

UNIVERSITY OF KERALA

First Degree Programme in Zoology **Choice Based Credit and Semester System**

Zoology Complementary Course

First Degree Programme
Semester I
Zoology Complementary Course I
Animal Diversity I

Course Code – ZO1131

Total hours: 36

No. of credits - 2

Aim of the Course

To inculcate in the student a love and understanding of the fascinating world of invertebrates

Objectives of the course

- Impart to the student a concrete idea of the evolution, hierarchy and classification of invertebrate phyla
- Understanding the basics of systematics by learning the diagnostic and general characters of various groups
- Getting an overview of typical examples in each phyla
- To study the economic importance of invertebrates with the special reference to insect pests

Module I

5 hrs

Introduction: Classification of organisms- two kingdom system, three kingdom system, four kingdom system, five kingdom system.

Kingdom Protista- general features and classification: Phylum Dinoflagellata eg. *Noctiluca* , Phylum Parabasalia eg. *Trichonympha*, Phylum Ciliophora eg. *Paramecium*.

Phylum Rhizopoda eg. *Entamoeba* – life history

Module II

5hrs

Kingdom Animalia : Salient features, levels of organization- cellular, tissue, organ and organ system. Branches- Mesozoa, Parazoa and Eumetazoa-radiata and bilateria- Protostomia and Deuterostomia; acoelomata, pseudo coelomata and eucoelomata- schizocoela and enterocoela; body segmentation- metamerism and pseudometamerism.

Phylum Porifera: general characters (self study), classification up to classes- Class Calcarea eg. *Sycon*, Class Hexactinellida eg. *Euplectella*, Class. Desmospongiae eg. *Spongilla*.

Phylum Cnidaria: general Characters (self study), classification up to classes, Class Hydrozoa eg. *Obelia*, *Physalia* , Class Scyphozoa eg. *Aurelia* (mention larval stage), class Anthozoa eg. *Sea anemone*

Module III

10 hrs

Phylum Platyhelminthes: general characters (self study), classification up to classes- Class Turbellaria eg. *Bipalium*, Class Cestoda eg. *Taenia Solium*, Class Trematoda e.g. *Fasciola*.

Phylum Nematoda: general characters (self study), classification up to classes- Class Secernentea (Phasmida) eg. *Ascaris*, Class Adenophorea (Aphasmida) eg. *Trichinella*. Human nematode parasites.

Phylum Annelida : general characters (self study), classification up to classes - Class Polychaeta eg. *Neries* (mention parapodium, heteronereis),- Class Oligochaeta eg. earthworm(mention vermiculture), Class Hirudinea eg. *Hirudinaria*.

Phylum Mollusca: General characters (self study), classification up to classes-Class Aplacophora - eg. *Neomenia*, Class Monoplacophora e.g. *Neopilina*, Class Bivalvia eg. Pearl oyster, Class Gastropoda eg. *Pila* ,Class Cephalopoda eg. *Sepia* , class Scaphopoda eg. *Dentalium*. Economic importance of molluscs.

Phylum Onychophora : General characters, eg. *Peripatus*-evolutionary significance.

Module IV

13 hrs

Phylum Arthropoda: General characters (self study), classification up to classes-Supylum Trilobitomorpha- Class Merostomata eg. *Limulus*, Class Arachnida eg. scorpion, Class Pycnogonida eg. Nymphon; Subphylum Mandibulata- Class Crustacea eg. prawn(detailed study), *Sacculina*, Class chilopoda eg. *Scolopendra*, Class Symphyla e.g. *Scutigera*, Class Diplopoda eg. *Spirostreptus*, Class Pauropoda eg. *Pauropus*, Class Insecta eg. Cockroach (self study- external characters mouth parts, digestive system), mosquitoes-*Anopheles*, *Culex* and *Aedes* - pathogenicity of mosquitoes. Pest of paddy - *Leptocorisa* and *Spodoptera*, Coconut palm *Oryctes rhinoceros* and Eriophid mite, stored food grains -*Sitophilus oryzae* and *Tribolium*.

Module V

3 hrs

Phylum Echinodermata: General characters (self study), classificationcn- Class Asteroidea eg. sea star, Class Ophiuroidea eg. brittle star, Class Echinoidea eg. sea urchin, Class. Holothuroidea eg. Sea cucumber, Class Crinoidea eg. sea lily (mention larval stages)

References

- Brusca R.C. and Brusca G.J. (1990) Invertebrates. Sinauer Associates, Sunderland, MA
- Chandler, A.C. and Read. Parasitology.
- Hickman C.P. and Roberts L.S. (1994) Animal Diversity. Wm. C. Brown, Dubuque, IA
- Pearse V and dPearse J, Buchsbaum M and Buchsbaum R. (1987) Living Invertebrates Blackwell scientific Publications, California.
- Ruppert E.E., Fox R and Barnes R.D. (2004) Invertebrate Zoology. Thomson Books. Cole. USA.

First Degree Programme
Semester II
Zoology Complementary Course II
Animal Diversity II

Course Code – ZO1231

Total hours 36

No. of credits – 2

Aim of the course

To inculcate in the student a fascination for nature and learn the bionomics of vertebrates .

Objectives of the course

- Learn the evolution, hierarchy and classification of different classes of chordates

- To get an overview of the morphology and physiology of typical examples.
- To study the adaptations and economic importance of specific vertebrates.

Module I **10 hrs**

Phylum Chordate: Salient features of the phylum Chordata (self study), classification up to classes- Subphylum Urochordata eg. *Ascidia*- general characters, external features and retrogressive metamorphosis; Subphylum Cephalochordate- general characters, eg. *Amphioxus*.

Module II **10 hrs**

Subphylum Vertebrata: General characters(self study), classification- Super class Agnatha eg. *Petromyzon*; Super class Pisces eg. *Scoliodon*, *Narcine*, *Anguilla*, *Echeneis*, *Hippocampus*, *Etroplus*, mackerel, sardine, pomfret; Super class Tetrapoda- Class Amphibia-general characters and eg. *Ichthyophis*, *Rhacophorus*, *Amblystoma*-axolotl larva.

Module III **9 hrs**

Class Reptilia: General characters (self study), eg. *Calotes*, *Draco*, *Chameleon*, *Chelone*, snakes-general features, non poisonous snakes eg. *Lycodon*, *Ptyas* (external features and peculiarities of examples), poisonous snakes eg. *Naja*, viper, *Bungarus*, *Enhydrina*(characteristic features), identification of poisonous and non poisonous snakes, different types of venom, mode of action.

Module IV **7 hrs**

Class Aves: General characters (self study), flightless birds- eg. ostrich and kiwi, flying birds eg. pigeon- mention different types of feathers and pea fowl. Flight adaptations of birds. Class Mammalia- general characters(self study), eg. echidna, kangaroo, bat, loris, tiger and whale.

References

- Dhama, P.S. and Dhama, J.K. Vertebrate Zoology. R. Chand and Co.
- Ekambaranatha Ayyar, M. and Ananthakrishnan, T.N. A Manual of Zoology. Vol II
- Green N.P.O., et al (2000) Biological Science. Cambridge University Press.
- Jordan, E.L and Verma, P.S. Vertebrate Zoology.S. Chand and Co.
- Kotpal, R.L. (2002) Modern Text Book of Zoology: Vertebrates. Rastogi Publishers
- Mayer E. (1980) Principles of Systematic Zoology. Tat Mc Graw Hill Publishing Co. New Delhi.
- The New Encyclopedia Britannica, Macropedia, (1998). Encyclopedia Britannica

First Degree Programme

Semester III

Zoology Complementary Course III

Functional Zoology

Course Code – ZO1331

Total hours 54

No. of credits – 3

Aim of the course

To familiarize students on the physiology of their own body and urge them to take precautionary measures to safeguard their health.

Objectives of the course

- To study the structure and function of each system in the human body.
- To study the etiology of common physiological disorders, syndromes and diseases.

Module I **4 hrs**

Nutrition: Types of nutrition – autotrophy and heterotrophy. Outline classification of food components. Brief mention of malnutrition disorders. Vitamins - physiological role and disorders (deficiency diseases).

Module II **6 hrs**

Respiration: Respiratory pigments and their functions with special emphasis on haemoglobin, transport of oxygen and carbon dioxide. Neural and hormonal control of respiration in man. Respiratory disturbances – brief mention of Apnoea, Dyspnoea, Hypoxia, Hypo and Hypercapnia, Asphyxia and Carbon monoxide poisoning. Physiological effects of smoking.

Module III **8 hrs**

Circulation : Blood-composition and functions, blood groups, mechanism of blood clotting (intrinsic and extrinsic pathways), anticoagulants, disorders of blood clotting –haemophilia and thrombosis. Heart - neurogenic and myogenic, peculiarities of cardiac muscle. Heart beat, pace maker. Blood pressure, ECG, cardiovascular disorders- arteriosclerosis, myocardial infarction, and hypertension; angiogram and angioplasty.

Module IV **6 hrs**

Excretion and osmoregulation: Classification of animals based on excretory wastes. Human nephron - structure and urine formation - ultrafiltration, selective reabsorption, tubular secretion and countercurrent mechanism; hormonal control of renal function; composition of urine. Kidney diseases - proteinuria, uremia, acidosis and alkalosis; dialysis.

Module V **6 hrs**

Neurophysiology: Neurone-structure, nerve impulse -resting potential, action potential and latent period; synapse and synaptic transmission- All or none law, refractory period, neurotransmitters. Saltatory transmission and EEG.

Module VI **8 hrs**

Muscle Physiology: Ultra-structure of a striated muscle fibre, mechanism of muscle contraction, brief mention of muscle twitch, summation, tetanus and tonus, all or none law, fatigue, oxygen debt and rigor mortis.

Module VII **8 hrs**

Endocrinology: List the various endocrine glands and their corresponding hormones, brief description of hormonal influence, action and hormonal disorders- goitre, cretinism exophthalmic goitre, diabetes mellitus, diabetes insipidus, dwarfism, gigantism and acromegaly. Role of Hormones in reproductive cycle.

Module VIII **8 hrs**

Immunology: Types of immunity-innate, acquired, active, passive, humoral and cell mediated. Cells, tissues and organs of immune system- lymphocytes, lymphoid tissue and organs (Lymph nodes, spleen, bone marrow, thymus and mucosa associated lymphoid tissue). Antigens. Antibodies- structure and function of immunoglobulin, classes of immunoglobulins. Hypersensitivity and allergy; immunization-passive and active; vaccination. AIDS and its etiology.

References

- Eckert R and Randall D (1987) Animal physiology, CBS Publishers and Distributors,
- Ganong, W.F. (2002) Lange Review of Medical Physiology. Mc G H.
- Ganong, W.F. (2003) Review of medical physiology, Mc Graw-Hill, New Delhi.
- Goyal, K.A. & Sastry, K.V. :Animal Physiology. 6e 2002, Rastogi Publishers.
- Guyton A.C. (1998) Text book of Medical Physiology. W.B. Sanders Co.
- Hoar W.S. (1975) General and Comparative Physiology. Prentice Hall.
- Joshi, K.R. (2003) Immunology. Agro.
- Kuby, J. (1994) Immunology. W.H. Freeman & Co.
- Nagabhushanan R, Kobardar M.S. and Sarojini R (1983) A textbook of animal physiology. Oxford IBH publishing Co. New Delhi.
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- Withers P.X. (1992) Comparative animal physiology. Saunders College Publishing, New Delhi.

First Degree Programme

Semester IV

Zoology Complementary Course IV

Applied Zoology

Course code – ZO1431

Total hours 54

No. of credits – 3

Aim of the course

To introduce the methodology and perspectives of applied branches of zoology with a view of educating youngsters on the possibilities of self employment

Objectives of the course

- To learn the basic principles involved in the culture and breeding of common edible and ornamental fishes of Kerala and the art of aquarium keeping.
- To get a basic understanding of human genomics and reproductive biology including stem cell research and prenatal diagnostic techniques

Module I

17 hrs

Aquaculture: Traditional methods of aquaculture, fishing crafts and gears, common fishes used for culture in Kerala, *Catla*, *Etrophlus*, *Tilapia* and *Mugil*; capture fishes- sardine, mackerel.

Pond culture: Construction, maintenance and management; carp culture, shrimp culture, shellfish culture, composite fish culture and pearl culture

Ornamental fish culture: Fresh water ornamental fishes – biology, breeding habits, spawning, hatching and rearing techniques.

Construction and maintenance of aquarium: Construction of home aquarium, materials used, setting up of freshwater aquaria, aquarium plants, ornamental objects, cleaning the aquarium, maintenance of water quality, control of snail and algal growth.

Module II**10 hrs**

Sericulture: Brief account of morphology and life history of silkworm, varieties of silkworm, rearing technique, mulberry cultivation, diseases and pests of silkworm. Processing of cocoon, reeling and marketing of silk.

Apiculture: Species of honey bees, social organization of honey bees, apiary management and maintenance, bee keeping equipments, bee pasturage, honey and bees wax and their uses.

Module III**8 hrs**

Live Stock Management: Poultry farming, poultry breeds: mention American, Asiatic, Mediterranean, English and indigenous breeds. Poultry breeding and poultry products; rearing of chicks, growers, layers, broilers, ducks, turkeys and quails; diseases of poultry.

Dairy farming: Types, loose housing system and conventional barn system; advantages and limitations of dairy farming; establishment of dairy farm and choosing suitable dairy animals, feed, diseases of dairy animals.

Module IV**7 hrs**

Human Genetics: Normal chromosome complements; karyotype study, pedigree analysis. Syndromes- autosomal syndromes (Down's syndrome and Edwards syndromes), sex chromosomal syndromes (Turners syndrome and Klinefelter's syndrome), genetic disorders-single gene disorders (sickle cell anemia and phenyl ketonuria), multifactorial disorders (cleft lip, and cleft palate), genetic counseling.

Module V**12 hrs**

Developmental Biology and Biotechnology : Types of egg; fertilization; types and pattern of cleavages, blastulation - different types of blastula, gastrulation- morphogenetic movements (epiboly and emboly); brief description of organizers and embryonic induction. Cloning experiments in animals and man. Embryonic stem cell research. Prenatal diagnostic techniques- amniocentesis, chorionic villus sampling, ultrasound scanning. Test tube babies, gene cloning, human genome project, human gene therapy.

References

- Bard, J. (1986). Handbook of Tropical Aquaculture.
- Gardner, E.J.(1983). Human heredity, John Wiley and Sons, New York
- Hawkins, A.D. (1981). Aquarium Systems, Academic Press
- Lewin, B. (1983). Genes, John Wiley and Sons, New York.
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- Philips, E.F. (2003). Bee Keeping, Agro
- Santhanam, R. A Manual of Aquaculture.
- Shukla and Upadyay. (2002) .Economic Entomology.
- Tembhare, D.B. (1997). Modern Entomology, Himalaya Publishing House.
- Zuka, R.I and Hamiyn. (1971). Aquarium fishes and plants

**First Degree Programme
Zoology Complementary Course V**

Practical I Animal Diversity I & II, Functional Zoology and Applied Zoology

Course Code – ZO1432

No. of credits – 4

Aim of the course

To provide an hands- on training experience in anatomy through simple dissections and mountings

Objectives of the course

- To familiarize students with conventional organ system in common, easily available animals.
- To emphasize the adage that ‘seeing is believing’ typical examples and economically important specimen (preserved) to be studied.
- To study and carry out routine clinical analysis of blood and urine

Animal Diversity I & II

Study specimens

1. Protista : *Noctiluca, Paramecium, Entamoeba, Trichonympha*[any 3]
2. Porifera : *Sycon*
3. Cnidaria : *Obelia, Aurelia*, Sea anemone (Adamsia)
4. Platyhelminthes : *Bipalium, Fasciola, Taenia solium*
5. Nematoda : *Ascaris, Ancylostoma*
6. Annelida : *Nereis, Hirudinaria*
7. Arthropoda : *Limulus*, Scorpion, *Scolopendra, Sacculina, Leptocorisa* , *Oryctes*, Larval stages of prawn[any 5]
8. Mollusca : Freshwater mussel, *Sepia, Pila*
9. Echinodermata : Starfish, Sea urchin, Brittle star, Sea cucumber, sea lily [any 3]
10. Chordates : *Branchiostoma (entire), Ascidia.*
Petromyzon
Scoliodon, Narcine, Echeneis, Hippocampus, Anguilla [any 3]
Ichthyophis, Amblystoma, Rhacophorus [any 2]
Chamaeleon, Bungarus, Naja, Vipera, Chelone [any 4]
Pigeon – different types of feathers
Pteropus

Minor Practicals (Mounting) – any three

1. Earthworm : Setae *in situ*
2. *Penaeus* : Appendages
3. Cockroach : Mouth parts
4. *Nereis* : Parapodium
5. Shark : Placoid scales

Major Practicals(Dissection) – any two

1. Earthworm : Alimentary canal and associated glands
2. *Penaeus* : Nervous system
3. Cockroach : Alimentary canal

Osteology

Study of the skeleton of frog

1. Vertebrae (typical, 8th, 9th and urostyle)
2. Limb girdles: pectoral girdle with sternum, pelvic girdle, astragalus & calcaneum.

Functional and Applied Zoology**Functional Zoology**

1. Preparation of human blood smear to study the different types of WBCs.
2. Human blood grouping: ABO and Rh Systems.
3. Urine analysis for abnormal constituents: albumin and glucose.
4. Study of slides/models of different types of eggs, blastula and gastrula of animals.

Applied Zoology

1. Study of beneficial insects *Apis* (worker, drone and queen), *Bombyx* (life cycle, silk)
2. Study of the following items of economic importance: *Perna*, *Pinctada*, *Penaeus*, *Sardinella*, *Rastrelliger*

Human Genetics

Study of the following using charts/photographs

1. Study of normal human karyotype.
2. Study of abnormal human karyotypes. [Klinefelter's, Turner's, Down's and Edward's syndrome]

References

- Brusca R.C. and Brusca G.J. (1990) Invertebrates. Sinauer Associates, Sunderland,MA
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- Pearse V and dPearse J, Buchsbaum M and Buchsbaum R. (1987) Living Invertebrates\ Blackwell scientific Publications, California.
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