody, Harper & Raw, N.Y. 1964.

Evolution, Process & Products: B.O. Dedson, Rginhold Publication, C.N.Y.

Organic Evolution: R.S. Lull, Revised Indian Edn. By Light & Life Publishers, New

Delhi, 1976.

Chordate Zoology: S.N. Prasad, Kitab Mahal, Allahabad.

A Manual of Zoology Part II: B. Ayyar.

Text Book of Zoology: T. J. Parker and B.A. Haswell.

Vol. II Vertebrates: English Language Book Society, Madras, Feb. Edn. 1974.

Text Book of Physiology: B.K. Annand and S.K. Manchand, TATA McGraw Hill, New

Delhi, 1976.

General Endocrinology: C.D. Turner and J.I. Bangara, W.B. Saunders Co. 1971.

An Introduction to Embryology: B.I. Balinsky, W.B. Saunders Co. 1976.

Histology: Bailey.

Prani Bigyan: Dibrugarh University.

Biochemistry: K. Trehan, Wiley Eastern Ltd. New Delhi.

Statistical Method in Biology: N.T.J. Bailey, REBS Publishers, New Delhi.

Text Book of Vertebrate and Invertebrates: P.L. Ketpal.