



DEPARTMENT OF ZOOLOGY, OSMANIA UNIVERSITY

REVISED PRACTICAL SYLLABUS FOR PG – SEMESTER I

(Revision as per the UGC Guidelines for discontinuation of dissection and animal experimentation in Zoology/Life Sciences in a phased manner)

Paper – I: Principles of Taxonomy and Functional Anatomy of Invertebrates

1. Structure and bionomics and biology of representative types of invertebrate groups from Protozoa to Echinodermata and Hemichordata.
2. Preparation of permanent slides of selected invertebrates (only those that are cultured or pests).
3. Collection and identification of invertebrates in pond water.
4. Collection of parasites from cockroach and fish (Labeo/Catla/Tilapia).
5. Dissections
 1. Minor dissections – a) Reproductive system of cockroach, b) Salivary glands of cockroach, and c) Mouth parts of cockroach.
 2. Major dissections – a) Silk glands in silk worm, and b) Nervous system of prawn/cockroach.

Paper – II: Genetics and Biostatistics

Genetics

1. Identification of sperm head abnormalities in albino mice.
2. Preparation of mitotic chromosomes in albino mice / wistar rat.
3. Preparation and identification of chromosomal aberrations of mitotic cells.
4. Pedigree analysis.
5. Banding techniques – karyotype study (human Chromosomes).

Biostatistics

1. Formation of frequency distribution, graphical representation and calculation of descriptive measures.
2. Chi-square test of goodness of fit contingency and heterogeneity.
3. Large and small sample test, sample means and preparations.
4. Analysis of variance – one way and two-way classification.

Paper – III: Physiological Chemistry

1. Determination of proteins by Biuret method/ Folin Phenol method
2. Determination of glucose by Somogi / Anthrone method
3. Determination of lipids by Vanilline method
4. Determination of glycogen by Kemp's method
5. Estimation of cholesterol
6. Determination of enzyme activities of SDH, LDH and GDH
7. Effect of substrate concentration and pH on SDH activity
8. Effect of competitive inhibitor on SDH activity
9. Estimation of amino acids by ninhydrin – hydridantin method.

Paper – IV: Environmental Biology

1. Estimation of phosphates in the water sample.
2. Estimation of nitrates.
3. Estimation of nitrites.
4. Estimation of magnesium.
5. Estimation of calcium.
6. Estimation of the primary productivity of water.
7. Biological indicators of water quality and their population dynamics – collection of water sample.
8. Identification, enumeration of zooplankton, and their ecological significance.
9. Estimation of total alkalinity of water and soil samples.
10. Estimation of particulate matter in air.
11. In vitro determination of lethal, LC 50 and threshold concentration of pesticide on Gambusia fish / protozoans.
12. In vivo effect of selected toxicants of AchE on albino mice or wistar rat.



DEPARTMENT OF ZOOLOGY, OSMANIA UNIVERSITY

REVISED PRACTICAL SYLLABUS FOR PG – SEMESTER II

(Revision as per the UGC Guidelines for discontinuation of dissection and animal experimentation in Zoology/Life Sciences in a phased manner)

Paper – I: Functional Anatomy of Vertebrates and Economic Zoology

1. Structure, bionomics and biology of the representative types of vertebrates.
2. Collection and preparation of slides of ticks, mites, bed bug, human lice, fleas, mosquitoes and house flies.
3. Structure, bionomics and biology of earthworms. Commercially important prawns, mussels and pearl oysters, harmful and useful insects and moths, cultivable fishes and frogs.
4. Dissections:
 1. Minor dissections – a) Weberian ossicles of Labeo, and b) Respiratory trees of Clarius.
 2. Major dissections – a) Cranial nerves of Labeo (V, VII, IX & X cranial nerves), b) Cornea and pecten of chick.

Paper – II: Cell and Molecular Biology

1. Extraction of DNA from tissues.
2. Extraction and isolation of RNA from tissues.
3. Estimation of RNA, DNA in tissues.
4. Protein fractionation using sodium sulphate.
5. Localization of DNA and RNA by Methyl green – pyronin 'Y'.
6. Feulgen reaction method for DNA localization.
7. Identification of micronuclei in bone marrow erythrocytes of mice.
8. Demonstration of gene amplification in salivary gland chromosomes of *Drosophila*.
9. LDH isoenzyme patterns in blood through Disc gel electrophoresis

Paper – III: Animal Physiology

1. Estimation of blood chlorides under hetero osmotic media
2. Cold and heat stress on metabolic rate in crab
3. Effect of heat stress on glycogen levels in crab
4. Estimation of Acetylcholinesterase activity
5. Estimation of phosphorylase activity
6. Adrenalin and insulin induced changes in blood glucose levels in frog
7. Kymographic recordings of twitch, tetanus and fatigue
8. Estimation of Hb, ESR and blood clotting time

Paper – IV: Developmental Biology and Evolution

1. Observation of live ova and sperms in frog and rat
2. Study of cleavage patterns in the eggs of *Lymnea*
3. Study of different stages of chick embryo (24 hrs, 48 hrs, 72 hrs and 96 hrs)
4. Comparative estimation of soluble and structural proteins in embryonic and extra embryonic layers of different stages (48, 72, and 96 hours) of development in chick (as an evidence to the utilization and synthesis of yolk proteins during differentiation and organogenesis)
5. Estimation of DNA & RNA in different stages of development (48, 72 & 96 hrs) in chick (as an evidence for cleavage, gastrulation and differentiation)
6. Estimation of the level of calcium in the shell of chick (48, 72 & 96 hrs)
7. Study of enzyme activity of SDH and LDH in various developmental stages of chick
8. Growth and differentiation of chick embryos (comparison of 4-day and 12-day old embryos) - morphometry and weight of the embryos



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REVISED PRACTICAL SYLLABUS FOR PG – SEMESTER III

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PAPER – I: INSTRUMENTATION AND COMPUTER APPLICATIONS IN BIOLOGY

1. Preparation of cell organelles and fractions of cell components.
2. Separation of amino acid and protein by chromatography techniques (paper, circular and / or ion-exchange).
3. Separation of proteins by electrophoresis.
4. Characterization and quantification of molecules by UV spectrophotometer.
5. Microtomy techniques for tissue from albino mice or wistar rats (liver and kidney).
6. Demonstration of Action Potential.
7. Hands-on experience for document preparation.
8. Internet browsing.
9. Statistical application -Data analysis.

PAPER – II: IMMUNOLOGY

1. Agglutination test
2. Precipitation techniques
3. Immunoelectrophoresis
4. Neutralization and complement fixation
5. Separation of lymphocytes
6. Collection of macrophages and their characterisation
7. Immunization schedules and rising of antibodies
8. Histology of spleen, lymph node, thymus after immunization from Wistar Rat or Laboratory-bred Rabbit.
9. Demonstration of lymphocyte transformation test with nitrogen and an antigen.

PAPER – III: SPECIAL GROUP-I: HELMINTHOLOGY-I(MONOGENEA, ASPIDOGASTREA, DIGENEA& CESTODA)

1. Collection fixation and staining techniques of permanent whole mount preparations and identification of monogeneans, digeneans, aspidogastreae and cestode (Hosts – cultured fishes, chick, sheep, goat and cattle viscera).
2. Faecal smear preparation, staining and study for eggs & concentration.
3. Collection and examination of infective larvae from intermediate hosts (snails, microcrustaceans-like Cyclops, Gammarus etc., cultured fishes)
4. Effect of light, and temperature on the emergence of cercaria.
5. Estimation of total proteins, carbohydrates and lipids in normal tissue, infected tissue and parasites.
6. Measurement of infection: Prevalence, density, intensity and index of helminth parasites.

PAPER – III: SPECIAL GROUP-I: ENTOMOLOGY-I(AGRICULTURAL ENTOMOLOGY)

1. Collection, preservation and identifications of insect pests of agricultural and stored products importance.
2. Preparation of permanent slides of different parts of insects and their stages of life cycle.
3. Study of permanent slides of different parts of insects, antennae, legs wings, mouth parts/Head of Tribolium, Red cotton bug, spodoptera.
4. Study of museum specimens of agricultural importance.
5. Rearing of pests of agricultural importance in the laboratory, Red cotton bug/ Tribolium/Spodoptera
6. Bioassay of insecticides using different methods of exposure.
7. Calculation of LD50 using probit analysis.
8. Dissection of digestive, nervous and reproductive systems of pests of agricultural importance (Red-cotton bug/grass hopper).

PAPER – III: SPECIAL GROUP-I: COMPARATIVE ANIMAL PHYSIOLOGY-I(ANIMAL ADAPTATIONS TO ITS HABITAT - A COMPARATIVE APPROACH)

(Note use minimal numbers of individuals, and discourage killing of animals)

1. Effect of hetero-osmotic media on blood chlorides in crab.
2. Acclimatization to hetero-osmotic media on SDH and LDH on gills of crab.
3. Effect of eye-stalk ablation on blood chlorides in crab.
4. Effect of starvation in fish on glycogen and free amino acids in liver and muscles.

6. Starvation induced changes in excretory products in fish.
7. Effect of decompression on Lactic acid and LDH levels in rat tissue.
8. Acclimatization to cold and high temp in crab and its effect on oxygen consumption
9. Levels of SDH, LDH, and GDH in liver/muscle in crab/fish/rat/sheep.
10. Levels of lactic acid and free amino acids in liver/muscle in crab/fish/rat/sheep
11. Effect of aestivation on metabolites and nitrogenous excretory products in snail.

PAPER – III: SPECIAL GROUP-I: PRINCIPLES OF FISHERIES AND FRESHWATER FISHERIES – I

1. Water analysis and its relation with fisheries – pH, dissolved oxygen, total alkalinity, salinity, calcium, magnesium, nitrates, nitrites, phosphates, total dissolved solids, suspended solids and turbidity.
2. Soil analysis and its relation with fisheries – pH, total alkalinity, electric conductivity, C/N ratio.
3. Identification of fishing crafts and gear models.
4. Fabrication of nets.
5. Karyotyping of chromosomes in fishes.

PAPER – III: SPECIAL GROUP-I: NEUROSCIENCE-I

1. Demonstration of gross anatomical regions of brain of wistar rats/albino mice, isolation of hippocampus, preparation of AchE staining.
2. Preparation of nerve and muscle for electrophysiological studies.
3. Estimation of acetylcholine in different regions of brain.
4. Estimation of acetylcholinesterase activity.
5. Estimation of sodium and potassium ATPase activity.
6. Electrophysiological demonstration of biopotentials.
7. Hands on experience on voltage and patch clamp techniques.
8. Determination of maze learning and estimation of proteins in hippocampus.
9. Circadian pattern of glucose levels in crab or mice.
10. Identification of different types of neural and glial cells.

PAPER – III: SPECIAL GROUP-I: BIODIVERSITY – UTILIZATION AND ITS CONSERVATION-I

1. Mapping of the study area.
2. Physical and chemical characteristics of the soil.
3. Exercise in the setting up and reading meteorological instruments.
4. Vegetation analysis – frequency and density.
5. Vegetation analysis – cover, basal area.
6. Listing of birds on the college campus.
7. Recording of frequency density and diversity of birds in college campus
8. Recording of frequency density and diversity of reptiles in college campus
9. Visit to Mrugavani National Park.
10. Exercise on Report writing on conservation issue and submitting dissertation.

PAPER – IV: SPECIAL GROUP-II: MAN & TROPICAL DISEASES –I

1. Identification of bacteria and fungi in wet smears and stained smears of blood, throat exudates and urine centrifugate.
2. Culture and staining techniques of bacteria and fungi.
3. Tri-dot test for detection of antibodies to HIV-1, HIV-2 in human serum.
4. RPR-test for quantitative and semi quantitative determination of region antibodies of human serum (syphilis).
5. Detection of bilirubin by Fouchet's test.

PAPER – IV: SPECIAL GROUP-II: APPLIED ENTOMOLOGY – I(SERICULTURE)

1. Study of Life history of Silk Worm by rearing.
2. Identification of different types of silk worms - Mulberry, Tasar, Eri and Muga.
3. Identification of defective cocoons.
4. Rearing appliances.
5. Sex differentiation of larva, pupa and adult silkworms.
6. Preparation of permanent slides of mouth parts, spiracles and appendages of larva.
7. Dissection of silk glands of the silk worm larva.
8. Dissection of digestive and nervous systems in the larva.
9. Dissection of reproductive organs in the adult moths.
10. Calculation of Shell Ratio.
11. Visit to the Cocoon market.
12. Visit to the Reeling Centre and Grainage Units.

PAPER – IV: SPECIAL GROUP-II: AGRICULTURAL NEMATOLOGY-I

1. Collection of soil and plant parasitic nematodes by various techniques
2. Nematode counting and calculations (frequency)
3. Nematode fixing, staining and mounting methods
4. Identification of predominant plant parasitic nematodes of the following crops:
1. Rice 2. Ground nut and, 3. Vegetables
5. Field trip – Observation Book

PAPER – IV: SPECIAL GROUP-II: ECONOMIC ZOOLOGY-I

1. Identification of dipteran vectors.
2. Life history of Anopheles, Culex, Aedes and Housefly.
3. Identification of larval forms of Anopheles, Culex and Aedes.
4. Identification of edible fishes.
5. Identification of specimens of poisonous snakes, insects, scorpions and spiders.
6. Identification of craft and gear models.

PAPER – IV: SPECIAL GROUP-II: APPLIED TOXICOLOGY-I

1. Mortality test – determination of various toxic values (Lethal, LC50, Threshold values) in selected animals (Paramecium and cultured fish)
2. GOT & GPT estimation in hepatotoxin exposure (in albino mice / wistar rats).
3. Micronuclear test in bone marrow cells.
4. Ames techniques.
5. Effect of toxicant on soluble and structural proteins in the muscle/blood of albino mice or wistar rats.
6. Behavioral examination of albino mice or wistar rat on exposure to pesticides.
7. Bioassay test for phagocytosis in Paramecium.
8. Preparation of mitotic chromosomal aberrations by any toxicant in albino mouse systems.

PAPER – IV: SPECIAL GROUP-II: ENDOCRINOLOGY – I(REPRODUCTIVE PHYSIOLOGY AND ENDOCRINOLOGY)

(Note use minimal numbers of individuals, and discourage killing of animals)

1. Reproductive system of crab.
2. Reproductive system of cockroach.
3. Effect of oestrogen on serum calcium levels in female albino mice.
4. Effect on oestrogen on oviduct weight in albino mice (Or) Effect of oestrogen on uterine weight in wistar rat.
5. Study of oestrogen cycle by vaginal smear technique in wistar rat.
6. Determination of cholesterol levels in testis and ovary of in albino mice or wistar rat.
7. Effect on testosterone on Gonado Somatic Index (GSI) of male albino mice or wistar rat.
8. Ovariectomy and its effect on ascorbic acid content in blood of wistar rat.
9. Effect of hysterectomy on ovarian cholesterol levels in wistar rat.
10. Identification of gonadotrophins (HCG) in human urine.
11. Effect of castration on cholesterol levels in blood in albino mice or wistar rats.
12. Histology of ovary, testis, uterus, pituitary, etc.



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REVISED PRACTICAL SYLLABUS FOR PG – SEMESTER IV

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PAPER – I: ANIMAL BIOTECHNOLOGY

1. Preparation of culture media - a) Bacteria, b) Fungi and, c) animal cells by filter sterilization methods.
2. Methods of cultivating bacteria and fungi.
3. Isolation and characterization of microbes useful in fermentation.
4. Staining techniques for microbes - a) Gram's staining, b) Spore and capsule staining, c) Acid-fast staining, and d) fungal staining.
5. Establishment of primary cell culture - chick embryo.
6. Isolation and maintenance of cell lines from sheep liver.
7. Determination of microbial growth curve.
8. Antibiotic sensitivity test.
9. Yield estimation in fermentations using a bioreactor or orbital shaker – a) *Aspergillus niger*-citric acid, b) Lactic bacteria – Lactic acid from curd, and c) *Saccharomyces cerevisiae* (Yeast) – Alcohol.
10. Microbial evaluation of stored foods from plant/animal origin for contaminants/toxins.
11. Experiments on Southern/Western/Northern blotting techniques.
12. Visit to Quality control labs.

PAPER-II: ENDOCRINOLOGY

(Note use minimal numbers of individuals, and discourage killing of animals)

1. In situ demonstration of endocrine glands prawn and albino mice/wistar rat.
2. Histology of endocrine glands - pituitary, thyroid, parathyroid, thymus, adrenal, pancreas, ovary, testis and uterus.
3. Allactectomy in cockroach.
4. Effect of eye-stalk ablation on blood glucose levels in crabs.
5. Identification of gonadotrophin in human urine samples.
6. Effect of thyroxine and thiourea (antithyroid agent) on oxygen consumption in *Gambusia/Tilapia*.
7. Effect of eye stalk ablation on chromatophore regulation in crab.
8. Effect of parathormone on serum calcium levels in albino mice or wistar rats.
9. Effect of insulin and adrenalin on glycogen levels in albino mice or wistar rats.
10. Effect of estrogen on weight of oviduct in albino mice or wistar rats.

PAPER – III: SPECIAL GROUP-I: HELMINTHOLOGY –II(NEMATODA & ACANTHOCEPHALA)

1. Collection of nematode and acanthocephalan parasites, fixation, preparation of permanent slides and their identification from hosts – cockroaches (invertebrate), fish (carps and catfishes), birds (fowl) and mammals (sheep and cattle).
2. Identification of nematode eggs and larval stages.
3. Qualitative and quantitative estimation of carbohydrates, proteins and lipids in normal, infected tissues and parasites.
4. Ecology of parasites and biostatistical calculations of incidence, intensity, density and index of infection of nematode parasites.

PAPER – III: SPECIAL GROUP-I: ENTOMOLOGY – II(MEDICAL ENTOMOLOGY)

1. Collection, preservation and identification of insects of medical importance.
2. Study of permanent slides of medical pests - the head louse, fleas, ticks or mites, mosquitoes
3. Preparation of permanent slides of head lice, fleas; mosquitoes, ticks or mites
4. Study of life history of pests of medicinal importance by rearing in the laboratory of mosquitoes/houseflies/cockroaches.
5. Differences between *Anopheles*, *Culex* and *Aedes* mosquitoes.
6. Preparation of slides of different parts of insects of medicinal importance like antennae, legs, wings, mouth parts, different stages etc. of cockroach, housefly, mosquito.
7. Dissection of digestive, nervous and reproductive systems of housefly and cockroach.
8. Salivary glands of cockroach, mosquitoes/houseflies.
9. Reproductive system of mosquitoes.

PAPER – III: SPECIAL GROUP-I: COMPARATIVE ANIMAL PHYSIOLOGY – II(ANIMAL ADAPTATION TO ITS HABITAT: SENSORY AND MOLECULAR BASIS)

(Note use minimal numbers of individuals, and discourage killing of animals)

1. Maze behaviour studies in wistar rats.
2. Metabolic distinction of slow and fast muscles.
3. Kymographic studies of muscle properties.
4. Effect of Adrenaline & Acetylcholine on heart beat of albino mice or wistar rat – kymographic study.
5. Juveno-mimic hormone and its effect on molting in insects.

PAPER – III: SPECIAL GROUP-I: PRINCIPLES OF FISHERIES AND FRESHWATER FISHERIES-II

1. Identification of freshwater fishes.
2. Identification of developmental stages of freshwater fishes.
3. Identification of freshwater prawns.
4. Identification of developmental stages of scampi.
5. Identification of diseased fishes and prawns.
6. Analysis and identification of phyto- and zoo- plankton and benthos.
7. Culture of phyto- and zoo- planktons.
8. Separation of pituitary gland from cultured fishes.
9. Demonstration of induced-breeding technology in cultured fishes.
10. Field trips to seed and rearing farms.

PAPER – III: SPECIAL GROUP-I: NEUROSCIENCE –II

1. Tail flick test for measurement of pain in albino mice or wistar rat.
2. Spinal reflexes in decerebrated albino mice or wistar rat.
3. Preparation of neuromuscular system for electrophysiological recording.
4. Biochemical differentiation of fast and slow muscles – SDH, LDH activities, glycogen and lactate content.
5. Effect of ankle sprain on muscle metabolism in albino mice or wistar rat.
6. Determination of contractile properties of muscle in pathological condition.
7. Determination of conduction velocity in nerve albino mice or wistar rat.
8. Induction of stress and estimation of on glycogen, lactate, AChE and Na-K ATPase activities.
9. Experimental studies on atrophy, hypertrophy of muscles and nerve degeneration as well as regeneration.

PAPER – IV: SPECIAL GROUP-II: MAN & TROPICAL DISEASES- II

1. Identification of protozoan and helminth parasites and different stages in fecal matter
 - a. Direct smear preparation
 - b. Smear preparation by concentration (by formalin ethyl acetate sedimentation)
2. Preparation of permanent stained smear by trichrome method
3. Preparation of stained smear by iron hematoxylin
4. Temporary and permanent whole mount preparation of protozoan and helminths
5. Preparation of thin blood film for blood parasites
6. Preparation of thick blood film for blood parasites (protozoan and helminths)
7. Collection and examination of medicinally important arthropods
8. Estimation of haemoglobin
9. Estimation of hematocrit
10. Estimation of ESR

PAPER – IV: SPECIAL GROUP-II: APPLIED ENTOMOLOGY-II (INTEGRATED PEST MANAGEMENT)

1. Collection, identification and preservation of insect pests of agricultural, medical and veterinary importance.
2. Light traps and insect collection.
3. Pheromone traps and insect collection.
4. Bird perches and their utility.
5. Spodoptera baiting.
6. Study of antifeedant activity in Spodoptera (Choice & Non-choice methods).
7. Rearing of parasites and predators of economic importance.
8. Culturing of NPV.
9. Preparation of natural plant products such as Neem seed kernel extract, chili-garlic mixture, tobacco decoction, utility of cow's urine in pest control.

PAPER – IV: SPECIAL GROUP-II: AGRICULTURAL NEMATOLOGY –II

1. Collection of pest insects from crops, veterinary pest and vectors of human importance from different habitats such as root, stem, soil, fruits, water, etc.
2. Collection of entomophilic nematodes, fixing, staining, counting, mounting and identification.
3. Field trips

4. Observation book, record and viva.

PAPER – IV: SPECIAL GROUP-II: ECONOMIC ZOOLOGY-II

1. Identification of silkworms.
2. Life history of Bombyx mori.
3. Practice of sericulture – demonstration.
4. Identification of prawns, shrimps and lobsters.
5. Identification of honey bees.
6. Analysis of honey.

PAPER – IV: SPECIAL GROUP - II: APPLIED TOXICOLOGY -II

1. Pesticides residue by TLC technique.
2. AchE estimation in exposed animals (albino mice and wistar rat) for analysis O.P. compounds in animals samples.
3. TLC technique for analysis of O.P. compounds in animal samples.
4. Estimation of RBC & Hemoglobin in lead exposed models.
5. Dermal sensitization in rat.
6. Ocular testing in occupational animals.
7. Variations in glycogen, glucose and free amino acids.

PAPER – IV: SPECIAL GROUP - II: ENDOCRINOLOGY-II(MOLECULAR AND PHARMACEUTICAL ENDOCRINOLOGY)

1. Biochemical tests for Lipid profile (Low density lipoprotein [LDL], High density lipoprotein [HDL], Very low density lipoprotein [VLDL]).
2. Effect of parathormone on serum calcium levels in cultured fish.
3. Effect of catecholamine on blood glucose levels in cultured fish.
4. Quantification of "cortisol" in fed and starved cultured fish.
5. Alloxan induced diabetes & glucose estimation in albino mice or wistar rats.
6. Estimation of estrogen/progesterone in albino mice or wistar rats.
7. Effect of thyroxine on BMR of cultured fish.
8. Study of histopathological slides of cancer tissues/breast/endometrium/prostate.
9. Cytogenetic Investigation – Micronucleus test – Buccal epithelium.
10. DNA isolation from ovary and testis of wistar rat.
11. Quantification of isolated rat DNA and polymerase chain reaction.

