SOLAPUR UNIVERSITY, SOLAPUR

Syllabus for B.Sc. III Zoology
Semester Pattern Syllabus
W.E.F. from June 2012

SOLAPUR UNIVERSITY, SOLAPUR

Semester Pattern Syllabus
for B.Sc. III Zoology (Semester – V)
w. e. f. June 2012

Paper- IX

Non-chordates

I. Protozoa –
   1. Nutrition in Protozoa. - (2)
   2. Reproduction in Protozoa. - (2)

II. Porifera –
   1. Types of Canal Systems. - (2)

III. Coelenterata –
   1. Polymorphism. - (2)
   2. Corals and Coral reef. - (2)

IV. Salient features and affinities of Ctenophora. - (2)

V. Annelida –Type study - Leech : - (10)
   1. Systematic position.
   2. Habits and habitat.
   3. Morphology and body wall.
   4. Locomotion.
   5. Food, feeding and digestive system.
   6. Haemo-coelomic system.
   7. Excretory system.
   8. Nervous system.
   9. Sense organs.
   10. Reproductive system, copulation and cocoon formation.
   11. Parasitic adaptations and economic importance.

VI. Arthropoda –
   1. Crustacean larvae. - (2)
   2. Insect larvae. - (2)
   3. Insect metamorphosis & its hormonal control. (2)
   4. Zoological importance of Peripatus and Limulus**.** - (2)

VII. Mollusca –
   1. Torsion and Detorsion. - (2)

VIII. Echinodermata –
   1. Type study –Sea star - (9)
      a) Systematic position.
      b) Habits and habitat.
      c) Morphology and body wall.
      d) Food, feeding and digestive system.

e) Water vascular system and locomotion.
f) Reproductive system.
g) Nervous system and sense organs.
h) Haemal and perihaemal system.

2. Echinoderm larvae. - (2)

X. Minor phyla - Salient features and affinities of- Lingula (2)

Total periods - (45)

Paper- X

Biostatistics, Bioinformatics, Medical Zoology and Evolutionary Genetics

I. Biostatistics:

1. Classification and Tabulation. - (3)
2. Frequency distribution & Graphical representation. - (2)
3. Measures of Central Tendency - Mean, Median and Mode. (4)
4. Dispersion – Mean Deviation, Standard Deviation & Standard Error. - (4)
5. Correlation – Scatter diagram, - (3)
   Types of correlation & Correlation coefficient.
   a. Spearman's Rank Correlation Coefficient.
   b. Karl Pearson's Correlation Coefficient.

II. Bioinformatics : - (7)

1. Introduction
2. Applications of search Engine
3. Importance and applications of Bioinformatics.
4. Three levels of Bioinformatics in Structural Biology.

III. Medical Zoology:

1. Brief introduction to pathogenic microbes. - (6)
   a. Viruses – Polio virus, Swine Flue Virus Rabies virus and Chicken Guinea Virus.
   b. Rickettsiae
   c. Bacteria – *Salmonella, Streptococcus, Mycobacterium tuberculosis,*
2. Study of Pathogenic Protozoons and their control – *Entamoeba histolytica* and *Plasmodium vivax.* - (4)
3. Study of Pathogen and control of Elephantasise - (2)

IV. Evolutionary Genetics:

1. Hardy-Weinberg Law of genetic equilibrium. (10)
2. Destabilizing forces of Natural selection with reference to Genetic drift and Migration

Total Periods- - (45)

Reference Books- (for Paper IX and X)

- There are few websites providing free downloadable books.
- Website of NCBI provides more than thirty books on microbiology, molecular biology, genetics and Biotechnology
- Website named Books4Doctor gives books on histology, physiology, molecular biology and Human genetics. The books can be searched alphabetically.

1. Invertebrate Zoology- (W.B. Saunders Co.) – Barnes R.D.
2. Treatise in Zoology Sedgwick Vol III
3. Modern Text Book of Zoology, Invertebrates – R.L.Kotpal.
4. life of Invertebrates – S.N. Prasad, Vikas publishing House, New Delhi.
5. A Life of Invertebrates- Russell & Hunter.
6. Practical Zoology, Invertebrates- S.S. Lal.
7. Info technology- S. Chand and Co.
8. Bioinformatics- Murti, Himalaya Publications.
9. Introduction to Bioinformatics Attwood Pearson Education Delhi
10. General Parasitology- Cheng, T.C. Academic Press.
11. Parasitology-Chandler, Allied Agency, Kolkata.
12. Essentials of Parasitology – Gerald D. Smidth.
13. Introduction to Biostatistics Pranab Kumar Banerjee S. Chand and Company. New Delhi
14. Wikipedia : Free encyclopedia Major topics in Population genetics and related examples can be searched.
15. Evolution : Mark Ridley Blackwell Publishing In India marketed by John Wiley and Sons.

Paper- XI

Comparative Anatomy of Chordates

I.	Integument and its derivatives	-	(7)
	Endoskeleton - Axial skeleton & Appendicular skeleton.	-	(6)
II.	Digestive system – Alimentary canal and associated glands.	-	(5)
III.	Respiratory system – Cutaneous respiration, Gills and lungs, Air sacs in birds.	-	(5)
IV.	Circulatory system – Evolution of heart and Aortic arches, Portal systems.	-	(7)
V.	Excretory system – Evolution of kidney and its ducts	-	(4)
VI.	Nervous system – Comparative anatomy of Vertebrate brain	-	(6)
VII.	Sense organs – Comparative anatomy of ear and eye.	-	(5)
	Total periods	**-**	**(45)**

Paper- XII

Developmental Biology

1. Gametogenesis - (2)
2. Process of fertilization (2)
3. Genetic regulation of Development - (1)
4. Types of eggs and cleavages - (4)
5. Development of Amphioxus - (10)
   a. Structure of Egg and Sperm
   b. Fertilization and cleavage
   c. Blastuala and its fate map
   d. Gastrulation
   e. Primary organ formation : Nerve cord, Notochord, Mesoderm and coelom and Gut
6. Development of chick (18)
   f. Structure of Egg and Sperm
   g. Fertilization and cleavage
   h. Blastuala and its fate map
   i. Gastrulation
   j. Structure of 24 Hr. Chick embryo.
   k. Development of nervous, digestive and circulatory systems in second day of incubation (Structure of 48 Hr. Chick embryo)
   l. Development of nervous, digestive and circulatory systems in Third day of incubation (Structure of 72 Hr. Chick embryo)
7. Organizer – Concept and process of induction. - (2)
8. Foetal membranes & their Significance in chick. - (2)
9. Placentae – types and significance. - (2)
10. Cloning – techniques, significance Surragate mother and ethical issues - (2)

Total Periods- - (45)

Reference Books – (for Paper XI and XII)

1. An Introduction to Embryology 2003, Balinsky B.L., Saunders College, Philadelphia.
2. Developmental Biology; Patterns/Principles/Problems, 1982, Saunders J. W. Collier MacMillan, Publishers, London.
3. Developmental Biology, 2004 , 3rd Edition, Gilbert S.F. Saunder Associates Inc. U.S.A.
4. Developmental Biology, 1992 3rd edition, Browder L.W. Erickson C.A. & Williams, R.J. Saunders College, Publications, London.
5. A Text Book of Embryology, Dr. Puranik P. G. , S. Chand & Co.
6. Developmental Biology, 1984, Browder L.W. , Saunders College Publicaions, U.S.A.
7. Development of Chick embryo, 1972, Lillie.
8. Outlines of comparative anatomy,Romer & Parsons, Central Book Depot, The Vertebrate Body (Saunders).
9. Biology of Vertebrates Walter & Sayles; (McMillan).
10. Modern Textbook of Zoology, R. L. Kotpal, Rastogi Publications, Meerut.
11. The Life of Vertebrates, 3rd Edition, 1993, J. Z. Young E. L. B.S. Oxford.
12. Chordate Zoology – E.L. Jordan, S. Chand & Co., New Delhi.
13. The Phylum Chordata – 1987, H.H. Newman, Distributor Satish Book Enterprise, Agra.
14. Comparative Anatomy of the Vertebrates G. C. Kent.

SOLAPUR UNIVERSITY, SOLAPUR

New Syllabus for B.Sc. III Zoology (Semester – VI)
w. e. f. June 2012

Paper - XIII
Physiology

I.	Nutrition	1. Nutritional requirements.	-	(8)
		2. Digestion and absorption.		
		3. Vitamins- Water soluble – B-Complex and C Fat soluble – A, D, E and K. With reference to source, Physiological role and deficiency .		
II.	Metabolism	-1. Carbohydrate metabolism - Glycogenesis, Glycogenolysis, Glycolysis, Kreb's cycle, and Gluconeogenesis.		(6)
		2. Protein metabolism -Transamination, Deamination and Ornithine cycle.		
		3. Lipid metabolism. -β- oxidation hypothesis. .		
IV.	Respiration	- 1. Transport of respiratory gases.-		(4)
		2. Chemical and nervous regulation of Respiration.		
V.	Circulation	- 1. Origin and conduction of heart beat.- Cardiac cycle,		(7)
		2. ECG, Blood pressure, Capillary pressure and Regulation.		
VI.	Excretion	- 1. Structure of nephrons		(4)
		2. Physiology of urine formation.		
		3. Composition of normal urine.		
		4. Dialysis.		
VII.	Muscle	1. Ultra structure of striated muscle,-		(6)
		2. Molecular mechanism of muscle Contraction.		
VIII.	Nerve	- 1. Ultra structure of neuron,	-	(7)
		2. Origin and conduction of nerve impulse.		
		3. Synapse and synaptic transmission.		
IX.	Stress	Physiological response to exercise and Yoga with reference to circulation and respiration.	-	(3)
		Total Periods-	**-**	**(45)**

Paper- XIV

Endocrinology, Environmental Biology and Toxicology

I. Endocrinology:

1. Study of endocrine glands – Anatomy ,Histology. And Hormones – (Nature, role, regulation and disorders) with reference to the following: Thyroid gland, Parathyroid gland, Adrenal gland and Islets of Langerhans. - (14)
2. Hormone receptors and Mechanism of hormonal actions - (2)
3. Prostaglandins. - (1)
4. Neurohormones.
   i. GnRH
   ii. CRH
   iii. TRH - (2)

II. Environmental Biology :

1. Biodiversit and conservations of indangeroured species (4)
2. Biological indicators of pollution. - (2)
3. Solid waste management. - (3)
4. Water management – Rain Water harvesting . Waste water management - (3)
5. Characteristics and faunal adaptations with reference to following habitats, Fresh water, Marine water and Terrestrial- (Grassland, desert, deciduous forest.) - (6)

III. **Toxicology** - (8)

1. Classification of toxicants.
2. Toxic agents and their action – Pesticides and Heavy Metals,
3. Applications of Toxicology.
4. Determination of LC – 50 and LD – 50 Values
5. Bioaccumulation and biomagnifications.

Total Periods - (45)

Reference Books (for Paper XIII and XIV)

1. General and Comparative Physiology – Hoar (Prentice Hall).
2. Animal Physiology – Nelson (Cambridge).
3. Comparative Animal Physiology – Prosser (Satish Book Enterprise).
4. Endocrinology – Hadley Pearson Education Delhi
5. General Endocrinology – Bagnara & Turner (W.B. Saunders)
6. Ecology – Odum (Amerind)
7. Limnology – Welch (McGraw Hill)
8. Introduction to Environmental Science – Y Anjaneyulu (B.S. Publications)

9. Animal Physiology – Adaptation and Environmental – Schiemdt Nielson (Cambridge)
10. Physiology : A regulatory systems approach – Strand F.L. (McMillon Publications Co.).
11. Environmental and Metabolic Animal Physiology – Prosser C.L. (Wiley – Liss Inc.)
12. Environment Physiology- Willmet P.G., Stone & Johnsion (Blackwell Science, Oxford).
13. Physiological Animal Ecology – Loan G.N. (Longman Harlog, UK)
14. Principles and methods of Toxicology – Hayes (Edited A. Wallace, Hayes Publications, Raven Press, N.Y.)
15. Books4Doctors Website Downloadable book of Endocrinology Nussey

Paper – XV

Molecular Biology and Biotechnology

I. Molecular Biology :

1. Organization of DNA (1)
2. Evidences for DNA as a genetic material (2)
   - i. Transformation
   - ii. Transduction
   - iii. Conjugation

1) Replication of DNA - (2)
2) DNA damage and repair mechanism. - (2)
3) Protein Synthesis
   - a) Transcription - - (3)
     - i. Process of transcription in prokaryotes
     - ii. RNA polymerases.
     - iii. Post transcriptional modifications in RNA.
   - b) Translation – (5)
     - i. Activation of amino acids
     - ii. Binding or transfer of amino acid to t RNA.
     - iii. Initiation
     - iv. Elongation
     - v. Termination.

6. Genetic Code - - (3)
   - i. Properties of Genetic Code
   - ii. Codon assignments.
     - a) Initiation codon
     - b) Termination codon
     - c) Codon and anticodon pairing
     - d) Wobble hypothesis
7. Regulation of gene expression –With reference to Lac- operon concept - (2)

II. Biotechnology:

1. Recombinant DNA technology
   - i. Mechanism and role of restriction enzymes, DNA ligase and DNA polymerase. (3)
   - ii Cloning vectors
2. Techniques in genetic engineering (12)
   - i Polymerase chain reaction :
     - a. Introduction
     - b. Mechanisum
     - c. Applications
   - ii DNA probe :
     - d. Introduction
     - e. Mechanisum of synthesis of probe
     - f. Application
   - iii Southern, Northern, western blotting :
     - g. Introduction
     - h. Mechanisum
     - i. Applications
   - iv DNA fingerprinting :
     - j. Introduction
     - k. Mechanisum
     - l. Applications
3. Immunological techniques : (7)
   - i Hybridoma & monoclonal antibody :
     - m. Introduction
     - n. Synthesis of mab
     - o. Applications
   - ii ELISA :
     - p. Introduction
     - q. DAC & DAS ELISA
     - r. Applications

Application of Biotechnology – Medicine ,animal husbandary and Agriculture (2)

Total Periods - (45)

Paper – XVI

Biotechniques and Applied Zoology

I. Biotechniques :

1. Tools and Techniques (Basic Principles and Uses)
   Balance,pH meter , colorimeter, spectrophotometer and ultracentrifuse (3)
2. Separation techniques (4)
   - i. Chromatography- TLC and Column chromatography.
   - ii.Gel Electrophoresis.
3. Animal Cell Culture (6)
   - i. Introduction and principle, Requirements and applications
   - ii. Stem cells and their culture
   - iii. Tissue and organ culture
   - iv. Embryo culture

II. Applied Zoology

I) Fisheries : (5)

1. Marine Capture fisheries
   Coastal fishery – sardine, mackerel, Bombay duck
   Off – shore fishery – Sole, Tuna, Pomphret
   Crustacean fishery – laobsters crabs, shrimps
2. Economic importance of Fin fishes. (3)
3. Economic importance of Fish Products (2)
4. Pearl Culture. (1)
5. Fishing Crafts and Gears. (6)
   a) Crafts-
      - i. Rafts
      - ii. Trawler
      - iii. Shampan
      - iv. Dinginauka
      - v. Chandinauka
      - vi. Koshanauka

   b) Gears-
      - i. Hooks and lines
      - ii. Cast net
      - iii. Gill net
      - iv. Trap net
      - v. Rampani net
      - vi. Trawl net

II) Agricultural Pest and Pest Management- (6)

a)Crop pests – Pyrilla,

Tribolium (Jowar grain borer)
Cotton Boll worm,
Grass hopper and Rat.
b) Biological control of crop pests.
c) Integrated pest management
d) Termite- castes, economic importance and control

III) **Rearing Technology of Silk worm** **(6)**

a. Principle of skilkworm rearing
b. Varieties of silkworms & their rearing methods
c. Financial Aids for rearing
d. Types of rearing houses
e. Rearing Appliences and maintenance

IV) **Silkworm diseases :-** **(3)**

a. Protozoon diseases
b. Bacterial diseases
d. Viral diseases
e. Fungal diseases

Total Periods - (45)

Reference Books- (for Paper XV and XVI)

1. Cell and Molecular Biology, 8th Edition, De. Robertis EDP and De Robertis Jr. EMF, Lippincott Williams and Wilkins, Philadelphia,'
2. Cell Biology, C.B. Powar, Himalaya Publication House.
3. Cell and Molecular Biology, E.J. Dupraw, Academic Press, NewYork.
4. Cell Structure and Function – A. G. Loewy, P. Siekevitz, J. R. Meninger & J. A. N. Gallant, Saunder College, Philadelphia.
5. Molecular Biololgy of the Cell – 3rd Edition, Bruce Alberts, Dennis Bray, Julian Lewis, Martin Raff, Keith Roberts & James D. Watson, Garlan Publishing, New York.
6. Elements of Biotechnology – P. K. Gupta, Rastogi Publications.
7. Gene V & VI, 1994, Lewin B., Oxford University Press, Oxford.
8. Prawn and Prawn Fishery of India – Kurian.
9. Fish Culture – K. H. Alikuhni.
10. Fish Culture – Lagler.
11. Fishes of India. – Zingran
12. Manual of sericulture – Krishnaswami et. al.
13. Introduction to sericulture – Ganga and Shetty.

Practical - I

Non-chordates, Biostatistics, Bioinformatics and Medical Zoology, and Evolutionary Genetics.

I. Dissection and Mountings –
Leech -
1. Digestive system.
2. Nervous system.
3. Reproductive system.
4.Mountings – Nephridium, Salivary glands and jaws.

II. Dissection and Mountings –
Sea star –
1. Digestive system.
2. Water vascular system.
3. Mounting – Tube foot.

III. Lingula – Mounting of Lophophore and Nephridium

IV. Dissection - Squilla Nervous system

V. Mountings – Zooids of Porpita, Obelia colony

VI. Study of Protozoans for locomotion – Amoeba, Paramoecium and Euglena.

VII. Study of Canal systems – T.S. and L.S of Sycon.

VIII. Study of Physalia and any four Corals

IX. Study of following –
1.Crustacean larvae.
2.Insect larvae.
3.Peripatus and Limulus.
4.Echinoderm larvae.

X. Examples on Biostatistics. (Any Ten Examples)

XI. Preparation of Rectal parasites in Frog / Rat / Cockroach.

XII. Study of Pathogens , *Entamoeba, Plasmodium, and Wuchereria bancropti*

XIII. Histopathological Slides –Liver (Cirrhosis), Kidney (Nephrosis) Tongue (Cancer).

XIV. Bioinformatics – a)Data search by search engines
b) Examples based on bioinformatics.

XV. Computer and its peripherals

XVI. Example based on Hardy Weinberg law (Ten examples)

PRACTICAL –II

Comparative Anatomy of Chordates & Developmental Biology.

I. Dissection of cranial nerves of **Scoliodon** /

II. Dissection of Neck nerves and reproductive system of rat

III. Dissection of Membranous labyrinth of **Scoliodon**/

IV. Dissection of Eye muscles and nerve innervations of scoliodon

V. Temporary stained preparations of - Scales – Placoid, Cycloid and Ctenoid/Ampulla of Lorenzini ,Weberian ossicle of Labeo

VI. Study of Eggs of Insects, Amphioxus, Frog and Chick.

VII. Study of Cleavage, Blastula and Gastrula – Amphioxus

VIII. Study of Whole mounts and T.S. of 18, 24, 33, 48, and 72 hrs Chick embryos.

IX. Temporary / Permanent preparation of Chick embryos.

X. Study of placenta Rat/ Human

XI. Study of following-

1. T.S. / V.S. of skin of vertebrates.
2. Scales- Fishes and Reptiles.
3. Feathers.
4. Gills of Fishes and Lungs of Amphibian, Reptiles, Birds and Mammals.
5. Hearts of Vertebrates.
6. Brains of Vertebrates.

PRACTICAL –III

Physiology, Endocrinology, Environmental Biology and Toxicology.

I) Demonstration of physiological practicals.
   a) Dissection of gastrocnemius muscle with sciatic nerve preparation in frog.
   b) Simple muscle twitch.
   c) Recording of normal cardiogram.
   d) Effect of temperature, Adrenaline, Nicotine on normal heart.
   e) Analysis of frog muscle twitch and cardiogram from provided graph .

II) Estimation of hemoglobin.

III) Total count of R.B.C., W.B.C and differential count. of WBC

IV) Measurement of blood pressure and heart beat under normal and stress condition.

V) To determine plasma volume of whole blood by centrifugation method.

VI) Endocrine glands – Anatomy and Histology.
Testis, Ovary, Adrenal, Thyroid, Pancreas.

VII) Estimation of dissolved O_2 and free CO_2

VIII) Estimation of Oxygen consumption in any aquatic animal.

IX) Testing of hardness of water.

X) Effect of pollutant / Toxicants on aquatic animals

XI) Study of animals in relation to their habitats.

1. Lotic – Guppies.
2. Lentic – Anabas/ Indian major Carp
3. Pelagic – Puffer fish/Mackerel, Sardine
4. Benthic – Lobster, Prawn
5. Grass land – Stick insect/Grasshopper
6. Desert – Phrynosoma, Uromastix.

XII) Ecological pyramids:

Presentation of given data in the form of ecological pyramids.

Data for the ecological pyramids.

1. Members of Grass land ecosystem – Grasshopper, rat snake, grass, herbs, shrubs, weeds, trees, vulture, squirrel, earthworm, centipede, scorpion , rabbit and Indian bustard.
2. Members of Pond ecosystem –

Sponge, nepa, leech, planaria, hydra, lymnea, planorbis, heron, kingfisher, Cyclops, daphnia, tortoise , diatoms Vallisneria, hydrilla, chara and spirogyra.

3. Members of Forest ecosystem-
   Monkey, tree snake, hyla, python, vulture, giant squirrel, gaur, tiger, leopard, deer, loris, earthworm, millipede, king cobra, shrub herb, tree, jungle fowl, moss and fern.
4. Members of Desert ecosystem-
   Opuntia, Aloe, sidewinder, wild ass, camel, ground spider, scorpion
   Phrynosoma, Uromastix, vitis , Khejadi, black buck, Pencil tree, nerium.

XIII) Project work- Under the guidance of teacher and report is to be submitted at the time of practical examination.

PRACTICAL – IV

Molecular Biology, Biotechnology and Applied Zoology.

I) Preparation and study of Whole mount – (Protozoans, Coelenterate colony, planktons, insect larvae, echinoderm larvae, crustacean larvae, fish scales, feathers- filoplume and down)

II) Microtomy- Frog / Rat (HE Technique)

III) Histochemical techniques-

a)Feulgen Technique,
b) AB Technique,
c) PAS Technique.

Submission of 10 permanent slides (HE-4; Histochemistry-2; Chick embryo-1; WM- 3)

IV) Biotechnology -i)Chromatography , Separation of Amino acids /Serum proteins by Paper or Thin Layer Chromatography (TLC)

ii) DNA Isolation
iii) Tissue culture / Embryo culture

V) Cytological preparations

i) Demonstration of DNA by Feulgen technique
ii) Meiosis in grasshopper testis /onion bud/ Rheodendron bud
iii) Study of polytene chromosomes to observe puffing in Chironomus larvae/Drosophila

VI) To find out codon sequences for known polypeptide chain of ten amino acids or to find out amino acid sequence from given codons (chart will be provided.)

VII) Economic importance of Leech, Prawn, Lobster, Crab, Oyster, Sepia.

VIII) Economic importance of Shark, Pomphret, Oil Sardine, Mackerel, Bombay duck, Eel, Ophiocephalus, Catala, Rohu, Mrugal and Cyprinus.

IX) Study of fish products- fish meal, fish glue, fish liver oil, fish body oil, fish manure, and shagreen.

X) Study of different Fishing Crafts and Gears (Models).

XI) Study of Crop pests – Pyrilla, Jawar grain borer, Cotton ball worm, Grass hopper

XII) Sericulture - Study of silk moth, silk cocoons, and silk and .silk glands

XIII) Excursion to a sea shore to study marine animal diversity, fishery centers, and offshore fisheries / National parks / Wild Life Centuries / National Research Institutes and submission of the report at the time of the practical examination (Duration-10-15 days).

Skeleton paper for practical examination

Practical – I		Marks
Q.1: Major Dissection	-	12
Q.2: Minor Dissection	-	6
Q.3: Mounting	-	4
Q.4: Identification	-	10
Q.5: Biostatistics example	-	6
Q.6: Example based on Hardy Weinberg law / Bioinformatics		7
Q.7: Practical record book	-	5
Total	**-**	**50**

Practical – II:

Q.1: Dissection	-	12
Q.2: Mounting	-	5
Q.3: Identification	-	10
Q.4: Mounting of Chick Embryo	-	10
Q.5 Submission of permanent Slides	-	8
Q.6: Practical record book	-	5
Total	**-**	**50**

Practical – III:

Q.1: Estimation of Oxygen Consumption/ Dissolved O2 from given sample/ Free CO2 from given sample	-	10
Q.2: Hemoglobin percentage /Blood Cell counts/Toxicological expt/ Hardness of water	-	6
Q.3: Ecological pyramid	-	4
Q.4: Analysis of given graph of muscle twitch / frog cardiogram	-	7
Q.5: Identification	-	5
Q.6: Submission of Project and Viva general (Theory)	-	13
Q.7: Practical record book	-	5
Total	**-**	**50**

Practical – IV:

Q.1: Microtomy – Preparation of Histological permanent slide	-	10
Q.2: Histochemistry.	-	5
Q.3: Cytological preparation/Chromatography/Feulgen technique	-	5
Q.4: Codon analysis	-	5
Q.5: Identification	-	10
Q.6: Excursion report	-	10
Q.7: Journal	-	5
Total	**-**	**50**

B.Sc. III : Zoology Equivalence to old Syllabus :

Old Paper V - Functional Anatomy of Non-chordates, Biostatistics, Bioinformatics and Medical Zoology.

New` Paper IX & X : Non-chordates and Biostatistics, Bioinformatics, Medical Zoology and Evolutionary Genetics

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Old Paper VI- Comparative Anatomy of Chordates Developmental Biology.

New Paper XI & XII Comparative Anatomy of Chordates and Developmental Biology.

Old Paper VII - Physiology, Endocrinology, Environmental Biology and Toxicology.

New Paper XIII & XIV Physiology and Endocrinology, Environmental Biology and Toxicology.

Old Paper VIII - Molecular Biology, Biotechnology, Biotechniques and Applied Zoology.

New Paper XV & XVI Molecular Biology, Biotechnology and Biotechniques Applied Zoology.

(Some changes in Paper-VIII (Section-II) and Paper-XVI)

- There is no equivalence for practical of old and new course. The student should appear for practical based on new course only