



# KUVEMPU UNIVERSITY

## CURRICULUM IN ZOOLOGY FOR B.Sc. (UG)

### 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	5.1	Cell Biology, Microbiology and Immunology	45 hrs	5	Cell Biology, Microbiology and Immunology	15 x3 = 45hrs
		5.2	Applied Zoology, Histology and Bio-techniques	45 hrs	6	Applied Zoology, Histology and Bio-techniques	15 x3 = 45hrs
	6	6.1	Genetics, Molecular Biology and Evolution	45 hrs	7	Genetics, Molecular Biology and Evolution	15 x3 = 45hrs
		6.2	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.

## CURRICULUM IN ZOOLOGY FOR B. Sc. (UG) 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.

Units	TITLE	hrs
1	<p>Introduction</p> <p><b>Animal Architecture:</b> 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.</p> <p><b>Principles of animal classification:</b> 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.</p>	7
2	<p><b>Phylum Protozoa:</b> General characters, classification of the phylum up to classes with examples. Type study – structure, life history and pathogenicity of <i>Plasmodium vivax</i> Locomotion in Protozoa: Locomotory organelles and modes of locomotion, Reproduction in Protozoa</p>	6
3	<p><b>Phylum Porifera:</b> 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 in sponges.</p>	5
4	<p><b>Origin of Metazoa:</b> Blastea and Gastrea theories and Hadzi's theory</p>	2
5	<p><b>Phylum Coelenterata:</b> General characters, classification of the phylum up to classes with examples. Type study – Obelia- Morphology &amp; Life history. Coral and Coral reefs, types and importance of coral reefs. Polymorphism in coelenterata</p>	4
6	<p><b>Phylum Platyhelminthes:</b> General characters, classification of the phylum up to classes with examples. Type study- <i>Taenia solium</i> - Structure, reproduction, life cycle and pathogenesis. Parasitic adaptations in helminthes.</p>	4
7	<p><b>Phylum Nematelminthes:</b> General characters, classification up to classes with examples. Pathogenicity of <i>Ascaris</i> &amp; <i>Wuchereria</i> Role of <i>Turbatrix aceti</i> (vinegar eels) and <i>Brachionus</i>.</p>	3
8	<p><b>Phylum Annelida:</b> General characters, classification up to classes with examples. Type study – <i>Hirudinaria granulosa</i> – Morphology, Excretory, digestive and reproductive systems.</p>	3
9	<p><b>Phylum Arthropoda:</b> General characters, classification up to classes with examples. Type study – <i>Penaeus</i> – appendages, concept of serial homology, digestive system, nervous system and Crustacean larvae: Nauplius, Zoea, cypris and mysis larval stages. Web building spiders, Structure and affinities of peripatus, Metamorphosis of insects. Economic importance of insects.</p>	10
10	<p><b>Phylum Mollusca:</b> General characters, classification up to classes with examples. Type study – <i>Unio</i>– structure, shell structure, Reproduction and life cycle. General study – Shells in Mollusca. Torsion in Gastropoda, Diversity of Cephalopods- Nautilus, Sepia &amp; Octopus</p>	9
11	<p><b>Phylum Echinodermata:</b> General characters, classification up to classes with examples. Type study: Star fish– Morphology, digestive and water vascular systems. Bipinnaria and Auricularia larvae.</p>	5
12	<p><b>Phylum Hemichordata:</b> General characters Type study: <i>Balanoglossus</i> – Morphology and Affinities of Hemichordata</p>	2

## B.Sc. ZOOLOGY PRACTICAL PAPER I

### DIVERSITY AND FUNCTIONAL ANATOMY OF NON-CHORDATES

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

	Title	Pr
1	Introduction to practicals- Microscopy-Laboratory handling of Compound & dissection microscope and stereoscopic microscopes.	1
2	<b>Protozoa:</b> Study of permanent slides – Study of <i>Entamoeba</i> , <i>Euglena</i> , <i>Noctiluca</i> , <i>Blattidium</i> , and <i>Elphidium</i>  Temporary slide preparation and observation of protozoan culture.(Amoeba,Euglena,Paramecium,vorticella,stentor ..... ) and soil protozoans	2
3	<b>Porifera:</b> Specimen study: <i>Sycon</i> , , <i>Hyalonema</i> , <i>Spongilla</i> . Permanent slides : spicules and gemmule. Temporary slide preparation and observation of spicules	1
3	<b>Coelenterata</b> Specimen study: Physalia, Aurelia , Gorgonia, Fungia, Metridium Permanent slides: study of T.S. of Hydra, Obelia colony,	1
4	<b>Platyhelminthes &amp; Nematelminthes</b> Specimen study – Planaria, <i>Fasciola hepatica</i> , <i>Taenia solium</i> , <i>Schistosoma</i>  <i>Ascaris lumbricoides</i> , <i>Ancylostoma duodenale</i> . T.S of Ascaris	1
5	<b>Annelida</b> Specimen study:Pheritema, Nereis, Sabella, Aphrodite, Hirudinaria granulose.	1
6	<b>Arthropoda</b> Specimen study: Penaeus, Sacculina, Scolopendra, Scorpion, Aranea, Lepisma, Gryllotalpa, Carausius, butterfly, Rhinoceros beetle,Cimex hemipterus (bed bug),wasp .  Permanent slides: Mouth parts cockroach& Mosquito	2
7	<b>Mollusca</b> Specimen study: Chiton, Dentalium, Cypraea, Conus, Limnaea, Mytilus, Unio, Sepia, Octopus, Permanent slides: Glochidium larva, Shells of Xancus, cyprea, scallop, Nautilus and Cuttle bone.	2
8	<b>Echinodermata</b> Specimen study: Astropecten, Ophiothrix, Echinus, cucumaria, Antedon, Slides of Bipinnaria& Echinopluteus larvae, Aristotle lantern, Pedicellaria <b>Hemichordata</b> – Balanoglaossus, Slide of Tornaria larva	2
9	<b>Demonstration of animations /model/pictures</b>  <b>Mountings-</b> Appendages of prawn, Mouth parts of Cockroach, mosquito, honey bee, Spiracles of cockroach(dead commercially available specimens)	2

**B.Sc. Zoology Practical Paper 1**  
**SCHEME OF PRACTICAL EXAMINATION**

**Duration : 3 Hrs.**

**Max. Marks : 40**

**Q I. Mounting :A-** Make temporary preparation & comment . 3marks

(A- Protozoan culture/mouth parts of mosquito)

B - Identify and comment 3 marks

(any one appendage of prawn, Identification & diagram 2 marks, description-1mark)

**Q II.** Identify, classify and comment with labeled diagram of **C , D,E,F, G, H, I &J** .....8X3=24marks  
(Identification 1/2 mark; classification 1/2 mark; Labeled diagram 1 mark, Description 1 mark).

**Q III .** Viva Voce 05 marks

**Q IV.** Class records 05marks

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**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 EkambarnathIyer andVishwanathan
- 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).
- 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
18. Integrated Principles of Zoology17<sup>th</sup>Edition(2016) Cleveland Hickman

## CURRICULUM IN ZOOLOGY FOR B. Sc. (UG) 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.

Units	TITLE	hrs
1	<b>Introduction:</b> General characters of Chordates, classification up to classes, origin of chordates( <b>Combined theory.</b> E.J.W. Barrington (1965))	3
2	<b>Protochordates:</b> General characters of Sub-phylum Urochordata –Morphology of Ascidia, Ascidian tadpole and retrogressive metamorphosis. Distinctive features of Sub-phylum Cephalochordata –Amphioxus– Morphology, Structure of pharynx and feeding mechanism in <i>Branchiostoma</i> sp.	4
3	<b>Subphylum Vertebrata: Division Agnatha</b> – distinctive characters and classification upto classes. Cyclostomata – Petromyzon, Myxine general organization, Ammocoete larva and its significance.	2
5	<b>Gnathostomata</b> – General characters of PISCES, Chondrichthyes and Osteichthyes. Classification up to Classes. Type study : <i>Scoliodon</i> -Morphology, Digestive system, Respiratory system, Circulatory system, Central nervous system & Urinogenital system General study- Accessory respiratory structure in teleosts, Salient features of Dipnoi fishes.	8
4	<b>Class Amphibia:</b> 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- <i>Nyctibatrachus</i> & <i>Nasikabatrachus</i> . Origin of tetrapod limbs.	5
5	<b>Class Reptilia</b> -General features and Classification up to order level. Snake venom, Poison apparatus of snakes and evolution of temporal fossae.	5
6	<b>Class Aves</b> – 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 Beak and feet modifications in birds	8
7	<b>Class Mammalia:</b> – general characters and classification up to orders with examples; Distinctive features and distribution of Prototheria, Metatheria & Eutheria, Distinctive features of mammalian orders (Rodentia, Carnivora, Chiroptera, Cetacea, Proboscidea, Ungulata – Perissodactyla and Artiodactyla, and Primates –Platyrrhini and Catarrhini) with examples. Dentition in Mammals- Types, Dental formula of dog, cow and man, Type study – Rabbit – Morphology, digestive, respiratory, Central Nervous System, cranial nerves, urinogenital systems.	9
8	<b>Comparative anatomy of vertebrates:</b> – vertebrate integument and its derivatives Evolutionary trends in the structure of Heart, Brain, and Kidney of Shark, frog, Lizard, Pigeon and Rabbit.	10
9	<b>Paleontology :</b> An account of fossils, dating of fossils, conservation methods of fossils. Paleontology of Dinosaurs: Tyrannosaurus, Brontosaurus, Pterosaurs, Ichthyosaurs and Archaeopteryx.	6

## B.Sc. ZOOLOGY PRACTICAL PAPER II

### DIVERSITY AND FUNCTIONAL ANATOMY OF CHORDATES

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

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

**B.Sc. Zoology Practical Paper 2**  
**SCHEME OF PRACTICAL EXAMINATION**

**Duration : 3 Hrs.**

**Max. Marks : 40**

**Q I.** Mounting : Make temporary preparation & comment on **A** ( Scales)..... 03marks

**Q II.** Demonstrate **B** (Demonstration model/Endoskeleton)..... 03marks

**Q III.** Identify, classify and comment with labeled diagram of **C , D ,E,F , G,H, I & J**... 8x3=24marks  
(Identification 1/2 mark; classification 1/2 mark; Labeled diagram 1 mark,  
Description 1 mark.- 6 specimens, 1 comparative anatomy and 1 from Paleontology).

**Q IV.** Viva – Voce 05 marks

**Q V.** Class records 05marks

**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.EkambaranathaAyyar, M. &Ananthkrishnan, T. N.: A Manual of Zoology. Vol. II Part I & II
- 7.Harvey Pough, F. et al.: Vertebrate Life. Pearson EdnInc, 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

## CURRICULUM IN ZOOLOGY FOR B. Sc. (UG) III SEMESTER

### Theory: Paper III : Ecology, Ethology and Biodiversity (60 Hrs)

This paper deals with ecological components and systems, social organization of animals and diversity of animals. You will understand the principles, various processes and factors pertaining to ecosystem. In addition, you will understand the diversity of animals, their distribution and status with reference to India, and the behaviour of animals, their social organization, etc.

1	<b>Concepts of Ecology &amp; Environment:</b> Definition-Environment, Ecology & Ecosystem; Environmental concepts - Atmosphere, Hydrosphere, Lithosphere & Biosphere, Environmental factors - Abiotic factors (Climate & Edaphic) & Biotic factors. <b>Ecosystem</b> :Concept, components, properties and functions; Ecosystem Processes - Energy flow in ecosystem and laws of thermodynamics, primary productivity, Biomass and productivity measurement, food chain, food web & ecological pyramids.	8
2	<b>Animal relationships:</b> Mutualism; commensalisms; parasitism; ammensalism; predation and competition with relevant examples	4
3	<b>Community ecology</b> : community structure; ecological determinants; ecological stratification; ecotone and edge effect; ecological niches; concepts ecological succession; climax community	3
4	<b>Limiting Factors-</b> basic concepts- Leibig's law of minimum, Shelford's law of tolerance, combined concept of limiting factors, Light and temperature as limiting factors.	2
5	<b>Habitat Ecology</b> : Marine habitat with zonation of sea; fresh water habitat: Lentic and Lotic systems; Terrestrial habitat - a brief account of forest and desert biomes; ecological adaptation of water and desert animals.	4
6	<b>Population ecology:</b> Properties of population- density, natality, mortality, age ,distribution, biotic - Potential- Allee's principle and Gause's principle, environmental resistance and carrying capacity, population growth forms, J and S shaped curves, emigration, immigration and migration, population fluctuation.	4
7	<b>Environmental toxicology</b> : Definition, scope and importance, Toxicants, Toxicity, LC50, LD50, classification of toxic agents. Biomagnification, Green house effects and global warming, sewage and sewage treatment.	4
8	<b>Ecosystem monitoring</b> - GIS ( Graphic information system), role of remote sensing in ecology, (Global positioning system) GPS and its application and Ecosystem Modeling (Brief account only).	3
9	<b>ETHOLOGY -Types of animal behavior with example</b> :Innate behavior - reflexes, instinct, motivation; Learning behavior - habituation, imprinting, conditioned reflexes, insight learning; Aggression and territoriality. pheromones and behavior.	4
10	<b>Social organization in animals</b> : Honeybee (with communication),- Termites, Macaques and Elephant.	3
11	<b>Animal migration</b> : A) Migration in fishes - types, Anadromous and catadromous migration with salmon and Eel as examples. B) Migration in birds - Types/pattern, Methods of study, advantages, mechanics, preparation, orientation and navigation.	5
12	<b>Courtship behavior</b> :General principle, courtships of Three spined stickle back fish, Betta splendens, Frog, Peacock.	2
13	<b>Parental care and Nesting behavior</b> Parental care : In fishes - Hippocampus & Arius In amphibians - Ichthyophis&Rhacophorus In birds - Jacana & Penguin. Nesting behavior - in Waver bird, bower bird & tailor bird	2
14	<b>Biological clock</b> :Its nature, types and significance.Chronobiology in human health and diseases	2
15	<b>BIODIVERSITY:</b> Levels of biodiversity — genetic, species, ecosystem level; number of species in different groups of animals — global, and India, Values of Biodiversity & Biodiversity hotspot-Western Ghats. Threats to Biodiversity, Man-wild life conflict, <b>Biodiversity conservation and management:</b> Conservation strategies: <i>in situ</i> ; <i>ex-situ</i> , National parks, Sanctuaries and Biosphere reserves. Wild life conservation - Wildlife Protection Act, 1972, Role of Government and Non-Governmental organizations in wild life conservation. International efforts : Convention on Biological Diversity (CBD), International Union for Conservation of Nature and Natural Resources (IUCN), Convention for International Trade of endangered species, RAMSAR, Red data book , & endangered fauna of India.	10



## B.Sc. ZOOLOGY PRACTICAL PAPER III

### Ecology, Ethology and Biodiversity (15 practicals of 3 Hrs each)

#### Ecology:

10 practicals

1. pH of water samples
2. pH of soil samples
3. Estimation of dissolved CO<sub>2</sub> of water samples
4. Estimation of dissolved O<sub>2</sub> of water samples (Winkler's method)
5. Estimation of dissolved chlorides of water samples
6. Visit to a pond for the study of ecosystem: Collection and observation of planktons and consumers
7. Estimation of total hardness in water samples
8. Animal relationships :
  - for Mutualism – hermit crab and sea anemone; Trichonympha and termite
  - for commensalism – sucker fish and shark; Chaetopterus and crab
  - for parasitism – Ascaris, Saculina on crab, leech, mosquito
  - for predation- insect and frog; rat and snake
  - for ammensalism – Pencillium, Microcystis
  - for competition – squirrel and bird;

#### Ethology :

2 practicals

9. Eel, Ichthyophis, Male Hippocampus, Rhacophorus, termites and honey bee colony.
10. Nesting patterns of Tailor bird and Weaver bird.

#### Biodiversity:

3 practicals

11. Endangered fauna of India- Slender Loris, Pangolin, Python, Great Indian Bustard, Varanus, Gharial, Horn bill, Musk deer, Green sea turtle.
  12. Visit to wildlife sanctuary/safari/Nature camp (Field visit report in record)
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## **B.Sc. ZOOLOGY PRACTICAL PAPER III**

### **SCHEME OF PRACTICAL EXAMINATION**

Duration: 3 Hours

Max. Marks: 40

- Q 1. Identify and comment on the given specimens **A** and **B**. 2x3= 6 marks  
(from Biodiversity)
- Q 2. Identify and comment on **C,D** ( Ethology), **E&F**(Animal relationships) 4x3=12 marks
- Q 3.Estimate the quantity of dissolved CO<sub>2</sub>/O<sub>2</sub>/ Cl<sub>2</sub> / total hardness in given sample **G**.  
(Principle-1mark, Requirement-1, Procedure-2, Observation and report -4 marks) 8 marks
- Q 4. Find the pH of the soil/water samples **H** and **I**. 2 marks
- Q 5. Identify and comment on **J** (pond ecosystem) 2 marks
- Q 6 Viva Voce. 5 marks
- Q 7. Class records 5 marks
- .....

#### **Suggested Readings:**

1. Animal behaviour by Alock(2013)
2. Survival strategies by R. Gadakar(1997)
3. Introducton to Animal behaviour by Manning A. & M.S.Dawkins(2012)
4. Animal Behaviour by Robert A(1966) 17
5. Learning and instinct in animals by Thorpe(1956)
6. Ethology bu Reena Matur(1998)
7. Ecology by Charles J. Krebs(2009)
8. Fundamentals of Ecology by Eugene P. Odum(1953)
9. Elements of Ecology by Clarke(2015).

## CURRICULUM IN ZOOLOGY FOR B. Sc. (UG) IV SEMESTER

### THEORY : PAPER IV : ANIMAL PHYSIOLOGY, BIOCHEMISTRY AND BIostatISTICS (60 Hrs)

This paper teaches you the physiological processes, mechanisms which control the various physiological processes, various systems organization, endocrine glands and their hormonal secretions, Fundamentals of Biomolecules and their structure and functions. In addition, you will understand the essential statistical methods used in biology.

1	<b>Osmoregulation in animals:</b> Types, osmoregulation in shark, marine & fresh water teleosts, kangaroo rat and camel.	2
2	<b>Digestion</b> : Mechanism of digestion; chemical digestion and absorption of carbohydrates, proteins and lipids ;nervous and hormonal control of digestion balanced diet, nutritional disorders - PEM , deficiency of iron, iodine and calcium, lifestyle diseases, role of fibres 'and probiotics.	4
3	<b>Respiration</b> : external and internal respiration; respiratory pigments (Hb, haemocyanin, haemoerythrin); Physiology of respiration — exchange of gases transport of oxygen — oxygen dissociation curve, Bohr effect; transport of CO <sub>2</sub> -chloride shift, respiratory quotient.	3
4	<b>Circulation</b> : types of circulation & hearts, Blood- Composition and functions, mechanism of blood clotting, disorders of blood clotting, anticoagulants, heartbeat, conducting system and pace maker, control of cardiac activity, electrocardiogram, angiogram, angioplasty.	4
5	<b>Excretion:</b> Nitrogen Excretion in animals, Ammonotelism, Ureotelism, Uricotelism, Guanotelism; Vertebrate Kidney - Function and regulation of vertebrate kidney; osmotic and Ionic Regulation.	3
6	<b>Nervous System</b> : Nerve Cells; Types, Structure of Multipolar neuro'ns ; Nerve Impulse ; Membrane Potential ; Action Potential, Conduction of nerve impulse ; Synaptic Transmission, Neurotransmitters, Neurodegenerative disorder ; Alzheimers diseases. <b>Human endocrine glands</b> - pituitary, thyroid, parathyroid, pancreas, adrenal, testes, ovaries and placenta ; hypothalamus and its stimulatory and inhibitory effects ; effects of hypo and hypersecretion of various hormones in human.	7
7	<b>Muscle physiology</b> : types of muscles ultra structure of Vetebrate Skeletal Muscles, Mechanism and control of Muscle Contraction. Properties of muscles :- Twitch, Tetanus, tone summation, all-or-none, principle and muscle fatigue,	4
8	<b>Thermoregulation in animals:</b> Effects of temperature, Acclimation and Acclimatization; Temperature Regulation in Poikilotherms and Homeotherms ;Hibernation, Aestivation, and daily torpor, Behavioural and Physiological Adjustments: Heat Production, Heat Loss, Heat Exchangers, Regulatory Mechanisms.	3
9	<b>Sense organs</b> : Classification of sense organs; structure and physiology of ear ; eye of mammal;	3
10	<b>BIOCHEMISTRY : Carbohydrates</b> :Structure and Biological importance: Monosaccharides, Disaccharides, Ploysaccharides and Glycoconjugates. Glycolysis, Krieb's Cycle, ETS, Gluconeogenesis, Glycogenesis. <b>Lipids</b> : Structure, classification and biological importance of saturated and unsaturated fatty acids, Tri-acylglycerols, Phospholipids, Glycolipids, Steroids. <b>Proteins: Amino acids:</b> Types and Biological importance of amino acids. <b>Proteins:</b> structure (Pri., Sec., ter., and quat.,) and Biological importance with examples, fibrous and globular proteins.	10
11	<b>Enzymes</b> : Definition, Classification (IUB system); Mechanism of enzyme action; specificity of enzymes; reversibility of enzyme action; Enzyme kinetics; Factors affecting rate of enzyme-catalyzed reactions; Derivation of Michaelis-Mentenequation, Concept of Km and Vmax, enzyme inhibitors; A brief account of coenzymes cofactors; clinical importance of enzymes	4
12	<b>Vitamins</b> : Definition, Classification and Bilogical importance and deficiency Symptoms.	3
13	<b>BIostatISTICS:</b> Introduction, Variable and attribute; Sampling methods: Qualitative sample, Quantitative sample, Random sample, Non random samples. Arrangement of data; Frequency distribution. Graphical presentation of data: Line diagram; Bar diagram; Pie chart; Histogram. Measures of central tendency: Arithmetic mean; Mode; Median. Measures of dispersion: Variance; Standard deviation; Standard error of mean.	10

## B.Sc. ZOOLOGY PRACTICAL PAPER IV

### IV semester :Practical Paper 4: Physiology, Biochemistry and Biostatistics.

(15 practicals of 3 Hours each).

#### Physiology & Biochemistry:

- |   |              |
|---|--------------|
| 1. Total RBC count  | 2 practicals |
| 2. Total WBC count  | 1 practical  |
| 3. Differential count of WBC                                    | 1 practical  |
| 4. Estimation of Hb   | 1 practical  |
| 5. Estimation of bleeding and clotting time                     | 1 practical  |
| 6. Preparation of Haemin crystals                               | 1 practical  |
| 7. Estimation of protein by colorimetric test                   | 1 practical  |
| 8. Sense organs: Structure of Ear and Eye of Mammals            | 1 practical  |
| 9. Types of Muscles slides – simple, striated and cardiac       | 1 practical  |
| 10. Commenting on the vitamins present with deficiency diseases | 1 practical  |

Vitamin A – Amaranthus leaves & Carrot

Vitamin B<sub>1</sub> & B<sub>2</sub> – Rice bran, Yeast

Vitamin C – Citrus fruits, Banana

Vitamin D – Milk & Fish liver oil

Vitamin E – Germinating seeds

Vitamin K – Cabbage and Spinach

- |   |             |
|---|-------------|
| 11. Qualitative detection of following;                               | 1 practical |
| Glucose- Benedict's test  |             |
| Starch -Iodine test   |             |
| Proteins - Biuret test  |             |
| 12. Qualitative detection of Nitrogenous wastes;                      | 1 practical |
| Ammonia - Nessler's reagent test ; Urea - Urease test                 |             |
| Uric acid - Folin's uric acid reagent test; Creatinine - Jaffe's test |             |

#### Biostatistics:

- |   |             |
|---|-------------|
| 13. Construction of graphs using the given data-      | 1 practical |
| Histogram, Bar diagram, Pie diagram and Line diagram. |             |
| 14. Measuring central tendency using the given data.  | 1 practical |
| Mean, Mode and Median                                 |             |
-

## B.Sc. ZOOLOGY PRACTICAL PAPER IV

### SCHEME OF THE PRACTICAL EXAMINATION

Duration: 3 Hours

Max. Marks: 40

- Q 1. Conduct the experiment and report. (by lot). 10 marks  
(Principle-2marks, Requirement-1, Procedure-3, Observation and report -4 marks)
- Q 2. Conduct qualitative detection test for samples 2X3=6 marks  
a) (proteins/starch/glucose) b) (Nitrogenous wastes)
- Q 3. Identify and comment on **A, B** and **C** 3X3= 9marks  
(A-Sense organs /types of muscles, B & C vitamin samples)
- Q 4. Biostatistics:  
Construct a graph using the given data (Line/Bar/Pie/Histogram) 5 marks  
/Measure of central tendency.
- Q 5. Viva voce. 5 marks
- Q 6. Class records. 5 marks.
- 

#### REFERENCE BOOKS:

1. Lehninger principles of biochemistry Albert L. Lehninger
2. Complete guide to vitamins, minerals, nutrients & supplements H. Winter Griffith
3. Biostatistics by Khan and Khannum(1994).
4. Elements of Biostatistics by Prasad(2016)
5. Animal Physiology by Hoar(1966)
6. Review of Medical Physiology by Ganong(2012)
7. Human Physiology by A.C. Guyton(2006)
8. Animal Physiology by Randol(2001)
9. Animal Physiology by P.S. Verma

## CURRICULUM IN ZOOLOGY FOR B. Sc. (UG) V SEMESTER

### V SEMESTER THEORY: PAPER 5.1 : CELL BIOLOGY, MICROBIOLOGY AND IMMUNOLOGY(25+10+10=45hrs)

Units	TITLE	hrs
	<b>CELL BIOLOGY</b>	
1.1	Ultra structure of animal cell and cell organelles Plasma membrane: structure - Fluid mosaic model, role of lipids in maintaining fluidity of cell membrane. Cell to cell interactions, surface markers, functions and Cell junctions. Ribosomes - different types, subunits, functions. Centrioles and basal bodies- structure and functions. Cytoskeleton- microtubules, microfilaments and intermediate filaments- structure and functions	10
1.2	Chromatin: organization of chromatin, Euchromatin and Heterochromatin , packaging (nucleosome), Metaphase chromosome, polytene and lampbrush chromosomes.	3
1.3	Cell Divisions: Cell cycle G1, S, G2, and M phases & (G0); and Cell cycle regulation. Amitosis, endomitosis, Mitosis-Stages, mitotic apparatus; role of mitotic inhibitors. Meiosis- Stages (Meiosis I stages only), synaptonemal complex and mechanism of crossing over & its significance. Significance of Mitosis and Meiosis	5
1.4	Cancer biology: types; characteristics of cancer cells, tumors, dedifferentiation of cancer cells, oncogenes and tumor suppressor genes. carcinogenesis, Carcinogenic agents (physical, chemical and biological); immunotherapy. Apoptosis.	7
2.1	<b>MICROBIOLOGY</b> Architecture of bacteria and virus. Nutritional requirements in bacteria and nutritional categories, different types of cultural media Microbial replication strategy: bacteria and virus (lytic, lysogenic cycle). Genetic recombination in bacteria: basic concept of transformation, conjugation, and transduction. Microbial interactions-Symbiosis, commensalism. Mutualism between microbes, microbes and plants, microbes and animals. A brief account of Microbial diseases in man -viral – chicken pox, measles, herpes, hepatitis,; bacterial – diphtheria, pneumonia; fungal –aspergillosis, candidiasis.	10
3.1	<b>IMMUNOLOGY</b> Definition, types of immunity; Innate, and acquired immunity, primary and secondary lymphoid organs(Thymus and lymph nodes); types of immune cells, T & B cells and their functions; , antigens, antigenicity ,various forms of antigen- antibody reaction, MHC molecules, immunoglobulins :classification, structure& functions of IgG, Hypersensitivity-allergens, Allergy-causes and types Immune response during bacterial (tuberculosis), parasitic (malaria) and viral (HIV) infections, vaccines –attenuated, heat killed and toxoids with examples Monoclonal antibodies.	10

## CURRICULUM IN ZOOLOGY FOR B. Sc. (UG) V SEMESTER

### V SEMESTER THEORY: PAPER 5.2 APPLIED ZOOLOGY, HISTOLOGY AND BIO-TECHNIQUES(30+10+05=45hrs)

Units	TITLE	hrs
	<b>APPLIED ZOOLOGY</b>	
1.1	Parasitology - Host-parasite Relationship, Definitive host, Intermediate host, Life history and pathogenicity of <i>Entamoeba histolytica</i> & <i>Schistosoma haematobium</i> .	4
1.2	Insect vectors: Classification & adaptations of Insect vectors, Insects of Medical Importance : Effects and control of <i>Anopheles</i> , <i>Culex</i> , <i>Aedes</i> , <i>Xenopsylla cheopis</i> Insect pests: Effects and Control of <i>Sitophilus oryzae</i> , <i>Achaea janata</i> , <i>Pyrilla perpusilla</i> , & <i>Callosobruchus chinensis</i>	5
1.3	Apiculture: Species, Honey bee morphology and structural adaptations ,Modern methods of bee keeping, economic importance of honey, bee wax & venom; a note on formation of honey& its chemical composition .	4
1.4	Lac culture: Lac cultivation & processing and uses of lac	1
1.5	Vermiculture : Indigenous and exotic Species of earthworms– epigeic, endogeic and anecic species . Methods of vermicomposting..	2
1.6	Sericulture: Mulberry and Non-mulberry silk worms, Life cycle of <i>Bombyx mori</i> . Silk proteins and structure of silk gland. Mulberry silkworm rearing (Chawki and adult worm rearing).	3
1.7	Poultry: Scope, Poultry breeds, Rearing of broilers and layers and poultry diseases( Nutrition deficiency, Bacterial, viral, protozoan , Helminthes and ectoparasites)	3
1.8	Dairy farming: Breeds of Cattle, Collection, processing, preservation and marketing of milk. Cattle breeding techniques: Artificial insemination, Super ovulation and embryo transplantation.	3
1.9	Aquaculture Culturing of Indian major carps and Induced breeding technique, Rearing of ornamental fishes , Culturing of Indian fresh water prawn and Fresh water pearl culture	5
2.1	<b>HISTOLOGY</b> of mammalian organs: Histological structure and functions of Liver, Intestine, Pancreas, Spleen, Kidney, Pituitary, Thyroid , Adrenal glands, testis and ovary. Histochemistry: stains and staining – Types: natural and synthetic dyes, mordents and their mode of action. Immuno-histochemical staining methods. ,Histopathology -Degenerative changes and histopathological manifestations in liver cirrhosis and nephrosis.	10
3.1	<b>BIO-TECHNIQUES</b> Microtechnique: – fixation, embedding, microtomy, staining (simple and differential) and mounting Immuno assay: Principle and applications. Separation techniques: Principle and applications of Centrifugation. Principle and applications of spectrophotometry, Electrophoresis(gel electrophoresis) and Chromatography(Paper chromatography) .	05

## B.SC. ZOOLOGY SEMESTER V – PRACTICAL 5.1

CELL BIOLOGY, MICROBIOLOGY, APPLIED ZOOLOGY, HISTOLOGY & BIO-TECHNIQUES

- 15 practicals

1. Study of Mitosis : permanent slides for different stages
2. Study of Meiosis : permanent slides for different stages
3. Preparation of Onion root tip squash and observation of stages of mitosis
4. Preparation of Grasshopper testis squash and observation of stages of meiosis
5. Study of salivary gland chromosomes and lamb brush chromosomes
6. Micrometry: measuring of microscopic objects by using stage micrometer & oculometer
7. Study of mouth parts and sting apparatus of honey bee.
8. Study of life cycle of Bombyx mori, Silk glands, Mulberry & Non-mulberry cocoons
9. Study of Indian major carps – Catla, Mrigal & Rohu.
10. Study of By-products of Poultry, Dairy & Aquaculture
11. Study of histological details with a note on physiology of the following mammalian organs –  
Intestine, Liver, Pancreas, Spleen, Kidney, Testis, Ovary and Adrenal
12. Gram staining of bacteria
13. Principle and applications of Centrifuge, Spectrophotometer, Gel electrophoresis & chromatography.

### B.SC. ZOOLOGY PRACTICAL PAPER 5.1 -SCHEME OF PRACTICAL EXAMINATION

Time : 3 hrs.

Max.marks : 40

- Q I Make squash preparation of Onion root tip/ Grass hopper testis/  
Measurement of cell organelle by micrometry / gram staining ( by lot) 6marks
- Q II Identify with reasons **A**( from mitosis) **B** (from meiosis) & **C**( Giant chromosome) 3x2=6marks
- Q III Comment on **D** , **E** ,**F** & **G** ( Apiculture, Sericulture, Aquaculture & Byproducts) 4x2=8marks
- Q IV Identify and comment on the slides **H** & **I** (histology slides) 2x3=6marks
- QV Comment on **J** ( Instrument) 4marks
- Q VI Viva voce 5marks
- Q VII Class records 5marks

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## **B.SC. ZOOLOGY SEMESTER V – PRACTICAL PAPER- 5.2**

### **PROJECT WORK**

Batches consisting of 4 -6 students each are formed. They are given a suitable project work by the Zoology faculty in-charge of the batch. Each batch should conduct survey/observations/experiments and submit the report on the project under the guidance of Zoology faculty. The project work should concentrate on the problems /animals of surrounding area pertaining to zoology. Each batch should work as a team with suitable coordination among them. A copy of project report must be submitted to the department.

### **PRACTICAL PAPER 5.2-SCHEME OF PRACTICAL EXAMINATION**

#### **Project work and report**

Time: 3 hrs.

Max. marks : 40

Q I Project submission:

Title and Objectives (about 100 words) should be mentioned clearly in answer book .... 20 marks

Q II Seminar / Presentation

15 marks

Q III Viva voce / Discussion

5 marks

## CURRICULUM IN ZOOLOGY FOR B. Sc. (UG) VI SEMESTER

THEORY: PAPER 6.1 GENETICS, MOLECULAR BIOLOGY AND EVOLUTION(18+12+15=45hrs)

Units	TITLE	hrs
	<b>GENETICS</b>	
1.1	Mendel's laws of inheritance, Incomplete dominance, <b>Interaction of genes:</b> Supplementary factor 9: 3: 3:1- comb pattern in fowl, Dominant epistasis 13:3- plumage color in Leghorn, Recessive epistasis 9:3:4-coat color in pigs, Polygenic inheritance- skin color of man. Lethal genes - coat color in mice . Co-dominance, Multiple alleles- ABO blood groups of man ; Rh factor; Isoalleles; Pseudoalleles and position effect.	8
1.2	Sex-linked inheritance: eye color in Drosophila and haemophilia and colorblindness in man; Y- linked genes. Inheritance of sex influenced and sex-limited characters inheritance. Pleiotropy , Sex determination system-XX-XY, XX-XO, ZW-ZZ. Genic balance theory & gynandromorphs	4
1.3	Linkage, Crossing Over and Chromosomal Mapping, Recombination frequency, two factor and three factor crosses.	2
1.4	Mutations: Types of mutations ( spontaneous & Induced with examples),Detection of induced mutations by ClB technique Hereditary diseases in man: Autosomal (Down's syndrome), sex chromosome( Turner's& Klienfelter's syndromes), Diseases due to mutation-Sickle cell anemia.	3
1.5	Concept of gene: Units of gene( Cistron, Recon & muton), split genes and jumping genes .	1
2.1	<b>MOLECULAR BIOLOGY</b> Nucleic acid : chemistry; Watson and Crick model of DNA; forms of DNA and types of RNA DNA Replication: DNA Polymerases, mechanism of replication in prokaryotes & eukaryotes <b>Transcription:</b> RNA polymerases and mechanism of transcription in prokaryotes & eukaryotes, Processing of eukaryotic pre mRNA.	8
2.2	Translation: Genetic code, Properties of the genetic code and Wobble Hypothesis; Process of Protein synthesis –translation process. Gene regulation: positive and negative regulation, activators, repressors, enhancers, silencers and promoter elements.	5
3.1	<b>EVOLUTION</b> Theories of Organic evolution : Lamarckism , Drawin-wallace theory of natural selection, Synthetic theory of evolution – Gene mutation, gene flow, genetic drift, isolation, and Natural selection, types of selection. Hardy-Weinberg`s Equilibrium Evidences of Organic evolution: Evidences from comparative anatomy & biochemistry. Biogenetic law & embryological evidences	7
3.2	Speciation- concept of species- Allopatric, sympatric, peripatric and parapatric Speciation; Reproductive isolation- pre and post zygotic isolation mechanism Polymorphism: transient and balanced	3
3.3	Evolution of horse and man using fossil data.	4

## CURRICULUM IN ZOOLOGY FOR B. Sc. (UG) VI SEMESTER

THEORY: PAPER 6.2 DEVELOPMENTAL BIOLOGY AND ANIMAL BIOTECHNOLOGY (27+18=45hrs)

Units	TITLE	hrs
	<b>DEVELOPMENTAL BIOLOGY</b>	
1.1	Gametogenesis; spermatogenesis & structure of mammalian sperm. Oogenesis, structure of mammalian ovum. Types of eggs: Based on amount of yolk and distribution of yolk with examples. Mosaic and regulative eggs, Cleidoic egg and its significance.	3
1.2	Fertilization: Definition, Types, Mechanism of fertilization and significance. Parthenogenesis :. Definition. , Natural parthenogenesis (arhenotoky and thelytoky) , Artificial parthenogenesis and Significance of parthenogenesis.	4
1.3	Patterns of cleavage – radial, biradial, spiral and bilateral cleavage with examples. Influence of yolk on cleavage.	2
1.4	Blastulation: Comparative account with reference to Frog and Chick.	2
1.5	Fate maps- Presumptive organ forming areas and fate maps in Frog and Chick.	1
1.6	Gastrulation in Chick upto primitive streak.. Foetal membranes of chick – development; structure and function of foetal membranes	3
1.7	Role of organizers in development: Transplantation experiments of Spemann and Mangold, Chemistry of Organiser.	2
1.8	Placenta: Types - Yolk sac and Chorio-allantoic placentation. Deciduate and non deciduate placenta; morphological and histological placental types with suitable examples	2
2.1	Regeneration:.. Definition and types – morphollaxis and epimorphosis with examples. Regeneration in Planarians	2
2.2	Reproductive cycles: Oestrous and Menstrual cycles and their regulation.	2
2.3	Early development of Human foetus : fertilization; morula; blastocyst; implantation; placenta; twins and multiple births , Assisted reproductive techniques . Sexually transmitted diseases and prevention.	4
3.1	Genetic	<b>2</b>
	<b>ANIMAL BIOTECHNOLOGY</b> engineering: Introduction, scope and basic concept of genetic engineering. Enzymology of genetic engineering: Restriction enzymes; DNA ligase; Polymerases	
3.2	Cloning vectors: Plasmids, phage vector, cosmids, shuttle vectors and artificial chromosomes as vectors	<b>3</b>
3.3	Introducing cloned genes in to the host cells: Transformation, Transduction, Particle gun; electroporation; liposome mediated method.	<b>2</b>
3.4	Restriction enzyme analysis; Southern blotting; Northern blotting; <i>in-situ</i> hybridization; RFLP; AFLP; RAPD; DNA finger printing and PCR.	<b>6</b>
3.5	Production of cloned and transgenic animals: Methods of Gene transfer-Nuclear Transplantation, Retroviral Method, DNA microinjection Applications of transgenic animals and knockout mice.	<b>2</b>
3.6	DNA sequencing: Sanger method Genome, Human genome project, genomics & proteomics.	<b>3</b>

**B.Sc ZOOLOGY SEMESTER VI – PRACTICAL 6.1** (15 practicals of 3 hrs each)  
GENETICS, MOLECULAR BIOLOGY AND EVOLUTION

1. Genetic problems : Dihybrid ratio( One animal and one human); Sex linkage – eye color in Drosophila & color blindness in man; Construction of pedigree charts for haemophilia
2. Study of blood groups (ABO & Rh) with special reference to mode of inheritance; Identification of blood groups and problems on inheritance of blood groups (3 problems)
3. Preparation of Buccal smear for sex chromatin
4. Drosophila study:
  - a) Culture of Drosophila
  - b) Identification of male and female flies
  - c) Study of life cycle
  - d) Mounting of sex comb
  - e) Study of mutants
5. Isolation of DNA from any tissue.
6. EVOLUTION i).Study of Homologous organs: Fore limb bones of terrestrial Vertebrates (Frog& Bird) ii). Study of Analogous organs: Wing of Insect and Bird iii). Study of Vestigial organs: Appendix and Molar tooth. iv) Study of Connecting links: Peripatus and Tornaria larva. v) Study of living fossils: Limulus & Sphenodon vi) Problems related to calculation of allelic frequency using Hardy-Weinberg Equilibrium ( at least 3 problems).

**PRACTICAL PAPER. 6.1**  
**SCHEME OF PRACTICAL EXAMINATION**

Time : 3 hrs.

Max. marks : 40

- |  |            |
|--|------------|
| Q I Identify the blood group (ABO & Rh) / prepare sex comb of Drosophila /Isolation of DNA /Buccal smear staining for sex chromatin ( by lot)                            | 7marks     |
| Q II Identify with reasons <b>A &amp; B</b> (any two from three below)<br>[i] from egg, lava. pupa, male and female Drosophila<br>[ii] from Drosophila mutants (any one) | 2X3=6marks |
| Q III Genetic problem (two problems)<br>marks  | 2X4=8      |
| Q IV Comment on <b>C, D</b> (Specimens related to evolution) & <b>E</b> (allelic frequency Problem)  | 3X3=9marks |
| Q V Viva voce  | 5marks     |
| Q VI Class records   | 5marks     |

## **B.Sc ZOOLOGY SEMESTER VI – PRACTICAL 6.2(15 practical of 3 hrs each)**

### **DEVELOPMENTAL BIOLOGY AND ANIMAL BIOTECHNOLOGY**

1. Early development of Frog: Cleavage, Blastula, Gastrula and Neurula.
2. Development of Chick: 18 hrs, 24 hrs, 48 hrs and 72 hrs incubation stages
3. Human embryology: T.S of testis& ovary; Structure of mature sperm& Graafian follicle .
4. Application of DNA Fingerprinting in criminology (photograph of electrophoretic pattern to be given for interpretation by the students)- at least four problems worked out in record.
5. Construction of restriction maps from the data provided.
6. Study of Cloning vectors: pBR 322, pUC18, Phage vector, Cosmid, Shuttle vector
7. Study of Genetic Engineering techniques through photographs i) Southern Blotting ii) Northern Blotting iii) DNA Sequencing (Sanger's Method) iv) PCR v) RAPD vi) RFLP
8. Visit to Biotechnology lab/ company.

### **PRACTICAL PAPER. 6.2 SCHEME OF PRACTICAL EXAMINATION**

Time : 3 hrs.

Max. marks : 40

- |   |              |
|---|--------------|
| Q I Identify with reasons <b>A&amp;B</b> ( Frog embryo stages)<br><b>C&amp; D</b> (Chick embryo stages) and <b>E</b> ( Human) | 5x3=15marks  |
| Q II DNA finger print analysis of given photograph  | 3 marks      |
| Q III Comment on <b>F</b> ( cloning vector); <b>G &amp; H</b> (GE techniques)   | 3X4= 12marks |
| Q IV Viva-voce  | 5marks       |
| Q V Class records   | 5marks       |

## **Suggested Readings:**

1. Parasitology (Protozoology and Helminthology) – K. D. Chatterjee, Chatterjee Medial Publishers.
2. Economic Zoology by Shukla and Upadayana(2016).
3. Economic Zoology by Reena and Mattur(2006).
4. Cell biology by C.B. Power Vol I and II(2010)
5. Cell biology by Tomer(2005)
  
6. Cellular and Molecular Biology Rastogi publication(2017)
7. Bloom and D. Faweett. Text book of histology. 10th Ed.
8. Janis Kuby. 1997. Text book of Immunology. 3rd Ed.
9. Histology by Bailey(1975) 10. Histology by Bevelander(1979)
11. Histology by Ham(1987)
12. Histology by Berry(2015)
13. Genetic Engineering by Sandhya Mitra(2015)
14. Gene cloning by Brown(2016)
15. Molecular biotechnology by Sathyanarayana U(2008)
16. Biotechnology by S.S. Purohith(2012)|
17. Transgenic animals by M.M.Ranga(2006)
18. Animal Biotechnology by M.M. Ranga(2007)
19. Molecular Biotechnology by Chennarayappa(2007)
20. Human Genetics by Mange and Mange(1993)
21. Principles of Genetics by Robert H Tamarin Ta Ta McGraw- Hill pub(2004).
- 22.** Genetics by Monroe W. Strickberger , Mac Millan Pub(2008)
23. Introduction to Embryology by Balinsky B.L.(1970)
24. Development by Beril N J and Karpotata(1978)
25. Developmental biology by Gilbert(2016)
26. Embryology by Gilbert and Raunio(1997)
27. Embryology by Barath 6. Chick Embryology by Patten(1971)
28. Gilbert, S.F. 2006. Developmental Biology (9th edn).

29. Gardner. J.E., Simmons, J.M and D.P. Snustad. 2007. Principles of Genetics (8th edn)..
30. Griffiths et al., 2002. Modern Genetic Analysis. W.H. Freeman, NY, USA.
31. Hartl, L.D., and E.W. Jones. 2009. Genetics: Analysis of Genes and Genomes (7th edn).
33. Herskowitz I.H, 1977. Principles of Genetics . Collier Macmillan.
34. Lewin B, 2008 .Genes (9th edn). Jones and Barlett Publishers Inc.
35. Klug, W.S. and Michael R. Cummings, 2009. Concept of Genetics.
36. Molecular Biology of Gene (5th edn.). Pearson Education Inc.
37. Systems Biology-Definitions & Perspectives.
38. Attwood T.K. and Parry Smith, D. 2006. Introduction to Bioinformatics. Pearson Education.
39. Bourne P. E and Weissig H, 2003. Structural Bioinformatics. Wiley -Liss. USA
40. Ghatak K.L. 2011. Techniques and Methods in Biology. PHI Learning Pvt. Ltd. New Delhi
41. Gupta A. 2009. Instrumentation and Bio-Analytical Techniques. Pragati Prakashan, Meerut.
42. Cooper, G.M. and Hausman, R.E. 2009. The cell: A Molecular Approach
43. Arora, D.R. and Arora, B. 2008. Text Book of Microbiology. CBS Publishers
44. Chakraborty, P. A. 2009. Text Book of Microbiology. New Central Book Agency.
45. Das, H.K. 2007. Text book of Biotechnology. Wiley India Pvt. Ltd.
46. Singh .B.D. 2006. Biotechnology. Kalyani Publishers, New Delhi.
47. Essentials of Biotechnology. Ane Books Pvt. Ltd.!
48. Ivan M. Roitt, 2002. Essential of Immunology. ELBS, New Delhi.
49. Khan. F.H. 2009. The Elements of Immunology. Pearson Education.
50. Richard Coico and Geoffrey Sunshine. 2009. Immunology: A short course.
51. C.B.L. Srivastava, Fish Biology, Narendra Publishing House
52. K. D. Chatterjee (2009). Parasitology: Protozoology and Helminthology. Knobil, E. et al. (eds). The Physiology of Reproduction. Raven Press Ltd.
53. Griffiths, A.J.F., J.H. Miller, Suzuki, D.T., Lewontin, R.C. and Gelbart, W.M. (2009).

Q.P.Code-.....

## Theory Question paper pattern

**SEMESTER B.Sc. DEGREE EXAMINATION** May/Nov 201-

Semester scheme

**ZOOLOGY**

Time : 3 Hours

Max. Marks : 50

*Instructions to the candidates:*

1. *Draw labeled diagrams wherever necessary*
2. *All questions are compulsory*

**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