

M. Sc. Zoology

First Year

Course Title : Non-chordate Zoology

Full Mark : 100

Course No : Zool. 511

Pass Mark : 40

Nature of Course : Theory

Year : I

Course Description : Theoretical aspects of non-chordate fauna (Protozoa – Echinodermata).

General Objectives :

- To make the M. Sc. Programme in Zoology more practical and relevant to the professional needs as required by the nation.
- To provide the students with advanced knowledge in the area of specialization and upgrading the quality of M. Sc. degree in Zoology as in other universities of the SAARC countries.

Specific Objectives:

- To identify the taxonomic status of the entire non-chordates and discuss the evolutionary model of the group.
- To describe the general biology of few selected non-chordates useful to mankind.
- To know about some of the important and common protozoans, helminthes and arthropods of parasitic nature causing diseases in Nepal.
- To help knowing the basic concept of biosystematics and procedure in taxonomy.
- To make able to discuss some and very important phenomena in Non-chordata.
- To help in the general survey of non-chordates in the area.

Course Contents :

Taxonomy. History and importance. Types : Chemo-, Cyto- and Molecular taxonomy. Theories and Taxonomic characters : Theories of Biological classification, Hierarchy of category, Cladistics: Pattern, Analysis, Classification and Cladogram. Taxonomic characters – Types and origin of reproductive isolation. Taxonomic procedures: Collection, handling, preservation and identification of specimens, typification, Systematic publication. Taxonomic keys and types. International Codes of Zoological Nomenclature (ICZN) – its operative principle. Interpretation and application of important rules.

20 hrs

Protozoology. Classification up to family*. General characters of Radiolaria and Sucktoria. Skeleton. Osmoregulation. Reproduction. Parasitism. Life-cycle, pathogenicity, prevention and control of –

Trypanosoma cruzi, *Entamoeba coli*, *Balantidium coli*, *Isospora belli*, *Cyclospora cayetanensis* and *Theileria parva*. Common pathogenic protozoans of domestic animals in Nepal.

15 hrs.

Porifera. Classification up to family(important ones). Origin. Affinities.

3 hrs.

Cnidology. Classification up to family*. Symmetry. Nematocysts. Mesenteries in Anthozoa. Corals: Growth, theories of formation and importance.

7 hrs.

Helminthology. a. Platyhelminthology: Classification up to family*. Host and parasite relationships. Larval forms. Structure, life-cycle, pathogenicity, prevention and control of – *Paragonimus westermani*, *Schistosoma* spp., *Echinococcus granulosus*, *Clonorchis sinensis* and *Hymenolepis nana*. Brief account of common pathogenic platyhelminthes of poultry and man with reference to Nepal.

16 hrs.

b. Nematology: Classification up to family*. Structure, life-cycle, pathogenicity, prevention and control of – *Trichinella spiralis*, *Ascaridia galli*, *Enterobius vermicularis*, *Brugia malayi*. Brief account of common parasitic nematodes of plants with reference to Nepal.

8 hrs.

Annelida. Classification up to family*. Larval forms. Structure and affinities of Archiannelida. Echiuroidea and Sipunculoidea. Adaptive radiation in Polychaeta. Earthworms in soil and nutrient dynamics. Earthworms in waste management and scopes in Nepal.

10 hrs.

Arthropoda. Classification up to family*. Evolutionary history. Characteristics and affinities of – Onychophora, Trilobita and Xiphosura. Economic importance of Crustacea. Metamorphosis and Diapause in Insects. Hormones and Pheromones in Insects. Pesticides in insect control and banned pesticides in Nepal. Arthropods of public health and medical importance.

16 hrs.

Malacology. Classification up to family*. Shell. Foot. Digestion. Respiration. Reproduction. Larval forms. Torsion and Detorsion in Gastropoda. Major evolutionary events in Gastropoda. Colonization of snails in freshwater and terrestrial habitats. Diversity of the land and freshwater molluscs in Nepal. Snails

as vectors of diseases. Invasive and pest species with reference to Nepal. General introduction to ammonites. 12 hrs.

Echinodermata. Classification up to family(important ones). Larval forms and symmetry. Skeletal system. Origin and Evolution. 7 hrs.

Minor Phyla. Characteristics with examples of – Acanthocephala, Nemartina, Nematomorpha, Rotifera, Gastrotricha, Bryozoa(Ectoprocta), Entoprocta, Mesozoa, Ctenophora and Brachiopoda. 6 hrs.

* Emphasis should be given to the families present in Nepal

References:

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- Hickmann, C. P. (1973) : Biology of the Invertebrates, C. V. Mosby Co. St. Louis.

- Hyman, L. H. (1940): The Invertebrates, Vol. I Protozoa through Ctenophora, McGraw-Hill, New York.
- (1951): The Invertebrates, Vol. II Platyhelminthes and Rhynchocoela, McGraw-Hill, New York.
- (1951): The Invertebrates, Vol. III. Acanthociphala, Aschelminthes and Entoprocta, McGraw-Hill, New York.
- (1955) : The Invertebrates, Vol. IV Echinodermata, McGraw-Hill, New York.
- (1959): The Invertebrates, Vol. V. Smaller Coelomate Groups, McGraw-Hill, New York
- (1967): The Invertebrates, Vol. VI Mollusca I, McGraw Hill, New York
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- (1968) : Invertebrate Zoology, Vol. II, Interscience Pub, New York USA
- Larrington, E. J. W. (1969): Invertebrate Structure and Function, Thomas Nelson & Sons, Ltd London.
- Meglitsch, P. A. (1972) : Invertebrate Zoology, Oxford Univ. Press, New York
- Morton, J. E. (1967): Mollusca, Hutchinson Univ. Library, London.
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- (2002): Molluscs as crop pests, CABI Pub.
- Fretter, V. and Peake, J. (Eds1975) Pulmonates: Functinal Anatomy and Physiology, Vol. I, Academic Press.
- (1978) Pulmonates: Systematic Evolution and Ecology, Vol. II, Academic Press.
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- Parker, T. J. and Haswell, W. A. (1972): A Text Book of Zoology, Vo. I. The Macmillian Press Ltd., London UK.
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- Cloudsley, J. L. and Thomson, S. (1988): Evolution and Adaptation of Terrestrial Arthropods, 1st Ed.
- Kettle, D. S. (1995) : Medical and Veterinary Entomology, CABI 2nd Ed.

International Code of Zoological Nomenclature 4th Ed., Adapted by the I.U. B. S. The Internal Trust for Zoological Nomenclature, London (International Commission on Zoological Nomenclature, 1999).

M. Sc. Zoology

First Year

Course Title : Chordate Zoology

Full Mark : 100

Course No : Zool. 512

Pass Mark : 40

Nature of Course : Theory

Year : I

Course Description : Theoretical aspects of chordate fauna (Lower Chordata to Mammalia), Comparative Anatomy, Embryology and Endocrinology .

General Objectives :

- To make the M. Sc. Programme in Zoology more practical and relevant to the professional needs as required by the nation.
- To provide the students with advanced knowledge in the area of specialization and upgrading the quality of M. Sc. degree in Zoology as in other universities of the SAARC countries.

Specific Objectives:

- To identify the taxonomic status of the entire chordates and discuss the evolutionary model of the group.
- To impart knowledge on ecology of some important fishes, amphibians and reptiles, birds and mammals of Nepal.
- To impart knowledge in comparative anatomy and development systems of chordates.
- To make able to discuss some and very important phenomena in Chordata.
- To know about the conservation and management strategies of the chordate fauna in Nepal.

Course Contents:

Lower Chordata. Theories on origin of Chordata. Ecology, distribution and phylogeny of – Hemichordata, Urochordata, Cephalochordata and Cyclostomata. 7 hrs.

Ichthyology. Origin and Evolution. Classification up to family*. Colouration. Mimicry. Parental care. Rare and Endangered fishes. Fish Vs Electricity. Fish sampling and survey techniques. Fish identification. Fishes of Trans-Himalayan region. Himalayan water fishery. Ornamental and Game fishes of Nepal. Fish in relation to climatic changes in Nepal. Fish diversity, distribution and conservation status in Nepal. Crisis in Nepalese fishery. Fishing laws. Fishery regulation and control. Ecology and distribution of *Tor putitoria*, *Schizothorax richardsonii* and *Wallgo attu* in Nepal. 20 hrs.

Herpetology. a. Amphibia : Evolution. Classification up to family*. General organization and affinities of Gymnophiona. Adaptive radiation. Extinct Orders. Metamorphosis and Neoteny. Defensing mechanisms. Habit, habitat and distribution of Himalayan newt (*Tylototriton verrucous*) in Nepal. Tree trogs (*Rhacophorus* and *Hyla* spp.) in Nepal. Rare frogs and toads in Nepal. Importance and conservation.

12 hrs.

b. Reptilia : Evolution. Classification up to family*. Threatened and Extinct reptiles with particular emphasis on Dinosaurs. Adaptive radiation. Biogeography of herpeto-fauna of Nepal. Ranching Turtles and Tortoises of Nepal. Ecology and behaviour of Mugger, Gharial, Crocodile, Python, Krait and Monitor Lizard.

12 hrs.

Ornithology. Origin. Evolution. Classification up to family*. Flight and Perching mechanisms. Palate. Threatened and Extinct birds. Rare and Endemic birds of Nepal. Birds of prey and vultures, their roles in ecosystem. Avian eco-toxicology. Migratory birds in Nepal in relation to flu. Bird trafficking problems. Wetland birds and water fowls of Nepal. Bird hot-spots of Nepal. 'Civil Aviation' and bird strike problems in Nepal. GIS application in bird study. Global climatological changes and avian population. Ecology and behaviour of – Monal(Danphey), Spiny-babler, Swamp Partridge, Sarus Crane.

20 hrs.

Mammology. Classification up to family*. Distribution. Stomach. Dentition. Adaptive radiation. Threatened and Extinct mammals. Primates(Monkeys) of Nepal. Status and conservation of mammals in Nepal.

20 hrs.

Comparative Anatomy. Brain, Heart, Aortic Arches, Integument, Respiratory system, Digestive system and Urino-genital system of Vertebrata.

15 hrs.

Embryology. Embryonic cell differentiation. Development of brain, eye, heart in vertebrates. Gene action in embryonic cells. Embryonic induction and evocators. Embryo transfer. Haemolytic diseases in the newly born human babies. Recent developments in embryology.

8 hrs.

Endocrinology. Major Invertebrate and Vertebrate endocrine tissues and roles of their hormones. Chemical nature of hormones and their action. Hypothalamo – hypophysial system. Regulation of hormone via feed – back mechanism. Neuro – endocrine system. Recent developments in Endocrinology.

8 hrs.

*Emphasis should be given to the families present in Nepal.

References:

- Ali, S. and Ripley, S. D. (2001): Hand-book of the birds of India and Pakistan Vol. 1-10, Oxford Univ. Press, Delhi.
- Balinsky, B. I. (1970): An Introduction to Embryology, W. B. Saunders, London.
- Ballaires, A. D. (1968): Reptiles Vol. I & II, Hutchison Univ. Library, London.
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- Gorbman and Bern (1974): A Text Book of Comparative Endocrinology, Wiley Eastern Ed., New Delhi.
- Grizmek's Animal life Encyclopedia (1995): Mammals I to V (and No. 4-13), Van Nastrand Rainhala Company, New York.
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- Shrestha, T. K. (2008): Ichthyology of Nepal, Himalayan Ecosphere, Kathmandu.
- (2001) : Birds of Nepal Vol. I & II, B. Shrestha Kath.
- (1997) : Mammals of Nepal, B. Shrestha, Kath.
- (2001): Herpetology of Nepal, B. Shrestha, Kath.
- (2003) : Wildlife of Nepal, B. Shrestha, Kath.

Thomas, M. L. and Ralf, W. K. (200) : Remote sensing and Image Inaterpretation, John Wilet Sons
Ind.

Van Tyne and Berger(1959) : Fundamental of Ornithology, MacGraw-Hill Book Comp. Gill.

Dickinson, E. (Ed 2003): Complete Checklist of Birds of the World, Priceton Univ. Press.

M. Sc. Zoology

First Year

Course Title : Ecology, Biogeography and Distribution,
Evolutionary Biology, Biostatistics and Behaviour

Course No : Zool. 513

Nature of Course : Theory

Full Mark : 100

Pass Mark : 40

Year : I

Course Description : Theoretical aspects of Ecology, Biogeography and Distribution, Evolutionary Biology, Biostatistics and Animal Behaviour.

General Objectives:

- To make the M. Sc. Programme in Zoology more practical and relevant to the professional needs as required by the nation.
- To provide the students with advanced knowledge in the area of specialization and upgrading the quality of M. Sc. degree in Zoology as in other universities of the SAARC countries.

Specific Objectives:

- To impart advance knowledge to the M. Sc. students with ecological principles and their functional aspects.
- To provide knowledge on distribution and behaviour types of animal in nature.
- To make the students acquaint with the use of Biostatistics in research fields in Zoology.
- To help students to know the principles of evolutionary biology.

Course Contents:

Ecology. Ecological Principles: Limiting factors of environment. Liebig's Law of Minimum. Shelford Law of Tolerance. Ecological productivity and ecological flow. Basic features of production. Primary and Secondary productivity in terrestrial and aquatic environments. Energy flow in environments. Population Growth : Population and Density. Indices of relative abundance. Intrinsic rate of natural increase. Forms of population growth. Concept of carrying capacity. Community Analysis: Biotic community concept. Community structure. Concept of community dominance. Species richness. Equitability. Heterogeneity. Community classification. Stratification. Ecotypes. Ecotones. Concept of 'Edge Effect'.

Ecological indicators. Trophic relations in community. Positive and Negative interactions. Co-evolution. Group selection. Ecological Regulations: Ecological succession. Climax concept. Evolution of ecosystem. Natural Resources: Renewable (Forest, Wildlife, Soil, Water, Sun and Air) and Non-renewable (Fossils, Fuel, Minerals) resources. Major Human impacts on Environment: Deforestation. Soil erosion. Landslide. Ozone-layer depletion. 40 hrs.

Biogeography and Distribution. Zoo-geographical realms (Horizontal or Superficial) – Australian, Ethiopian, Palaearctic, Nearctic, Neo-tropical and Oriental: their Physical and Climatic nature, Important fauna, Sub-realms, Boundaries, Extension and recent developments. Geological distribution of animals. Bathymetric distribution (Vertical and Altitudinal): Introduction, Organic realms (Geo-biotic, Limno-biotic and Halo-biotic), Inter – migration of animals. 15 hrs.

Evolutionary Biology. Paleontology (Kinds and Formation of fossils). Mechanism of Evolution : Natural Selection at Macro- and Micro-levels. Variations (Types and Causes). Speciation (Types and Modes). Isolation (Types). Sexual Selection (Characteristics, Theories and Drawbacks). Protective resemblances: Colouration (Types and Functions) and Mimicry (Types and Functions). 15 hrs.

Biostatistics. General: Introduction to Bio-statistics. Sources of data. Classification. Tabulation and Presentation techniques. Descriptive techniques: Measures of central tendency (Arithmetic and Geometric means, Median and Mode). Dispersion (Range and Standard deviation). Elementary Probability concepts: Prosperities and examples on Binomial, Poisson and Normal distribution. Sampling techniques: Experimental data. Sample survey. Sampling and non-sampling errors. Sampling methods (Simple random, Stratified and Systematic). Sampling with and without replacement. Standard errors associated with sample means. Correlation and regression Techniques and applications, Making inferences about parameters. Modeling techniques: Linear, Exponential and parabolic. Hypotheses testing Nomenclature. T-test, Chi-square test, F-test and their applications. Analysis of Variance: One way and two ways analysis of variances and applications. Confidence intervals and tests on means (Duncan multiple range test, least significant difference test). Experimental designs, Planning an experiment. Concept of experimentation, Controls and Precision of measurements. Replications. Randomization. Fixed and random effects models. Completely randomized design, Randomized block design, Latin square design.

40 hrs.

Animal Behaviour. Stereo- and Acquired types. Social behaviour. Reproductive behaviour (Courtship and Parental care). Agnostic behaviour. Migratory behaviour (Orientation in fishes and birds). Pheromones in reproduction. 10 hrs.

Reference:

- Krebs, C. J. (1976): Ecology, Harper International Ed., New York
- Odum, E. P. (1971): Fundamentals of Ecology, W. B. Saunders Company, Philadelphia and London.
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M. Sc. Zoology

First Year

Course Title : Molecular & Cell Biology,

Genetics and Physiology.

Course No : Zool. 514

Nature of Course : Theory

Full Mark : 100

Pass Mark : 40

Year : I

Course Description : Theoretical aspects of Molecular and Cell Biology, Genetics and Animal Physiology.

General Objectives :

- To make the M. Sc. Programme in Zoology more practical and relevant to the professional needs as required by the nation.
- To provide the students with advanced knowledge in the area of specialization and upgrading the quality of M. Sc. degree in Zoology as in other universities of the SAARC countries.

Specific Objectives :

- To impart advance knowledge of present day in molecular and cell Biology.
- To provide knowledge on some important aspects of Genetics.
- To make familiar with the functions of different organs of human body.
- To provide an understanding of currently established interdisciplinary approaches used in the study of animal physiology.

Course Contents :

Molecular Biology. Review of physical and chemical structures and properties of nucleic acids. Organization of cellular DNA in Prokaryotes. Proteins of chromosomes. Organization of DNA in Eukaryotic chromosomes. Structure of Eukaryotic chromosome : Satellite DNAs, Micro-Macro satellite DNA, Nuclear gene, Repeated DNA sequence. Molecular structure of DNA and Chromosome – Heterochromatin and Euchromatin. Nucleosome. Assembly of chromosomal organization of gene. Mobile DNA. RFLP, RFLP, DdNA Amplification. Advances in PCR technology. Sequencing. Restriction Maps and Molecular Genetic Maps, Gene transformation. Recent advances on cloning. Advance study of transgenic animals.

25 hrs.

Cell Biology. Molecular structure and function of cell membrane. Membrane transport principle. Vesicle transport by secretion and endocytosis. Mitochondria – Structure pyruvate transport. Oxidative phosphorylation. Signal molecules. Receptors in membrane. Second messenger. Role of signal molecules in gene activation. Interaction and regulation of signaling pathways. Control of cell cycle in unicellular and multicellular organisms. Genetic variability. General concept of Karyotype Analysis. 15 hrs.

Ageing. Ageing at cellular level. Ageing of connective tissue. Protein regulatory mechanisms. Theories of ageing – Free radical, Somatic, Mutation and Immunological. Mechanism of ageing – Intracellular, Extracellular and Cellular levels. Mental aspects of ageing. Ageing and termination of synthesis programme. 8 hrs.

Cancer. Characteristics of cancer cells. Genetic basis. Hypothesis – Microbial, Irritation, Somatic and Oncogene. Abnormal processes during mitosis and meiosis. 7hrs.

Genetics. Mendelian and Non-Mendelian – Sex limited and Sex influence traits. Genetic linkage and Linkage maps. Gene and Chromosome mutations. Inheritance of qualitative traits. Population Genetics – Inheritance of qualitative traits. Gene and Genotypic frequency. Hardy and Weinberg principle. Breeding values and Variance. Inbreeding and Heterosis. Methods in animal genetic improvements. 15 hrs.

Physiology. Gastro – intestinal : Nutrients. Balanced diet and Malnutrition and effects. Absorption principles of nutrients (including salts and water). Disorders: Oesophageal, Gastric, Intestinal and General. Respiratory: Details of respiratory pigments (Haemoglobin, Haemoerythrin, Haemocynin and Chlorocruorin) and Myoglobin. Regulation of respiration (Nervous and Chemical) and during exercise. Respiratory abnormalities (Hypoxia, Dyspnoea, Tuberculosis, Pneumonia, Asthma, Edema, Emphysema).

Cardio – vascular: Cardiac cycle. Cardiac output. Cardiac failure. Regulation of heart pumping and pacemaker. Heart valves and valvular diseases. Regulation of arterial blood flow. Regulation of venous blood flow. Regulation of blood pressure. Resistance to blood flow. Inter – relationships between pressure, blood flow and resistance. Hypertension regulatory mechanisms. Neuro-physiology: Gross functional evolution of – Fore, Mid and Hind brains. Vision: Photo-chemistry. Dark and Light

adaptations. Colour vision. Hearing: Neuronal pathways. Somatic sensations: Pain suppression (Analgesia) and Headache (Intra-and Extracranial) including those of eye diseases. Thermal regulation (Heat and Cold). Thermal comfort. Acclimatization (Heat and Cold). Excretory and Osmoregulatory: Homeostatic and Osmoregulatory functions of vertebrate kidney. Abnormalities of micturition. Diuretic and Kidney diseases (Acute Renal failure). Reproductive: Hormones in Ovulation (Ovarian cycle) and Menstruation(Uterine cycle). 50 hrs.

Reference:

- De Robertis D. P. and E. M. P. De Robertis (1998) (8th Ed): Cell and Molecular Biology B. I. Worely Pvt. Ltd., New Delhi.
- Gupta., P. K. (Reprint 1998) : Genetics, Rostogi Pub., Merut.
- Edward, L. S. and John W. K. (1996)(4th Ed.) : Hand book of the Biology of Ageing, Academic Press.
- Jones, R. N. and Karp, A. (1986) : Introducing Genetics, John Murray, London.
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- Prosser, C. L. and Brown, F. A. (1965): Comparative Animal Physiology W. B. Saunders, Philadelphia.
- Seelay, R. R: Stephens, T. D. and Tate P. (1992): Anatomy and Physiology, Mosby-year book, Inc.(2nd Ed.)
- Strand, F. L. (1965): Modern Physiology, MacMillan, New York.

M.Sc. Zoology (Tribhuvan University)

Course title: Non chordate, Ecology, Biostatistics, Animal behavior, Zoo-geography

Course No. Zoo 515

Full mark- 50

Nature of course: Practical

Pass mark- 20

Year: I

Course objectives

The general objective of this course is to upgrade the knowledge of theoretical studies through experiments.

Specific objectives are to;

- Develop practical experience on animal organs, systems and morphology including ecology, behaviour,
- make students able in developing basic knowledge on taxonomy
- Apply statistical tools for the field work analysis,
- Make students able to study different life cycle.

Study of microscopic animals

- Culture of different protozoans and preparation of their permanent slides
- Identification, drawing of the prepared permanent and temporary slides.
- Micrometry : Measurement of microscopic objects using micrometer.

Study of animal parasites of vertebrates (ecto and endo parasites)- Ticks, mites, helminthes and their identification upto family level.

Culture a holometabolous and hemimetabolous insect in the laboratory and make Recordings on their life cycle (a caterpillar/ a bug)

Extraction of soil fauna and identification of any 5 soil arthropod and nematode species (extraction by funnel method)

Study of internal Anatomy:

Dissection of Annelids and Arthropods (crustaceans, insects commonly available preferably pest species such as grasshoppers, beetles,): Digestive system, reproductive system, nervous system.

Preparation of permanent slide of at least two different mouth parts of insects.

Dissection of mollusks (slug species, terrestrial snails including pest species such as *Lissachatina fulica*, *Bensonia*, *Macrochlamys* etc): Alimentary canal, reproductive system. Permanent slide preparation of jaws, radula of the dissected snail or slug.

Museum and zoo visit: Study of animals in the museums (CDZ, NHM, NARC), learning techniques, prepare report on any one species or group of animal about current situation of that group or species.

Collection and identification

Collection and preservation techniques of different animals

Handling of specimens

Each student must follow the standard techniques provided by teachers.

Collection, curation, identification and deposition of the animals belonging to following higher invertebrate phyla;

Collection of aquatic fauna

Annelida - 3 (nos)

Arthropoda - 5 (nos)

Mollusca - 5 (nos)

Collection of terrestrial fauna

Annelida - 3 (nos)

Arthropoda - 10 (nos)

Mollusca - 5(nos)

All these species should be sketched exactly on the basis of observation and by using camera lucida.

Ecology

Measurement of primary productivity in aquatic ecosystem, determination of biomass of terrestrial habitat, Transect/quadrat method of animal survey of plants and animals.

Biodiversity indices – (a) population, (b) density and relative density, (c) frequency and relative frequency, (f) abundance and distribution, (g) Shannon- Wiener index.

Biostatistics

Preparation of tables and bar diagrams using suitable software, from the data provided.

Statistical Analysis (Chi-square, t-test, correlation, regression, standard deviation and standard error) of the data derived from the animal surveys or given data using a suitable software.

Report preparation and presentation

M.Sc. Zoology (Tribhuvan University)

Course title: Chordate, Cytology, Animal physiology, Comparative anatomy and embryology

Course No. Zoo 516

Full mark- 50

Nature of course: Practical

Pass mark- 20

Year: II

Objectives

The general objective of this course is to develop practical knowledge of theoretical studies

The specific objectives area to;

- develop skills on taxidermi of vertebrates and preparation skills of bone preparation,
- make students able to know organ system of fishes, birds and mammals,
- make students able to apply different techniques of wildlife surveys
- provide basic knowledge of cytological, molecular and physiological tests.

Chordates

Taxidermi

1. Study of preservation media and tools and materials for taxidermi.
2. Stuffing of a (1) frog, (2) lizard, (3) bird and (4) mammal.
3. Preparation and study of osteology of small mammals, birds, fish, reptiles and amphibians

Dissection

Major dissection

1. Fish: Labeo, channa, or any common fish to expose alimentary canal and accessory organs, Affereent Vessel, Efferent Vessel, Cranial nerve and accessory respiratory organs.
2. Birds: Pigeon- digestive tract, circulatory and musculature (pectin, flight muscles), air sacs.
3. Mammal: Rat – digestive tract, circulatory, nervous system and reproductive system.

Histological studies

4. Identification of cross sections of chick embryo, through eye, ear, heart.
5. Study of different types of placenta in mammals.
6. Preparation of histological slides of tissues of different animals by using microtomy.

Museum visit : Preparation of report on the museum visit on any group of animal and species.

Wildlife surveys

7. Mist nets use in bird and bat study
8. Seasonal counting of bird species in TU garden
9. Study of rodents by setting traps in the garden

Cytology

Study of cytological slides

Survey of certain genetic traits in man and their mode of inheritance

Handling of PCR: PCR amplification and sequencing, template preparation and electrophoresis, use of the internet gene banks and their analysis.

Physiology

Test of carbohydrate (Mollisch's test, Barfoed's test, Benedict's tests, Fehling's test, Iodine test), protein (protein precipitation, ninhydrin reaction, biuret reaction, Xanthoproteic reaction) and lipids (solubility test, reaction with sudan IV, Saponification, Dunstan's test)

Measurement of human blood pressure

Determination of the total number of human red and white blood cells in cubic millimeter.

Estimation of urea, sugar, protein in urine

Glycogen estimation from animal tissues,

Blood group test

Measurement of the rate of muscle contraction and relaxation using kymograph.

Field trip- 15 days

Report writing and presentation