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Allahabad State University, Allahabad
Syllabus of Zoology
(B.Sc. I Year 2017 on words)

Following Major title of Papers of B.Sc. I year were finalized with their contents.

Theory paper's duration is of three hours and duration of practicals is four hours.

B.Sc.I

| <u>Papers</u> | <u>Title of Paper</u> | <u>Max.Marks</u> |
|----------------------|---|-------------------------|
| Paper I | Lower Non-Chordata-I (Protozoa-Helminthes) | 50 |
| Paper II | Higher Non-Chordata-II (Annelida-Echinodermata) | 50 |
| Paper III | Cell Biology and Genetics | 50 |
| Practical | Practical Syllabus based on theory papers | <u>50</u> |
| | | <u>200</u> |

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B.Sc. Part I (THEORY) Zoology 2017 onwards

B.Sc. Part-I

Paper-I : Lower Non-Chordata-I (Protozoa to Helminthes)

General characters, habits, habitat morphology, reproduction development, life cycle, salient features and classification up to order with example of the following groups of animals including a detailed study of the types given in each, origin of metazoa.

Unit-I

Protozoa: Euglena, Monocystis, Paramecium (Locomotion, Nutrition and reproduction).

Unit-II

Porifera: Sycon and Leucosolenia (structure, skeleton, canal system and reproduction).

Unit-III

Coelenterata: Obelia and Aurella (structure and reproduction), Polymorphism In Coelenterates, coral reefs, Lagoons.

Cnidaria and Ctenophora: Salient features, Affinities with coelenterata.

Unit-IV

Platyhelminthes: *Fasciola hepatica* (liver Fluke) and *Taenia solium*, *T. saginetta* (tapeworm) (structure, reproduction, life cycle and parasitic adaptation).

Nematehelminthes: *Ascaris*, *Ancylostoma* (hook worm), *Echinococcus*, *Schistosoma* (structure, reproduction and life cycle).

Paper-II : Higher Non-Chordata (Annelida to Echinodermata)

Unit-I

Annelida: Nereis and Hirudinaria (Leech) (structural features and reproduction)

- Trochophore Larva and its evolutionary significance
- Segmentation
- Coelom

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Unit-II

Arthropoda: *Palaemon* (Prawn) (structural features and reproduction)

- Apis, Honey bee: life cycle
- Metamorphosis In insects

Unit-III

Mollusca: *Unio*: (Fresh water mussel) (structural features and reproduction)

- Pila: (apple snail), Salient features (structural features and reproduction)
- Torsion and Detorsion in gastropods

Unit-IV

Echinodermata: *Asterias*: (structural features, water vascular/hydrostatic system/Ambulacral system).

Larval forms of Echinodermata and their significance.

Paper-III : Cell Biology and Genetics

Unit-I

Cell Biology-I:

- Structure and function of cell
- Different cytoplasmic inclusions
- Ultrastructure and function of cell membrane
- Nucleus
- Cell theory
- Cell cycle
- Cell division : mitosis and meiosis
- Elementary knowledge of cell transformation and cancer.

Unit-II

Cell Biology-II:

- Structure and function of cell organelles: (a) Mitochondria (b) Golgibodies (c) ribosome (d) Lysosome (e) endoplasmic reticulum (f) Cytoskeleton.
- Polytene and Lampbrush Chromosome.

Unit-III

Basic Genetics-I :

(I) Elements of Heredity and Variation

- (a) Mendel's Laws of inheritance
- (b) Chromosomal basis of inheritance
- (c) Application of Laws of Probability to Mendalian inheritance

(II) Extenslon of Mendelism

- (a) Dominance relationship
- (b) Multiple allelism
- (c) Lethal allelism
- (d) Pleiotrophy
- (e) Epistasis
- (f) Polygenic inheritance
- (g) Organelles of inheritance

(structure of chromosome, Watson and Crick Model of DNA, Differences between DNA, RNA

- Sex chromosomes
- Linkage

Unit-IV

- (i) Sex determination and differentiation in Drosophila
- (ii) Sex determination in human
- (iii) Sex linkage and genetic disorders
- (iv) Chromosomal aneuploidy : Dawn, Turner and Klinfilter syndrome
- (v) Chromosome translocation : Leukemia, Cry and Cat syndrome
 - Eugenics
 - Euphenics
 - Euthenics.
- (vi) Gene mutation : Sickel cell anaemia.

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**Syllabus of Zoology Practical for Allahabad State University
B.Sc. I Year (Practical) 2017 onwards**

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|----|---|-----------------|
| 1. | Dissection (Major) : (1) Different body parts of Cockroach (2) Nervous System of <u>Unio</u> , <u>Pila</u> and <u>Palaemon</u> (Prawn) | 12 Marks |
| 2. | Dissection (Minor) : Appendages of <u>Palaemon</u> Salivary gland of Cockroach, Alimentary Canal of Cockroach, Mouth parts of Cockroach, Sting apparatus of <u>Apis</u> (Honey bee) | 05 Marks |
| 3. | One Temporary Mount | 03 Marks |
| 4. | One Permanent Mount | 05 Marks |
| 5. | Cytology & Genetics Preparation/Prepared Slides | 05 Marks |
| 6. | Identify and Comment Upon Spots (1-10) | 10 Marks |
| 7. | Viva-Voce | 05 Marks |
| 8. | Class Record | 05 Marks |
| | Total | 50 Marks |

B.Sc. Part I**ZOOLOGY PRACTICAL SYLLABUS****PROTOZOA**

- (a) **Amoeba**: Examination of culture and observation of their locomotion, Prepared Slide : Amoeba.
- (b) **Euglena**: Culture examination for Euglena and observation of their locomotion, Prepared slides.
- (c) **Monocystis** : Examination of contents of seminal vesicles of *Pheretima* for different life- history stages and permanent preparation. Prepared slides.
- (d) **Plasmodium** : Preparation of blood film (Leishman's stain). Prepared slides showing the parasites.
- (e) **Paramecium** : Culture examination and observation of their Locomotion.
- (f) Demonstration of ciliary movements In *Paramecium*
- (g) Addition to mucilage to restrain active movement. Treatment with Methyl green for staining.
- (h) Feeding experiment with Congo Red and Yeast.
- (i) Trichocysts (discharged).
- (j) Prepared slides for structure, binary division and conjugation.
- (k) Examination of pond water for different kinds of protozoa.
- (l) Study of prepared slides:
Polystomella, Gregarina, Trypanosoma and Noctiluca.
- (m) Examination of rectal protozoans Opalina, Balantidium and Nyctotherus.

PORIFERA

- (a) **Sycon**
General characters
Spicules (glycerine preparation).
Transverse and longitudinal sections-prepared slides.
- (b) Permanent preparation of Gemmule.
- (c) Different kinds of sponge spicules and spongin fibres of *Euspongia*-prepared slides.

- (d) *Euplectella* (Venus's flower-basket) *Spongilla* (fresh-water sponge), *Euspongia* (bath sponge), *Hylonema*, *Cliona*.
- (e) Canal systems : Asconoid, Syconoid, Leucoid, (from prepared slide and models).

COELENTERATA

(a) **Hydra**

Live specimens.

Prepared slides of entire specimens.

Longitudinal and transverse sections-prepared slides : T.S. of Hydra through ovary and Testis region.

- Scyphistoma and Ephyra

(b) **Obelia**

Clony-prepared slide and preparation of permanent slides of obelia.

Medusa-prepared slide.

(c) **Aurelia**

General morphology.

Tentaculocyst-prepared slide.

Prepared slides and models of life-history stages.

(d) ***Physalia*** (Portuguese Man of war), *Corallium* (red coral), *Porpita*, *Tubipora*

Fungia (Mushroom coral), *Madrepora* (staghorn coral), *Gorgonia*, *Millepora*

Pennatula (sea pen), *Sagartia* of *Metridium* (sea anemone), *Beroe*, *Hormiphora*

PLATHYHELMINTHES:

(a) ***Fasciola***

Specimens in situ and prepared slides.

Transverse sections and prepared slides.

Larval forms-prepared slides.

(b) ***Taenia*** : Prepared slides of scolex, mature and gravid proglottids, Transverse section of mature proglottid.

- (c) Slide/Specimens : *Planaria*, *Polystomum*, *Paramphistomum*, *Schistosoma*, *Echinococcus*, *Dipylidium* Cysticercus (Bladder worm) and Cysticercoid, Fasciola, Taenia, Miracidium, Sporocyst, redia, Cercaria, Metacercaria, Hexacanth Bladder worm, Cotugnia and Rollentia
- (d) Examination of type worms of pigeon or fowl in situ
- (e) Permanent preparation of mature and gravid proglottids of Cotugnia and Ralletina.

NEMATHELMINTHES

- (a) *Ascaris*
 External characters.
 Dissected specimens of male or female.
 Transverse section of male and female-prepared slides.
- (b) *Ascaris lumbricoides* (from man) specimens *Enterobius vermicularis* (from man). Ancylostoma duodenale (from man) prepared slides.

ANNELIDA

- (a) ***Nereis***
 External characters.
 Dissected specimens.
 Parapodium-permanent preparation.
 Transverse sections-prepared slides.
- (b) ***Pheretima***
 External characters.
 Dissection.
 Glycerine preparations of setae (in situ) and brain.
 Permanent preparations of ovary and septal nephridia.
 Prepared slides of transverse section through various regions.
- (c) Neries *Heteroneries*, *Arenicola*, *Aphrodite*, *Eutyphoeus*, *Dero*, *Branchellion*. *Hacnadipsa*. *Bonella* (female), Sabella, Acanthobdella
- (d) **Leech**

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External features

Dissections : Digestive system

Mounting of Jaws and Salivary glands

ARTHROPODA

(a) ***Palaemon***

External characters; Examination of appendages.

Glycerine preparation of hastate plate.

Permanent and glycerine preparations of statocysts.

Dissection : Nervous system, Brain, Ganglia and Hastat plate

(b) ***Periplaneta***

External characters. Differences between male and female.

Dissections.(Mouth parts, Salivary gland, Alimentary canal and Tracheal system)

Glycerine preparation of mouth appendages, salivary glands.

Permanent preparations of salivary glands, Malpighian tubules, ovaries, testes, Trachea and heart.

(c) ***Anopheles and Culex***

Glycerine preparation of mouth parts of male and female, Wings-prepared slides.

Life history-prepared slides.

Difference between Anopheles and Culex

(d) ***Musca***

External characters.

Glycerine preparation of proboscis

(e) *Daphnia*, *Cyclops*, *Balanus*, *Eupagurus* (hermit crab) *Scylla* (crab), *Sacculina* (on crab). Larval forms Nauplius, Zoea, *Lepisma* (Silver fish), *Schistocerca* (locust). *Odontotermes* (white ant), Cimex (bed bug), Pediculus (louse), *Papilio* (butterfly), *Bombyx* (Silk moth), *Apis* (honey-bee), *Pollistes* (wasp), *Camponotus* (Black ant). *Xenopsylla* (rat flea), or *Ctenocephalus* (dog flea), *Thyroglutus* (millipede), *Scolopendra* (centipede). *Lycosa* (wolf-spider), *Ixodes* (tick), *Limulus* (King carb), Bedbug, Human body lice, Head lice, Mites.

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MOLLUSCA

(a) ***Unio***

External characters

Dissection : Nervous System, Ganglia connectives and commissure

Permanent preparations of gill lamella

Transverse section through middle region of body-prepared slides

Glochidium (larva) prepared slides

(b) ***Plla***

External characters

Dissection : Nervous System, Ganglia connectives and commissure

Permanent preparations of gill lamella and osphradium.

(c) Chiton, Teredo, Turbinella (Shankh), Laevicaulis (slug), Doris, Cyprea Aplysia, Dentalium Nautilus, Sepia margaritifera (Pearl Oyster), Patella, Mytilus, Pecten, Teredo, Loligo and Octopus.

ECHINODERMATA

(a) ***Asterias***

External characters

Dissected specimens

Pedicellaria-prepared slides : Bipinnaria, Brachiolaria, Auricularia
Ophiopluteus and Echinopluteus

Transverse section of arm(prepared slide)

(b) ***Echinus*** (Sea urchin), ***Ophiothrix*** (brittle star), ***Holothuria*** (sea cucumber) and ***Antedon*** (feather star).

CYTOLOGY

(a) Cell-Structure - Prepared slides

(b) Cell Division - Mitosis and Meiosis

(c) Squash method preparation of onion root tip for the stages of mitosis

(d) Preparation of giant chromosomes

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Allahabad State University, Allahabad
Syllabus of Zoology
(B.Sc. II Year 2017 on words)

Following Major title of Papers of B.Sc. II year were finalized with their contents.

There will be three written papers and one practical examination.

Theory paper's duration is of three hours and duration of practicals is four hours.

B.Sc.II

| <u>Papers</u> | <u>Title of Paper</u> | <u>Max. Marks</u> |
|----------------------|--|--------------------------|
| Paper I | Chordata | 50 |
| Paper II | Animal distribution, Evolution and Developmental Biology | 50 |
| Paper III | Physiology and Biochemistry | 50 |
| Practical | Practical Syllabus based on theory papers | <u>50</u> |
| | | <u>200</u> |

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B.Sc. Part-II**Paper-I : Chordata**

Classification upto subclasses and detailed study (habit and habitat, morphology, anatomy, physiology and development) as following prescribed unit.

Unit-I : Protochordates (Lower-Chordates)

Hemichordata: Balanoglossus: Affinities with Lower and Higher chordates.

Cephalochordata: Branchiostoma (Amphioxus): Affinities with lower and higher chordates.

Urochordata: Herdmania: Affinities with lower and higher chordates.

Unit - II

Classification of different classes of vertebrates (Pisces, Amphibia, Reptilia Aves and Mammals) upto order with characters and example.

Unit -III

Comparative anatomy of vertebrates : Histology (types of tissues), comparative study of the systems-Integument, skeleton, digestive, respiratory, circulatory, nervous, receptor organs, urinogenital and reproductive systems.

Unit -IV

Migration in fishes and birds. Parental care in Amphibian. Biting Mechanism of Snakes, Dentition in Mammals.

Paper-II : Animal distribution, Evolution and Developmental Biology**Unit-I**

Animal Distribution and Palaeo Zoology: Geological and geographical distribution with their characteristic Fauna.

Fossils.

Unit-II

Origin of Life : Concept of species (classical and modern concept)

Evolution : Evidences (Including physiological and serological); Theories of Evolution (Including Neo Lamarkism, Darwin-Wallace theory of Natural selection. Neo-Darwinism, Modern Synthetic theory.

Unit-III

Developmental Biology-I: Aims and Scope of Developmental Biology, Gametogenesis, Fertilization, Egg : Structure and types of egg. Types and Patterns of Cleavage (e.g. Chick & Frog).

Unit-IV

Developmental Biology-II: Process of Blastulation and Gastrulation. Fate map. Development of chick upto formation of Primitive streak, Extra embryonic membranes of chick. Placentation and types of Placenta in mammals.

Paper-III : Physiology and Biochemistry

General physiology with special reference to mammals.

Unit-I

Physiology of digestion, respiration, blood and circulation.

Unit-II

Physiology of excretion and osmoregulation.

Nerve conduction and its transmission.

Unit-III

Physiology of different endocrine glands in mammals.

Hormone: Biosynthesis, actions and regulation.

Thermoregulation.

Unit-IV



General chemistry and classification of carbohydrates, lipids, proteins, Enzymes and Nucleic Acids.


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Syllabus of Zoology

B.Sc. II Year Zoology Practical 2017 onwards

| | | |
|--------------|--|-----------------|
| 1. | Dissection (Major) : Cranial nerves, Afferent, Efferent branchial arteries (<u>Mytus</u> Species, <u>Wallago attu</u>) | 10 Marks |
| 2. | Dissection (Minor) : Display of Endocrine glands of mammals, Accessory respiratory/ breathing organs, air sacs of pigeon. | 05 Marks |
| 3. | Permanent Mount : Pecten, ear ossicles, Columella of Pigeon, ear ossicles of mammals Placoid scales, cycloid scales. | 04 Marks |
| 4. | Study of Blood groups of human | 04 Marks |
| 5. | (i) Suitable preparation of Hemin crystals from the blood (ii) Detect the Human blood sugar from urine sample/blood | 04 Marks |
| 6. | Stained Preparation of (i) Striped and Unstriped muscles of mammalian/ Cockroach (ii) Cartilage (hand cut Section) (iii) Blood film/Alveolar tissue | 04 Marks |
| 7. | Identify and Comments upon spots (1-10) | 10 Marks |
| 8. | Viva-voce | 05 Marks |
| 9. | Class record | 04 Marks |
| Total | | 50 Marks |

B.Sc. Part II**ZOOLOGY PRACTICAL SYLLABUS-2017 onwards****Hemichordata : Balanoglossus species****Urochordata****(a) Herdmania**

- (i) External characters
- (ii) Dissection
- (iii) (a) Permanent preparation of branchial wall
(b) Section of test and glycerine preparation of spicules.
Glycerine and permanent preparation on neural gland complex (neural gland, nerve ganglion and dorsal tubercle).
- (iv) Larva and metamorphosis- prepared slides.
- (b) (i) Thaliacea : *Pyrosoma, Doliolum*
(ii) Larvacea: *Oikopleura*

Cephalochordata**Branchiostoma (*Amphioxus*)**

- (i) General features
- (ii) (a) Permanent preparation of the pharyngeal wall
(b) Oral hood and velum- prepared slides
(c) Transverse section through the body — prepared slides.
(d) Models illustrating development

Cyclostomata***Petromyzon* (Lamprey) - External characters****Chondrichthyes****(a) Fish**

- (i) External characters

- (ii) Exo-skeleton-Glycerine and permanent preparation of placoid scales
- (iii) Myotomes
- (iv) Endoskeleton

(1) Axial skeleton :

- (a) skull
- (b) Visceral Skeleton
- (c) Vertebral column

(2) Appendicular skeleton :

- (a) Pectoral girdle and fins
- (b) Pelvic girdle, fins and claspers
- (c) Median fins

(v) Dissection :

(a) Digestive system

(b) Vascular system

Heart, ventral aorta, dorsal aorta, arterial arches (afferent and efferent)

(c) Gills

(d) Urinogenital system

(e) Nervous system: Cranial nerves

(f) Internal ear

(g) Eye muscles

(h) Permanent preparation of ampullae of Lorenzini

(i) Section through various regions of the body of adult and embryo

- (b) *Pristis* (Saw fish), *Astrape* (Indian electric ray), *Chimaera* (rabbit fish) Slide showing development of placoid scales.

Osteichthyies

- (a) *Labeo rohita* (rohu)- General morphology and dissected specimen.
- (b) *Acipenser* (sturgeon), *Lepidosteus* (gar-pike), *Hippocampus* (sea house), *Antennarius* (Indian angler), *Anguilla* (eel), *Pleuronectes* (sole), *Exocoetus* (flying fish), *Clarias* (cat fish), *Heteropneustus fossils*, *Channa*, *Rita, rita*, *Bagarius*, *Xenentodon*, *Mastacembelus*, *Amphiponous cuchia*, *Ompaok*, *Cyprinus*, *Catla catla*, *Clupisoma*, *Setipinna phasa*, *Notopterus*.

Anabas (climbing perch) and *Neoceratodus* (lungfish).

- (c) Different kinds of scales- prepared slides

Amphibia

- (a) Development of any amphibian model
- (b) Urodela:
Necturus, *Ambystoma* and Axolotl larva
- (c) Anura:
Bufo, *Rhacophorus* (tree frog), *Alytes* (midwife toad), *Hyla*
- (d) Gymnophiona : *Ichthyophis*

Reptillia

- (a) ***Varanus***
 - (i) External characters
 - (ii) Skeleton
- (1) **Axial Skeleton**
 - (a) Skull
 - (b) Vertebral column
 - (c) Ribs and sternum
- (2) **Appendicular Skeleton**
 - (a) Pectoral girdle and fore-limb.
 - (b) Pelvic girdle and hind-limb.

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(b) **Lacertilia**

Varanus (Indian monitor), *Heloderma* (poisonous lizard)
Hemidactylus (wall lizard), *Chamaeleon* (garden lizard) *Draco*
 (flying lizard).

(c) **Ophidia**

Difference between poisonous and non-poisonous snakes,
Naja (cobra), *Vipera* (viper), *Typhlops* (burrowing snake),
Crotalus, *Bungarus*, *Dhamin*, *Rattlesnake*, *Krait*, *Water snake*,
Python. Biting mechanism of a poisonous snake (model).

(d) **Chelonia** : Dermal armature, Tortoise, Turtle, Kachuga.(e) **Crocodylia**: Difference between Alligator, Crocodile, Magar, Caven and Gavialis

(f) Extinct reptiles, Models (five)

Dimetrodon, Diplodocus, Pteranodon, Tyrannosaurus & Ichthyosaurus

Aves(A) ***Columba livia Intennedia*** (pigeon)

(i) External Characters: Structure of Feather. Varieties of feathers. Development of feather-prepared slide.

(ii) Skeleton of fowl Axial skeleton:

(a) Skull

(b) Vertebral column

(c) Ribs and sternum

(2) Appendicular skeleton.

(a) Pectoral girdle and fore-limb

(b) Pelvic girdle and hind-limb.

(B) (i) **Archaeornithes-Archaeopteryx** (Model)

(ii) Neornithes:

(a) Palaeognathae: **Struthio** (ostrich), Kiwi, Emu, Dodo
 (Model)

(b) Neognathae: **Gallus** (fowl), **Anser** duck, **Corvus**
 (crow), **Psittacula** (parrot) and **Pavo** (peacock).

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Perching mechanism: Model

Skulls and Beaks of Birds.

Feet of birds: Models

- (C) Embryonic membranes - whole mount of 72 and 96 hours chick embryo

Mammalia

- (A) (i) Prototheria: *Ornithorhynchus* (Duck-billed Platypus)
 (ii) Metatheria: *Macropus* (Kangaroo).
 (iii) Eutheria:
- (a) Edentata: *Dasypus* (Armadillo)
 - (b) Pholidota: *Manis* (Scaly ant-eater)
 - (c) Cetacea: *Platanista* (Ganges dolphin)
 - (d) Perissodactyla: *Equus caballus* (horse), *Equus vulgaris* (ass), *Equus zebra* (zebra), *Rhinoceros unicornis* (rhinoceros).
 - (e) Artiodactyla: *Camelus dromedaries* (A rabian camel), *Giraffa camelopardalis* (giraffe) Bos (ox), *Ovis* (sheep), *Capra* (goat), *Cervus* (deer), *Sus* (dog).
 - (f) Proboscidea: *Elephas indicus* (elephant).
 - (g) Carnivora: *Felis domesticus* (Cat), *Panthera leo* (lion), *Acinonyx tigris* (Cheetah), *Canis familiaris* (dog), *Ursus* (bear), *Hyaena* (hyanea), *Phoca* (seal).
 - (h) Rodentia: *Mus* (domestic rat), *Hystrix* (Porcupine)
 - (i) Lagomorpha: *Lepus* and *Oryctolagus* (hare and rabbit)
 - (j) Insectivora: *Erinaceus* (hedge-hog), *Crocidura* (chhachhundar)
 - (k) Chiroptera: *Pteropus* (Flying-fox).
 - (l) Primates: *Macaca* (rhesus monkey), *Hyobates* (gibbon). *Simia* (Orangutan), *Anthropopithecus* (chimpanzee), *Gorilla*. *Homo sapiens* (man).

Histology

- (l) Tissues: Preparation of the following
 - (a) Epithelia:
 - (i) Squamous (ii) Ciliated (iii) Stratified
 - (b) Muscular:
 - (i) Striped muscles (ii) Unstriped muscles.
 - (c) Connective
 - (i) Areolar tissue (ii) Tendon the leg muscles of frog(glycerine preparation)
 - (ii) Adipose tissue from insect and frog (iv) cartilage (free hand sections of frogs hyoid and suprascapula, train with haematoxylin and (v) Bone (Decalcified).
 - (d) Blood; Preparation of Vertebrate blood film, stain with Leishniann's stain.
 - (e) Nervous: Neurons
 - (f) Histology of various organs-prepared slides.

Physiology

- (i) Experiments to be performed by candidates: Test for amylase. Osmolarity of blood, Hemin crystals and test for sugar and uric acid In urine. Determination of haemoglobin % in blood sample (s).
- (ii) Detection of amino acids in blood of an animal by paper chromatography.

General:

Candidates will be required, to show knowledge of the method of microscopic techniques and to examine, describe or dissect the types prescribed. Candidates will also be required to submit their notebooks containing a complete record of laboratory work initiated and dated by the teacher for the determination of result of examination.

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Allahabad State University, Allahabad
Syllabus of Zoology
(B.Sc. III Year 2017 on words)

Following Major title of Papers of B.Sc. III year were finalized with their contents.

Theory paper's duration is of three hours.

Duration of practicals classes is four hours

There will be three written papers and one practical examination.

B.Sc.III

| <u>Papers</u> | <u>Title of Paper</u> | <u>Max. Marks</u> |
|----------------------|---|--------------------------|
| Paper I | Applied and Economic Zoology | 75 |
| Paper II | Biotechnology, Immunology, Biological tools, Techniques and Biostatistics | 75 |
| Paper III | Ecology, Microbiology, Animal Behaviour, Pollution and Toxicology | 75 |
| Practical | Practical syllabus based on theory papers | <u>75</u> |
| | | <u>300</u> |



B.Sc. Part III (THEORY) Zoology 2017 onwards

PAPER-I : Applied and Economic Zoology

Unit-I

Parasitology :

- (a) Structure, life cycle, Pathogenicity, including diseases, causes, symptoms and control of the following parasites of domestic animals and humans: *Trypanosoma*, *Giardia*, *Diphyllobothrium*, *Hymenolepis*, *Dracunculus*, *Wuchereria*, *Paragonimus*, *Fasciolopsis*.
- (b) Plant Parasitic Nematodes, nature of their damage and control measures including *Meloidogyne*.

Unit-II

Vectors and pests:

Vectors like mosquito, house fly, bed bug, louse and their control.

Pest-types, characteristic features, life cycle, nature of damage and control of termite, cockroach, cloth moth, grain moth, wax moth, gandhi bug, sugarcane leaf-hopper and rodents.

Unit-III

- | | | |
|----------------|-----------------|----------------|
| 1. Aquaculture | 2. Pisciculture | 3. Poultry |
| 4. Sericulture | 5. Apiculture | 6. Lac culture |
| 7. Dairy | 8. Piggery | 9. Computer |

Unit-IV

Wild life Conservation, Important sanctuaries and parks of India:

Modern concept (IUCN categories), endangered species. Important sanctuaries; national parks of India; Different projects launched for the preservation of animal species; In-situ and ex-situ conservation of wild life.

Biodiversity: Benefits, hotspots, threats and conservation.

Solid waste management.

PAPER-II : Biotechnology, Immunology, Biological Tools, Techniques and Biostatistics

Unit-I

Biotechnology: Genetic Engineering: Concept of recombinant DNA technology.

Application of genetic engineering in agriculture, medical areas and energy production.

Biotechnology of food-processing, pharmaceuticals (e.g. use of microbes in insulin production) and fermentation.

Unit-II

Immunology: Concepts of Immunity, types of immunity, components of immune system. Antigen and Antibodies. Vaccines of different diseases and Immunological reactions.

Unit-III

Biological Tools and Techniques: Principles and uses of instruments: pH Meter, Colorimeter, Microtome, Spectrophotometry and Centrifuge.

Microscopy : Light, transmission, scanning electron microscopy, Chromatography, Electrophoresis, Photomicrography.

Recombinant DNA techniques: Polymerase chain reaction, principal and applications.

Unit-IV

Biostatistics:

- Collection and classification of data.
- Sampling, Measures of central tendency: mean, median and mode.
- Dispersion: Varlance, Standard deviation and Standard error.
- Correlation
- Regression

Probabililty :

- Bionomial distribution
- Poisson distribution

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Graphical representation of Data :

- Pie Chart
- Bar diagram
- Histogram
- Frequency polygon
- Cumulative frequency Curve
- Box plot
- Parametric tests
- Non Parametric Test : Chi-square Test
- Mann-Whitney U-Test

PAPER-III : Ecology, Microbiology Animal Behaviour, Pollution and Toxicology

Unit-I

- **Ecology:** Ecosystem: Concept, components, fundamental operations, energy flow, food-chain, food webs, trophic levels, ecological niche, abiotic and biotic factors.

Population: Characteristics and regulation.

Ecological succession.

Adaptation: Aquatic, terrestrial, aerial and arboreal.

Unit-II

Microbiology: Morphology, physiology and infection of bacteria, viruses.

Bacterial and viral diseases.

Microbial biotechnology.

Unit-III

Animal Behavior: Introduction to Ethology Patterns of behavior : taxes, reflexes, instinct and motivation.

Biorhythms: Innate, learning, memory and communication.

Migration of fishes and birds : Orientation, Navigation.

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Adaptive coloration and Mimicry.

Control of behaviour : Neural and Hormonal control.

Unit-IV

Pollution and Toxicology: Concept, sources, types (air, water, soil, thermal, noise and radiation), and control of environmental pollution. Exposure of toxicants (routes of exposure, duration and frequency of exposure); dose - response relationship, categories of toxic effects. Environmental monitoring.

- Purposes of monitoring.
- Role of remote sensing in environment.
- Biological Indicators of pollution.

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Allahabad State University
Department of Zoology
B.Sc. III Year Zoology Practical

| | | |
|---|---|-----------|
| 1. | Life cycle of <u>Trypanosoma</u> , <u>Plasmodium</u> , <u>Fasciola hepatica</u> , <u>Wuchereria</u> , <u>Taenia</u> , Silk moth, Lac insect and <u>Ascaris</u> | 05 |
| OR | | |
| Dissection : Central Nervous System of Cochroach | | |
| Cranial nerves, Afferent, Efferent blood vessels of <u>Wallago attu</u> and <u>Mystus</u> | | |
| 2. | Slide study : Permanent slides based on theory | 05 |
| 3. | Plant parasitic nematodes prepared slide comments | 05 |
| 4. | Mouth parts of house fly, mosquitoes, Honeybee and Cockroach, permanent preparation | 05 |
| 5. | Life cycle of cloth moth/grain moth and wax moth | 05 |
| 6. | Visit to fishery, poultry, piggery, Pond, Ditches, pools lake reservoir, Computer, dairy farm, Lac culture, Sericulture | 15 |
| 7. | Write a report on any Indian national parks and conservatory | 15 |
| 8. | Term paper: Detailed report on tour/field works/ choice of topic by the students | 10 |
| 9. | Viva-voce | 05 |
| 10. | Practical record | 05 |
| | | 75 |

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B.Sc. Part III
ZOOLOGY PRACTICAL

Permanent slide Preparation of: *Euglena*, *Paramecium* and rectal protozoans. Stool examination of animals for different intestinal parasites.

Study of prepared slides/ specimens of *Entamoeba*, *Giardia*, *Leishmania*, *Trypanosoma*, *Plasmodium*, *Fasciola*, *Cotugnia*, *Taenia*, *Rallietina*, *Polystoma* *Paramphistomum*, *Schistosoma*, *Echinococcus*, *Dipylidium*, *Enterobius*, *Ascaris* and *Ancylostoma*.

Permanent Preparation of *Cimex* (bed bug)/ *Pediculus* (Louse), *Haematopinus* (cattle louse), fresh water annelids, arthropods; and soil arthropods.

Larval stages of helminthes and arthropods.

Permanent mount of wings, mouth parts and developmental stages of mosquito and house fly. Permanent preparation of ticks/ mites, abdominal gills of aquatic insects viz. *Chironomus* larva, Dragonfly and Mayfly nymphs, preparation of antenna of housefly.

Collection and identification of pests.

Life history of silkworm, honey bee and lac insect.

Different types of important edible fishes of India.

Prepared slides of plant nematodes.

Demonstration of counting of cells (blood and protozoan) by haemocytometer, haemoglobinometer, pH meter, Colorimeter.

Microbiological Techniques: Media Preparation and sterilization, inoculation and Examination. Staining of bacteria.

Study of an aquatic ecosystem, its biotic components and food chain.

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Preparation of chromosomes, Test for carbohydrate Photochemical demonstration of proteins and lipids, using hand sections. Endocrine glands (Neurosecretory cells) of cockroach.

Demonstration of developmental stages of chick.

Project Report/ model chart making.

Dissection:

Cockroach: Central Nervous System

Wallago: Afferent and efferent branchial vessels, Cranial nerves, Weberian ossicles.

Practical exercises based on Biostatistics, Microbiology, Immunology, Biotechnology, Animal Behavior, Pollution & Toxicology.

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Recommended books for Allahabad State University
Allahabad - Subject: Zoology

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Life and Diversity of Animals – Non Chordates

1. Barnes – **Invertebrate Zoology** (Holt-Saunders International) Philadelphia, USA
2. Barradalle L.A. & Potts F.A. – **The Invertebrate**
3. Nigam – **Biology of Nonchordates**
4. Kotpal, Agrawal & Khetrapal – **Modern Text Book of Zoology - Invertebrates**, Rastogi Publication, Meerut
5. Puranik P.G. & Thakur R.S. – **Invertebrate Zoology**
6. Majupuria T.C. – **Invertebrate Zoology**
7. Dhama & Dhama – **Invertebrate Zoology**
8. Parker & Hashwell, **Textbook of Zoology Vol. I (Invertebrates)** A.Z.T.B.S. Publishers & Distributors, New Delhi
9. Dr. S.S. Lal **Practical Zoology Invertebrates 9th edition**, Rastogi Publication Meerut
10. E.J.W. Barrington – **Invertebrate Structure and Function** ELBS III Edition
11. R.L. Kotpal – **Phylum Protozoa to Echinodermata (series)**, Rastogi and Publication, Meerut

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12. Parker J. and Haswell W. – **Text Book of Zoology**, ELBS Edition
13. Vidyarthi – **Text Book of Zoology**, Agrasia Publishers, Agra
14. Jordan E.L. and Verma P.S. – **Chordate Zoology**, S. Chand and Co., New Delhi
15. Ayer E. – **Manual of Zoology**
16. M.D. Bhatia – **The Indian Zoological Memories – Leech**
17. Beni Prasad – **The Indian Zoological Memories – Pila**
18. P. K. Gupta – **Vermicomposting for Sustainable Agriculture**, Agrobios India Ltd
19. A manual of Practical Zoology Invertebrates – P. S. Verma

Environmental Biology

1. Ashthana D.K. – **Environmental Problem & Solution**
2. Agrawal K.C. – **Environmental Biology**
3. Agrawal K.C. – **Biodiversity**
4. Mukharjee – **Environmental Biology**
5. S. Arora – **Fundamentals of Environmental Biology**
6. Sharma – **Ecology & Environmental Biology**
7. Verma P.S. & Agrawal V.K. – **Environmental Biology**, S. Chand.
8. Trivedi & Rao – **Air Pollution**
9. Chapman & Reiss – **Ecology-Principles and Applications**, Cambridge
10. Chatterjee B – **Environmental Laws-Implementation and Problems**
11. Sharma P.D. – **Environmental Biology**, Rastogi Publication, Meerut
12. Trivedi R.K. – **Hand Book of Environmental Laws, Rules, Guidelines, Compliances and Standards, Enviromedia**
13. Odum E.P. and Barret – **Fundamentals of Ecology**, Thomson

14. Verma, A.V. A Hand book of Zoology. Ist edition, Balaji publication Muzaffar Nagar.



14. Smith R.L. – **Ecology and Field Biology**, Harper Collins
15. D.N. Saxena – **Environmental Biology**, Studium Press (India)
16. Davis – **Behavioral Ecology**
17. Kumar and Asija – **Biodiversity – Principle of Conservation**
18. Rao and Rao – **Air Pollution**
19. S. Satyanarayan, S. B. Zade, S.R. Sitre and P.U. Meshram – **A Text Book of Environmental Studies**, Allied publisher (India)
20. Smitz – **Introduction to Water Pollution**
21. N.S. Subrahmanyam A V.S.S. Sambamurthy – **Ecology Cell Biology**
 1. C.B. Powar, **Cell Biology** – Himalaya Publication, New Delhi
 2. Dr. S.P. Singh, Dr. B.S. Tomar – **Cell Biology** 9th revised edition, Rastogi Publication, Meerut
 3. Gupta P.K. – **Cell and Molecular Biology**, Rastogi Publication, Meerut
 4. Veer BalaRastogi – **Introduction to Cell Biology**, Rastogi Publication, Meerut
 - 9
 5. Gerald Karp – **Cell and Molecular Biology-Concepts and Experiments**, John Wiley, 2007
 6. De-Robertis – **Cell Biology**
 7. Verma and Agrawal – **Concepts of Cell Biology**
 8. Dowben – **Cell Biology**
 9. Witt – **Biology of Cell**
 10. Ambrose and Eastyr – **Cell Biology**

**List of Recommended Books:(For Semester - III and IV)
Life and Diversity of Animals -Chordates**

1. T. B. of Zoology vol II – Parker & Haswell
2. T. B. of Vertebrate Zoology -S. N. Prasad
3. Chordate Zoology –E. L. Jordan and P. S. Verma
4. Vertebrate Zoology – Vishwanath
5. Zoology of Chordates – Nigam H. C.
6. Phylum:Chordata – Newman H.H.
7. Biology of Vertebrates –Walter & Sayles
8. The Vertebrate Body – Romer A. S.
9. Comparative Anatomy of the Vertebrates – Kingslay J. D.
10. The Biology of Amphibia – Noble G. K.
11. Snakes of India – Gharapura K. G.
12. Life of Mammals – Young J.Z.
13. Vertebrates – Kotpal R. L.
14. Introduction to Chordates – Majupuria T.C.
15. Vertebrate Zoology – Dhami&Dhami
16. T. B. Vertebrate Zoology – Agrawal
17. Protochordates – Chatterjee&Pandey
18. Protochordates – Bhatia

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19. T. B. of Chordates – Bhamrah and Juneja
20. Chordate Anatomy – Arora M.P.
21. The Chordates – Alexander.
22. T. B. of Animal Embryology – Puranik
23. T. B. of Chordate Embryology – Dalella & Verma
24. T. B. of Embryology – Sandhu
25. T. B. of Embryology – Armugam
26. Early Embryology of Chick – Pattern
27. Chordate Embryology – Verma & Agrawal
28. Chordate Embryology – Tomar
- 16
29. The Frog – Rugh
30. An Introduction to Embryology – Balinsky
31. Comparative Vertebrate Embryology – Mcwen
32. Developmental Biology – S. C. Goel
33. Introduction to Embryology – Berry
34. Organic Evolution – N. Armugam
35. Evolution – M. P. Arora
36. Animal Behavior – Smith and Hill
37. Animal Behavior – Arora
38. Animal Behavior – Gundevia and Singh
39. Practical Zoology Vertebrates – Dr. S. S. Lal, Rastogi Publication, Meerut
40. A manual of Practical Zoology Vertebrates – P. S. Verma

Genetics

1. Genetics & Genetic Engineering – Joshi
2. Genetic Engineering & its applications – Joshi
3. Genetics – Gardener
4. Genetics – Winchester
5. Genetics – Gupta
6. Principles of Genetics – Sinnot Dunn, Dobzansy
7. Genetics – Ahluwalla
8. Genetics – Sarin
9. Elementary Genetics – Singleton
10. General Genetics – SRB, Owen & Edger
11. Genetics – Alenberg
12. Foundation of Genetics – Pai
13. Genetics - Stickberger
14. T. B. of Genetics- Veerbala Rastogi
15. Gene VI by Benjamin Lewis, Oxford press
16. Gene VIII by Benjamin Lewis, Oxford press
17. Genetics Vol. I and II by Pawar C. B., Himalaya publication

Molecular Biology

1. Cell and Molecular Biology by De Robertis- E. D. P., I. S. E. publication
2. Molecular Biology by Turner P. C. and McLennan, Viva Books Pvt. Ltd

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3. **Advanced Molecular Biology** by Twyman R. M., Viva Books Pvt. Ltd
4. **Molecular Biology** by Freifelder D., narosa publication House
5. **Molecular Biology of Gene** by Watson J. D. et. al., Benjamin publication
6. **Molecular Cell Biology** by Darnell J. Scientific American Books USA
7. **Molecular Biology of the Cell** by Alberts B., Bray D. Lewis J., garland publishing Inc
- 17
8. **Essentials of Molecular Biology** by Freifelder D., narosa publication House
9. **Molecular Cell Biology** by Laodish H., Berk A., Zipursky S. L., Matsudaira P. Baltimore D. and Darnell J., W. H. Freeman and Co.
10. **The Cell: Molecular Approach** by Cooper G. M.
11. **Molecular Biology** by Upadhyay A and Upadhyay K. Himalaya publication
12. **Molecular cell Biology** by Bamrath
13. **Cell and Molecular Biology** by P.K. Gupta

Immunology

1. **Immunology** – R. C. Kuby et al.
2. **Immunology** - Tizzard
3. **Immunology** - Roitt, Brostoff and D. Male
4. **Immunology** – Abbas

List of Recommended Books: (For Semester V and VI)

Physiology

1. **Human Physiology** – Chatterjee A. G. vol. I & II
2. **Medical Physiology** – Gyton
3. **T. B. of Animal Physiology** – Berry
4. **Introduction to Animal Physiology and Related Biotechnology** – H. R. Singh
5. **Animal Physiology** – Arora M.P.
6. **General and Comparative Physiology** – Hoar W. S.
7. **T. B. of Animal Physiology** – Hurkat and Mathur
8. **Animal Physiology** – Nahbhushan and kodarkar
9. **T. B. of Animal Physiology & General Biology** – Thakur &Puranik
10. **General Endocrinology** – Turner Bagnaro
11. **Reproduction and Human welfare** – Greep and koblinsky
12. **Animal Physiology** – Shashtri&Goel
13. **Animal Physiology** – Verma&Tyagi
14. **Human Physiology** - Vander and sheman
15. **Applied Physiology** – Keels, Nells and Joels
16. **Animal Physiology** – Rastogi S. C.
17. **Animal Physiology** – VeerbalaRastogi
18. **Comparative Vertebrate Endocrinology** – Beutley

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Aquaculture

1. **Wealth of India, Raw Material, Vol. IV** – ICAR
2. **Fishes of India vol I & II**- Day
3. **Fish & Fisheries of India** – Jhingran

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4. Hatchery Manual for Common Indian & Chinese carps – Jhivgan&Pallin
5. Fish Pathology – Roberts
6. Introduction of Fishes – Khanna
7. Fishery Science & Indian Fishes – Khanna
8. Fishery Science & Indian Fisheries – Shrivastava
9. A Manual of F. W. Aquaculture – Santhanam
10. An Aid to Identification of Commercial Fishes of India & Pakistan- Mishra
11. Standard Methods for Examination of Water & Waste Water - APHA
12. Hand Book of Breeding of Major Carps by Pituitary Hormones – S. L. Chonder
13. Principles of Aquaculture – Zade S. B., Khune C. J., Sitre S.R. and Tijare R.V.

Entomology

1. T. B. of Applied Entomology – K. P. Shrivastava
2. T. B. of Agricultural Entomology - II S Pruthi
3. Modern Entomology – D. B. Tembhare (2nd Edition)
4. A Hand Book of Practical Sericulture – Ullar S. R. &Narsimhanna M.N.
5. Destructive and Useful Insects – Metcalf C.L. & Flint W.P.
6. General Text Book of Entomology – Richards O. W. & Davis R. G.
7. Agricultural Pests of India & South East Asia – Atawal A.S.
8. Hand Book of Economic Entomology for South Asia – Ayyar& Ram Krishna.
9. Medical Entomology – Hati A. K.
10. Bee-Keeping in India – Singh S

Biotechnology and Microtechnique

1. Animal Tissue Technique – Humason
2. Histological Technique – Devaenport
3. Microtechnique – Jiwaji&Patki
4. Microtechnique – Wankhede
5. Biophysical Chemistry – Upadhyay, Upadhyay and Nath
6. Techniques in Life Sciences – D. B. Tembhare

Biotechnology

1. Elements of Biotechnology – Gupta
2. T. B. of Biotechnology – Dubey
3. Modern Concept of Biotechnology – Kumar H. D
4. Advances In Biotechnology – Jogdand
5. T. B. of Biotechnology – Chatwal

25

6. Molecular Biotechnology – Primrose

Bioinformatics and Biostatistics

1. Mount W. 2004. Bioinformatics and Sequence Genome Analysis 2nd Edition CBS Pub. New Delhi.
2. Bergman, N. H. Comparative Genomics. Humana Press Inc. Part of Springer Science+BusinessMedia, 2007.
3. Baxevanis, A. D. Ouellete, B. F. F. 2009. Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins. John-Wiley and Sons Publications, New York.
4. Campbell A. M. and Heyer, L. J. 2007. Discovering Genomics, Proteomics and





Bioinformatics, 2nd Edition. Benjamin Cummings.

5. Des Higgins and Wille Taylor 2000. Bioinformatics: Sequence, Structure and Databanks. Oxford University Press.

6. Rashidi H. H. and Buehler 2002. Bioinformatics Basics: Applications in Biological

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PAPER - I Structures and functions of Invertebrates.

Recommended Books

Hyman, L.H. The invertebrates - Vol. I. Protozoa, Ctenophora, McGraw Hill Book Co. New York
 The invertebrates. Vols. II, V and VII McGraw Hill Book Co. New York

Barrington, E.J.W. Invertebrate structure and function. Thomas Nelson and Sons Ltd. London.

Jargenstein, G Evolution of metazoan animals. McGraw Hill Book Co. New York and London

Barnes, R.D. Invertebrate Zoology. III edition. W.B. Saunders Philadelphia

Russel - Hunter, W.D. A biology of invertebrates. MacMillan Co. Ltd., London

Read, C.P. Animal Parasitism. Prentice Hall

Parker, T.J. and Haswell, W.A. Text Book of Zoology. Vol. I

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PAPER - II: Techniques & Tools for Biology, and Biotechnology.

Books recommended

John R.W. Masters (ed). Animal cell culture - A practical approach, Ed. IRL Press

Robert Braun. Introduction to instrumental analysis. MacGraw Hill International Edition

K. Wilson and K.G. Goulding A biologist's guide to the techniques of practical biochemistry. F.I.B.S. ed

R.W. Old and S.B. Primrose. Principles of genetic engineering - an introduction to genetic engineering

R.A. Meyers (Ed.). Molecular biology and biotechnology. Wiley Publishers

Glick, Molecular biotechnology

M.D. Trevan et al. Biotechnology - The biological Principles. Ed. MacGraw - Hill Co. Ltd. New Delhi

John E. Smith. Biotechnology. 3rd ed. Cambridge University Press

PAPER - III : Molecular Biology & Molecular cytogenetics

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Books recommended

Atherly, A.G., J.R. Girtton, J.P. MacDonald. *Transcription Genetics*. Saunders College Publishing. Harcourt Brace College Publishers. New York.

Brooker, R.J. *Genetic analysis*. Benjamin/Cummings, Longman. London.

Gardener, E.J., M.J. Simmons and D.P. Snieszko. *Introduction to genetics*. John Wiley and Sons. New York.

Lewin, B. *Genes VI*. Oxford University Press. Oxford, New York, Tokyo.

Watson J.D. et al. *Molecular Biology of genes*. The Benjamin/Cummings Publishing Co. Inc. Harcourt.

J.Darnell, H.Lodish and D.Baltimore. *Molecular cell biology*. Scientific American Books, W.H. Freeman, N.Y.

Benjamin Lewin. *Genes VI*, Oxford University Press. New York.

P.D. Dabre. *Introduction to Practical Molecular Biology*. Wiley and Sons Ltd. New York.

PAPER - IV : Animal behaviour & Wild life Conservation and Management

P

Books recommended

- Wilson, E.O. **Sociobiology** the new synthesis. Harvard University Press, Cambridge, Massachusetts, USA
- Hinde, R.A. **Animal Behaviour: a synthesis of ethology and comparative psychology**, McGraw-Hill, New York
- Alcock, J. **Animal Behaviour: An evolutionary analysis**, McGraw-Hill, Association, Sunderland, Mass. USA
- Gadkar, **Strategies for survival.**
- Krebs, J.R. and N.B.Davies. **Behavioural ecology**, Blackwell Oxford, U.K.
- Saharia, **Wild life of India**
- Dasman. **Wildlife biology.**

Paper V- Biostatistics and Population Ecology

Books Recommended

- Sokal, R.R. and F.J. Rohlf. **Biometry**, Freeman, San Francisco, USA
-
- Snedecor, G.W and W.G. Cochran. **Statistical Methods**, 8th ed., East-West Press, New Delhi
 - Began, M. et al. **Ecology, Individuals, Populations and Communities**, Blackwell Sci Publ, Oxford, U.K.
 - Elseth, B.D. and K.M. Baumgartner. **Population ecology**, Van Nostrand Co New York
 - Krebs, C.J. **Ecological methodology**, Harper and Row, New York

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