MAULANA AZAD UNIVERSITY, JODHPUR

B.Sc. ZOOLOGY SYLLABUS

CODE	DESCRIPTION	PD/W	EXAM	CIA	ESE	TOTAL
BSZO111	Taxonomy of Lower Non chordate	3	3hrs	20	80	100
BSZO112	Cytology and Genetics I	3	3hrs	20	80	100
BSZO121	Zoology Lab I	6	3hrs	20	80	100
BSZO211	Evolution and Biology of Higher Non Chordate	3	3hrs	20	80	100
BSZO212	Molecular Biology and Genetics II	3	3hrs	20	80	100
BSZO221	Zoology Lab II	6	3hrs	20	80	100
BSZO311	Biology of chordates	3	3hrs	20	80	100
BSZO312	Immunology & Microbiology	3	3hrs	20	80	100
BSZO321	Zoology Lab III	6	3hrs	20	80	100
BSZO411	Comparative anatomy of chordates	3	3hrs	20	80	100
BSZO412	Animal Embryology	3	3hrs	20	80	100
BSZO421	Zoology Lab IV	6	3hrs	20	80	100

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B.Sc. Semester I[st]

ZOOLOGY

CODE	DESCRIPTION	PD/W	EXAM	CIA	ESE	TOTAL
BSZO 111	Taxonomy of Lower Non chordate	3	3hrs	20	80	100
BSZO112	Cytology and Genetics I	3	3hrs	20	80	100
BSZO121	Zoology Lab I	6	3hrs	20	80	100
Total				**60**	**240**	**300**

BSZO 111 - TAXONOMY OF LOWER NON CHORDATE

UNIT- I

- Taxonomy
  - General principal
  - Need of classification
  - Basis of classification
  - System of classification
  - Binomial and trinomial nomenclature
  - Significance of classification
- Five kingdom concept
- Concept of Protozoa & Metazoa
- Basis of classification- Level of body organization, Coelom, Symmetry, Segmentation
- Embryogeny
  - Diploblastic & Triploblastic
  - Protostomia & Deuterostomia

UNIT-II

- Salient features and classification upto orders with suitable examples and economic importance of each Phyla
  - **i.** Protozoa
  - **ii.** Porifera
  - **iii.** Coelenterata
  - **iv.** Ctenophora
  - **v.** Platyhelminthes
  - **vi.** Aschelminthes
  - **vii.** Annelida
  - **viii.** Arthropoda (emphasis on Lobster and Palaemon)
  - **ix.** Mollusca (emphasis on cuttle fish and squid)
  - **x.** Echinodermata

UNIT-III

PARAMECIUM

1. Locomotion- Cilliary beat,Mode of swimming
2. Nutrition- Food and feeding, Digestion, Egestion
3. Reproduction- Transverse Binary Fission, Conjugation, Autogamy , Cytogamy, Endomixis, Cytoplasmic particles

PLASMODIUM

- Life cycle- asexual and sexual
- Symptoms and pathogenesis
- Malaria – control measures

SYCON

- **Cellular Organization-** Different types of cells
- **Canal System -**
  a) Elements of canal System b) Significance

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- **Reproduction-**
  - Asexual
  - Sexual
    - Spermatogenesis
    - Oogenesis
    - Fertilization
- **Development –**
  - Early Embryonic Period –Cleavage , Stomoblastula
  - Larval Period- Amphiblastula , Gastrula
  - Metamorphosis

UNIT-IV

- ***Obelia***
  - **Sense Organs -** Statocyst
  - **Reproductive System & Life Cycle**
    - Sexual Reproduction
    - Development- Cleavage
    - Alternation of Generation
    - Fertilization
    - Planula larva
  - **Polymorphism -** Definition & Origin
    - Two Basic Forms-
      - Polyp
      - Medusa
    - Pattern-
      - Dimorphic
      - Trimorphic
      - Polymorphic
    - Significance
- **CORAL-** Structure of Coral Polyp
- **CORAL REEF-**
  - Kinds-
    a) Fringing b) Barrier c) Atoll
  - Economic Importance

UNIT 5

TAENIA

- **Reproductive System** -Male Reproductive System, Female Reproductive System
- **Development & Life Cycle-**
  - Copulation & Fertilization
  - Capsule Formation
  - Formation of Onchosphere
  - Hexacanth
  - Cycticercus
  - Infection of Primary Host Man

HIRUDINARIA

- **Digestive System-**Alimentary Canal **,** Food and feeding**,** Digestion
- **Haemocoelomic System-**Haemocoelomic Channels, Course of Haemocoelomic Fluid Circulation
- **Reproductive System-**Male Reproductive System, Female Reproductive System
- **Life History & Development**
  - Copulation
  - Cocoon Formation and development
  - Fertilization

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BSZO112 - CYTOLOGY AND GENETICS I

UNIT-I

- Cell and cell Theory
- Prokaryotic & eukaryotic cells
- Bacteria

i. Structure
ii. Types on the basis of flagella and shape
iii. Gram positive and Gram negative bacteria
iv. Thermophilic bacteria
v. Reproduction in Bacteria
vi. Asexual (Binary Fission, Budding, Conidia, Endospore, Antrospore)
vii. Sexual reproduction (Transformation, Transduction,conjugation),

- General Structure and characteristics of Virus (TMV, Phage)
- Elementary study of Microscopy
  - **i.** Resolution and resolving power
  - **ii.** Principle and application of the light microscope
  - **iii.** Phase contrast microscope and interference microscope
  - **iv.** Fluorescence microscope
  - **v.** Electron microscope (Scanning electron microscope and transmission electron microscope)

UNIT-II

- Cell membrane
  - **i.** Characteristic of cell membrane
  - **ii.** Fluid mosaic model
  - **iii.** Concept of unit membrane
  - **iv.** Membrane molecules (lipids, carbohydrates and proteins)
- Transport across cell membrane
  - **i.** Passive
  - **ii.** Facilitated
  - **iii.** Active transport (Na^+ and K^+ pump)
  - **iv.** Symport and Antiport transporter
  - **v.** Pinocytosis
  - **vi.** Phagocytosis
  - **vii.** Exocytosis
  - **viii.** Endocytosis
    - o Carrier mediated Endocytosis

UNIT-III

Cell Organelles- Structure, Composition and Functions of

i. Endoplasmic reticulum (RER and SER)
ii. Golgi complex
iii. Lysosomes
iv. Ribosomes
v. Centrioles
vi. Mitochondria

UNIT-IV

- Interphase
- Nucleus
- Cell cycle
- Mitosis-
  - Phase and steps in division
  - Spindle fibers and their functions
- Meiosis-
  - Phases and steps
  - Synaptic membrane complex
  - Chaismata and crossing over

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UNIT-V

- Brief History of Genetics
- Mendelism-Selection of pea plant, Mendelian laws and their significance
- Recombination
- Linkage
- ABO blood group and its genotype

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BSZO121: ZOOLOGY LAB I

A. Dissections - Earthworm – Nervous System, Nerve Ring, Spermatheca & Nephridia.
B. Microscopic Preparation - Sponge Spicules, Gemmules, *Obelia* Colony, *Neries* Parapodium.
C. Identification And Systematic Position upto order of Following Museum Specimens-
   Protozoa- *Paramecium, Trypanosoma, Noctiluca, Opalina, Balantidium, Nyctotherus, Entamoeba.*
   Porifera- *Sycon, Hyalonema, Euplectella, Euspongia, Spongila*
   Coelentrata- *Physalia, Porpita, Rhizostoma, Alcyonium, Corallium, Gorgonia, Pennatula*.
   Paltyhelminthes- *Fasciola, Taenia, Dugesia, Schistosoma*
   Aschelmenthes- *Ascaris, Trichinella, Dracunculus, Wucheria*
D. Study Of Prepared Slides- T.S *Sycon,* L.S *Sycon, Ephyra* Lrava, Mature & Gravid Proglottid of *Taenia,* Hexacanth , cysticercus larva (bladder worm) T.S of *Taenia* .

E. Experimental Zoology –
   1. Test for Carbohydrate, Protein And Lipid
   2. Harvesting of cell by scraping and trypsinization
   3. Cell viability studies
   4. Cell counting
   5. Collection of serum
   6. Determination of quality of milk – MBRT test and phosphatase test

Distribution of Marks	**Marks Allotted**	**Time duration**
1. Dissection	22	(**3hrs)**
2. Microscopic Preparation	12	
3. Spots (5 x 4)	20	
4. Experimental Zoology	16	
5. Year Work/ Practical Record (CIA*)	10	
6. Practical Class Test (2 x 5 Marks each) (CIA)	10	
7. Viva Voice	10	
Total	**100**	

Suggested Readings

1. Theory and Practices of Animal Taxonomy- VC Kapoor – Oxford and IBH Publication.
2. Principles Of Animal Taxonomy – G.G Simpson- Oxford and IBH Publication.
3. The Invertebrates – Mcneill Alexender – Cambridge University Press.
4. A textbook of Modern Zoology: Invertebrates- R.L. Kotpal – Rastogi Publication .
5. A Text Book of Zoology – Invertebrates –Vishwanath – S Chand and Co, New Delhi.
6. Invertebrate Zoology- E.L Jordan , P.S.Verma – S.Chand and Co, New Delhi.
7. The Inveretebrate Structure And Function – EJW Barrington- Thomas Nelson and Sons.
8. Text Book Of Zoology By T. J Parker And W.A Haswell- Vol I – Mcmillan and Co, London.
9. Invertebrates- Protozoa To Echinodermata Ashok Sharma – Narosa Publishing House.
10. The Invertebrates- Vol I- VI –L.H Hyman – Mcgraw Hill Co.
11. Genetics – P.K Gupta, Rastogi Publication.
12. Molecular Cell Biology – Lodish, K. *Et. Al.* - Freeman Publication.
13. Cytology Genetics And Evolution - P.K.Gupta –Rastogi Publication.
14. A Text Book Of Practical Zoology – Invertebrates – By S.S.Lal – Rastogi Publication, Merrut.
15. A Manual Of Practical Zoology – PS Verma, Tyagi, Agarwal- S Chand Publication.

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ZOOLOGY IIND SEMESTER

CODE	DESCRIPTION	PD/W	EXAM	CIA	ESE	TOTAL
BSZO 211	Evolution and Biology of Higher Non Chordate	3	3hrs	20	80	100
BSZO212	Molecular Biology and Genetics II	3	3hrs	20	80	100
BSZO221	Zoology lab II	6	3hrs	20	80	100
Total				60	240	300

BSZO 211: EVOLUTION AND BIOLOGY OF HIGHER NON CHORDATE

UNIT I

- Origin of Life
- Natural Selection,
- Genetic Basis of Evolution,
- Evidences of Organic Evolution

UNIT II

- Variation,
- Isolation and Adaptation.
- Geological Time Scale and Distribution of Animals in Different Era

UNIT III

- Origin and Evolution Of Man ,Origin and Evolution Of Horse, Extinct Animals Dinosaurs, *Archaeopteryx*

UNIT IV

Palaemon- Appendages, Digestive System, Respiratory System, Blood Vascular System, Sense Organs , Reproductive System & Reproduction, Economic importance of *Palaemon.*

UNIT V

Pila- Digestive System, Respiratory System, Blood Vascular System, Reproductive System and Reproduction.

Asterias- Water Vascular System, Reproductive System, Life History and Developmental Stages, Regeneration

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BSZO212: MOLECULAR BIOLOGY AND GENETICS II

UNIT I:

Nuclear Organization:

- Structure and function of Nuclear Envelope,
- Nuclear matrix and Nucleolus
- Chromosome Morphology, Chromonema, Chromomeres Telomere, chromatids,
- Primary and Secondary constriction
- Chromosomes Types: Polytene and Lampbrush chromosomes

UNIT II:

DNA

- Structure,
- DNA Replication: Semi conservative mechanism of replication
- Enzymes involves in Replication:- Elementary Idea about Topoisomerase, Polymerase, Single Stabilizing Binding Protein (SSBP), RNA primase.
- Okazaki fragments, Replication Forks-Leading and Lagging Strands.

UNIT III:

RNA Structure Types, Transcription of RNA, Genetic Code & Translation

UNIT IV:

Chromosomal Aberration:-

- Structural- Translocation, Inversion, Deletion, Duplication,
- Numerical- Aneuploidy,.- Hypo – monosomy, nullisomy, double monosomy. Hyper- trisomy, double tetrasomy and polysomy
- Numerical- Euploidy- monoploidy and polyploidy.
- Gene mutation

UNIT V:

Gene Interactions: - Supplementary, Complimentary, Epitasis Gene Expression , Lethal Genes., Pliotrophic Genes and Multiple Gene.

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BSZO221: ZOOLOGY LAB II

A. Dissections - *Palaemon* – General Anatomy, Study Of Appendages, Digestive System, Nervous System.
   Cuttle fish – General Anatomy and nervous system
B. Microscopic Preparation- *Palaemon*- Hastate Plate, Statocyst, pollen basket of honey bee, mosquito moth parts, *Cyclops, Daphnia*
C. Identification And Systematic Position up to order Of following Museum Specimens-
   Annelida- *Neries And Hetroneries, Aphrodite, Pheretima, Hirudinaria*.
   Onchyophora-*Peripatus*
   Arthropoda- *Limulus, Aranea, Palaemon, Apus, Lepas, Balanus, Sacculina, Schistocerca*, Pediculus, *Lobster, Eupagarus, Crab,Lepisma, Papillo, Bombyx, Apis, Julus, Scolopendera.*
   Mollusca- *Chiton, Mytilus, Ostrea, Teredo, Nautilus, Octopus, Pila*
   Echinodermata- *Pentaceros, Ophiothrix, Echinus, Holothuria, Antedon*.
D. Study of Prepared Slides- Annelida- T.S *Nereis* and *Hirudinaria* From Various Regions, Trocophore Larva, Parapodia of *Nereis* and *Heteronereis*.
   Arthropoda Larval Forms- Nauplius, Zoea, Megalopa, Mysis. Mollusca - Glochidium Larva, Echinodermata- Pedicillariae
E. Experimental zoology
   1. Radial immunodiffussion
   2. Ouchterlony double diffusion
   3. Determination of bacteria by SPC method
   4. Bacterial examination of water – multiple tube fermentation test or multiple tube test
   5. Presumptive, confirmed and complete coliform test
   6. Immunological detection of blood groups

Distribution of Marks	**Marks Allotted**	**Time duration 3hrs**
1. Dissection	22	
2. Microscopic Preparation –	12	
3. Spots – (5 x 4)	20	
4. Experimental zoology	16	
5. Year Work/ Practical Record – (CIA)	10	
6. Practical Class Test - (2 x 5 Marks) (CIA)	10	
7. Viva Voice -	10	
Total	**100**	

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SUGGESTED READINGS

1. The Invertebrates – Mcneill Alexender – Cambridge University Press.
2. Invertebrates- R.L. Kotpal – Rastogi Publication.
3. A Text Book Of Zoology – Invertebrates –Vishwanath – S Chand And Co.
4. Invertebrate Zoology- E.L Jordan , P.S.Verma – S.Chand And Co, New Delhi.
5. The Inveretebrate Structure And Function – Ejw Barrington- Thomas Nelson And Sons.
6. Text Book Of Zoology By T.Jparker And W.A Haswell- Vol I – Mcmillan And Co, London.
7. Invertebrates- Protozoa To Echinodermata Ashok Sharma – Narosa Publishing House.
8. The Invertebrates- Vol I- VI –L.H Hyman – Mcgraw Hill Co.
9. A Text Book Of Practical Zoology – Invertebrates – By S.S.Lal – Rastogi Publication, Meerut.
10. A Manual Of Practical Zoology – PS Verma, Tyagi, Agarwal- S Chand Publication.
11. Genetics – P.K Gupta , Rastogi Publication.
12. Molecular Biology And Genetic Engineering (Paperback) - P.K Gupta , Rastogi Publication.
13. Genetics And Molecular Biology (Special Indian Edition) (Paperback)- By Hyde D R-Publisher**:** Tata Mcgraw Hill Education Private Limited (2010).
14. Molecular Cell Biology – Lodish, K et.al - Freeman Publication.
15. Cytology Genetics And Evolution (Paperback)- P.K.Gupta –Rastogi Publication.

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ZOOLOGY IIIRD Semester

CODE	DESCRIPTION	PD/W	EXAM	CIA	ESE	TOTAL
BSZO 311	Biology of chordates	3	3hrs	20	80	100
BSZO312	Immunology & Microbiology	3	3hrs	20	80	100
BSZO321	Zoology lab III	6	3hrs	20	80	100
Total				60	240	300

BSZO311: BIOLOGY OF CHORDATES

UNIT I:

Classification and characters of phylum chordate-excluding extinct forms (up to orders), affinities of Hemichordates, Urochordates, cephalochordates.

UNIT II:

Amphioxus-Digestive system, Circulatory system, Nervous system and reproductive system, larval forms. Petromyzon- Buccal funnel, Digestive system, Respiratory system, circulatory, nervous and sense organs, reproductive and larval forms.

UNIT III:

Pisces- Types of fins, origin of fins, scales of fishes, accessory respiratory organs, parental care in fishes and migration. Amphibia- Neoteny and paedogenesis, parental care in amphibians.

UNIT IV:

Reptiles-Identification of poisonous and non poisonous snakes. Dinosaurs and cause of its extinction. Snakes of desert. Aves- Flight adaptation, types of feet, migration in birds

UNIT V:

Mammals- Egg laying mammals, marsupials, insectivorous, gnawing, toothless mammals ,and aquatic adaptation in mammals.

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BSZO312: IMMUNOLOGY & MICROBIOLOGY

UNIT I:

Innate and acquired immunity, humoral and cell mediated immunity, cell and molecules of immune system, MHC (Major histocompatibility complex) -basic concepts.

UNIT II:

Antigen – antigenicity of molecules. Antibody-structure & function of each classes of immunoglobin. Antigen and antibody reactions

UNIT III:

Historical aspect of microbiology, Patterns of arrangement & structural organization of gram positive & gram negative bacteria

UNIT IV:

Bacteria -genetic material of bacteria, reproduction in bacteria, medical importance of gram negative and gram positive bacteria, role of microbes in pest control, waste water treatment (Preliminary idea)

UNIT V:

Industrial microbiology – fermented food production – Dairy products, Alcoholic beverages and Vinegar. Methods of food preservation and microbial spoilage.

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BSZO221: ZOOLOGY LAB III

A. Dissections -
Scoliodon – General Anatomy, Brain , Afferent and efferent blood vessels, cranial nerves V,VII,IX,X and internal Ear.

B. Microscopic Preparation- placoid scales, identification of gram positive and gram negative bacteria

C. Identification and Systematic Position up to order of following Museum Specimens-
Hemichordata- *Balanoglossus*
Urochordata- *Salpa, Doliolum,* and *Herdmania*
Cephalochordata- *Amphioxus*
Cyclostomata- *Petromyzon* and *Myxine*
Pisces- *Protopterus, Labeo, Hetropneustes, Wallago, Clarias, Anabas, Exocoetus, Echeneis.*
Amphibia- *Necturus, Amphiuma, Ambystoma,* Axolotol larva
Reptiles- *Naja, Bungarus, Echeis, Hydrophis, Eryx, Ptyas, Ophiosaurus*
Aves- *Pavo, Choriotis, Francolinus*
Mammals- *Meriones, Funambulus,Rattus, Suncus, Hemiechinus*

D. Study of Prepared Slides- Hemichordata- *Balanoglossus*- section through proboscis and branchiogenital region
Cephalochordata- *Amphioxus*- T.S oral hood, pharynx, intestine, gonads, and caudal region
Rana- T.S through various organs-stomach, intestine, lung, liver, kidney, spleen,
Reptiles- V.S. skin
Aves- different types of feather
Mammals – T.S through various organs - stomach, intestine, lung, liver, kidney, spleen,

E. Experimental Zoology
1. Immunoelectrophoresis
2. ELISA
3. Cell culture – Lymphocyte/ hepatocytes

Distribution of Marks	Marks Allotted
1. Dissection – Major	22
Minor	
2. Microscopic Preparation –	12
3. Spots – (5 x 4)	20
4. Experimental zoology	16
5. Year Work/ Practical Record – (CIA)	10
6. Practical Class Test - (2 x 5 Marks) (CIA)	10
7. Viva Voice -	10
Total	**100**

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SUGGESTED READINGS

1. Text book of Zoology Vol-1I Vertebrates – Parker & Haswell (Edited by Marshall &Williams) (ELBS & Macmillion)
2. Vertebrate life- Pough and McFerland
3. Life of Vertebrates . J. Z. Yong
4. The Vertebrate body- Romer & Parsons
5. Biology of Vertebrates- Walter & Sayles
6. Chordate Zoology and Animal Physiology – by E.L.Jordan, and P.S.Verma, S. Chand Publication
7. Chordate Zoology – R.L. Kotpal , Rastogi Publication, Meerut
8. Microbiology – An Introduction – Gerard Tortora- Pearson Education
9. A Text Book Of Microbiology – R. Ananthnaryan , C.K Jayaram Paniker
10. Text Book Of Microbiology – Naveen Kango- Ik Publishing House
11. Text Book Of Microbiology And Immunology – S.C Parija- Elsevier India
12. Food Microbiology – SK Sinha, Ashok Kumar Sharma-Hb- Oxford Book Co
13. Microbial Taxonomy And Culture Techniques- R P Singh- Kalyani Publisher
14. Introduction to immunology – Kuby.

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ZOOLOGY IVTH SEMESTER

CODE	DESCRIPTION	PD/W	EXAM	CIA	ESE	TOTAL
BSZO 411	Comparative anatomy of chordates	3	3hrs	20	80	100
BSZO412	Animal Embryology	3	3hrs	20	80	100
BSZO421	Zoology lab IV	6	3hrs	20	80	100
Total				60	240	300

BSZO411: COMPARATIVE ANATOMY OF CHORDATES

UNIT I:-

Integument including structure & development of placoid scales, Feathers, & Hairs. Jaw suspensorium.

UNIT II:

Comparative anatomy of Alimentary Canal, Respiratory System- Pisces, Amphibia, Reptiles, Aves & Mammals.

UNIT III:

Heart and aortic arches, Urino genital system - Pisces, Amphibia, Reptiles, Aves & Mammals.

UNIT IV:

Comparative anatomy of Brain & Sense organs - Pisces, Amphibia, Reptiles, Aves & Mammals.

UNIT V:

Comparative anatomy of Endocrine systems - Pisces, Amphibia, Reptiles, Aves & Mammals. General accounts of hormones & mechanism of hormone action.

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BSZO412: ANIMAL EMBRYOLOGY

UNIT I:

Gametogenesis, vitellogenesis, types of eggs & sperms, parthenogenesis, physiology of fertilization.

UNIT II:

Cleavages- Plains & Patterns of cleavage & significance, fate map. Blastulation, Gastrulation & its Significance.

UNIT III:

Development of *Branchiostoma* up to gastrulation, Chick egg & its development up to formation of primitive streak. Extra embryonic membranes of chick.

UNIT IV:

Development of Placenta in Rabbit, types & function of Placenta in Mammals, Various types of stem cells & their application.

UNIT V:

Cloning of Animals: Nuclear Embryonic Transfer technique, Nuclear transfer technique, Twins & test tube babies, Identical Siemens & Fraternal Twins, Artificial inseminations. Teratogenesis.

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BSZ0421 ZOOLOGY LAB IV

A. Dissections -
Labeo – General Anatomy, Afferent and efferent blood vessels , Brain , cranial nerves V,VII, IX, and X, Weberian ossicles

B. Microscopic Preparation- cycloid scales, ampulla of Lorenzi

C. Osteology – Articulated and disarticulated bones of – *Rana, Varanus, Gallus,* and *Oryctolagus*

D. Identification and Systematic Position up to order of following Museum Specimens-
Pisces- *Scoliodon, Zygaena, Pristis, Torpedo, Trygon, Belone*
Amphibia- *Hyla, Uraeotyphlus*
Reptiles- *Trionyx, Chelone, Varanus, Uromastix, Crocodilus, Gavialis*.
Aves- *Columba, Streptopelia*
Mammals – *Pteropus, Presbytis, Maccaca*

E. Study of Prepared Slides- Scoliodon – T.S gills, scroll valve
Rana- T.S and L.S of developmental stages, T.S through various organs.
Aves – V.S of skin
Chick embryology – whole mount of developmental stages of chick of 18,24,36, 48,and 72 hours
Mammals – T.S through various organs- thyroid, testes, ovary adrenal gland, pancreas

F. Experimental Zoology
1. Estimation of Lactate dehydrogenase
2. Estimation of alkaline phosphate

Distribution of Marks	Marks Allotted
1. Dissection – Major	22
Minor	
2. Microscopic Preparation –	12
3. Spots – (5 x 4)	20
4. Experimental zoology	16
5. Year Work/ Practical Record – (CIA)	10
6. Practical Class Test - (2 x 5 Marks) (CIA)	10
7. Viva Voice -	10
Total	**100**

1. Text book of Zoology Vol-1I Vertebrates – Parker & Haswell (Edited by Marshall &Williams) (ELBS & Macmillion)
2. Vertebrate life- Pough and McFerland
3. Life of Vertebrates. J. Z. Yong
4. The Vertebrate body- Romer & Parsons

5. Biology of Vertebrates- Walter & Sayles
6. Analysis of Vertebrate Structure- Hildebrand
7. Comparative Anatomy of Vertebrates- G.C. Kent & R. Carr
8. Chordate Zoology and Animal Physiology – by E.L.Jordan, and P.S.Verma, S. Chand Publication
9. Chordate Zoology – R.L. Kotpal , Rastogi Publication, Meerut
10. Developmental Biology – Scott Gilbert – PB- Palgrave Publication
11. Foundations Of Embryology – Bradley M Patten And Carlson
12. Introduction To Embryology – B.I Balinsky- Thomson Nelson Publication
13. Embryology – Rajendra Kausik – Oxford Book Co
14. Text Book Of Embryology - D.R. Khanna- Discovery Publishing House