KUVEMPU UNIVERSITY

B.Sc. DEGREE SEMESTER SYLLABUS (Effective from 2018-19 onwards)

	Theory					**Practical**		
Year	**Sem**	**Paper**	**Title**	**Teaching Hrs**		**Paper**	**Title**	**Teaching Hrs**
I	1	1	Diversity and Functional Anatomy of Non-Chordates	60 hrs		1	Diversity and Functional Anatomy of Non-Chordates	15 x3 = 45hrs
	2	2	Diversity and Functional Anatomy of Chordates	60 hrs		2	Diversity and Functional Anatomy of Chordates	15 x3 = 45hrs
II	3	3	Ecology, Ethology and Biodiversity	60 hrs		3	Ecology, Ethology and Biodiversity	15 x3 = 45hrs
	4	4	Animal Physiology, Biochemistry and Biostatistics	60 hrs		4	Animal Physiology, Biochemistry and Biostatistics	15 x3 = 45hrs
III	5	5	Cell Biology, Microbiology and Immunology	45 hrs		5	Cell Biology, Microbiology and Immunology	15 x3 = 45hrs
		6	Applied Zoology, Histology and Bio-techniques	45 hrs		6	Applied Zoology, Histology and Bio-techniques	15 x3 = 45hrs
	6	7	Genetics, Molecular Biology and Evolution	45 hrs		7	Genetics, Molecular Biology and Evolution	15 x3 = 45hrs
		8	Developmental Biology and Animal Biotechnology	45 hrs		8	Developmental Biology and Animal Biotechnology	15 x3 = 45hrs

Teaching hours: I & II year 4 hours theory and 3 hrs Practical / week.

III year 3+3=6 hrs theory and 3+3=6 hours Practical / week.

I SEMESTER

Theory: Paper 1 : Diversity and Functional Anatomy of Non-Chordates (60 HRS.)

This paper deals with the diversity of Non-chordates. This paper will help students to understand the diversity of various species among non-chordates including organization of animal body architecture, principles of classification, general characteristics of different phyla along with specific type study.

		Hrs
1	Introduction **Animal Architecture:** i) Body symmetry- types – spherical symmetry, radial symmetry, biradial symmetry and bilateral symmetry. ii) Organization- the hierarchical organization of protoplasmic level, cellular level, tissue level and organ level of organization. iii)Germ layers- diploblastic and triploblastic condition. iv) Coelom- origin and types– acoelom, pseudocoelom, eucoelom (enterocoelom and schizocoelom). v) Metamerism- types – pseudometamerism, true metamerism. vi) Cephalization. **Principles of animal classification:** An outline classification of Animal kingdom. - binomial nomenclature; international rules of Zoological nomenclature (brief account); New trends in systematics: Numerical taxonomy (Phenetics), Cladistics (Phylogenetic systematics), Molecular systematics.	6
2	**Phylum Protozoa:** General characters, classification of the phylum up to classes with examples. Type study – structure, life history and pathogenicity of *Plasmodium vivax* Locomotion in Protozoa: Locomotory organelles and modes of locomotion, Reproduction in Protozoa	7
3	**Phylum Porifera:** General characters, classification of the phylum up to classes with examples. General study –Cell types, skeleton, canal system(Asconoid, Syconoid, Leuconoid and Rhagonoid types). Reproduction & development in sponges.	5
4	**Origin of Metazoa:** Blastea and Gastrea theories and Hadzi's theory	2
5	**Phylum Coelenterata:** General characters, classification of the phylum up to classes with examples. Type study – Obelia- Morphology & Life history. Coral and Coral reefs, types, ecology and conservation. Polymorphism in Siphonophora	4
6	**Phylum Platyhelmithes:** General characters, classification of the phylum up to classes with examples. Type study- *Taenia solium* - Structure, reproduction, life cycle and pathogenesis.	4
7	**Phylum Nemathelminthes**: General characters, classification up to classes with examples. Type study- Structure, life cycle and pathogenicity of *Ancylostoma duodenales.* General study-Soil Nematodes and Rotifers.	3
8	**Phylum Annelida:** General characters, classification up to classes with examples. Type study – *Hirudinaria granulosa* – Morphology, body wall, digestive and reproductive systems.	3
9	**Phylum Arthropoda:** General characters, classification up to classes with examples. Type study – Penaeus – appendages, concept of serial homology, digestive system, nervous system and Life cycle. General study – Cirripedia, spiders, ticks & mites, Structure and affinities of peripatus, Metamorphosis of insects.	10
10	**Phylum Mollusca:** General characters, classification up to classes with examples. Type study – Unio/Lamellidens – structure, shell structure, Reproduction and life cycle. General study – Shells in Mollusca. Torsion in Gastropoda, Pearls & Pearl formation, Diversity of Cephalopods	9
11	**Phylum Echinodermata:** General characters, classification up to classes with examples. Type study: Star fish– Morphology, digestive and water vascular systems. Echinoderm larvae.	5
12	**Phylum Hemichordata:** General characters Type study: Balanoglossus – Morphology, coelom, Tornaria larva. Affinities of Hemichordata	2

13	**Topics for Assignment / Field study:** Soil protozoa.,Parasitic protozoans of man, Parasitic adaptations in Helminthes, Ecological importance of earthworm and vermiculture, Economic importance of Insects & mollusca. Construction of cladogram/dendrogram/phylogram of different species. Parasitic platyhelminthes of human/live stock/pet animals, Parasitic Namatodes of human/live stock/pet animals, Parasitic insects of human/live stock/pet animals. Archanida/Insect pests human/ live stock/pet animals/ household/agriculture/horticulture…	2

Practicals

Paper 1: Diversity and Functional Anatomy of Non-Chordates

(15 practicals of 3 hours each = 45 hrs).

		Pr
1	**Protozoa**: Study of permanent slides – Study of *Entamoeba, Euglena, Noctiluca, Blantidium,* and *Elphidium.* Temporary slide preparation and observation of protozoan culture.(Amoeba, Euglena, Paramecium, Vorticella, Stentor ……) and soil protozoans	2
2	**Porifera**: Specimen study: *Sycon, , Hyalonema, Spongilla*. Permanent slides : spicules and gemmule. Temporary slide preparation and observation of spicules	1
3	**Coelenterata** Specimen study: Physalia, Aurelia , Gorgonia, Fungia, Metridium Permanent slides: study of T.S. of Hydra and sea anemone, Obelia colony.	1
4	**Platyhelminthes** & **Nemathelminthes** Specimen study – Planaria, *Fasciola hepatica*, *Taenia solium, Schistosoma, Ascaris lumbricoides, Ancylostoma duodenale . T.S of male and female Ascaris*.	1
5	**Annelida** Specimen study:Pheritema, Nereis, Sabella, Aphrodite, Hirudinaria granulose. T.S of Hirudinaria granulose through crop.	1
6	**Arthropoda** Specimen study: Penaeus, Sacculina, Scolopendra, Scorpion, Tick, Aranea, Lepisma, Gryllotalpa, Carausius, butterfly, Rhinoceros beetle,Cimex hemipterus (bed bug),wasp . Permanent slides: Mouth parts cockroach, Mosquito& Honey bee.	2
7	**Mollusca** Specimen study**:** Chiton, Dentalium, Cypraea, Conus, Limnaea, Mytilus, Unio, Sepia, Octopus, Permanent slides: Glochidum larva, Radula and statocyst of Pila. Shells of Xancus, cyprea, scallop, Nautilus and Cuttle bone.	2
8	**Echinodermata** Specimen study**:** Astropecten, Ophiothrix, Echinus, cucumaria, Antedon, Slides of Bipinnaria & Echinopluteus larvae, Aristotle lantern, Pedicellaria **Hemichordata** – Balanoglaossus, Slide of Tornaria larva.	2
9	Demonstration of systems by animations /model/pictures Leech- Digestive and reproductive system Penaeus – nervous system Cockroach - digestive and reproductive system **Mountings-** Appendages of prawn, Mouth parts of Cockroach, mosquito. Spiracles of cockroach(dead commercially available specimens)	3

Suggested Readings:

1. Barnes R.D. 1968. Invertebrate Zoology, 2nd Edn. Saunders Philadelphia.
2. Barrington, E.J.W.1967. Invertebrate structure and function. Neelson, London.
3. Hymann, L.H. 1940-67. The Invertebrate, Vol. I-IV. Mc Graw- Hill, New York.
4. Marshall, A.J. and Williams, W.D. (Eds.). 1995. Text book of Zoology – Invertebrates, B.S. Publishers.
5. Russell-Hunter, W.D. 1968. A biology of lower Invertebrates. Macmillan Company, New York.
6. Russell-Hunter, W.D. 1969. Biology of higher Invertebrate. Macmillan Company, New York.
7. Sedgewick Volumes
8. Parker and Haswel Vol. I
9. R. L. Kotpal Volumes Invertebrates
10. A Manual of Zoology by Ekambarnath Iyer and Vishwanathan
11. Ruppert and Barnes, R.D. (2006). Invertebrate Zoology, VIII Edition. Holt Saunders International Edition.
12. Invertebrate Structure and Function Paperback – 2012 by Barrington E J W (Author)
13. Barnes, R.S.K., Calow, P., Olive, P.J.W., Golding, D.W. and Spicer, J.I. (2002). The Invertebrates: A New Synthesis, III Edition, Blackwell Science.
14. Invertebrate Zoology - E. L. Jordan and Verma
15. Biology of Animals Vol-1- Ganguly, Sinha, Adhikari
16. Zoology for degree students- Dr. V.K. Agarwal
17. Anderson, D. T.: Invertebrate Zoology. 2e, 2001, Oxford Uty. Press (Indian Edn.2006
18. Integrated Principles of Zoology17th Edition(2016) Cleveland Hickman, Jr. and Susan keen and Allan Larson and david Eisenhover and helen I'Ánson and Larry Roberts.

Practical 1

SCHEME OF PRACTICAL EXAMINATION

Duration : 3 Hrs. **Max. Marks : 40**

Q I. Mounting : Make temporary preparation & comment on **A** & **B** …….. 5x2=10 marks

Q II. Identify, classify and comment with labeled diagram of **C , D, E, F & G** …… ……3x5=15 marks
(Identification 1/2 mark; classification 1/2 mark; Labeled diagram 1 mark,
Description 1 mark.- 3 specimens, 2 slides).

Q III. Submission of Field study report / Assignment 05 marks

Q IV . Viva – Voce 05 marks

Q V . Class records 05 marks

II SEMESTER

Theory: Paper 2: Diversity and Functional Anatomy of Chordates (60 Hours)

This paper deals with the diversity and anatomy of Chordates. This will help students to understand the diversity of various species among chordates. Students will learn general characteristics of different phyla from Protochordates to Mammalia along with specific type study. This paper also deals with comparative anatomy of vertebrates, and paleontological and evolutionary aspects.

		Hrs
1	**Introduction:** General characters of Chordates, classification up to classes, origin of chordates	3
2	**Protochordates**: Sub-phylum Urochordata –distinctive characters Ascidia, Ascidian tadpole and retrogressive metamorphosis. Sub-phylum Cephalochordata –Amphioxus– Morphology, Structure of pharynx and feeding mechanism in *Branchiostoma* sp.	4
3	**Subphylum Vertebrata: Division Agnatha** – distinctive characters and classification upto classes. Cyclostomata – Petromyzon, Myxine general organization, Ammocoete larva and its significance.	2
5	**Gnathostomata** – General characters of PISCES, Chondrichthyes and Osteichthyes. Classification up to Classes. Type study : *Scoliodon*-Morphology, Digestive system, Respiratory system, Circulatory system, Central nervous system sense organs & Urinogenital system General study- Accessory respiratory structure in teleosts, Dipnoi fishes.	8
4	**Class Amphibia:** General characters and classification of living Amphibians upto orders, with suitable examples. Paedomorphosis with special reference to Axolotl larva. Endemic anuran species of Western Ghats. Evolution of tetrapod limbs.	5
5	**Class Reptilia** -General features and Classification up to order level. Poisonous and non-poisonous snakes, Poison apparatus of snakes and evolution of temporal fossae.	6
6	**Class Aves** – General characters and classification up to subclasses; distinctive features of Archaeornithes and Neornithes with reference to Paleognathae, Impennae and Neognathae with suitable examples; a brief account on forest, wetland and shore birds; adaptation to flight	6
7	**Class Mammalia**: – general characters and classification up to orders with examples; Distinctive features and distribution of Prototheria, Metatheria, Distinctive features of mammalian orders (Rodentia, Carnivora, Chiroptera, Cetacea, Proboscidia, Ungulata – Perissodactyla and Artiodactyla, and Primates –Platyrhini and Catarhini) with examples. Dentition in Mammals, Type study – Rabbit – Morphology, digestive, respiratory, Central Nervous System, cranial nerves, urinogenital systems.	8
8	**Comparative anatomy of vertebrates:** – vertebrate integument and its derivatives Evolutionary trends in the structure of Heart, Aortic arches, and Kidney of Shark, frog, Lizard, Pigeon and Rabbit.	10
9	**Paleontology :** An account of fossils, dating of fossils, conservation of fossils. Paleontology of Dinosaurs: Tyrannosaurus, Brontosaurs, Pterosaurs, Ichthyosaurs and Archaeopteryx Origin and evolution of horse and man.	8

10	**Topics for Assignment / Field study:** Parental care in fishes, fins, scales, airbladder in fishes, Parental care in amphibians Snake venom: nature; composition; antivenin. Aquatic mammals and their adaptations. Beaks/feet adaptations in birds, Echolocation, vocal signals in different groups of vertebrates. Sexual dimorphism in fishes/amphibians/reptiles /birds & mammals, Biometry.	

Suggested Readings:

1. Kardong, K.V. (2005) Vertebrates Comparative Anatomy, Function and evolution. IV Edition. McGrawHill Higher Education.
2. Kent, G.C. and Carr R.K. (2000). Comparative Anatomy of the Vertebrates. IX Edition. The McGraw-Hill Companies.
3. Young, J.Z. (2004). The life of vertebrates. III Edition. Oxford university press.
4. Bhaskaran, K. K. & Biju Kumar, A.: Textbook of Zoology (Chordata), Manjusha
5. Dhami, P. S. & Dhami, J. K.: Chordate Zoology. R. Chand & Co
6. Ekambaranatha Ayyar, M. & Ananthakrishnan, T. N.: A Manual of Zoology. Vol. II Part I & II
7. Harvey Pough, F. et al.: Vertebrate Life. Pearson Edn Inc, Indian Edn
8. Jordan, E. L. & Verma, P. S.: Chordate Zoology S. Chand & Co, New Delhi
9. Kardong, K. V.: Vertebrates: Comparative Anatomy, Function and Evolution. 1995, WCB
10. Kotpal, R. L.: Modern Textbook of Zoology: Vertebrates. Rastogi
11. Romer, A. S: The Vertebrate Body; 1992 reprint, Vakils, Feffer & Simons, Bombay
12. Salim Ali: The Book of Indian Birds. BNHS, Oxford
13. Sedgewick Volumes
14. Parker and Haswel Vol. II
15. Comparative Anatomy by Romer
16. Integrated Principles of Zoology17th Edition(2016) Cleveland Hickman, Jr. and Susan Keen and Allan Larson and David Eisenhour and Helen I'Anson and Larry Roberts.

Practicals

Paper 2: Diversity and Functional Anatomy of Chordates.

(15 practicals of 3 hours each = 45 Hours).

	Title	Prs
1	**Sub-phylum Urochordata** – Herdmanja, Ascidian tadpole. Sub-phylum Cephalochordata – Amphioxus, T.S. of Amphioxus through Pharynx Cyclostomata – Petromyxon, Myxine	1
2	**Pisces** – Scoliodon, Narcine,sting ray, Rhinobatus, Pristis, Hippocampus, Synaptura, Echenis, Mackerel, Anabas, Ophiocephalus, Antennarius, Dipnoi fishes Mounting & temporary slide prepareation of placoid, ctenoid, cycloid scales and Ampullae of Lorenzini.	3
3	**Amphibia** – Ichthyophis, Bufo, Ambystoma and Axolotl Larva, Necturus, Alytes, *Nasikabatrachus sahyadrensis*.	1
4	**Reptelia** – Bungarus, Calotes, Chameleon, Draco, Naja naja, viper, Hydrophis, Python, Green snake, Hemidactylus, Alligator, Chelone mydas, Sphenodon, Phrynosoma. Fossil models- Tyrannosaurus, Brontosaurs, Pterosaurs, Ichthyosaurs and Archaeopteryx	3
5	**Aves** – Parrot, Owl, Penguin, Ostrich, Wood pecker, Cattle egret, Duck, Kingfisher, Pigeon, Gypus bengalensis (Bengal vulture), Psittacula (parrot), *Mulus migrans* (black winged kite), Bubulcus ibis (cattle egret).	2
6	**Mammalia:** Echidna, Ornithorhynchus, Macropus, Whale, Dolphin, Pteropus, Loris, Porcupine Macaca mulatta, *Elephas indicus*, Funambulus palmarum, Rattus rattus, *Panthera tigrina*, Horse, Rhinoceros, Axis axis, *Balaenoptera rostrate.*	2
7	**Comparative Anatomy or Vertebrates** – Heart & urinogenital system of Shark, Frog, Pigeon and Rabbit	1
8	Endoskeleton of Rabbit – Skull, vertebrae, girdles and limb skeleton	1
9	Demonstration of systems by animations /model/pictures Rat– digestive and respiratory system and Brain	1

Practical 2
SCHEME OF PRACTICAL EXAMINATION

Duration : 3 Hrs. **Max. Marks : 40**

Q I. Mounting : Make temporary preparation & comment on **A** …….. 05 marks

Q II. Demonstrate **B** (specimen/model/image/bone)……. 05 marks

Q III. Identify, classify and comment with labeled diagram of **C , D ,E,F & G** …… ……3x5=15marks
(Identification 1/2 mark; classification 1/2 mark; Labeled diagram 1 mark,
Description 1 mark.- 2 specimens, 1 slide, 1 comparative anatomy and 1 from Paleontology).

Q IV. Submission of Field study report /Assignment 05 marks

Q V. Viva – Voce 05 marks

Q VI. Class records 05 marks

Theory Question paper pattern
I semester B.Sc., degree examination May/Nov 201-
Semester scheme
Zoology
Paper 1: Diversity and Functional Anatomy of Non-Chordates
Time : 3 Hrs. Max. Marks : 50

Instructions to the candidates:
1. Objective type question should be answered in the first two pages of the answer book
2. Draw labeled diagrams wherever necessary

I. Answer any **FIVE** of the following questions 5x2=10 marks
1.
2.
3.
4.
5.
6.
7.

II. Explain briefly any **FOUR** of the following: 4x5=20 marks
8
9
10
11
12
13

III. Answer any **TWO** of the following 2x10=20 marks
14
15
16