

2016-17

CBCS



BANGALORE UNIVERSITY

Jnana Bharathi Campus, Bangalore – 560 056

FACULTY OF SCIENCE

DEPARTMENT OF ZOOLOGY
SYLLABUS —

For THE YEAR 2014-15



PROPOSED CURRICULUM IN ZOOLOGY FOR B.Sc.,(UG), 2014

Theory

Semester	Paper Code	Title of the paper	Total number of hours	Hours / Week	Marks	Internal Assessment *	Total marks
I	Paper – I (ZT101)	Non-Chordata part -I	56	4	70	30	100
II	Paper – II (ZT102)	Non-Chordata part -II	56	4	70	30	100
III	Paper –III (ZT103)	Chordata	56	4	70	30	100
IV	Paper -IV (ZT104)	Comparative Anatomy, Cell Biology, Immunology and Histology	56	4	70	30	100
V	Paper – V (ZT105)	Environmental Biology and Ethology	40	3	70	30	100
	Paper – VI (ZT106)	Developmental Biology and Organic Evolution	40	3	70	30	100
VI	Paper - VII (ZT107)	Genetics and Biotechnology	40	3	70	30	100
	Paper –VIII (ZT108)	Animal Physiology and Techniques in Biology	40	3	70	30	100

Internal Assessment marks* - 30 (2 tests or assignments)

PROPOSED CURRICULUM IN ZOOLOGY FOR B.Sc.,(UG), 2014
Practical

Semester	Paper Code	Title of the paper	Total number of hours	Hours / Week	Marks	Internal Assessment	Total marks
I	Paper – I (ZP 101)	Non-Chordata part -I	45	03	35	15	50
II	Paper – II (ZP 102)	Non-Chordata part -II	45	03	35	15	50
III	Paper –III (ZP 103)	Chordata	45	03	35	15	50
IV	Paper -IV (ZP 104)	Comparative Anatomy, Cell Biology, Immunology and Histology	45	03	35	15	50
V	Paper – V (ZP 105)	Environmental Biology and Ethology	45	03	35	15	50
	Paper – VI (ZP 106)	Developmental Biology and Organic Evolution	45	03	35	15	50
VI	Paper - VII (ZP 107)	Genetics and Biotechnology	45	03	35	15	50
	Paper –VIII (ZP 108)	Animal Physiology and Techniques in Biology	45	03	35	15	50

Internal Assessment marks* - 15 (05 marks for attendance and 10 marks for test)

PROPOSED CURRICULUM IN ZOOLOGY FOR B.Sc.,(UG)

I SEMESTER

PAPER – I: NONCHORDATA: PART – I

	- 56 hours
Unit I: Animal Architecture	- 14 hours
(To be taught citing suitable examples and keeping in view of evolutionary trends and significance)	- 07 hours
1.1. Body symmetry: Definition, types – spherical symmetry, radial symmetry, biradial symmetry and bilateral symmetry.	- 01 hour
1.2. Body organisation: The hierarchical organisation of animal complexity – protoplasmic level of organisation, cellular level of organisation, tissue level of organisation and organ level of organisation.	- 01 hour
1.3. Germ layers: Definition, Types - diploblastic condition (apparent and absolute) and triploblastic condition.	- 01 hour
1.4. Body coelom: Definition, origin and types– acoelom, pseudocoelom, eucoelom (enterocoelom and schizocoelom).	- 01 hour
1.5. Metamerism: Definition, types – pseudometamerism, true metamerism-homonomous and heteronomous.	- 02 hours
1.6. Cephalisation: Definition and its process (formation).	- 01 hour
Protozoa: The Animal-like Protista	- 07 hours
1.7. General characters of the phylum up to classes with examples	- 01 hour
1.8. Nutrition: Holozoic, Holophytic, Saprozoic, Mixotrophic and Parasitic with an example for each.	- 02 hour
1.9. Locomotion: Locomotory organelle – Pseudopodia, Cilia and Flagella. Modes of locomotion – Amoeboid movement (Walking movement and Sol-Gel theory), Flagellar and Euglenoid movement, ciliary movement (Paddle stroke theory) and Metabolic movement (Gregarines and Euglena).	- 03hours
1.10. Reproduction: Conjugation in <i>Paramecium caudatum</i> , significance of conjugation.	- 01hour
Unit II: Porifera: The Sponges – Nature's dead end	- 06 hours
2.1. General characters of the phylum up to classes with examples.	- 01 hour
2.2. Sycon: Morphology, microscopic structure of body wall and sexual reproduction.	- 03 hours
2.3. Canal System and its evolution: Asconoid, Syconoid, Leuconoid and Rhagonoid types.	- 02 hours
Coelenterata	- 08 hours
2.4. General characters of the phylum up to classes with examples.	- 01 hour
2.5. Hydra: Externals, feeding and digestion, nerve net and reproduction	- 03 hours
2.6. Polymorphism: Meaning, significance and polymorphism in <i>Hydra</i>	- 01 hour
2.7. Coral reefs: Meaning, types, theories on coral reef formation	- 01 hour
2.8. Ctenophores: General organisation and affinities.	- 02 hours

Unit III: Metazoa	- 14 hours
3.1 Geological Time Scale (eras, periods and epochs with major fauna of each period) and an account of phylogenetic tree	- 02 hours
3.2. Origin of Mesozoa: Blastea and Gastrea theories and Hadzi's theory.	- 02hours
Helminthes	- 05 hours
3.3. General characters of the Phylum Platyhelminthes up to classes with examples.	- 01 hour
3.4. Planaria: Externals, digestive system, excretory system and nervous system.	- 03 hours
3.5. General characters of the Phylum Nematoda with examples.	- 01 hour
Annelida	- 05 hours
3.6. General characters of the phylum up to classes with examples.	- 01 hour
3.7. Type Study: Earth worm (<i>Pheretima</i>) - Morphology, digestive system and nutrition, excretory system, reproductive system, reproduction and development.	- 04 hours
Unit IV: Economic Zoology & Parasitology	- 14 hours
Economic Zoology	- 04hours
4.1. Protozoa in water supplies and soil.	- 01 hour
4.2 Beneficial and harmful sponges	- 01 hour
4.3. Economic importance of corals and coral reefs.	- 01 hour
4.4. Economic importance of leech, vermiculture and vermicomposting	- 01 hour
Parasitology –	- 10 hours
4.5. Introduction: Definition of parasitism and types	- 01 hour
4.6. Occurrence, disease caused, mode of transmission, life cycle and preventive measures of the following parasites: <i>Entamoeba histolytica</i> , <i>Plasmodium vivax</i> (mentioning of other species of plasmodium is necessary), <i>Taenia solium</i> , <i>Fasciola hepatica</i> , <i>Ascaris lumbricoides</i> and <i>Wuchereria bancrofti</i> .	- 08 hours
4.7. Parasitic adaptations- Parasitic flat worms and leech.	- 01 hours

REFERENCES:

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 – Invertebrate VII Ed.*, Vol. I, A.I.T. 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. Sedgewic Volumes
8. Parker and Haswel Vol. I
9. Kotpal Volumes Protozoa through Echinodermata
10. *A manual of Zoology* by Ekambarnath and Vishwanathan
11. *Economic Zoology* by Shukla and Upadayana
12. *Economic Zoology* by Reena and Mattur
13. *Invertebrate Zoology* by S.N. Prasad.

**I SEMESTER B.Sc., ZOOLOGY PRACTICAL
NON-CHORDATA: PART I**

-15 Units

1. **Use of microscopes** – Simple, Compound, Oil immersion and Stereozoom - 01 unit
2. Preparation and observation of plankton culture (also Protozoans). - 01 unit
3. **Protozoa:** Study of permanent slides of *Amoeba*, *Euglena*, *Noctiluca*, *Paramoecium*, *Vorticella* and *Radiolarian* - *Foraminiferon ooze (Elphidium)* - 01 unit
4. **Porifera:** *Sycon*, *Euplectella*, *Hyalonema*, *Spongilla* and *Euspongia*.
Permanent slides of T.S. of *Sycon*, spicules and gemmule. - 01 unit
5. **Coelenterata:** *Hydra*, T.S. of *Hydra*, *Obelia* colony, *Obelia* medusa, *Physalia*, *Aurelia* and *Ephyra* larva. - 01 unit
6. **Coelenterata and Ctenophora:** Corals–*Fungia*, *Corallium*, *Meandrina*, *Gorgonia* and *Pennatula*, *Ctenophora* – *Pleurobrachia* W.M. - 01 unit
7. **Helminthes:** *Planaria* and its T.S, Liver fluke and Tape worm.
Ascaris – Male, female as well as T.S of both. - 01 unit
8. **Annelida:** Different varieties of Earthworm, T.S of Earthworm, *Nereis* and *Herteronereis*, T.S of *Parapodium*. - 01 unit
9. **Annelida:** Earthworm dissection – Nervous system, mounting of ovary and setae. - 02 units
10. **Parasitology:** Permanent slides of *Entamoeba*, *Plasmodium*, life history stages of Liver fluke (Miracidium, Redia, and Cercaria) and Tape worm (Bladder worm). - 02 units
11. **Parasitology:** Leech dissection – Digestive system, mounting of jaw and testicular nephridium. - 03 units

SCHEME OF PRACTICAL EXAMINATION UNDER CBSS 2014-15 ONWARDS

B.Sc. I SEMESTER ZOOLOGY

NON - CHORDATA – PRACTICAL – 01

Duration: 3 hrs

Max. Marks : 35

01	Taxonomy: Identify, classify and comment on A to E with labeled diagrams	15 marks
02	Project Report: Economic Zoology*	07 marks
03	Dissection (Question set on dissection)** Or Mount and stain the plankton culture given, identify and comment on any one specimen	08 marks
04	Class Records	05 marks
Total		35 marks
	*Economic Zoology: 1) Protozoa in water supply and soil 2) Economic importance of Sponges 3) Economic importance of Corals and Coral reefs 4) Parasitic adaptations and economic importance of Leech 5) Vermiculture and vermicomposting	

6) Parasitology: Entomobahistolitica, Plasmodium vivax, Taeniasollum, Fasciola hepatica, Ascaris lumbricoides and Wuchereria bancrofti	
**Dissection: Draw a neat labeled diagram of the system given and describe.	
Note: Earthworm : Nervous system Leech : Digestive system	

II SEMESTER ZOOLOGY PAPER II: NON CHORDATA: PART – II

- 56 hours

Unit I: ARTHROPODA

- 14 hours

- 1.1. General characters of the phylum and classification upto classes with suitable examples - 02 hrs
- 1.2. **Peripatus** - Unique features, affinities with Annelida and Arthropoda, systematic position. - 02 hrs
- 1.3. **Type study - Prawn (*Penaeus*)** - Morphology, appendages - structure of a typical appendage, concept of serial homology, structure and function of appendages, circulatory system, reproductive system and life cycle. - 08 hrs
- 1.4. **Metamorphosis** – Definition and types with suitable examples. - 01 hr
- 1.5. A brief account on Arthropods as a successful animal group. - 01 hr

Unit II:

- 14hours

ARTHIROPODA

- 10 hours

- 2.1 **Body wall** – Structure and significance. - 01 hr
- 2.2 **Respiratory organs** – Gills, book gills, trachea and book lungs. - 02 hrs
- 2.3 **Sense organs** – Simple eye, compound eye, gustatory and tactile organs - 02hrs

MOLLUSCA

- 09 hours

- 2.4. General characters of the phylum and classification upto classes with suitable examples - 02 hrs
- 2.5. **Type study - *Unio***: Externals, structure of shell (sectional view), digestive, circulatory, respiratory and reproductive systems, and life cycle - 07 hrs

Unit III:

- 14hours

ECHINODERMATA

- 10 hours

- 3.1. General characters of the phylum and classification upto classes with suitable examples - 02 hrs
- 3.2. **Type study: Sea Star (*Asterias*)**- Externals, digestive and water vascular systems, reproduction and life history. - 06 hrs
- 3.3. **Echinoderm larvae**: Structure and significance of the following larvae – Bipinnaria, Ophiopluteus, Echinopluteus and Auricularia. - 02 hrs

MINOR PHYLA

- 01 hour

3. 4 **Rotifera**: Salient features and biological significance.

HEMICHORDATA - link between Non-Chordates and Chordates	- 03 hours
3.5. Type study – Balanoglossus – Morphology, coelom, Tornaria larva.	- 02 hrs
3.6. Affinities and systematic position of Hemichordata.	- 01 hr
UNIT IV:	
ECONOMIC ZOOLOGY –	- 14 hours
Arthropoda:	- 10 hrs
4.1. Sericulture: silk worm species, silk worm rearing and management practices, pests of silkworm, byproducts of silk industry.	- 4 hrs
4.2. Apiculture: honeybee species, bee keeping and management practices, bee products, pests of honey bees.	- 3 hrs
4.3. Prawn Fisheries: prawn species, prawn rearing- inland (fresh water and brackish), salt water, products	- 3 hrs
4.5. Insects and Human welfare - General account of beneficial and harmful insects, control of insects – chemical and biological.	- 01 hrs
4.6. Parasitic Arthropods -of crabs, mussels and fishes – Effects and control	- 01 hr
4.7. Mollusca - Beneficial and harmful molluscs. pearl culture, Mytilus culture, Oyster culture, chank and lime industries.	- 02 hrs

REFERENCES:

14. Barnes R.D. 1968. *Invertebrate Zoology*, 2nd Edn. Saunders Philadelphia.
15. Barrington, E.J.W. 1967. *Invertebrate structure and function*. Neelson, London.
16. Hymann, L.H. 1940-67. *The Invertebrate*, Vol. I-IV. Mc Graw- Hill, New York.
17. Marshall, A.J. and Williams, W.D. (Eds.). 1995. *Text book of Zoology – Invertebrate VII Ed., Vol. I*, A.I.T. B.S. Publishers.
18. Russell-Hunter, W.D. 1968. *A biology of lower Invertebrates*. Macmillan Company, New York.
19. Russell-Hunter, W.D. 1969. *Biology of higher Invertebrate*. Macmillan Company, New York.
20. *Sedgewic Volumes*
21. *Parker and Haswel Vol. I*
22. *Kotpal Volumes Protozoa through Echinodermata*
23. *A manual of Zoology by Ekambarnath and Vishwanathan*
24. *Economic Zoology by Shukla and Upadayana*
25. *Economic Zoology by Reena and Mattur*
26. *Invertebrate Zoology by S.N. Prasad.*

II SEMESTER B.Sc., ZOOLOGY PRACTICAL NON-CHORDATA: PART II

	-15 Units
1. Arthropoda: <i>Penaeus</i> , <i>Palaemon</i> , Lobster and Crayfish. Crustacean larvae – Nauplius, Zoea, Mysis	- 01 unit
2. Arthropoda: Scorpion, Spider, <i>Limulus</i> , <i>Peripatus</i> , Millipede and Centipede	- 01 unit
3. Arthropoda: Apiculture - Honey bee – queen, drone and worker, trophi, legs	- 01 unit
4. Dissection Honey Bee: Mounting of pollen basket and sting.	- 01 unit
4. Sericulture: Life history of <i>Bombyx mori</i>	- 01 unit

6. **Dissection of Cockroach:** -03 units
 - a. Mounting of trophi
 - b. Nervous system
 - c. Mounting salivary apparatus
7. **Mollusca:** Mytilus, Chiton, Aplysia, Octopus, Sepia, Loligo and Glochidium larva. -01 unit
8. **Mollusca:** Shell pattern – Unio, Pila, Ostrea, Cypraea, Murex, Nautilus, Patella, Dentalium and cuttle bone - 01 unit
9. **Dissection of Unio:** - 02 units
 - a. Digestive system
 - b. Mounting of pedal ganglia
10. **Echinodermata:** Sea star, Brittle star, Sea urchin, Cake urchin, Sea cucumber, Sea lily. Bipinnaria larva and Echinopluteus larva, and Pedicellaria - 02 units
11. **Hemichordata:** Balanoglossus – specimen, T.S through proboscis, Tornaria larva - 01 unit

SCHEME OF PRACTICAL EXAMINATION UNDER CBSS 2014-15 ONWARDS
B.Sc. II SEMESTER ZOOLOGY
NON-CHORDATA – PRACTICAL – 02

Duration: 3 hrs

Max.Marks : 35

01	Taxonomy: Identify, classify and comment on A to E with labeled diagrams	15 marks
02	Project Report: Economic Zoology*	07 marks
03	Dissection : Honey bee – Mounting of pollen basket or sting apparatus Or Dissection : (Question set on dissection)**	08 marks
04	Class Records	05 marks
	Total	35 marks
	*Economic Zoology: 1) Sericulture, Apiculture, Prawn fisheries 2) Economic importance of Insects, Control of Harmful insects, Parasitic Arthropods 3) Economic importance of Mollusca, Pearl culture, Mytilus culture, Oyster culture, Chank and Lime industry	
	**Dissection: (Cockroach – Trophi, Salivary apparatus and Nervous system. Unio – Digestive system).	

III SEMESTER ZOOLOGY PAPER III: CHORDATA

Unit I:	- 56 hours
PROTOCHORDATA	-14 hours
	- 07 hours
1.1. Basic Chordate characters and outline classification upto classes	- 01 hr
1.2. Cephalochordata : Amphioxus – Morphology, feeding and circulatory system	- 04 hrs.
1.3. Urochordata : Ascidian – Morphology, Ascidian tadpole and retrogressive metamorphosis.	- 02 hrs
AGNATHA – THE JAWLESS VERTEBRATES	- 03 hours
1.4 General characters of Agnatha	- 01 hr
1.5. Salient features of Cyclostomata and Ostracodermi with examples.	- 01 hr
1.6. Ammocoete larva and its significance.	- 01 hr
PISCES	
1.7. Salient features and classification upto subclasses - Chondrichthyes and Osteichthyes	- 01 hr
1.8. Dipnoi : Interesting features and their evolutionary significance.	- 01 hr
1.9. Placodermi : Salient features with examples.	- 01 hr
1.10 Origin of Amphibia : transition from water to land.	- 01 hr
Unit II	- 14hrs
PISCES –	
2.1. Type Study : Scoliodon – Morphology, digestive system, circulatory system, nervous system, neuromast organs (Lateral line sensory system and Ampullae of Lorenzini) and urinogenital system.	- 07 hrs
AMPHIBIA –	
2.2. General characters and classification of living Amphibians upto orders, with suitable examples	- 02 hrs
REPTILIA –	
2.3. General characters and outline classification of modern reptiles with suitable examples	- 02 hrs
2.4. Adaptive radiation in extinct and extant reptiles with suitable examples	- 01 hr
2.5. Temporal fossae in reptiles.	- 02 hrs
Unit III	- 14 hrs
3.1. Interesting features of Sphenodon.	- 01 hr
AVES –	- 03 hrs
3.2. General characters, differences between Ratitae and Carinatae	- 01 hr
3.3. Interesting features of Archaeopteryx.	- 01 hr
3.4. Flight adaptations in birds.	- 01 hr
MAMMALIA –	- 10 hrs

- 3.5. General characters and classification upto subclasses (prototheria, metatheria and eutheria) with suitable examples. - 01 hr
- 3.6. Interesting features of mammalian orders (Insectivora, Carnivora, Chiroptera, Cetacea, Proboscidea, Ungulata – Perissodactyla and Artiodactyla, and Primates – Platyrrhini and Catarrhini) with examples. - 08 hrs
- 3.7. Dentition in Mammals, evolution of molar tooth. - 01 hrs

Unit IV:

- 14 hrs

ECONOMIC ZOOLOGY –

4.1. Pisciculture :

- 05 hrs

- a. Meaning of Aquaculture and Pisciculture, inland and marine fisheries, inland Pisciculture – Procedure, composite fish forming and significance.
- b. A brief account of fishing gears and crafts.
- c. Fish processing and preservation.
- d. Economic importance.

4.2. Poultry:

- 05 hrs

Definition, breeds of Fowls – indigenous and exotic breeds, birds of American class, birds of English class, birds of Mediterranean class, poultry products and bi-products. Diseases of poultry – Ranikhet, Fowl pox, Fowl Cholera, Fowl Typhoid and infectious Laryngo-trachitis.

4.3. Dairy:

- 04hrs

- a. Breeds of cattle: indigenous and exotic breeds.
- b. Improvements in cattle breeding - artificial insemination, MOET.
- c. Milk and its bi-products, pasteurization and gobar gas.
- d. Diseases in cattle- Causes and effects of Mastitis, Anthrax, Septicemia, Foot and mouth disease.

REFERENCES:

1. *Sedgewic Volumes*
2. *Parker and Haswel Vol. II*
3. *Kotpal Volume- Vertebrates*
4. *A manual of Zoology by Ekambarnath and Vishwanathan*
5. *Economic Zoology by Shukla and Upadayana*
6. *Economic Zoology by Reena and Mattur*
7. *Protochordata by Bhatia*
8. *Asciand by Kurian and Sebastian*
9. *Comparative Anatomy by Romer*
10. *Comparative Anatomy by Eten and Kent*
11. *Vertebrate by Young*

III SEMESTER B.Sc., ZOOLOGY PRACTICAL
CHORDATA
PART-III

- 15 Units
1. **Protochordata:** Ascidian and Amphioxus, T.S. of Amphioxus through pharynx and intestine.
 2. **Cyclostoma:** Petromyzon, Ammocoete larva and Myxine. - 01 unit
 3. **Pisces**
 - a. Cartilaginous Fishes – Narcine, Trygon, Pristis, Myxolobatis (any two) - 02 units
 - b. Bony Fishes – Hippocampus, Muraena, Ostracion, Tetradon, Pleuronectes, Diodon and Echeneis
 - c. Accessory respiratory organs – Saccobranchus, Clarias and Anabas.
 4. **Amphibia:**
 - a. Frog, Bufo, Ambystoma, Axolotl larva, Necturus and Ichthyophis - 02 Units
 - b. **Endoskeleton of frog:** Skull, lower jaw, vertebrae, pectoral and pelvic girdles.
 5. **Reptilia:** Turtle, Tortoise, Varanus, poisonous snakes – Cobra, Krait, Russell's viper and Hydrophis. - 01 unit
 6. **Aves:**
 - a. Endoskeleton – Skull, heterocoelous vertebra, synsacrum, sternum, pectoral girdle, pelvic girdle. - 01 unit
 - b. Beak modifications.
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7. **Mammalia**
 - a. Mongoose, Squirrel, Pangolin, Hedge Hog, Rabbit, Monkey and Loris (any four)
 - b. **Endoskeleton of human** – Skull, mandible, vertebrae – first, second, typical cervical, thoracic, lumbar and sacrum with coccyx, girdles and limb bones (bones of wrist, hand, ankle and foot not required). - 03 units
 8. **Dissections:** - 05 units
 - a. *Shark:* Afferent and efferent branchial systems, glossopharyngeal and vagus nerves, mounting of brain.
 - b. *Rat:* Dissection (only demonstration) – Circulatory system (arterial and venous), urinogenital system.

SCHEME OF PRACTICAL EXAMINATION UNDER CBSS 2014-15 ONWARDS
B.Sc. III SEMESTER ZOOLOGY
CHORDATA – PRACTICAL – 03

Duration: 3 hrs

Max.Marks : 35

01	Systematics: Identification classification & Comment on a) Specimens – A, B, & C	09 marks
	b) Endoskeleton – D (Frog/bird) E (Human)	06 marks
02	Project Report: On Economic Zoology*	07 marks
03	Dissection : With a neat labeled diagram describe the given system* <u>Note:</u> Dissected Rat (or) Shark (or) Model may be used to set the Question 3. *a) Shark : - Afferent and efferent branchial systems b) Rat : - i) Circulatory (arterial & venous) ii) Urinogenital system	08 marks
04	Class Records	05 marks
Total		35 marks

IV SEMESTER
PAPER IV – COMPARATIVE ANATOMY, CELL BIOLOGY, IMMUNOLOGY
AND HISTOLOGY

- 56 hours

Unit I:

- 14 hrs

COMPARATIVE ANATOMY

- 1.1 Integument and its derivatives in fishes (cartilaginous and bony), amphibians, reptiles, birds and mammals. - 04 hrs
- 1.2 Circulatory system: - 06 hrs
 - a. Evolutionary trends of vertebrate hearts.
 - b. Trends in the evolution of aortic arches in vertebrates
- 1.3 Evolutionary trends in the structure of vertebrate brains: shark, frog, lizard, bird and rabbit - 04 hrs

Unit II:

- 14 hrs

- 2.1. Respiratory organs in fishes- swim bladders and origin of lungs, respiratory organs of amphibians, reptiles, birds and mammals. - 03 hrs
- 2.2. Evolution of excretory structures in animals: contractile vacuoles in fresh water Protozoans, protonephridia in Helminthes, metanephridia in Annelids, antennary glands/ green glands in Crustaceans, malpighian tubules in insects and pronephros, mesonephros and metanephros in different classes of vertebrates. - 04 hrs
- 2.3. Evolutionary trends in the structure of eye and ear in vertebrate groups - 03 hrs
- 2.4. Immunology: First, Second and Third line of body defences. - 04hrs

Unit III
CELL BIOLOGY

- 14 hrs

- 3.1. Ultra structure of an animal cell: - 07 hrs
- a. Plasma membrane: chemical composition, structure - Fluid mosaic model, role of lipids in maintaining fluidity of cell membrane. Cell to cell interactions, surface markers, functions – transport across cell membrane: passive transport (simple and facilitated diffusion; osmosis) and active transport (Na^+ , H^+ and Ca^{2+} pumps, exocytosis, endocytosis -phagocytosis and pinocytosis); Cell junctions.
 - b. Cytoplasm: properties, cell organelles and cell inclusions.
 - c. Nucleus
- 3.2. Giant chromosomes: Polytene and Lamp brush chromosomes. - 02 hrs
- 3.3. Parthenogenesis: Definition, types with examples - 02 hrs
- a. Natural = Complete and incomplete parthenogenesis, Arhenotoky and Thelytoky (ameiotic and meiotic).
 - b. Artificial parthenogenesis.
 - c. Significance.
- 3.4 Cell senescence and Apoptosis - 01 hr
- 3.5. Biology of cancer: Introduction, general properties of cancer cells, carcinogens, prevention and regulation; chemotherapy, radiotherapy and gene therapy.

- 02 hrs

Unit IV: HISTOLOGY

- 14 hrs

- 4.1. Histological features of the following mammalian organs:
Tongue, Stomach, Pancreas, Spleen, Kidney, Ovary, Pituitary, Thyroid and Adrenal glands. - 09 hrs
- 4.2. Histochemistry : stains and staining – Types: natural and synthetic dyes, mordents and their mode of action. - 02 hrs
- 4.3. Histopathology -Degenerative changes and histopathological manifestations in liver cirrhosis and nephrosis. - 03 hrs

REFERENCES:

1. *Comparative Anatomy* by Romer
2. *Comparative Anatomy* by Eten and Kent
3. *Cell biology* by C.B. Power Vol I and II
4. *Cell biology* by Tomer
5. *Cellular and Molecular Biology* Rastogi publication
6. Bloom and D. Faweett. 1972. *Text book of histology*. 10th Ed.
7. Janis Kuby. 1997. *Text book of Immunology*. 3rd Ed.
8. Pearse, A.G.E.1968. *Histochemicatry*. Vol. 1 and II. ChurchillLivingstone,Edinburgh, London, NewYork.
9. *Histology* by Bailey
10. *Histology* by Bevelander
11. *Histology* by Ham
12. *Histology* by Berry
13. *Atlas of Histology* Papero
14. *Atlas of Histology* Freeman
15. *Atlas of Histology* Mariano.

**IV SEMESTER B.SC., ZOOLOGY PRACTICAL
COMPARATIVE ANATOMY, CELL BIOLOGY AND HISTOLOGY
PART- IV**

-15 Units

Comparative Anatomy

1. Comparative study of derivatives of integument in vertebrates: Scale of a fish – cartilaginous and bony, carapace and plastron of tortoise/turtle, contour feather of bird, horn of sheep/goat/cow, hoof of sheep/ goat/cow. - 02 units
2. Comparative study of skin of Vertebrates – fish, frog and rat - 01 unit
3. Comparative study of heart of Vertebrates: fish (shark), amphibian (frog), bird (hen) and mammal (rat/ human) - 01 unit
4. Comparative study of brain of Vertebrates: fish (shark), amphibian (frog), bird (hen) and mammal (rat/ human) - 01 unit
5. Comparative study of mesonephric kidneys of frog and metanephric kidneys of rat (or human) - 01 unit

Cell Biology:

1. Preparation of a whole mount and comments on the technique – any planktonic form, larvae of parasitic helminthes like liver Fluke, crustacean larvae, obelia colony, fish scale - 01 unit
2. Preparation of Squash: Onion root tip for mitosis, grass hopper testis for meiosis. - 02 units
3. Micro-technique: Preparation and submission of 2 permanent slides - 02 units

Histology:

Permanent slides of sections of mammalian organs- Tongue, stomach, pancreas, spleen, kidney, adrenal gland, ovary and thyroid gland. - 04 units

**SCHEME OF PRACTICAL EXAMINATION UNDER CBSS 2014-15 ONWARDS
B.Sc. IV SEMESTER ZOOLOGY**

COMPARATIVE ANATOMY, CELL BIOLOGY & HISTOLOGY –PRACTICAL- IV

Duration: 3 hrs

Max. Marks : 35

01	Comparative Anatomy : Identify A and B and comment on the Evolutionary trends with labeled diagrams	08 marks
02	Cell Biology / Microtechnique: a) Preparation of whole mount / Squash of the given material (procedure to be written for whole mount preparation. Identification as well as comment on the observed cell stage for Squash preparation). b) Submission of two permanent slides (one whole mount, and micro slide)	05 marks 05 marks
03	Histology: Identify, give histological features with neat labeled diagrams for the slides C, D and E.	12 marks
04	Class Records	05 marks
Total		35 marks

V SEMESTER
PAPER V – ENVIRONMENTAL BIOLOGY AND ETHOLOGY

- 40hrs

Unit I

- 14 hrs

ENVIRONMENTAL BIOLOGY

- 1.1. Fundamentals of the Ecology: - 04 hrs
 - a. Introduction, Sub-divisions and Scope of Ecology.
 - b. Concept of habitat: Micro-habitat and macro-habitat.
 - c. Concept of Ecological Niche: Spatial, Trophic and Multi-dimentional.
 - d. Abiotic factors: Light, Temperature and Soil.
- 1.2. Energy Flow in the Ecosystem: Laws of thermodynamics and Ecosystem - 01 hr
- 1.3. **Concept of Productivity:** - 01 hr
- 1.4. **Population Ecology:** Population properties – Density, Natality, Mortality, Age distribution, Growth, Dispersion and Biotic Potential. - 02 hrs
- 1.5. **Community Ecology:** Intra and interspecific interactions – Negative (Antibiosis, Competition, Parasitism and Predatism) and Positive (Commensalisms, Proto co-operation and Mutualism) - 02 hrs
- 1.6. **Ecological succession:** Introduction, Causes, Trends, Types, General process, Examples – Hydrosere and Xerosere. Concept of climax – Monoclimax theory, Polyclimax theory and Climax pattern hypothesis. - 02 hrs
 - a. **Toxicology:-** Definition, Toxins – Types: Insecticides (Chlorinated hydrocarbons, Organophosphates and Carbamate), Pesticides, Rodenticides, Herbicides, Fungicides and Heavy metals (Lead, Mercury, Cadmium, Arsenic, Chromium and Nickel).
 - b. Mechanism of toxicity
 - c. Concept of Biomagnification and Biotransformation - 02 hrs

Unit II

- 13 hrs

2.1. Current Environmental Issues:

- 03 hrs

- a. Green house effect and Global warming: Introduction, Green house gases and their main anthropogenic sources, Global warming and its impact on climatic change – Sea level change, Crop yield, Water balance and human health. Green house effect – Policy response. El Nino Climatic cycles.
- b. Acid rain: Introduction, Nature of acid rain, Impact of acid rain on Human health, Aquatic environment, Terrestrial environment, and the Build environment. Mitigation of Acid rain problems.
- c. Global Ozone layer depletion: Introduction, Ozone layer depletion process, Consequence of Ozone layer depletion – Human health, Animals, Terrestrial plants, Aquatic ecosystems, Climate, The Montreal Protocol.
- d. Environmental risk assessment by EPA.

- 2.2. **Integrated pest management (IPM):** Definition, mechanical control, chemical control, biological control, genetic control, resistant plant varieties, environmental manipulations. - 01hr
- 2.3. **Environmental Biotechnology:** Concept, Sewage/ Waste water treatment, Microbial degradation of xenobiotics, Mineral recovery and Pollution control by genetic engineering, biological treatment of air pollutants. - 02 hrs
- 2.4. **Energy Resources:**
- Types: renewable and non-renewable.
 - Non-Conventional Renewable sources of Energy: Solar, Tidal, Wind, Geothermal, Biogas, Biodiesel, Hydrogen –the fuel of future.
 - Nuclear energy and Nuclear reactions: Introduction, The risk of nuclear accidents, Advantages and disadvantages of Nuclear power plants. - 02 hrs
- 2.5. **Solid waste management:** Disposal and recovery (Collection centres, Land filling, Incinerations, Recycling of Wastes and construction of Sanitary Latrines). - 01 hr
- 2.6. **Wild life conservation and its management:**
- Red data book; Endangered species,
 - In situ conservation : Wild life sanctuaries, National parks and Biosphere reserves.
 - Ex situ conservation : Zoological gardens, Botanical gardens, Seed banks, Pollen storage, Tissue culture. - 03 hr
- 2.7. **Remote sensing :**
- Principle, Types – passive and active, Satellite remote sensing, Microwave remote sensing, Applications of remote sensing.
 - Geographic information system (GIS): Definition, Components and applications. - 01 hr

Unit III

ETHOLOGY (Animal Behaviour)

13 hrs

- 3.1 Introduction to animal behaviour, Historical perception, aims and objectives. - 01 hr
- 3.2 Stereotyped and Acquired behaviour: - 02 hrs
- Stereotyped behaviour: Kinesis, Taxes, Reflexes, Instincts and Motivations with suitable examples.
 - Acquired behaviour: Learning – Imprinting, and Habituation, Trial and Error learning.
- 3.3 Pheromones and Behaviour (Chemical communication): Types, Pheromones in Insects, Vertebrates and Human. - 01 hr
- 3.4 Social behaviour: - 02hrs
- Social behaviour in Insects – Honey Bees, Termites and Ants.
 - Social dominance.
 - Territoriality
 - Social systems in Primates.

- 3.5. Migratory behaviour: Fish migration and Bird migration. - 02 hrs
- 3.6. Biological rhythms: Circadian rhythms, Diagnostic features of Biological clock. - 01 hr.
- 3.7. Communication in Animals: Types of communication, Dances of Honey Bees, Alarm calls, Eco-location or Sonar in Bat, Releaser, Aggression and Bioluminescence. - 02 hrs.
- 3.8. Courtship Behaviour: Mechanism and causes, Examples of mating in Animals - 01hr
- 3.9. Parental care: In Insects, Fishes, Amphibians and Mammals. - 01 hr
- 3.10. Colouration and Mimicry (Defensive Behaviour): - 01 hr
 - a. Colouration and types of pigments in Animals.
 - b. Predatory and Parasitic mimicry.

V SEMESTER B.Sc., ZOOLOGY PRACTICAL - 05

Environmental Biology and Ethology

-14 Units

- I. Limnological studies:** - 05 units
1. Examination of water samples from near by ponds and tanks for the identification of phytoplankton and zooplankton.
 2. Estimation of DO by BOD.
 3. Estimation of Salinity
 4. Estimation of dissolved organic matter
 5. Estimation of pH using pH meter/ pH paper/ Titrimetry
 6. Estimation of Total hardness

- II. Ecological Adaptations:** - 03 units
1. Tubiculous worms: Arenicola and Chaetopterus.
 2. Fossorial (Burrowing) forms: Dentalium,
 3. Sedentary form: Sea anemone, Lepas and Balanus
 4. a. Passive fliers: Exocoetus, Rhacophorus and Draco.
b. Active fliers: Birds and Bat
 5. Animal associations:
 - a. Polymorphic forms: Physalia
 - b. Facultative mutualism: Hermit crab and Sea anemone
 6. Mimicry/ Camouflage: Stick insect, Dryophis and Chameleon.
 7. Desert forms: Phrynosoma
 8. Deep sea forms: Flat fish
 9. Arboreal form – Hyla

- III. Ethology:** - 02 units
1. T- maze experiment on Earth worm: Conditioned learning behaviour
 2. Study of taxis in Paramecium – light, dye and hot water.

- IV. Project report submission on** - 04 units
- a. Toxicology- Analysis of water (polluted), Solid waste management, Air pollution (Tie up with Pollution control Board, BWSSB, PG dept of Environmental Science, DST and NGOs may be useful)
 - b. Rain water harvesting
 - c. Social organisation in Termites, Ants and Primates

- d. Migration in Fishes and Birds.
- e. Visit to Wild Life Sanctuary, National Park, Bio-reserve, Sacred Groove.

SCHEME OF PRACTICAL EXAMINATION UNDER CBSS 2014-15 ONWARDS
B.Sc. V SEMESTER ZOOLOGY
ENVIRONMENTAL BIOLOGY AND ETHOLOGY – PRACTICAL - V

Duration: 3 hrs.

Max. Marks : 35

01	Limnology: Identification and comments on the Plankton in the given water sample or Any experiment from serial number 2 to serial number 6	08 marks
02	Ecological adaptations: Identification and commenting on the Ecological adaptations with labeled figures of A, B, C, D and E	15 marks
03	Project Report submission	07 marks
04	Class Records	05 marks
	Total	35 marks

V SEMESTER
PAPER VI – DEVELOPMENTAL BIOLOGY AND ORGANIC EVOLUTION

- 40 hours

- 13 hrs

Unit I:

Developmental Biology

- 1.1. **Introduction:** Definition and scope, Historical review – Preformation theory, Epigenetic theory, Baer's Law and Biogenetic law. - 01 hr
- 1.2. **Gametogenesis:** Introduction, Spermatogenesis- formation of spermatids, spermiogenesis, sertoli cells and their role in spermatogenesis. Structure of a typical mammalian sperm, Oogenesis, Types of eggs –based on amount of yolk and distribution of yolk with examples. Mosaic and regulative eggs, Types of egg membranes with examples. Significance of egg membranes. Cleidoic egg (e.g., Hen's egg) and its significance. - 04 hrs
- 1.3. **Reproductive cycles:** Estrous and Menstrual cycles and their regulation - 01 hr
- 1.4. **Patterns of development:** Oviparity, ovoviviparity and viviparity with examples. - 01 hr
- 1.5. **Fertilization:** Introduction, Types, Mechanism of fertilization, monospermic and polyspermic fertilization (pathological and physiological polyspermy) with examples, mechanism to block polyspermy in monospermic forms (fast block and slow block). Significance of fertilization. - 02hrs
- 1.6. **Cleavage:** Characteristics of cleavage, planes of cleavage – meridional, vertical, equatorial and latitudinal plane. Pattern of cleavage – radial type, biradial, spiral, bilateral, determinate and indeterminate cleavage with examples. Influence of yolk in cleavage. - 02 hrs
- 1.7. **Blastulation:** Comparative account with reference to Amphioxus, Frog and Chick. – - 02 hrs

Unit II

-14 hrs

- 2.1. Fate maps and cell lineage:** Methods of preparation of fate maps, Cell lineage in Nereis, Presumptive organ forming areas and fate maps in Frog and Chick - 02 hrs
- 2.2. Gastrulation:**
- a) Introduction, Gastrulation in Amphioxus, Frog and Chick. - 02 hrs
 - b) Neurulation, post-neurular development and metamorphosis in Frog. - 01 hr
- 2.3. Role of organizers in development:** Transplantation experiments of Spemann and Mangold, Chemistry of Organiser. - 01 hr
- 2.4. Foetal membranes in Chick** - formation, structure and function. - 01 hr
- 2.5. Placenta:** Types - Yolk sac and Chorio-allantoic placenta; Deciduate and non-deciduate placenta; morphological and histological placenta types with suitable examples. - 02 hrs
- 2.6. Regeneration:** Introduction, types – morphallaxis and epimorphosis with examples. Regeneration in Sponges, Hydroid coelenterates, Planarians (Polarity, dominance of head, Axial gradient theory of Child), Earthworms, Star fishes and Amphibians (wound healing or preblastic phase, blastic phase and differentiative phase) -03 hrs.
- 2.7. Environmental regulation of Animal development :** Developmental symbiosis, larval settlement, sex manifestation, diapause and polyphenism (phenotypic plasticity) - 01 hr
- 2.8. Developmental constraints in Evolution:** Physical, Morphogenetic and Phyletic. - 01 hr

Unit III

Evolutionary Biology

- 13 hrs

- 3.1. Chemical Evolution of Life:** Contribution of Oparin, Haldane and Sydney Fox to be highlighted, Stanley Miller's experiment. - 01 hr
- 3.2. Neo-Darwinism:** Critical analysis of Darwinism, Concept of Gene pool and Gene frequency, Hardy - Weinberg law – Definition and significance. - 02 hrs
- 3.3. Role of Evolutionary forces in speciation:**
- a. Sexual reproduction
 - b. Mutation
 - c. Genetic drift
 - d. Natural Selection- Introduction, Stabilizing selection, Directional selection and Disruptive selection.
 - e. Isolation: Isolating mechanisms –
 - i. Introduction, Geographical and Reproductive isolation.
 - ii. Reproductive isolation: a. Prezygotic/Premating isolation – Ecological, Seasonal, Ethological, Mechanical, Physiological and Gametic mortality isolation; b. Post zygotic/Postmating isolation – Cytological, Zygotic mortality, Hybrid inviability, Hybrid sterility isolation.
 - f. Speciation: Introduction, Types: Phyletic, Allopatric and Sympatric speciation. - 04 hrs

- 3.4. Evidences of Organic Evolution:
- Palaeontological evidences: Fossils – Introduction, Fossil formation and types (Petrification, preservation, impressions, moulds and casts); Dating of fossils – Lead method, Carbon method, Potassium – Argon method, Fission Track method.
 - Morphology and Comparative anatomy: Homologous structures, analogous structures, atavism and adaptive radiations.
 - Embryological evidences
 - Physiological and Serological evidences - 04 hrs
- 3.5. Evolution of Man: Introduction, Salient features of important fossil stages of Human – Ramapithecus, Australopithecus, Homo erectus, Rhodesian man, Neanderthal man and Cromagnon man. - 02 hrs

V SEMESTER B.Sc., ZOOLOGY PRACTICAL - 06 **Developmental Biology and Organic Evolution**

- 14 Units
- I Developmental Biology:** - 08 units
- Early development of Frog: Cleavage, Blastula, Gastrula with yolk plug stage and Neurula.
 - Late development of Frog: Metamorphosis (Tadpole to young Frog)
 - Development of Chick: 18 hrs, 24 hrs, 36 hrs, 48 hrs and 72 hrs stages
 - Study of different stages of Chick development through 'Window pane' technique (Demonstration only)
 - Mammals: T.S. of uterus and fallopian tube
 - Placenta: Histological types.
- 06 units
- II. Organic evolution:**
- Study of Homologous organs:
 - Fore limb and Hind limb bones of terrestrial Vertebrates (Frog, Lizard, Bird, Rat or Rabbit or Human).
 - Mouth parts of Cockroach, House fly, Butterfly and Mosquito.
 - Study of Serial homology: Appendages of Prawn.
 - Study of Analogous organs:
 - Vertebrate eye and Cephalopod Eye
 - Wing of Insect and Bird
 - Study of Vestigial organs: Appendix, Coccyx, Molar tooth, Study of Fossil.
 - Study of Connecting links: Peripatus and Tornaria larva.
 - Evolution of Man: Study of Phylogeny using models.

SCHEME OF PRACTICAL EXAMINATION UNDER CBSS 2014-15 ONWARDS
B.Sc. VI SEMESTER ZOOLOGY
COMPARATIVE ANATOMY, CELL BIOLOGY & HISTOLOGY –
PRACTICAL - VI

Duration: 3 hrs

Max.Marks : 35

01	<u>Developmental Biology</u> : Identify and comment on A, B, C and D with supportive labeled diagram. (Note: D – Metamorphosis or Late development of Frog.)	04x04 16 marks
02	<u>Organic Evolution</u> : Identify and comment on the Evolutionary trends of E and F with labeled diagrams.	06 marks
03	Organic Evolution: Identify and comment on 'G' & 'H' (Note: Any one from 3, 4, 5)	08 marks
04	Class Records	05 marks
Total		35 marks

VI SEMESTER
PAPER VII – GENETICS AND BIOTECHNOLOGY

- 40hours

Unit I:
GENETICS

13 hrs.

- 1.1. **Heredity and Environment**: Concept of genotype, phenotype, phenocopy, Norm of reactions (Experiments on *Potentilla glandulosa*, Fur colour in Himalayan Rabbit, studies of Human twins). - 02 hrs
- 1.2. **Introduction to Mendelism** - Mendelian principles - 02 hrs.
- 1.3. **Deviation from Mendelism**: - 05 hrs
 - a. Multiple allelism (Ex: Inheritance of ABO and MN blood groups), Rh factor and its inheritance (Gene complex and Multiple allele theories), Erythroblastosis foetalis and Applications of Blood groups.
 - b. Interaction of genes: Concept and Example - Inheritance of comb shape in poultry.
 - c. Multiple factor inheritance: Concept and Example - Inheritance of skin colour in man.
 - d. Sex linkage: Concept and types. X – linked inheritance: Eye colour in *Drosophila*, Colour blindness and Haemophilia (inheritance and construction of pedigree charts); and Y – linked inheritance : Hypertrichosis in man.
- 1.4. **Chromosomal basis of sex determination**: Types with examples. Genic balance theory, Gynandromorphs and Free Martins. - 02 hrs
- 1.5. **Concept of gene**: Classical concept, Fine structure of gene: Cistron, Recon and Muton, Operon concept: Inducible Operon (E.g. Lac Operon) and Repressible Operon (Tryptophan Operon). - 02 hrs

Unit-II

13 hrs

- 2.1. **Cytoplasmic inheritance:** Kappa particles in Paramecium, Coiling of shells in Snail. - 01 hr
- 2.2. **Chromosomal aberrations:** Types – Structural (Duplication, Deletion, Inversion and Translocation) and Numerical (Aneuploidy) – Cri du Chat syndrome, Down's syndrome, Edwards's syndrome, Turner's syndrome and Klinefelter's syndrome. - 03 hrs
- 2.3. **Gene mutations:** Spontaneous and induced mutations, CIB method of detection of mutations, Physical, Chemical and Biological mutagens, Molecular basis of mutation - 05 hrs
- 2.4. **Eugenics:** Definition, Positive and negative aspects, Genetic counselling, Euthenics and Euphenics. - 02 hrs
- 2.5. **Biochemical Genetics:** Inborn errors in metabolism – Phenylketonuria, Alcaptonuria, Albinism, Sickle cell anaemia, Thalassemia, Galactosemia and Cystic fibrosis – 02hrs

Unit III

BIOTECHNOLOGY

-14 hrs

3.1. Genetic Engineering / Recombinant DNA (rDNA) Technology:

- 03 hrs

- a. Introduction.
- b. Components of rDNA technology:
 - i. Molecular tools: Restriction enzymes, DNA ligases, Alkaline phosphatase.
 - ii. Host cells: Prokaryotic hosts and Eukaryotic hosts.
 - iii. Vectors: Plasmids, Bacteriophages, Cosmids, Artificial chromosome vectors, Shuttle vectors. Choice of a vector.
 - iv. Bioreactors.
- c. Methods of gene transfer in animals: Transfection – microinjection, electroporation, of DNA, lipofection and direct transfer of DNA.

3.2. Applications of Biotechnology:

- a. **Transgenesis:** - 02 hrs
 - i. Introduction – Meaning and significance.
 - ii. Transgenesis in mice, Gene targeting in mice, Knock out and Knock in technology.
- b. **Animal improvement:** - 02 hrs
 - i. Super ovulation and Embryo transfer: Steps, Difference between surgical and non-surgical transfers, Benefits and limitations of embryo transfer.
 - ii. Artificial insemination
 - iii. Sperm sexing.
- c. **Gene therapy:** - 02 hrs
 - i. Introduction.
 - ii. Approach for gene therapy: Somatic cell gene therapy, Embryo cell gene therapy and Germ cell gene therapy.
 - iii. In vivo and ex-vivo gene therapy.
 - iv. Gene therapy strategies for Cancer: Tumor necrosis factor gene therapy, Suicide gene therapy, Gene replacement therapy and Antisense and antisense gene therapy.
- d. **Stem cells:** Introduction, features, types, sources and applications - 01 hr
- e. **Bioinformatics:** Meaning, Scope and applications. - 01 hr.
- f. **Hybridoma technology:** Monoclonal antibodies and their applications. - 01 hr.
- g. **DNA fingerprinting or Profiling:** RFLP, VNTR, Microsatellites (Simple tandem repeats and Single nucleotide polymorphisms (SNPs) techniques. Application of DNA fingerprinting. - 02 hrs

VI SEMESTER B.Sc., ZOOLOGY PRACTICAL - 07
Genetics and Biotechnology

1. *Drosophila* Genetics:
 - a. Sexual dimorphism and Mutant forms – Vestigial wing, White eye, Bar eye, Sepia eye, Yellow body and Ebony.
 - b. Mounting of Polytene chromosomes (Salivary gland chromosomes)
 - c. Mounting of Sex comb and Genital plate.
2. Human Genetics:
 - d. Blood typing
 - e. Preparation of Buccal smear for sex chromatin
 - f. Preparation of Blood smear for identification of Cell types and to comment on the types of leucocytes.
 - g. Differential counting of blood cells using haemocytometer.
 - h. Micrometry of cell types.
3. Biotechnology:
 - i. Staining and identification of Bacteria (Gram staining)
 - j. Biochemical analysis to determine the interaction of bacteria with different substrates.
 - k. Isolation of plasmid DNA
4. Isolation of DNA from animal tissue (Sheep, Goat, Cow or Hen)
5. Qualitative detection of acetic acid in Yeast culture (Student is required to prepare the culture)
6. Study of polyploidy in Onion root tip using Colchicine
7. Translocation in Rheo.

SCHEME OF PRACTICAL EXAMINATION UNDER CBSS 2014-15 ONWARDS
B.Sc. VI SEMESTER ZOOLOGY
GENETICS AND BIOTECHNOLOGY – PRACTICAL - VII

Duration: 3 hrs.

Max.Marks : 35

01	<u>Drosophila Genetics:</u> a) Mounting : Polytene Chromosome (Salivary Gland Chromosome) or Sex comb or Genetial Plate Or Two Genetic problems b) Identify and comment with a neat labeled diagram. <i>Drosophila</i> male, female and mutants (any two)	07 marks 05 marks
02	Human Genetics : from d to f	06 marks
03	Biotechnology: a) From i, j and k (any one) b) From 4, 5, 6 and 7 (any one)	06 marks 06 marks
04	Class Records	05 marks
Total		35 marks

VI SEMESTER
PAPER VIII – ANIMAL PHYSIOLOGY AND TECHNIQUES IN BIOLOGY

- 40 hrs

Unit I

- 13 hrs.

ANIMAL PHYSIOLOGY

Vegetative functions:

- 1.1. **Digestion:** - 02 hr
- i. Neural-Hormonal control of digestive glandular secretion.
 - ii. Symbiotic digestion in Ruminants.
- 1.2. **Circulation:** - 02 hrs
- i. Respiratory pigments: Major types and their features.
 - ii. Transport of respiratory gases.
 - iii. Theories of blood clotting: Best and Taylor's theory, Fuld and Spiro's theory, and Howell's theory. Mechanism of blood clotting.
- 1.3. **Respiration:** - 02 hrs
- i. Regulation of respiration.
 - ii. Oxygen dissociation curves: Definition and factors affecting the Oxygen dissociation curve (Oxygen, Carbon Dioxide, Temperature and pH; Body size and Organic phosphate compounds – Bohr effect, Haldane effect and Root Effect to be highlighted).
- 1.4. **Excretion:** - 02 hrs
- i. Introduction.
 - ii. Ammonotelism, Ureotelism and Uricotelism with examples.
 - iii. Formation of Ammonia (Deamination of amino acids), Urea (Ornithine cycle) and Uric acid (Purine degradation)
- 1.5. **Energy metabolism:** - 02 hrs
- i. Metabolism and Metabolic rate.
 - ii. Basal metabolic rate (BMR)
 - iii. Measurement of metabolic rate: Methods – Calorimetry, Oxygen consumption method, amount of Carbon dioxide liberated, calculation of energy difference in food consumed and excreta.
 - iv. Factors affecting metabolic rate- Body size, Sex, Age, Disease, Food and Hormones.
- 1.6. **Muscle Physiology:** - 03 hrs
- i. Ultrastructure of skeletal muscle.
 - ii. Chemical composition of muscle.
 - iii. Physico-chemical aspects of muscle contraction.
 - iv. Sliding filament theory of muscle contraction.

Unit-II

-14 hrs

2.1. Physiology of Nerve

- 02 hrs

- i. Propagation and conduction of nerve impulse – Axonal and Synaptic.
- ii. Neuro-transmitters.

2.2. Physiology of Sense organs:

- 02 hrs

- i. Vision
- ii. Hearing
- iii. Equilibrium
- v. Olfaction

2.3. Homeostatic functions:

- a. Concept of Homeostasis and role of feed back mechanism- Positive – Oxytocin secretion and Negative – Thyroid, Parathyroid and Adrenal secretion (details of regulation required) - 02 hrs
- b. Endocrinology: - 03 hrs
 - i. Introduction, Chemical nature of hormones.
 - ii. Endocrine glands: secretions and their actions, effect of hyposecretion and hypersecretion.
 - iii. Concept of neuro-secretion with examples.
 - iv. Hormonal control of metamorphosis in Insects and Amphibians.
- c. Osmoregulation: Introduction, Types of osmoregulatory mechanisms with examples, and osmoregulation in Migratory fishes. - 02 hrs
- d. Thermoregulation in Homeotherms: Methods of heat loss and heat gain, Role of Hypothalamus in thermoregulation. - 01 hr

2.4. Common disorders in Humans: Jaundice, Hyperacidity, Peptic Ulcer, Hypertension, Anaemia, Diabetes mellitus and Obesity. - 02 hrs

Unit 3

TECHNIQUES IN BIOLOGY

- 13 hrs

- 3.1. **Microtechnique:** Introduction and procedure – fixation, embedding, microtomy, staining – simple and differential and mounting.
- 3.2. Immuno assay: Principle and applications.
- 3.3. Separation techniques: Principle and applications of Centrifugation, Chromatography, Fractionation and Electrophoresis (Details of types and techniques to be avoided).
- 3.4. Autoradiography: Principle and applications.
- 3.5. Microscopy: Principle – magnification and resolution. Types: Light, Phase contrast, Fluorescent and Electron microscopy (TEM and SEM).
- 3.6. Micrometry: Principle and applications.
- 3.7. Endoscopy: Principle and applications.
- 3.8. Kidney replacement therapy: Dialysis – Haemodialysis and Continuous ambulatory peritoneal dialysis.
- 3.9. Statistical tools and their applications – Mean, Median and Mode, Standard Deviation (SD), Regression, Correlation co-efficient and Probability.

VI SEMESTER B.SC., ZOOLOGY PRACTICAL - 08
PHYSIOLOGY AND TECHNIQUES IN BIOLOGY

I. Physiology Experiments:

1. Qualitative analysis of Carbohydrates, Proteins and Lipids in Hen's egg.
2. Qualitative analysis of Nitrogenous wastes – Ammonia, Urea and Uric acid.
3. Effect of temperature on heart rate of Unio.
4. Quantitative estimation of Oxygen consumption by fresh water Crab.
5. Quantitative estimation of salt gain and salt loss by fresh water Crab.
6. Detection of glucose, albumin and ketone bodies in urine.
7. Osmotic relations in animals (E.g., Earthworm).
8. Qualitative analysis of digestive enzymes in the alimentary canal of Cockroach.
9. Estimation of Muscle glycogen (Anthrocin method).

II. Techniques in Biology:

1. Paper Chromatography for separation of amino acids and proteins.
2. Demonstration of Rocket Electrophoresis technique for detection of specific antigens.
3. Scientific drawing : To draw microscope specimens using a prism type camera lucida.

III. Project report on:

Dialysis, Diabetes mellitus, Obesity, Cardio vascular diseases and Anaemia.

SCHEME OF PRACTICAL EXAMINATION UNDER CBSS 2014-15 ONWARDS
B.Sc. VI SEMESTER ZOOLOGY
PHYSIOLOGY AND TECHNIQUES IN BIOLOGY – PRACTICAL - VIII

Duration: 3 hrs.

Max.Marks : 35

01	Physiology Experiment	13 marks
02	Biological Techniques*	10 marks
03	Project Report submission	07 marks
04	Class Records	05 marks
Total		35 marks
Note:* i) Differential counting of blood cells using haemocytometer ii) Micrometry of cell types iii) Paper chromatography for separation of amino acids and proteins iv) Scientific drawing :- using Camera Lucida		

REFERENCES:

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 – Invertebrate VII Ed.*, Vol. I, A.I.T. 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. *Sedgewic Volumes*
8. *Parker and Haswel Vol. I*
9. *Kotpal Volumes Protozoa through Echinodermata*
10. *A manual of Zoology by Ekambarnath and Vishwanathan*
11. *Economic Zoology by Shukla and Upadayana*
12. *Economic Zoology by Reena and Mattur*
13. *Invertebrate Zoology by S.N. Prasad.*

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