

M.Sc. Ist Zoology

Semester I

Practical Paper I : Pertaining to theory papers I, II & III

Paper I

1. Techniques of collection and preservation with respect to insects and fishes,
2. To prepare identification keys of various animal groups
3. To study external morphological features of various animal groups (beaks & claws, scales of fishes, wing venation and external genitalia of insects).
4. Identification methods for insects, fishes, birds etc.

Paper II

1. Study of course of meiosis in grasshopper and bug.
2. Study of chiasmata position and chiasma frequency during Prophase I
3. Study of polytene chromosomes of *Chironomous* larva.
4. Chromosome preparation by air-drying technique to study morphological details of monocentric chromosomes.
5. Chromosome preparation by air drying technique to study morphological details of holocentric chromosomes.

Paper III

1. Study of organisms with reference to their evolutionary significance (adaptations, connecting links, modifications, missing links, living fossils, continuous and discontinuous distribution).
2. Phylogenetic analysis in context with phenetics and cladistics.

Practical Paper II : Pertaining to theory papers IV, V & VI

Paper IV

1. To study life cycle of acellular slime mould.
2. To study life cycle of cellular slime mould.
3. To study the internal structure of Chick egg.
4. To study the external morphology of blow fly.
5. To study the development of chick embryo from permanent slides.
6. To study the development of frog embryo from permanent slides.

Paper V

1. To study the life history of honey bee.
2. To study the life history of lac insect
3. To study the life history of silk worm (*Bombyx mori*).
4. To study the life history of *Musca domestica*
5. To study the life history *Culex*-mosquito
6. To study the life history of *Anopheles*-mosquito
7. To study the morphological features of honey bee
8. To study the different types of mouthparts in insects.
9. To study the wing venation in different insects.
10. To study the genitalic features in insects
11. Visit to apiary/vermi-composting unit and preparation of report

Paper VI

1. Sterilization of glassware used in microbiology laboratory and preparation of nutrient broth and nutrient agar.
2. Preparation of nutrient agar plates and swabbing to obtain colonies
3. Study of morphology-texture, colour, margin of bacterial colonies.
4. Differential staining of given culture to identify gram positive and gram negative bacteria.
5. Perform hanging drop mount method to examine the motility of bacteria.
6. Determine the quality of given milk sample by using methylene blue test.
7. Perform stormy clot fermentation test to detect the presence of anaerobic bacteria in given milk sample.
8. Demonstration of Catalase activity for H₂O₂ production in the given bacterial colony.
9. Determine the growth curve of given bacterial colony.

Practical Paper III : Pertaining to theory papers VII, VIII & IX

Paper VII

1. To study the sex chromatin body in the human neutrophil cells.
2. To study the sex chromatin body in the human buccal mucosal cells.
3. To prepare the polytene chromosomes from salivary glands of *Chironomous* larva.

4. To calculate the allelic frequencies of given population.
5. To calculate the genotypic frequencies of given population.
6. To study the human karyotype.

Paper VIII

1. Analysis of soil for the following parameters: soil texture, pH, temperature, humidity, water holding capacity.
2. To study the external morphology and ecological adaptations of : *Pristis*-the sawfish, *Draco volans*, *Hyla arborea*, Axolotl larva of *Ambystoma*, *Varanus*, *Trygon*-the Sting ray, *Syngnathus*-the pipe fish, Stick Insect.
3. Estimation of population:
 - a.i. Insect population using sweep net method.
 - a.ii. Population estimation using Mark and Release method (using beads/pulses etc).
4. To take up marbles of 5-6 different colours, mix these in different ratio by selecting one colour for one species and find out:
 - a.i. Species composition/Diversity
 - a.ii. Dominant Species
 - a.iii. Population ratio
5. To study and identification of beaks and their adaptations in following birds: Sparrow, Parrot, Hawk, Pigeon, Lapwing, jungle Crow, Weaver bird, Blue Jay.
6. To study and identify the claws of some birds: Parrot, Wood Packer, Weaver bird, Hawk, Myna, Pigeon, Koel, Horned bill.

Paper IX

1. To estimate the content of milk protein casein in a given sample of milk.
2. To study the effect of concentration on the rate of reaction between sodium thiosulphate and HCl.
3. To study the action of enzyme amylase from the saliva of human beings.
4. To study the effects of change in temperature on the rate of reaction between sodium thiosulphate and HCl.
5. To study the permeability of plasma membrane.
6. To perform tests to identify : Carbohydrates, Proteins, Lipids

Practical Paper IV : Pertaining to theory papers X, XI & XII

Paper X

1. Preparation and staining of thin blood film to study polymorphonuclear leukocytes
2. Determination of A,B,O blood group typing and Rh factor.
3. Determination of haemoglobin content of given sample of blood.
4. Determination of cooke-Arneth count.
5. Determination of Peroxidase reaction
6. Enumeration of column chromatography.

Paper XI

1. Knowledge about computer, different softwares, operating systems & web.
2. Knowledge of HTML and its usage
3. Phylogenetic analysis based on parsimony
4. Various types of data bases & their usage
5. Linux & its applications
6. Programming with PERL

Paper XII

1. Perform differential leukocyte count (DLC) of the given blood sample.
2. Perform total leukocyte count (TLC) of the given blood sample.
3. Perform antigen-antibody reactions by Ouchterlony method (precipitation reaction).
4. Study of histological section of primary and secondary lymphoid organs-
 - a. Thymus
 - b. Spleen
 - c. Peyer's patches
5. Study of histological sections to demonstrate cellular infiltration as pathological sign caused by parasitic infections.

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Semester III

Practical Paper I : Pertaining to theory papers XIII, XIV, XV & XVI

Paper XIII

1. To study the behavior of rat by using the "Skinner's Boxes"
2. Habituation/Sensitization in mosquito larvae.
3. To study the Grooming behavior of Cockroach.
4. To study the predation behavior of Rats.
5. Simulating the dilution, confusion and odd prey effects.
6. To study the rolling behavior of pill bugs.
7. To assess the importance of a visual stimulus (background colour/brightness) on an individual's decision to position itself relative to it.
8. To assess the importance of an olfactory stimulus (background food/odorant) on an individual's decision to position itself relative to it.

Paper XIV

1. To prepare permanent slides of some endocrine glands by microtomy: Thyroid, Pancreas, Thymus, Spleen, Adrenal gland, Testis & Ovary.
2. To study the Process of spermatogenesis, process of oogenesis, Corpus luteum, Structure of sperm, Parathyroid gland, Sickle cell anemia, Mammary gland & Calcified and decalcified bone.
3. To demonstrate the abnormalities of growth hormone: Dwarfism, Gigantism and Acromegaly etc.
4. To demonstrate the abnormalities related to Thyroid Gland: Hyperthyroidism-Exophthalmos, Goiter and Grave's disease; Hypothyroidism-Myxedema, Cretinism.
5. To demonstrate the abnormalities of Adrenal Gland: Cushing Syndrome.

Paper XV

1. To identify, classify and study morphological characteristics of Chondrichthyes fishes.
2. To identify, classify and study morphological characteristics of Osteichthyes fishes
3. To prepare permanent slides of Placoid scales.
4. To prepare permanent slides of Ctenoid scales.

5. To prepare permanent slides of Cycloid scales.
6. To prepare permanent slides of Ganoid scales.
7. To prepare permanent slides of ampulla of lorenzini.

Paper XVI

1. To study the principle, working and applications of Compound microscope.
2. To study the principle, working and applications of Stereo zoom microscope.
3. To study the principle, working and applications of Phase contrast microscope.
4. To study the principle, working and applications of Fluorescent microscope.
5. To study the principle, working and applications of Spectrophotometer.
6. To prepare the chromatograph for different inks/oils by paper chromatography.

Specialization Entomology

Practical Paper II : Pertaining to theory papers Specialization I & II

Paper I

1. Morphology of head region (Sutures, Structure, Tentorium etc.)
2. Morphology of thorax
3. Wing and its modifications
4. Morphology of abdomen & genitalic structures
5. To study digestive system of Ak grasshopper.

Paper II

1. To study Nervous system of Ak grass hopper.
2. To study internal reproductive system of an insect.
3. To study excretory system of different insects.
4. To study respiratory system of different insects.
5. To study circulatory system of different insects.
6. To prepare assignment s on
 - a. Nerve conduction in insects.
 - b. Muscle contraction

Specialization Parasitology

Practical Paper II : Pertaining to theory Specialization I & II

Paper I

1. Permanent preparation of GI protozoan parasites of the given animal.
2. Collection, fixation and temporary mounting of GI nematode parasites of the given animal.
3. Collection, fixation and permanent mounting of GI cestode parasites of sheep and goat.
4. Dissect and study the detailed morphology of eggs, male and female of *Ascaris suum*.
5. Detailed study of morphology of eggs, male and female of *Trichuris globulosa*.
6. Make a stained preparation of *Fasciola* sp. and study the detailed morphology.
7. Make a stained preparation of *Moniezia* sp. and study the detailed morphology.
8. Examination of freshwater snails for the presence of larval forms of *Fasciola hepatica* and make permanent preparation.
9. Study of permanent slides – *Plasmodium berghei*, *Leishmania* sp., *Balantidium coli*, *Nyctotherus* sp., *Opalina*, *Entamoeba histolytica* –Trophozoite, *Taenia* Scolex, proglottids, cysticercus, hexacanth, Hydatid cyst, *Dipylidium*-scolex, *Paramphistomum*, *Fasciola* –egg, radia, cercaria, *Taenia*-T.S., *Fasciola* – T.S., *Ascaris* -T.S., *Ancylostoma duodenale*- male & female, *Enterobius vermicularis* – Male & female, *Dracunculus medinensis*-female.

Paper - II

- a.i.1. Preparation of permanent mounts of mouth parts of major vector species.
- a.i.2. Study of permanent slides related to vectors (Whole mounts and various structures).
- a.i.3. Preparation of permanent slides of antennae, wings, legs and other. morphological structures of insects having medical importance.
- a.i.4. Study of immature stages of various species of mosquitoes (eggs, larvae and pupae)
- a.i.5. Collection and preservation of ticks and mites of medical and veterinary importance.

Specialization Physiology

Practical Paper II : Pertaining to theory papers Specialization I & II

Paper I

1. To estimate CO₂ production in human body.
2. To determine the effect of impurities on ice.
3. To determine gustatory receptors.
4. To determine acuity of taste sensation.

5. To determine the zone of tolerance and zone of resistance for mosquito larva.
6. To study the effects of temperature on respiratory rate of a fish.
7. To study the role of glycerine in bringing down freezing point of water.
8. To observe the selective permeability of plasma membrane.

Paper II

1. Anatomy of male reproductive system of rat.
2. Anatomy of female reproductive system of rat.
3. Histology of male reproductive system of rat using microtomy: Testis, Epididymis, Ductus deferens and accessory reproductive glands of male rat; Seminal vesicles, Prostate gland, Cowper's gland
4. Histology of female reproductive system of rat: Ovary, Oogenesis, Structure of Ovum and Corpus luteum
5. Study of Permanent slides : Spermatogenesis, Mammary gland and Placenta.

Specialization Cytogenetics

Practical Paper II : Pertaining to theory papers Specialization I & II

Paper I

1. To make the chromosome preparations from the bone marrow of Rat and study the chromosome complement from somatic metaphase plates.
2. To make the chromosome preparations from the bone marrow of *Hemidactylus* and study the chromosome complement from somatic metaphase plates.
3. To make the chromosome preparations from testes of Rat and study the different stages of meiosis.
4. To study the somatic metaphase chromosomes from permanent slides of Rabbit.
5. To study the chromosome complement in different stages of meiosis from permanent slides of Varanus.
6. Study of normal human chromosome complement and karyotyping
7. Study of chromosome abnormalities in complements of human syndromes and their karyotyping.

Paper II

1. To prepare karyotype of grasshopper chromosomes.
2. To prepare the karyotype of bug chromosomes.

3. Comparative study of sex determining mechanisms in insect chromosome.
4. To perform C banding and study distribution of C-heterochromatin in acrocentric chromosomes.
5. To perform C banding and study distribution of C-heterochromatin in holocentric chromosomes.
6. To perform silver nitrate staining and study the NOR regions in the acrocentric chromosomes.
7. To perform silver nitrate staining and study the NOR region in holocentric chromosomes.
8. Study of sequence specificity (AT and GC) of heterochromatin under the fluorescent microscope.

Semester IV

Practical Paper III : Pertaining to theory papers XVII, XVIII, XIX & XX

Paper XVII

1. Test for detection of formalin in given milk samples.
2. Test for detection of water in given milk samples.
3. Test for detection of pulverized soap in given milk samples.
4. Test for detection of urea in given milk samples.
5. Test for detection of starch in given milk samples.
6. Test for detection of cane sugar in given milk samples.
7. Test for detection of salt in given milk samples.
8. Test for detection of ammonium sulphate in given milk samples.
9. Test for detection of benzoic acid & salicylic acid in given milk samples.
10. Egg structure and evaluation of egg quality.

Paper XVIII

1. To deliver a seminar on a topic related to wild life conservation.
2. To submit an assignment on a topic concerning wild life in India.
3. To prepare a report on the latest events concerning wild animals at the national and international level.
4. To observe the behavior of one wild animal and to write a report on it.
5. To visit a wild life National Park and to submit a report on it.

Paper XIX

1. To study the habitat, distribution, habits and important characters of various animals:-*Naja naja*, Pigeon, *Hystrix* (Porcupine), *Hyla*, *Salamander*, *Apteryx* (kiwi), Flying Squirrel, *Ornithorhynchus*, *Protopterus*, *Peripatus*, *Balanoglossus*, *Archaeopteryx*.
2. To study the vestigial organs in animals.
3. To study the zoogeographic realms of the world.
4. Map studies:
 - a. India – Climatic Regions
 - b. India - Rainfall and wind
 - c. India – Distributions of Animals
 - d. Distribution of endangered animal species in Himalayan region
5. Map studies : Biodiversity Hotspots location in (a) World (b) India
6. Map Studies: Protected Areas of India such as National parks, Wildlife Sanctuaries, Biosphere Reserves.
7. To study the Leg modifications in case of insects.

Paper XX

1. To estimate the CO₂ concentration in given water sample.
2. To estimate the concentration of Dissolved Oxygen in given water sample.
3. To estimate the total alkalinity of given water sample.
4. To estimate chloride in given water sample.
5. To estimate total hardness in given water sample.
6. Analysis of phytoplankton and zooplankton in given water sample.

Specialization Entomology

Practical Paper IV : Pertaining to theory papers of specialization III & IV

Paper III

1. To study different kinds of hand operated sprayers:- Syringe, Bucket Pump Sprayer, Knap Sack Sprayer, Rocket Sprayer, Foot of Paddle Pump Sprayer, Wheel Barrow Sprayer and Hand Atomizer (Flit Pump)
2. To study spray lances and cut off devices.

3. To study the effect of concentration of insecticides on given Insect.
4. To make a comparative study and determine the strongest fumigant.
5. To study the testing of attractancy of a substance on Insects.

Paper - IV

1. Study of major crop pests: their identification and writing a note on their economic importance.
2. Study of the biology of some stored grain pests by rearing them in the laboratory.
3. Identification of major insect vectors and writing note on their medical importance
4. Study of permanent slides of vectors.
5. Preparation of permanent mounts of mouth parts of major vector species.
6. Preparation of permanent slides of antennae, wings, legs and other morphological structures of insects having medical importance.

Specialization Cytogenetics

Practical Paper IV : Pertaining to theory of specialization III & IV

Paper IV

1. Histochemical preparation of slides to demonstrate localization of glycogen in the given tissue.
2. Histochemical preparation of slides to demonstrate localization of lipids in the given tissue.
3. Histochemical preparation of slides to demonstrate localization of proteins in the given tissue.
4. Histochemical preparation fo slides to demonstrate localization of nucleic acids in the given tissue.
5. Demonstration of laminar air flow and its applications.
6. Demonstration of instruments used in extraction and amplification of DNA and their applications.

Paper - III

1. To study the distribution of constitutive heterochromatin in the somatic metaphase plates of Rat bone marrow.
2. To study the distribution of constitutive heterochromatin in somatic metaphase plates of *Hemidactylus* bone marrow.
3. To study the distribution of constitutive heterochromatin in the different stages of meiosis of Rat testes.

4. To study nucleolar Organizer regions (NOR) in the somatic metaphase plates of Rat bone marrow.
5. To study Nucleolar Organizer regions (NOR) in the somatic metaphase plates of *Hemidactylus* bone marrow.

Specialization Parasitology

Practical Paper IV : Pertaining to theory papers of specialization III & IV

Paper III

1. Preparation of Immunoglobulin IgG from Sheep/goat serum.
2. Immunoprecipitation of immunoglobulin from sheep/goat serum.
3. To demonstrate the process of Hemagglutination assay.
4. To study the techniques of immunohistochemistry.
5. To demonstrate ELISA (Enzyme linked Immunoabsorbent Assay) technique.
6. To separate lymphocytes from peripheral blood.
7. To prepare cell suspension from lymphoid organ.

Paper IV

1. Enumeration of eggs/oocysts/larvae of gastrointestinal protozoan and helminth parasites of sheep and goat by Salt-Flootation method, Zinc-Sulphate method and Formaldehyde-Ether Sedimentation method.
2. Prepare and stain (H + E) histological sections of nematode (*Trichuris*) and cestode (*Moniezia*) parasites to demonstrate the host-parasite interface.
3. Study of detailed morphology and classification of nematode, cestode and trematode parasites of sheep and goat : *Trichuris globulosa*, *Trichuris ovis*, *Haemonchus contortus*, *Oesophagostomum* sp., *Moniezia* sp., *Stilesia* sp., *Avitellina* sp., *Paramphistomum* sp. and *Cotylophoron* sp.
4. . Study of histopathology of large intestine caused by the nodular worm. *Oesophagostomum columbianum*.

Specialization Physiology

Practical Paper IV : Pertaining to theory of specialization III & IV

Paper III

1. To demonstrate osmotic haemolysis in RBC's.
2. To demonstrate the activity of amylase.
3. To demonstrate the activity of enzyme catalase.
4. To demonstrate the dehydrogenase activity in milk.
5. To demonstrate the absorption chromatography for the separation of leaf pigments using a piece of chalk.
6. Demonstration of absorption curves of KMnO_4 .
7. Spectrophotometric demonstration of Beer-Lambert's Law.

Paper IV

1. To plot the calibration curve for standard solution of glycogen.
2. To determine the amount of ascorbic acid in the given sample.
3. Extraction and quantitative analysis of glycogen in liver.
4. To plot the calibration curve for standard solution of proteins.
5. Demonstration of thin layer chromatography of neutral lipids.
6. Determination of total leukocyte count of given sample of blood.
7. Enumeration of red blood corpuscles in the given sample of blood.