

UNIVERSITY OF KERALA
First Degree Programme in Zoology
Choice Based Credit and Semester System
Zoology Complementary Course

Zoology Complementary Course

FIRST DEGREE PROGRAMME SCHEME OF INSTRUCTION OF ZOOLOGY COMPLEMENTARY COURSE

Course code	Course Title	Sem I			Sem II			Sem III			Sem IV			Total Credit	Duration of Examination	Evaluation	
		Contact Hour		Credit	Contact Hour		Credit	Contact Hour		Credit	Contact Hour		Credit			CE	ESE
		T	P		T	P		T	P		T	P					
ZO1131	ANIMAL DIVERSITY I	2		2									2	3Hrs	20%	80%	
ZO1231	ANIMAL DIVERSITY II				2		2						2	3Hrs	20%	80%	
ZO1331	FUNCTIONAL ZOOLOGY							3		3			3	3Hrs	20%	80%	
ZO1431	APPLIED ZOOLOGY									3		3	3	3Hrs	20%	80%	
ZO1432	PRACTICAL OF ZO 1131,1231, 1331 &1431		2			2			2			2	4	3 Hrs	20%	80%	

**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

5 hrs

Kingdom Animalia : Salient features, levels of organization- cellular, tissue, organ and organsystem. 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* (mention polymorphism); 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. *Nereis* (mention parapodium, heteronereis); Class Oligochaeta eg. Earthworm (mention vermiculture); Class Hirudinea eg. *Hirudinaria*.

Phylum Mollusca: General characters (self study), classification up to classes-Class Aplousobranchia - 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-Supphylum 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), classification- Class Asterozoa eg. sea star, Class Ophiurozoa eg. brittle star, Class Echinozoa eg. sea urchin, Class. Holothurozoa eg. Sea cucumber, Class Crinozoa eg. sea lily (mention larval stages)

NB:Assignments/ Seminar – Topics related to syllabus can be given to students as assignment/ seminar.

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

NB:Assignments/ Seminar – Topics related to syllabus can be given to students as assignment/ seminar.

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
No. of credits – 3**

Total hours 54

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.

NB:Assignments/ Seminar – Topics related to syllabus can be given to students as assignment/ seminar.

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.
- Roitt J (2000) Immunology. W. Freeman, Oxford.
- Schimdt-Nielson K (2002) Animal Physiology. Prentice Hall India Ltd. Sebastian M.M. (1990). Animal Physiology. Madona Books, Kottayam.
- 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
No. of credits – 3**

Total hours 54

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*, *Etroplus*, *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.

NB:Assignments/ Seminar – Topics related to syllabus can be given to students as assignment/ seminar.

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.
- Mishra, R.C (2002). Perspectives in Indian Apiculture, Agro
- 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]
Icthyophis, *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
2. *Penaeus* : Appendages(Maxillipeds, Chelate, First abdominal- any three)
3. Cockroach :Mouth parts
4. *Nereis* : Parapodium
5. Shark : Placoid scales

Major Practicals(Dissection) – any two

1. Earthworm : Alimentary canal and associated glands (Demonstration, Flag labeling of parts.
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.

Functional and Applied Zoology

Functional Zoology [1-4, Compulsory]

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 (frog, chick), blastula of frog and gastrula of frog.

Applied Zoology[1-2, Compulsory]

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*.

Human Genetics[1-2, Compulsory]

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]