॥ अंतरी पेटवू ज्ञानज्योत ॥

उत्तर महाराष्ट्र विद्यापीठ,जळगाव
NORTH MAHARASHTRA UNIVERSITY,
P.B.NO.80, UMAVINAGAR, JALGAON- 425 001 (M.S)
EPABX:(0257)2252187-90 Fax No:0257-2252183Gram: UTTAMVIDYA

जा.क्र.: उमवि/१२ /विज्ञान विद्याशाखा /१६३३/२००३. दिनांक :१८/०६/२००३

* परिपत्रक क्र.१३५/२००३ *

विषय :- जून, २००३ पासून सुधारित अभ्यासक्रम लागू करणेबाबत....

विद्यापीठ अनुदान आयोगाचे निर्देशाप्रमाणे व विद्यापीठ अधिकार मंडळाने घेतलेल्या निर्णयानुसार **जून, २००३** पासून विज्ञान विद्याशाखेतील पदव्युत्तर विषयांचे खालील सुधारित अभ्यासक्रम लागू करण्यात येत आहेत. कृपया याची नोंद घ्यावी व योग्य ती कार्यवाही करावी.

एम्.एस्सी. (भाग-२)

१) रसायनशास्त्र.
२) प्राणीशास्त्र.
३) वनस्पतीशास्त्र.
४) भूगोल. (एम्.ए./एम्.एससी.)

सदपत्र :- वरीलप्रमाणे अभ्यासक्रमाच्या प्रती .

उपकुलसचिवांकरिता.

प्रति,
मा.प्राचार्य,
सर्व संबंधित संलग्नित महाविद्यालये.

प्रतिलिपी :-
१) मा.अधिष्ठाता, विज्ञान विद्याशाखा.
२) मा.अध्यक्ष, विज्ञान विद्याशाखे अंतर्गत येणारी सर्व अभ्यासमंडळे, उ.म.वि., जळगांव.
३) मा.कुलगुरू कार्यालय, उ.म.वि., जळगाव.
४) मा.कुलसचिव कार्यालय, उ.म.वि., जळगाव.
५) मा.परीक्षा नियंत्रक, उ.म.वि., जळगाव.
६) मा.उपकुलसचिव, संलग्नता विभाग, उ.म.वि., जळगाव
७) मा.पध्दती विश्लेषक, संगणक विभाग, उ.म.वि., जळगाव.
८) मा.सहा.कुलसचिव,परीक्षा (गोपनीय) विभाग,उ.म.वि.,जळगाव.(सोबत-अभ्यासक्रमाच्या ५ प्रती)
९) मा.सहा.कुलसचिव, परीक्षा विभाग, संबंधित विद्याशाखा, उ.म.वि., जळगाव.
१०) मा.कक्षाधिकारी, सभा व दप्तर विभाग, उ.म.वि., जळगाव.

॥ अंतरी पेटवू ज्ञानज्योत ॥

North Maharashtra University, Jalgaon

Syllabus for M.Sc.Part-II. (Semester III & IV)

ZOOLOGY

W.E.From June, 2003

NORTH MAHARASTRA UNIVERSITY JALGAON
SYLLABUS FOR M.Sc [ZOOLOGY]
PART:-II [SEM.III AND SEM.IV]
] W.E.From June, 2003]

SEMESTER – III

Paper –I Any ONE special Paper.

Zoo – 301 Reproductive physiology 80 + 20 marks Internal
Zoo – 302 Physiology
Zoo – 303 Entomology – I
Zoo – 304 Fishery science – I
Zoo – 305 Applied Parasitology –I

Paper – II Any Two course from the following (Zoo 311 to 314)

Zoo – 311 Enzymology 80 + 20 marks Internal
Zoo – 312 Systematics and palaeontology and Organic Evolution
Zoo – 313 Parasitology
Zoo – 314 Biophysics

Paper – III Any Two course from the following (Zoo 315 to Zoo 320)

Zoo – 315 Endocrinology
Zoo – 316 Insect Anatomy
Zoo – 317 Aquaculture
Zoo – 318 Insect development and Insect Ecology
Zoo – 319 Computer Programming
Zoo – 320 Taxonomy, distribution and bionomics of fishes

Zoo – 325 Practical – I

18 Practicals w.r.t. Zoo – 301 to Zoo – 305 – 60 marks
07 Practical w.r.f. Zoo – 311 to Zoo – 314 – 20 marks
(Any one Course)
Internal Assessment ---------- 20 marks

Zoo – 326 Practical – II

07 Practical w.r.f. Zoo – 311 to Zoo – 314 – 20 marks
Any ONE course other than Zoo – 325
09 Practical w.r.f. each for any Two courses from Zoo – 315 to Zoo – 320
(30 + 30) marks
Internal Assesment ---------- 20 mks

Note : Students offering special paper Zoo – 305 Applied Parasitology are not allowed to take course Zoo – 319 Parasitology)

Semester – IV

Paper – 1 any one Special paper

Zoo – 401 Reproductive Physiology – II 80 + 20 marks Internal Assesment.
Zoo – 402 Physiology – II
Zoo – 403 Entomology – III
a) Applied Entomology
b) Insect Physiology
Zoo – 404 Fishery Science – II
Zoo – 405 Applied Parasitology – II

Paper – 2 Any Two Courses from Zoo – 411 to Zoo – 414

Zoo – 411 Physiology of Reproduction 80 + 20 marks Internal. Assesment
Zoo – 412 Pest Control
Zoo – 413 Animal behavior
Zoo – 414 Insect Endocrinology

Paper – 3 Any Two Courses from Zoo – 415 to Zoo – 419 80+20 mks. Int.Ass.

Zoo – 415 Insect toxicology
Zoo – 416 Ichthyology
Zoo – 417 Histochemistry
Zoo – 418 Basic Biotechnology
Zoo – 419 Fish physiology

Zoo – 425 Practical – I

18 Practical w.r.f. Zoo – 401 to Zoo – 405 --- 40 marks
07 Practical w.r.f. Zoo – 411 to Zoo – 414 --- 15 marks
Project work/Review ----------25 marks
Internal Assesment---------- 20 marks

Zoo – 426 Practical – II

09 Practical each for any two course from Zoo – 415 to Zoo – 419 (20+20 marks each)

07 Practical w.r.f. Zoo – 411 to Zoo – 414 (any One course other than Zoo – 425)---------- 15 marks

Project work /Review ---------- 25 marks

Internal Assesment ---------- 20 marks

New Syllabus For M.Sc. Zoology

Zoo 301- Reproductive Physiology –I

1. a) Reproductive strategies in vertebrates.
   b) Reproductive cycles in vertebrates.
2. a) Histology of male &female reproductive organs & accessory reproductive structure .
   b) Hormonal regulation of gamatogenesis in male & females.
   c) Accessory sex organs & their dependence as steroid hormones. Sex determination & sex differentiation.
3. Histological structure of pituitary gland the role of Gonadotropin hormones in male and female reproduction.
4. History of adrenal gland. The role of steroid hormones in reproduction.
5. Pheromones – their occurrence, structure, and physiology.
6. Prostaglandin, their chemical structure, and physiology action.
7. **Physiology of Ovary.**
   - Maturation of ovum & endocrine control of ovarian functions.
   - Ovarian hormones and their actions.
   - Corpus luteum its structure, formation, fate and function.
8. **Physiology of testis.**
   - Growth and develoment of seminiferous epilthelium.
   - Maturation, spermiogenesis.
   - Sperm movement, viability and survival capacitation.
   - Endocrine testis.

Zoo 325 Practical corresponding to zoo 301

Reproductive physiology – I

1. Surgical operation in rat/mice – ovariectomy.
2. Surgical operation in rat /mice. – unilateral adrealectomy.
3. Dissection of rat/mice to expose the endocrine glands.
4. Histological structure of female reproductive organs in relation to sexual cycle in continuous breeders rat/mice/human.
5. Histological structure of thyroid & adrenal gland.
6. Histologucal structure of accessory male and female reproductive organs.
7. Study of various stages of development of mammalian egg. Cleavage, blastula, gastrula.
8. Vaginal samear – vaginal cytology in relation to oestrous cycle.
9. Millon reaction : for detection of proteins.
10. Detection of lipids by Nile blue sulphate method/Sudan black B – method.
11. Estimation of protein in liver and ovaries of rat by Lowry's Method.
12. Estimation ascorbic acid in liver and ovaries of rat by using phenyl hydrazine reagent..
13. Effect of adrenalin administration on liver glycogen of rat/mice.
14. Effect of adrenaline administration on glycogen content of ovaries of rat.
15. Estimation of total gonadal (ovary).cholesterol from rat/mice.
16. Study of different types of sperm by smear preparation (grasshopper, frog ,rat /mice).
17. Effect of castration on accessory sex organs of rat/mice.
18. Demonstration of <u>in vitro</u> fertilization.

Zoo 302 Physiology – I

1. Aim and scope of physiology – cell physiology, mammatian physiology, comparative physiology and applied physiology.
2. Chemical foundations of physiology – solutions, osmotic pressure, diffusion, PK and pH, buffers.
3. Chemistry and metabolic functions of water and fat soluble vitamins, its significances.
4. Metabolism: comparative aspects of the metabolism, fats, phospholipids, purines, pyrimidine, & sterols.
5. Detoxification mechanisms and role of Microsomal enzymes.
6. Physiology and biochemical aspects of aging.

7. Immune responses in animals. Types of immunity and anaphylactic reactions.
8. Physiological, compensation to environmental variation. Tolerance and resistance, acclimation and acclimatizations, patterns of acclimation.
9. ECG and cardiac cycle its significance.
10. Blood pigments: chemistry & role in gas transport.
11. Mechanism of thermoregulation in homeothermal animals, Diapauses, heat stroke.
12. Pressure as an environmental factor and adaptations of animals to high altitudes and oceanic depths.
13. Biological rhythm : rhythmic activity in biological rhythms, (circadian rhythms. Lunar and tidal rhythms). Exogenous and endogenous clock hypothesis.

Zoo 325 Practical corresponding to Zoo 302

Physiology – I

1. To estimate the quantity of digestive enzyme in hepatopancreas of crab, liver of frog or rat.
2. Determination of iodine number from a given sample (oil).
3. To estimate amount of fat presents in the tissue by chloroform method/extraction method.
4. Determination blood sugar level of human blood.
5. Study of reflex actions with suitable animals.
6. Estimation of O_2 consumptions in crab in relations to temperature by winkler's modified method.
7. Estimation of O_2 consumptions in crab in relation to salinity, by winkler's modified method.
8. Effect of salinity on blood chloride of crab.
9. Determination of Glomerular filtration rate by creatinine clearance test method.
10. Perfusion of heart and counting of heart beats (any suitable animal).
11. To study the phenomenon of equilibrium by dialysis.
12. Experiments to show diffusions.

Zoo 303 Entomology – I

Origin of insect relationship among the orders of insect.
Classifications of following insects orders up to families.
01) Thysanura. 02) Collembola. 03) Ephimeroptera. 04) Odomata. 05) Orthoptera Ensifera – Tettigoniidae, gryllotalpidae, Caelifera – Acrididae. 06) Dictyoptera – Blattidae, mantidae. 07) Phasmida. 08) Dermaptera. 09) Isoptera. 10) Mallophaga. 11) Siphanculata. 12) Hemiptera – sub order –homoptera fulgoridae, cicadidae, cicadellidae, cicadellidae alerodidae, aphididae,sub order –heteroptera-cimiadae pyrrhocoridae, pentatomidae, Belostomatidae. 13) Thysameptera. 14) Coleaoptera – sub order – Adephaga – carabidae, Dytiscidae, sub order –Polyphaga – Hydrophilidae, Staphylinidae, Scarabaeidae. Buprestidae, Cantharidae.Dermestidae,coccinellidae, Tenebrionidae,meloidae, curculionidae 15) Diptera – i] Sub Order – Nematocera, Culicidae, Chironomidae.
ii] Sub Order – Brachycera – Tabamidae. Sub Order – Cyclorrhapha – Syrphidae, Muscidae, Hippoboscidae, Glossinidae. 16) Lepidoptera – Nymphalidae Pieridae, papilionidae. Geometridae, Sphingidae, Noctuidae, Saturniidae. 17) Hymenoptera – Sub Order – Symphyta – Tenthreadinidae. Sub Order Apocrita – Ichneumonidae, Braconidae, Apidae.
Integument and its derivatives. Comparative study of head and its appendages thorax and its appendages. Abdomen and its appendages.

Zoo 303 – Entomology – I

Reference Books

1. Imm's text book of entomology by O.W.Richards & R.G Davies (Mathuem & com, London 1977) vol. I & II .
2. Principles of Insect Morphology by R.E Snodgrass (Tata Mc Graw Hill Bombay 1978).
3. Introduction to comparative Entomology by R.M. Fox and J.W. Fox (Reinhold, NewYork 1964).
4. The Insects:- Structure and Function by R.E. Chapman (ELBS and EUP London, 1972).
5. General Applied Entomology by K.K. Nayar, T.N. AnanthaKrishan & B.V. David (Tata McGraw Hill, New Delhi. 1976).

Zoo 325 Practical

Corresponding to Zoo303 Entomology – I

1. Collection and preservation of Insects.
2. Classification of insects up to order.
3. Collection Preservation and identification of at different orders 50 insect species belonging to different orders and families.
4. Histogy of integument and study of derivatives of integument.
5. Comparative study of head – any 4.

Grasshopper, honey bee, vasp(Adult or larvae) Beetle, Red Cotton bug, House Fly etc.

6. Study of types of mouth parts and antenna.
7. Study of types of legs, wings, & veination.
8. Study of abdominal appendages.
9. Compulsory visit to agriculture college, University or institute.

Zoo 304 – Fishery Science – 1

1. Food & feeding habits of fresh water fishes and prawns, Gastro somatic index.
2. Reproduction, embryonic & Larval development of freshwater fishes and prawns, Spawning habits, gonosomatic index, fecundity & breeding
3. Feeding behavior and Parental care in care in some fishes. Direct nurseries and indirect nurseries.
4. Age and growth – length weight relationships, growth curve, vital ponderal index, condition factor, scale as an indication of growth of the fish.
5. Migration for feeding, breeding and development.
6. Fish population studies – Population structure, Estimation of fish population. Population dynamics and growth fluctuations.
7. Transport and marketing of fishes.
8. Conventional and unconventional methods of fish collection.
9. Applied genetics of cultivable fishes.
10. Riverine fisheries of India.
    a. Ganga System
    b. Brahmaputra System
    c. Indus System
    d. East coast system
    e. West coast system
11. Fisheries of Lakes and reservoirs.

LIST OF BOOK ON FISHERY SCIENCE

	AUTHOR	NAME OF BOOKS
1.	Jhingran V.G.	Fish and fisheries of India.
2.	War and whipple	Fresh water biology.
3.	Hickling C.G.	Tropical Indian Fisheries.
4.	Neoduhan Neodham	A guide to the study of fresh water biology
5.	Bardach J.E.	Agriculture the framing and husbandary of freshwater and marine organisms.
6.	Huett Marcel	Text book of fish culture breeding and cultivation of fish.
7.	Hickling C.G.	Fish culture.
8.	Kurian C.V. and Sebastian V.D.	Prawn &Prawn fisheries of India.
9.	Hanson J.A.	Shrimp and prawn farming in the western Hemishphere.
10.	Alabaster J.S.	Water quality criteria for freshwater fish.

Zoo 325 PRACTICALS CORRESPONDING TO ZOO 304 FISHERY SCIENCE – 1

To 3 Study of some herbivorous, carnivorous, larvivorous, omnivorous & detritus fishes.

4) Analysis of gut contests of some locally available fishes.
5) Study of microscopic observation & counting of diameter of egg.
6) & 7) Study of life histories of selected edible fishes.
8) Observation of different types of fins in fishes.
9) Computation of length, weight relationship & indices on the basis of observation on fish population.
10) Demonstration of different type of boats & nets.
11) Fish parameter.
12) Parental care of fishes.
13) Observation of different types of scales, estimation of growth and age of fishes on the basis scale.
14) Field trip to fish farm etc.

M.Sc. Syllabus (ZOOLOGY) Semester III

Any One Special Paper

Zoo – 305 – Applied Parasitology I

1. Classification of parasitic protozoa – saracomastigophora, Apicomplexa, Myxozoa, Microspora and Cbibophora.
2. Patterns of life cycle in parasitic protozoa.
3. Flagellate parasites of digestive system and urinogenital tract of human and domestic animals.

4. Geographic distribution , habits, habitat, life cycle, transmission, pathogeni -city, diagnosis, prevention and treatment of :
   i. Trypanosomes of human and domestic animals.
   ii. Leishmania of human and domestic animals.
   iii. Naeglaria fowleri
   iv. Coccidic of poultry, sheep, goat and cattles.
   v. Plasmodidae.
5. Types of malaria, clinical features, diagnosis, immunity , prevention and treatment.
6. Piroplesmia, Toxoplasmia sarcocystis, Isospora, Balantidum and Pnemocystic infections.
7. Outline classification of Monogenes and terematodes.
8. Biology of eggs in trematoda.
9. Biology of larvae of trematodes.
10. Patterns of life cycle in treamatodes.
11. Geographical distribution, habits, habitat diagnosis prophylaxis and treatment of following representative types.
    a) Clonorenis sinensis.
    b) Fasciolepsis buski.
    c) Paragonimus westermanii
    d) Schistosome mansonii.
12. Brief introduction to pathogenic microbes,Viruses,Rickettsiae, Spirochaetes & Bacteria .
13. Parasitism – concept, origin, evolution, advantages & disadvantages in parasitic life
14. Classification of parasites according to habitat, microenvironment , degree of host specificity , association with host , behavior , evolution, taxonomy etc.
15. Kind of host - Definitive, intermediate, primary, secondary, specific, paratenic, carrier ,susceptible, resistant, accidental, reservoir, vector etc.
16. Mode of parasitic invasion - passive mechanical, active, contact, transovarial Pathway of entry sites of habitation.
17. Host specificity -- Definition, origin types structural, physiological, ethological, tissue response ecological, phylogenetic.
18. Habitat & environments of parasites – Vertebrate - digestive system, blood, reticulo – endothelial system & other micro- habitats ; invertebrate – environmental condition at different habitats , intra & inter specific competition the environment.
19. Structure, physiological and biological adaptations of parasites for infectiousness, establishment and transmission;
    Shape, size, attachment and protective devices; feeding mechanism, locomotion, respiration, metabolism, reproduction, life cycle, regressive change, resistant and quiescent free living stages.
    Parasitism – specialization or degeneracy?
20. Host – Parasite system: effects of parasites on the hosts - - mechanical, nutritional, destructive, toxic, biological etc.
    Host's is reaction to parasites – resistance, compatibility, immunity, cellular and tissue reactions – phagocytosis, information, repair, abnormal growth, humoral reaction (physilogical resistance, immune response etc), premunition, avadance of parasites by hosts, influence of hosts on parasitic life cycle.

18 Practical/Corresponding to Zoo 305

Zoo 325 – Practical I – 18 Practical w. r. t. Zoo 305

1. Study of skeletal structures and locomotors organelles in parasitic protozoa.
2. Study of protozoan parasites: Leishmania, Trypanosoma, Herpetomonas, Leptomonas, Chilomastic, Giardia, Histomonas, Opalina, Trichomonas, Trichonympha.
3. Study of protozoan parasites: Endolimax, Entamoebae, Naegleria, Eimeria, Gregarina, Monocystis, Plasmodium, Sarcocystis, Toxoplasma, Myxosoma, Nosema, Balantidium, Ichthyopthirius, Nyctotherus.
4. Host autopsy - Recovery of protozoan parasites from a suitable host (Goat, Chicken, Fish).
5. Host autopsy – Recovery of Trematode parasites from suitable host (Goat, Chicken, fish, bird, rat, cockroach, frog etc.)
6. Methodology for preparation of parasitic specimens for the study.
7. Blood smear preparations (Thin and thick) for alimentary canal.
8. Smear preparation for parasitic protozoa from alimentary canal.

9. Smear preparation for parasitic protozoa of gall bladder.
10. Smear preparation for parasitic protozoa of urinary tract.
11. Facal smear technique for protozoan cysts and trematode eggs.
12. Zinc sulphate flotation technique for protozoan cysts and trematode eggs.
13. Formalin – ether centrifugation technique for schistosoma eggs.
14. Study of hold fast organs and alimentary canals in trematodes.
15. Study of uteri and eggs in trematodes.
16. Study of larvae in trematodes.
17. Examination of cercaria from snail by vital staining method.
18. A visit to a pathological laboratory to study parasitic. Technique and submission of a report.

Reference Books for Zoo 305 and Zoo 405

Applied parasitology I and II

1. Burnet M and D.O. White (1972): Natural history of infections diseases. Cambride Uni. Press Cambridge, London, NewYork.
2. Boycott J.A.(1971) : Natural history of infections diseases : Edward Arnold, London.
3. Chandler and Read (1970) : Introduction to Parasitology, Wiley Eastern, Delhi.
4. Chatterjee K.D. (1976) : Parasitology in relation to clinical medicine, Chatterjee Medical Publication, Calcutta.
5. Cheng T.C. (1970) : General Parasitology Saunders, Philadelphia. London, Toppan, Tokyo.
6. Dogiel V.A.(1964) : General Parasitology, Oliver and Boyd, Edinbergh and London.
7. Jones A.W. (1967) : Introduction to Parasitology; Addison Wesley, Reading, London.
8. Lapage (1951) : Parasitic Animals, Cambridge University press, Cambridge, London.
9. Levine N.D. (1961) : Protozoan Parasites of Domestic animals and man.
10. Levine N.D. : Nematode parasites of domestic animals and man Burgess Publication. Minneapolis.
11. Noble and Noble : Parasitology. the biology of animals parasites, Lea and Febiger, Philadelphia.
12. Read C.P. (1972) : Animals Parasitism : Prentice Hall Inc. Englewood.
13. Smith J.D. (1962) : Introduction to Animal Parasitology, English Univ. Press, London.
14. Fraust and Russel : Clinical Parasitology.
15. Cameron : Parasitism.
16. Van Brand : Biochemistry of Parasites.
17. Kelkar and Kelkar : A Textbook of Parasitology.
18. Schmidth : Essentials of Parasitology.

Zoo – 311 Enzymology

1. Introduction ; A brief history of enzymology.
2. Enzyme Structure and properties :
   i. Primary and secondary structure.
   ii. Tertiary structure.
   iii. The active site.
   iv. Quaternary structure
   v. Enzyme purification.
3. Enzyme Activity :
   i. Methods of Investigating the mechanisms of enzyme catalyzed reactions :- Isotope labeling. Kinetics methods (enzyme velocity, units), steady – state methods, continuous methods, Radioassays.
   ii. Steady – state enzyme Kinetics :- Effect of substrate concentration on Initial velocity ÷ Henri – Michaels – Menten Hypothesis, Briggs – Haldane Hypothesis, Determination of K_m and Vmax, derivations from Hyperbolic Michaels – Menten Behavior, Enzyme Immunoassay(ELISA & EMIT).
4. Enzyme Physiology :
   i. Sub cellular Fractionation (Homogenization and differential Centrifugation).
   ii. Enzyme Localization (membrane enzymes, Nuclear enzymes, Mitochondrial enzymes, Cytoplasmic enzymes, Lysosomal enzymes).

iii. Structure and properties of some iso enzymes – LDH, Glucose – 6 – phosphate dehydogenase and carbonic anhydrase.

5. Enzyme Inhibition : competitive and non – competitive inhibition, Allosteric activation and inhibition – sequential and concerned symmetry models.
6. Immobilized enzyme and their applications.
7. AIDS HIV Enzymes - (Three dimensional structures), HIV-PR and its Inhibitors.
8. Biochemistry of AIDS therapeutics.

Refrence Books

1. Nicolas, C: Price and Lewis Stevens,1993.Fundamentals of Enzymology 2nd edn. Oxford University Press, New York.
2. Foster,R.L. Essentials of enzymology,1980, Croom Helm London.
3. Foster, R.L. The Nature of enzymology,1980, Croom Helm London.
4. Lehninger, A. L. Principles in Biochemistry, CBS Publication, New Delhi.
5. Samuel Delvin, Enzyme, I st edn. 2000, Sarup & Sons, New Delhi.

Reference Books

- Methods in Enzymology (Vol-I to IV)- Edited by Sidney P. Colowick and Nathan O. Kaplan, 1955, Academic Press, New York, San Francisco, London.

Practical w.r.f. Zoo 311

1 Preparation of tissue Homogenates and fractionation of liver cell components.
2 Purification of human salivary amylase.
3 Determination of α – amylase activity by starch digestion.
4 Determination of tryptic activity by casein digestion method.
5 Determination of pancreatic lipase activity.
6 Determination of acid phosphatase activity.
7 Determination of amino acid sequence in enzyme protein.

Zoo 312 SYSTEMATICS PALAEONTOLOGY AND ORGANIC EVOLUTION.

I) Systematic :-

A) Trends in systematic.
- i) Chemotaxonomy.
- ii) Cytotaxonomy.
- iii) Molecular taxonomy.

B) Taxonomy.
- i) Approach to systematic concept of classification theories of classification, Linean hierarchy.
- ii) Taxonomic practice and binomial nomenclature.
- iii) Taxonomic procedures -- taxonomic collections, preservations, cureting process of identification.

II) Palaeontology.
- i) Process of fossilization, Radiometric dating.
- ii) Different eras of geological time scale with particular emphasis on climate flora and fauna. Distinctive features of existing species and new addition during the eras.
- iii) Coal ball formation.
- iv) Microfossil. Oil exploration.

III) Evolution.
- i) Concept of evolution and theories of organic evolution with an emphasis on Darwinism.
- ii) Evidences in support of organic evolution
  - (a) Serological. (b) Physiological.
  - (c) Zoogeographical. (d) Genetical.
  - (e) Taxonomical. (f) Palaeontological.
- iii) Sources of variation, Mutation, recombination, Natural selection.
- iv) Isolation mechanism – Geographical and Reproductive.
- v) Mechanism of speciation in panmictic and apomictic species.
- vi) Species concepts, species category subspecies and other infra specific categories.
- vii) Synthetic theory of Evolution. Role of Natural selection, mutation and Recombination.

References

1. Biology of Biodiversity M. Kats, Springer.

2. J.C. Avis Molecular Markers. Natural History and Evolution Chapman and Hall. New York.
3. Biodiversity, E.O.Wilson. Academic Press Washington.
4. Organic Evolution Lull.
5. Vertebrate paleontology by Roomer.
6. Animal Taxonomy – Theodore savory.
7. Principles of Animal Taxonomy Simpson G.G. Oxford.
8. Biological Nomenclature. Charles Jeffrey
9. Numerical Taxonomy – Cole A.J.
10. Evolution of Vertebrates – Colbert.
11. Vertebrate Paleontology – Olson.
12. Paleontology – Shrock.

Zoo 325 Practical Corresponding to Zoo 312 Systematic , Paleontology and Organic Evolution.

1 – 4. Systematic classification up to species from any two of Invertebrates and any two of vertebrate groups with help of key.

5. Study of palaeontological specimen.
   a. Mesozoic Reptiles – Models /Chart.
   b. Fossil Birds – Archaeopteryx Models /chart.
   c. Human fossils – models /charts.
6. Study of different types of fossils w.r.t. Geological time scale.
7. Study of there evolution – model/chart.
8. Visit to museum, coal mine or oil exploration area or fossil sites in Indian sub continent.

ZOO 313 : PARASITOLOGY

1. Introduction, scope and significance.
2. Evolution of Parsitism. Pace of Parasite evolution, rules of affinity, parasite host co-evolution, biological races, progressive and regressive evolution.
3. Origin of specific groups of parasites : Protozoa, Platyhelmintes, Acanthocephala, Nematoda, Arthropoda.
4. Pheromones in parasites.
5. Parasites induced immune reaction in vertebrates and invertebrates.
6. Parasitism and genetics.
7. Stress and Parasitism.
8. Population ecology of parasites.
9. Parasites and Zoonosis : Viral, ricketsia, Bacterial, Protozoan, Helminthes and arthropodises.
10. Biocontrol of parasites.
11. Study of life cycle. aetiology. diagnosis, preventive methods, treatment etc. of the following parasites.

a. Entamoeba histolytica.
b. Plasmodium falciparum.
c. Leishmania donovani.
d. Schistosoma species.
e. Trichinella spiralis.
f. Ancylostoma duodenale.
g. Enhinococcus granulosus.
h. Sarecoptes scabiei.

REFERENCES

1) Chandler, A.C & C.P. Read(1970), "Introduction to Parasitology", Wiley Eastern, Delhi.
2) Cheng, T.C.(1964), "The Biology of Animal Parasites", Saunders Philadelphia, London and Toppa, Tokyo.
3) Chattergee, K.D., "Parasitology in relation to clinical medicine.", Chatteergee Medical Publications, Calcutta.
4) Croll, N.A. – "Ecology of Parasite", Heinemann, London.
5) Jones, A.W. – "Introduction to Parasitology", Addison – Wesley, Reading Mass.
6) Lapage, G. – " Parasitic Animals", Cambridge, London.
7) Noble & Noble : "Parasitology", The Biology of Animal Parasites, fifth edition, Lea & Febiger, USA.

ZOO 325 : PRACTICALS CORRESPONDING TO ZOO 313 : PARASITOLOGY.

1) Study of life cycle stages of protozoans parasites.
2) Study of life cycle stages of Platyhelminthes parasites.
3) Study of life cycle stages of Nemathelminthes parasites.
4) Study of life cycle stages of Arthropodan parasites.
5) Study of vectors.
6) Study of cloacal or intestinal parasites from any suitable animal.
7) Study of geographical distribution of some parasites (use map).

Zoo 314 Biophysics.

1. Biophysics scope and applications.
2. Molecular Biophysics structure of atoms and molecules physical forces in stabilization of bio-molecules e.g. hemoglobin, keratin, ribonuclease, concepts and laws of thermodynamics, thermodynamics and living state. Biogenetics principles, ATP as energy of cell Free radicals in Biology.
3. Biophysical chemistry. Structure and properties of water, amino acids, proteins, nucleic acids, lipids, carbohydrates, vitamins, hormones metabolism and integration.
4. Biophysics of cell organization of prokaryotic and euknyotic cells, cell size and cell cycle, growth kinetics, tumor growth, cell membranes structure and function, cell surface change, diffusion, osmosis, Domain equilibrium, active transport, Proton AT pases.
5. Molecular enzymology – General properties of enzymes, active sites of enzyme, Michaelis and Menton equation, Linewenver Burk plot, signification of Vmax, km,kp. Enzyme inhibition, effect of pH, temp.
6. Biophysical techniques – Principles and applications of colorimetry UV-VIS Spectrophotometry. Atomic Absorption Spectroscopy, NMR ESR spectrum, Viscometry. Microscopy-compound, phase contrast. fluorescence HMSEM, chromatography – paper, TLC, gas, lon – exchange, affinity, electrophoresis – paper, PAGE, agar gel, immunoelectrophoresis, centrifugation RCF, velocity, equilibrium, density gradient, differential.
7. Radiobiology photobiology, radioactivity, isotopes and half life effects on living system, use of radioisotopes in biology and medicine auto radio –grapy, radio immunoassay, bioluminescence, photochemical filtering of solar radiation optical traction fluorescence, Phosphorescence solar energy and living system photosynthesis, photoperiodism. Photo taxis, photo moprphogensis, UV effect on DNA
8. Electrophysiology . Active potential, nature and measurement of electrical signals from living body, Principle & use of Bioelectric transducers ECG, EEG, EMG, ERG, EOG
9. Molecular Genetics – Structure and function of DNA and RNA, DNA replication gene expressions, molecular basis of mutations, types of mutations genetic transfers in prokaryotes and eukmyotes – transformation, tranduction, conjugation, transposition, linkage, crossing over, principles and applications of DNA hybridization techniques.
10. Concepts in immunology & immunochemistry, immunglobulins, immune reactions principles, methodology and applications of immuntechniques.
11. Bioinformatics concepts fundamentals and basic computing for biologist, Basic computing for biologists, Biological databases (sequence database, Nucleic acid databases, Gene bank, protein database, ------), Sequence analysis, Tools for bioinformatics, Protein prediction Emerging areas of Bioinformatics.

Practicals

1. To verify Lambert Beer's law evaluate molar extinction coefficient using inorganic salts.
2. To determine molar rotation of anion acids/sugars using.
3. To determine effect of concentration on viscosity of protein solution using Oswald viscometer.
4. To estimate the protein by Biuret/Folins method.
5. To record and analyse the ECG.
6. To record and analyse BRG of Cockroach (by demonstration)
7. To isolate and study the chlorophyll absorption spectra.
8. To separate the amino acid by paper/TLC.
9. To separate the amino acid by paper electrophoresis.
10. To fractionate the serum proteins by PAGE.

11. To convert compound microscope into phase contrast microscope and determine concentration of proteins in living cell.
12. To isolate DNA from liver cells.
13. To study immune reaction by immunoelectrophoresis.
14. To isolate and study cell organelles by differential ceutirfugation.
15. To perform basic operations in computer using Pentium – 4.
16. To study and demonstrate the educational and molecular modeling software.
17. To evaluate the kinetic parameters – Vmax, Km, Kp of enzyme alpha amylase.
18. To study the effect of pH and temp. on enzyme nativity.
19. To study the effect of detergent on RBC membrane.
20. To grow and study the crystals of biomolecules.
21. To study the Characteristics of absorption spectra of protein.
22. To demonstrate and study the bioluminescence in firefly.

Reference Book

1. Introduction to Bioinformatics - S. Sunder Rajan, R. Balaji, Himalaya Publishing House.
2. Biophysical Sciences - Ackemann, E.A, Billa L.E.E. & Williams L.E. Prentico Hill
3. Physical chemistry for life sciences - Barrow, C., McGraw Hill
4. Biophysical chemistry - Calton C.R. & Sclemmel P.R. W.A. freeman & Co., New York
5. Biophysics, concept & Mechanisms - Casey E.J., Afflinated enst west Press Pvt. Ltd. New Delhi
6. Basic priciples of spectroscopy - Change R., McGraw Hill
7. Essentials of cell and molecules Biology - Dc Robertis E.D.P. & De Roberts E.M.P. International Editions
8. Aspects of Biophysics - Hoghese W. John Wlley and sons
9. Introduction to biological membrane - Jain M.K. & Wugner R.C. John Wiley & sons
10. Enzyme Kinetics - Segol F,II., John Wiley & sons
11. Molecular Biophysics - Selow R.B. & Polland E.I., Penganon Press
12. Foundation of Biophysics - Staond J.R., Acadmic Press
13. Biochemistry
14. Molecular Biophysics
15. Biophysical Chemistry
16. Biological radiation
17.

Zoo 315 Endocrinology

1 Aims and Scope of endocrinology.
   i Definition.
   ii Discovery of hormones.
   iii Hormones as messengers.
   iv Classification of hormones.
2 Neuroendocrine relationships, neurosecretions in the vertebrates and invertebrates.
3 Phylogeny of endocrine glands.
   i Pituitary, Thyroid, Pancreas, Adrenals, Gonads.
   ii Histology of the above glands.
   iii The hormones they secrete and their role.
4 General principles of hormones action.
   i Nature of hormone action.
   ii Hormone receptors and mechanism of hormone actions.
   iii Hormones and homeostasis.
   iv Hormonal; regulation of carbohydrate, protein and lipid metabolism.
5 Hormone structure and evolution.
   i Chemical nature of hormones.
   ii Gross features of hormone.
   iii Evolution of protein hormones and their receptors.

6 Hormones and Behavior.
7 Hormones, Growth and Development.
8 Hormone, control of digestion and renal function.
9 Hormonal control of amphibian metamorphosis.
10 Hormones and Reproduction –
   i Hormonal control of reproductive cycles in vertebrates.
   ii Seasonal breeders.
   iii Continuous breeders.

References

1. E.J.W. Barrington. General and comparative endocrinology, Oxford, Clarendon Press.
2. P.J. Bentley, Comparative vertebrate endocrinology Cambridge University Press.
3. R.H. Williams. Text Book of endocrinology W.B .Saunders.
4. C.R. Martin endocrine physiology oxford Univ. Press.
5 A Gorbman etal. Comparative endocrinology john Wiley & sons.
6. C.D. Turner & J.T. Bagnara (1976) General endocrinology.

Practicals with respect to Zoo 315 Endocrinology

1. Dissection of any suitable vertebrate animal pertaining to endocrine glands
2. Histology of endocrine glands.
3. Bioassays for hormones - Androgens, estrogens and pituitary gonadotrophins.
4. Detection of the stages of estrous cycle in mice by using vaginal smear.
5. Experiment - Tubectomy in female mice and vasectomy in male mice.
6. Isolation and characterization of a steroid hormone.
7. Purification of any protein hormone.
8. Surgical techniques like adrenalectomy and thyroidectomy in rat or mice.
9. Surgical techniques – ovearioctomy in rat/mice.
10. Submission of 5 permanent slides of endocrine glands of rat/crab/prawn/cockroach.

ZOO 316 INSECT ANATOMY

1. Comparative anatomical and histological study of the following:-
   i. Alimentary canal and associated glands.
   ii. Circulatory system.
   iii. Ventillatory system.
   iv. Excretory system and fat bodies.
   v. Nervous system.
   vi Sense organs and exocrine glands.
   vii. Reproductive system.
2. Light and sound producing organs.

Reference Books

1. The insects – structure and function by
   R.F. Chapman (ELBS) London 1972
2. The text book of Entomology by H.H. Ross.
   John Wiley & sons) Inc. New York 3rd ed 1965
3 Imm's Text book of Entomology by
   O.W. Richards & R.G. Davias (Methuen London 1977) Vols. I and II.

ZOO 326 – Practical – II

Practical related to Zoo 316 Insect Anatomy.

1. Dissection of Grasshopper to study the following systems –
   i. Digestive systems
   ii. Reproductive system.
   iii. Nervous system.
2. Mountings from Grasshopper –
   spiracles, tympanum, and Genetalia.
3. Dissections of plant bug, Beettle, Butter fly, House fly, Honey bee related for study of their anatomy of (any Three Insects)
   i Alimentary canal.
   ii. Reproductive system.
   iii. Nervous system.
   iv. Mounting of Halter.
4. Histology of different organs of Alimentary canal, Tracheae, heart, muscle and blood of Insects.
5. Visit to different entomological Institutions.

ZOO 317 AQUACULTURE

1) Introduction -

Definition, principles, History, Purpose of aquaculture, Types of fish farming- Fresh water, brackish water, Mari culture and metahaline aquaculture –

2) Physical condition of water : Depth, Temperature, Turbidity & Light.
3) Chemical condition of water : Oxygen, carbon dioxide, Total alkalinity, pH, Total hardness, Total Dissolved solids.
4) Biological condition of water : Aquatic vegetation, plankton and benthos.
5) The Soil Types, soil fertility, chemical condition of soil, Calcium, carbonate – phosphorous system & Iron phosphorous system.
6) Trophic level, Food chain, concept of productivity, methods of measuring productivity, classification of water bodies.
7) Construction of fish farm :-
   Structure of fish pond, construction of pond, type of fish ponds.
8) Water recirulation system for fish culture.
9) Fish farming with agriculture and livestock.

REFERENCE BOOKS

1) A manual of fresh water aquaculture by R Santhanam & Natarajan – Oxford & IBH publishing Co Ltd., New Delhi.
2) Freshwater aquaculture by R K Rath – Scientific publisher Jodhapur.
3) Fish & Fisheries of India by V G Jhingran.
4) Fishes of India by K C Jayraman
5) World fish farming, Cultivation & Economics by Brown E E
6) Cago Aquaculture by Beveridge M
7) Inland Fisheries Vol. I & II by P.K. Talwar & AG Jhingran
8) A T B of Fish Biology and Indian Fisheries by R P Parihar
9) An Introduction of fishes by S S Khanna
10) Aquaculture by John E Bardch , J H Rhyther & W D Mclarney

Zoo 326 : Practicals corresponding to Zoo 317 Aquaculture.

1) & 2) – Aquaculture instrumentation :-
   a) Nensen's bottle
   b) Reversing thermometer
   c) Secchi disc
   d) B O B incubator
   e) Paterson dredge
3) Study of estimations in aquaculture –
   i) Oxygen Estimation
   ii) Carbon dioxide estimation.
   iii) Total alkalinity.
   iv) Turbidity.
   v) Total hardness.
4) Study of organisms constituting & utilizing various tropic levels.
5) Study of energy flow through the trophic levels in aquatic environment.
6) Certain important measurents parameters & conversion table for worker.
7) Visit to any fishery pond or reservoir.

Zoo 318 Insect Development and Insect Ecology.

1) Early Development of the embryo. Cleavage, Gastrulation, Formation of Segments and appendages, Blastokinesis.
2) Late, Embryonic or Definitive : Development :- Organogenesis : Mesodermal organs, Endodermal organs, alimentary canal. Eclosion.
3) Post embryonic Development : types of metamorphosis Physiology of metamorphose is.
4) Insect and Its Environment.
   i. Intra specific Relations :- Concurrence, cannibalism, Parental care, Social life.
   ii. Intera specific relations :
      a. Other animal as enemies of insects.
      b. Insects as enemies of other animals –predators, Parasitism – Blood sacking parasitism and Entomophagous parasites.
      c. Insects as vectors of diseases of animals.
   iii. Inter-relation with plants :- Plants as enemies of insects, insects as enemies of plants – plant galls.
   iv. Dormancy – diapauses – preparatory phase, induction phase, refractory phase, termination.

References

1) General Entomology. M S Mani. IBH Publishing co Pvt Ltd. New Delhi.

2) Imm's Text Book of Entomology by O.W.Richards and R.G. Davias. Vol. I and II.
3) The Insects - Structure and function by R.E. Chapman (ELBS) London.
4) Embryology of Insect and myriapods.O.A. Johanson and F.H. Batt. (McGraw Hill, New York).

Practical Corresponding to Zoo 318.

1) Insect Eggs Mosquito, housefly, etc. Ootheca Cockroach, grasshopper, egg.
2) Insect larvae – Different types x poda oligopola, polypoda,
3) Pupae –different types.
4) Parental Care - Hydrophilid female, belastomatid male, worker ant
5) Predators - odonata, water striders, dytiscidae.
6) Blood sucking parasites - Lice, flea, mosquito, Bed bug
7) Insect as vectors of disease of Animals - Bug, Louse, Fleas, Mosquito.
8) E - surface Tension Gerri's.
9) E - Trophisms – Phototrophism +ve, –ve cockroach & others. Thgmotriphism – Dermatera – any available insect.
10) Aquatic insects and their adaptations e.g. Nepa, Ranatra, Belostoma, Dytiscus, Naid (Dragonfly Nywph) Gerris.

Zoo : 319
Computer Programming

1) Introduction to Computer.
   i Five parts of computer : input unit, output units, memory, arithmetic and logic units & control units.
   ii) Types of computer – digital analog. General purpose & specific purpose, micro computers, mini computers, main frame computers & super computers.
   iii) Primary memory & secondary memory, RAM & ROM.
   iv) General terminology used by computer specialists, hardware, software, computer interpreter.
   v) Secondary storage devices floppy disc, magnetic tape.
2) Introduction to number system - Decimal number system, Binary number & vice verse.
3) Computer programming language : BASIC – Turbo BASIC version is expected :
   i Input output statement : LET, INPUT, READ, PRINT, USING, LPRINT.
   ii. Control statements : If THEN, IF – END, IF – ELSE : ENDIF SELECT CASE END SELECT.
   iii. Loops - for – NEXT WHITE - WEND, DO WHILE – LOOP, DO UNTIL LOOP.
   iv More BASIC STATEMENT – DIM, REM,SWAP.
   v. Built in function – ABS, INT, RND, CELL, LEFTS RIGHTS ,MIDS STRINGES, VAL, STRS.
   vi Programming using C.
4) Programmers vs. Software products : Emergence of software engineering
   i. Early computer programming.
   ii. High – level language programming.
5) Introduction to graphics High resolution & medium resolution, Statements for graphics – PSET, PRESET, GET, PUT, WINDOW.

Reference Books

1 Using Turbo Basic :F.E.Mosher,
D.J.Schneider, Pub. Barland Desborne McGraw Hill.
2 Fundamentals of software Engineering :
by Rajib Mall, Prentice Hall of India Private Limited New Delhi.

ZOO : 326 PRACTICALS CORRESPONDING TO ZOO : 319
COMPUTER PROGRAMMING.

1. Preparation of frequency distribution when classes are given.
2. Drawing of simple bar diagram and histogram.
3. Determination of mean & standard deviation for ungrouped & grouped data.
4. Determination of correlation coefficient for ungrouped data.
5. Fitting of regression line for ungrouped data.
6. Testing of single mean & two means for large and small sample.
7. X2 test for i) goodness for fit ii) independence of attributes.
8. Use of Internet for finding Research Publication References.

N.B. Concerned teacher may have some more allied practical suitable for the laboratory.

ZOO 320 - TAXONOMY, DISTRIBUTION AND BIONOMICS OF FISHES

1. Classification and characters.

2. Origin & evolution.
3. Ecological & classification of fishes factors governing distribution in marine, estuarine & freshwater habitats.
4. Exo & Endoskeleton and Jaw suspension.
5. Hill stream fishes.
6. Larvivorous fishes.
7. Zoogeography of Indian fishes.
8. Adaptation in fishes
9. Extinct fishes.
10. Coloration in fishes.

ZOO 326 PRACTICALS CORRESPONDING TO ZOO 320
(TAXOMONY, DISTRIBUTION AND BIONOMICS OF FISHES)

1 to 3) : Identification of bony and cartilaginous fishes up to species level (appro. 25 fishes.)
4, 5) : Identification of hill stream and larvivours fishes.
6) : General adaptations in fishes.
7) : Extinct fishes.

Zoo 401 Reproductive Physiology – II

1. Fertilization - Chemo taxis.
   - Early development of embryo
   - Pre implantation changes.
   - decidual reaction.
   - Pseudo pregnancy.
2. Implantation - Morphological and physiological relationship between blastocyst and uterus during implantation.
   - Delayed pregnancy and it's hormonal control.
   - Uterine changes during pregnancy.
   - ecotopic pregnancy.
3. Fetal Membranes : Types, Structure and modifications in various mammals (Marsupialia, insectivore, Chiropters, rodents).
4. Placenta
   - Types of Placenta.
   - Histological structure placenta.
   - Physiological, hormones and its role
   - utero placental, circulation.
   - Placental haematoma, hippo manes.
   - Fertility regulation.
5. Purpose and importance of birth control.
   - Family planning programme in India.
   - Premature birth problems.
6. Female - contraception : Types of Contraceptives.
   - Traditional, Modern methods and their efficiency.
   - Advantages and disadvantages Biology and Chemistry of Contraceptives.
   - Permanent Methods.
   - Recent advances in fertility regulation.
7. Male contraception : Available Methods and recently developed methods
   - Advantages and disadvantages.
   - Mode of action.
   - Anti fertility drugs.
8. Male and female sterility problems.
9. Artificial insemination in form animals.
10. Remedies of population control.

Zoo 425 Practical Corresponding To Zoo 401

1) Operation in rat/mice – Tubectomy.
2) Surgical operation in rat/mice – vasectomy.
3) Collection of Mammalian sperms.
4) Total Count of sperm from rat/mice.
5) Study of histological slides of placentas.

Reproduction Physiology – II

6) Dissection of male and female rat/mice so as to expose reproduction system.
7) Surgical Permanent preparations of histological slides from male and female reproductive organs.
8) Types of contraceptives.
9) Pregnancy test (immunological)

10) Extraction of total urinary gonadotropins from human pregnant urine.
11) Study of instruments used in artificial insemination of farm animals.
12) Estimation of total gonadal (testis) cholesterol from rat/mice.
13) Estimation of total liver cholesterol from rat/mice.
14) Estimation of total adrenal cholesterol from rat/mice.
15) Animal house – design breeding & Maintenance of animals – production of transgenic animals.
16) Embryo cloning and cloning of animals by nuclear transfer.
17) In vitro fertilization and embryo transfer.
18) Sperm function tests and semen analysis.

Zoo 402 Physiology – II

1. Structural elements of the Nervous system, Brief account of the organization and evolution of the Nervous system of vertebrates.
2. Excitable properties of nerve cells, Resting membrane potential, ionic basis of action potential, properties of nerve impulse, Conduction velocity, Measurement of nerve potentials.
3. Synaptic transmission : ultra structure of synopsis. Electrical and chemical synapses, Neurotransmitters and their metabolism, Neurotransmitters receptors, Involvement of cyclic AMP, axonal transport, Excitatory and inhibitory synapses.
4. Integrative properties of Nervous system, integration at synapses, Reflexes and Nervous integration.
5. Classification of receptors.
6. Mechano reception : Pacinian corpuscles. proprioceptors, Kinesthetic sense, Lateral line organs, Stato cysts.
7. Chemo-reception – Olfaction and Gus traction in insects and vertebrates cellular aspects of chemo stimulation.
8. Photo-reception : visual pigments, photopic and scotopic responses, color vision , visual cortex, Functioning of the compound eye in arthropods.
9. Physiological aspects of brain energy metabolism.
10. Learning and Memory : Short term and Long term memors molecular basis of memory and Sleep.
11. Muscle Contraction : ultra structure of skeletal muscles, Molecular basis of Muscle contraction, excitation, contraction coupling, Neuromuscular junction. Types of contraction Muscle fatique.
12. Circulation : Conducting tissue of the vertebrate heart, Nervous and Hormonal Control of the Heart, Effect of inorganic ions on heart – Erythropoesis, Leucopoesis.
13. VAQ ratio (Ventilation Quotient) Respiratory centers of brain and ventilation. Long volumes and capacities.
14. Electric organs : Structure and function.
15. Bioluminescence : Structure of luminescent organs, Chemistry and functions of luminescence.
16. Chemistry and action of venom and toxins.

Zoo 425 Practical Corresponding to Zoo 402

Physiology – II (Any Fourteen expts. to be performed).

1. Instrumentation. (Principles)
2. Measurement of Nerve conduction velocity.
3. To record ECG (Demonstration) from human.
4. Preparation of motor end plates.
5. Study of the effect of ATP, $MgCl_2$ and KCl on muscle contraction of frog.
6. Effect of Adrenaline on Muscle glycogen of rat.
7. Estimation of the amount of lactic acid in normal and fatigue muscle of frog.
8. Reflex actions in frog.
9. Effects of inorganic ions on hearts rate of frog by Kymograph.
10. Determination of the flask constant with wargburg's manometer.
11. Determination of Oxygen consumption of different tissues by Wargburg's manometer.
12. Effect of starvation on liver glycogen of Rat.
13. Effect of eye stalk ablation on oxygen consumption in crab.
14. Recording of lung volumes and capacities by spirometry.
15. Quantitative estimation of SDH (Succinic dehydrogenase in muscle of Rat.
16. Perform the various tastes of the given food.

Reference books for the Courses Zoo 301 and Zoo 401

1. Austin C.R. and short R.V. Reproduction in mammals (Vol. 1 to 8)
2. Parkes, A.S. : Marshall's Physiology of Reproduction, (Vol. I to II).
3. Parkes, A.S. : Patterns of sexuality & Reproduction,

4. Nalbandov : Reproduction Physiology.
5. Van Tienhoven : Reproduction Physiology
6. Hanssou : Physiology of Reproduction.
7. Asdell : Patterns of Reproduction.
8. Molaren : Advances in Reproduction Physiology; Vol. I to VI
9. Human Physiology by Guyton.
10. Concis of human physiology by Chaudhari.
11. Ganong : Human Physiology.
12. Chattergy : Human physiology,Vol. I & II
13. Finn & pitter : The uterus..
14. Labhart Alexis : Clinical Endocrinology.
15. Swyer : Reproduction and Sex.
16. Cole, H.H. : Gonadotropins.
17. Malkinson A.M. : Hormone action
18. Atwood : Recent progress in Hormone research.
19. Burrows : Biological action of sex hormones.
20. Pincus and Thimann : The Hormones (Vol. I & II)
21. Martini and Ganong : Neuro endocrinology (Vol. I & II)
22. Lipyd, C.W. Endocrinology of Reproduction
23. Nalbandov : Advances in Neuro endocrinology.
24. Well P.W. : The prostaglandin's (Vol. I & II)
25. Gringhton et.al : Control of ovulation.
26. Strand : Human Physiology.
27. Saidapur, S.K. : Reproductive Cycles (Allied Publishers)
28. Hadley : Endocrinology.
29. R.H. Williams : Text book of Endocrinology (W.B. Saunders)
30. C.R.Martin : Endocrine Physiology Oxford Univ. Press.
31. A. Gorbmanetal Comparative Endocrinology, John Willey & Sons.

Reference books for the courses Zoo 302 & Zoo 402

1) Conn, stump R.K., Bruening and Doc. Outlines of Biochemical (Wiley)
2) Ganong : Reciew of medical physiology (Lange)
3) Eckert, R : Animal Physiology (W.H.Freeman).
4) Hadley – Endocrinology.
5) Nielsen : Animal Physiology (Cambridge)
6) Prosser : Comparative Animal physiology (satish book)
7) Hoar : General and comparative physiology.
8) Strand, F.L. Physiology : A regulatory systems, approach, Macmillan Publishing Co. New York.
9) Wilson K and Walker, J. Practical Biochemistry.
10) Pummer, L : Practical Biochemistry Tata McGraw-Hill.
11) Wilmer, P.G. Stone, and Johnston. Environmental physiology, Blackwell Sci. Oxford, UK, London, UK,644 pp.
12) Newell, R.C. (ed) 1976. Adaptation to environment. Essays on the physiology of marine animals. Butterworths, London, UK. 539 pp-
13) Dejours, P.L. Bolis, C.R.Taylor and E.R. Weibel (eds). Comparative physiology. Life in water and on land. Liviana Press, Pad ova, Italy.
14) Louw, GN. Physiological Animal Ecology : Long man Harloss, UK.
15) Alexander, R.M.N. Optima for Animals. Princeton university, Press, Princeton NJ.USA.
16) Wood, D.W. Principles of Animal Physiology.
17) Eckert, Animal Physiology (N.H. Freeman)
18) William S Hoar, General and Comparative Physiology, Prentice Hall of India Pvt. Ltd.
19) G.H. Bell, D. Emslie – Smith & C.R. Paterson : Text book physiology and Biochemistry (ELB.S)
20) P.N.R. Usher wood, Nervous system, Edward Arnold.
21) H.S. Bachelard – Brain Biochemistry, Chapman & Hall.
22) A.C. Guyton – Text book of Medical Physiology.
23) Ganong – Human Physiology.
24) Chaudhari – Concise of Human Physiology.
25) Chattergy – Human Physiology Vol. I & II
26) Patwardhan – Practical on Human Physiology
27) Deb – Biochemistry.

28) Ram swami – Biochemistry.
29) A.N. Davson ED.(1977) Biochemical correlates. Of brain
30) G.A. Cottrell and PNR Usher wood – Synapses, Blackie and sons.
31) A.K.Lissack ED (1973) Hormones and functions, Plenum Press.
32) Shepherd, G.M. (1983) Neurobiology. Oxford Univ. Press, New York.

Zoo : 403 Entomology – II

[A] APPLED ENTOMOLOGY

1. Fundamentals of Agriculture, forest, medical and veterinary entomology.
2. General biology of important pests of crops cultivated in Maharashtra in particular and India in general :-
   [a] Cereal Pests - Sugarcane, Paddy, Maize etc
   [b] Fiber crop pests – cotton, Jute etc.
   [c] Vegetable pests – Bhendi, Bringgle, Cabbage. etc.
   [d] Fruit pests – Lemon, Mango, guava, Beret, cucarbita etc
3. Important Pests of forest tree and steps taken to check their infestation – e.g. Termites, forest defoliators, borers, Sap suckers etc.
4. Brief outline of medical and veterinary entomology with reference to important measures to control vectors.
5. Household and stored grain pests their control.
6. Principles and methods of insect control. In brief :-
   [a] Mechanical control.
   [b] Biological control.
   [c] Radiology techniques.
   [d] Use of sex – attractants, chemosterialants and hormone insect pest control.
7. Study of useful insects of economic importantance.

Reference Books

1) Fundamental of Applied Entomology by R.E. Pfadt (Mac Millan, New York, 2nd Ed, 1971)
2) Introduction to Applied Entomology by JRI Short (Longmans Green London 1963).
3) Entomology by D.N. Roy and AWA Brawn. The Bang lore Printing and Publ. Co. Ltd. 1970
4) Insects and other Arthropods of Medical importance by KGV Simi Trustees of Brit mus London, 1973
5) Crop pests and how to fight them – Govt. of Maharashtra Pub. Bombay
6) Insect pests of crop by S. Pradhan (NBY, New Delhi 1969).

ZOO:403 ENTOMOLOGY – II

[B] Insect Physiology

1. Integument as a barrier to penetration of substance.
2. Digestion and Nutrition.
3. Circulation of blood, Haemolymph , Haemopotic organs.
4. Excretion, water and Temperature. relation.
5. Respiratory Mechanisms.
6. Physiological properties of insect muscle
7. Locomotion – Terrestrial, Aerial, and Aquatic.
8. Neural integration and sense organs
9. Behavior and pheromones.
10. Hormonal control of reproduction and metamorphosis.

Reference Books

1) The principles of Insect Physiology by V.B. Wigglesworth (Chapman and Hall Ltd. London. 7th Ed 1972)
2) An Introduction to Insect Physiology By E Bursell (Academic Press Inc. New York, 1978)
3) The Physiology of Insects by M. Rock stein Vol. I – VI (Academic press London 1973-76)

Practical – I ZOO 425 II

(Related to Zoo 403 Entomology II)

[a] Applied Entomology

1. Study of Insect pests of agriculture importance :-
2. Pests of cereals :- Jawar, Maize, Paddy, Sugarcane etc.
3. Pests of vegetables :- Bhendi, Bringle, Cabbage etc.
4. Pests of fibre crops :- cotton
5. Pests of fruit plants :- Lemon, Mango, Guava etc.
6. Study of insect vectors of man:- Mosquitoes, Housefly Bedbug, Flea, Head louse, Sand fly, Eye fly etc.
7. Study of insect pests of cattle and domestic animals

8. Study of stored grain pests and Household pests – Rice weevil, pulse beetle, Cockroach silver fish.
9. Study of forest pests :- Termites, Borers defoliators, etc.
10. Study of useful Insects of economics importance – Honeybees, Lac insect.
11. Compulsory field Trip – To visit agriculture university, Institutes, etc.

[b] Insect Physiology

1. Detection of chitin in insects.
2. Detection of $CaCo_3$ in Maphighian tubules of cockroach.
3. Study of haemocytes in insect haemolymph.
4. Detection of uric acid from malphighian tubules of cockroach
5. Detection of amylase activity in alimentary canal of cockroach.
6. Counting heart beats of cockroach by using normal insect saline.
7. Study of effect of drugs, temperature on heart beats.
8. Recording of ventilatory movements of suitable insect using kymograph.

ZOO 404 : FISHERY SCIENCE II

1] Importance of marine, estuarine and inland fisheries of inland with reference to the commercially important fisheries such as
   a. Mackerel fishery.
   b. Sardine fishery.
   c. Bombay duck fishery
   d. Sole fishery
   e. Hilsa fishery
   f. Prawn fishery
   g. Molluscan fishery.

2] Induced breeding –
   a. Induced breeding technique.
   b. Collection, care, identification and selection of breeders.
   c. Breeding technique.
   d. Hatching technique.

3] a. Hatcheries and their management.
   b. Fish culture, composite culture, monoculture.
   c. Pond fertilization and management.

4] Preservation and processing of fishes.

5] Aquatic weeds and their control.

6] Common diseases of fish and their cure.

7] By product of fish industry –
Fish oil, liver oil, fish meals, fish manures, Isinglass and glue, fish skin and scales.

ZOO 425 PRACTICAL CORRESPONDING TO ZOO 404 FISHERY SCIENCE II

1 to 3) Identification of important food fishes, prawns, molluscs and cultivable fishes.
4 to5) Water analysis – estimation of, O_2, PO_4, CO_3 and pH
6 to7) Study of fresh water planktons and marine planktons.
8) Control of Pistia, Utericularia, Vallisneria, Potamogon, pectinatus & Nelumbo – nucefera.
9) Estimation of fish population by formulae of Peterson, Schnable & Echmnyer.
10) Estimation of water content and dry wet ratio of sample of local fish.
11) fish fecundity.
12) Study and observation of some byproducts of fish industry.
13) Visit to centre where induced breeding is performed.
14) Visit to fish preservation, curing and freezing plant.

Semester IV

Any one special paper

Zoo 405 – Applied Parasitology II

1) Outline classification of cestoidea.
2) Biology of eggs and larvae of cestoidea.
3) Geographical distribution, Habits, Habitats, Morphology, Life cycle, Pathogene - city, Diagnosis, Prophylaxis and treatment of following representative types.
   a. Diphyllobothrium latum
   b. Taenia pisciformis.
   c. Echinococcus granulosus
   d. Hymenolepis diminuta.
4) Outline classification of Nematohelminthes.
5) General morphology and biology of Nematoda.

6) Biology of eggs and larvae of Nematoda.
7) Geographical distribution, Habits, Habitats, Morphology, life cycle, pathogenicity, Diagnosis, prophylaxis and treatment of following types.
   a. Trichiuris trichiura
   b. Strongyloides ratti.
   c. Ancylostoma carium
   d. Necator americanus
   e. Toxocara canis
   f. Enterobius vermicularis
   g. Dracunculus Sp.
8) Parasitic Acanthocephala and Annelida
9) Outline classification of parasitic Arthropoda.
10) Parasitic Crustacea and Acari.
11) Parasitic Siphonoptera, Anopleura and Mallophaga.
12) Parasitic Diptera.
13) Parasitic Hemiptera and Pentastomida.
14) Hyper infestation : Infection, disease, crowding effect, self cure, Hyper parasitism multistage complex, Hyper parasitic, transmission, multi parasitism, parasitic mix.
15) Disease cycle : Concept of diffusion, principles of protection of hosts, control in and outside the host.
16) Measures of control of parasites : chemical, Biological, Cultural and Therapeutic.
17) Economic important : Direct effects on human and animal life, economic loses in agriculture, poultry, form animals, fisheries etc.
18) Population Biology : Parasite – Host, Predator – prey interactions; Pyramid of numbers; seasonal variations of parasite population; Influence of host migration on parasite population; host migration on parasite population.
19) Parasites and Zoonosis : Viral, Bacterial, Rickettsial, Protozoan, Helminthes and Arthropod diseases.
20) Parasitism and Genetics

Zoo 425 Practical I – 18 Practical w.r.f. Zoo 405

1. Morphology and life cycle stages of following parasites : Diphyllobothrium, Proteocephalus, Tacnia, Echinococus, Diphyllidium, Hymenolepis,
2. Morphology and life cycle stages of following parasites : Trichinella, Trichiuris, Strongyloids, Ancylostoma, Necator, Nematospiroides.
3. Morphology and life cycle stages of following parasites : Ascaris, Toxocara, Enterobius, Syphacea, Gnathostoma, Physaloptera.
4. Sapero and Lawless fixative stain for helminthes eggs. Host
5. Host/Autopsy – Recovery of cestode parasites from a suitable host (Goat. Chicken, fish, Rat, bird etc.)
6. Host Autopsy – Recovery of Nemetohelminth parasites from a suitable host.
7. Methodology for preparation of cestode and nematohelminth parasites for the study.
8. Collection of soil nematodes by Baermann. Funnel.
9. Mounting of Nematodes and preparation of En face views.
10. Trisodium phosphate method for softening cysts, helminthes and Insect.
11. Potassium Hydroxide method for clearing arthropod parasites.
12. Preparation and submission of five slides Parasitic Cestode, Nematodes and arthropods.
13. Life cycle exercise – infection of a suitable host by suitable parasite and follow the development.
14. Study of Leptorhynchoidea, Moniliformes, Piccolo, Hirudo, Lernaea, Argulus, Sacculina, Dermacentor, Argas, Sarchoptes.
15. Study of Xenopsylla, Pulex, Pediculus, Phthirus Haematopinus, Trichodectos, Porocephalus.
16. Study of month parts of Vectors : Phlebotomus, Culicoides, Simulium, Anopheles, Culex, Aedes, Glossina, Melophagus, Panstrongylus, Trachoma, Rhodnius and Cimex.
17. Visit to a veterinary clinic and submission of a report.
18. Visit to a Pharmaceutical industry manufacturing anthelminthic drugs and submission of a report.

ZOO 411 : PHYSIOLOGY OF REPRODUCTION

Physiology and biochemical aspects. Review on hormones and prostaglandins. Ovarian cycles : control by hormones and environmental factors.

Puberty and menopause.
Blastocyst and its implantation.
Placentation: nutritive and endocrine functions. Foetal antigens and immunological tolerance. Hormones factors in pregnancy and parturition.
Applied aspects: ; control of fertility [contraception, sterility, induced breeding, artificial insemination, in vitro fertilization. Immunological approach of fertility, synchronization of cycle in populations etc.)
Genetic aspects:- Counseling, Cloning etc.

Reference Books

1] P.J. Hogarth, 1978 – Biology of Reproduction Wiley, New York.
2] J.S. Perry, 1971 – The Ovarian cycle of animals, Oliver and Boyed.
3] C.R. Austin and R.V. Short, 1972 Reproduction in Mammals, Vol. 1 – 8, Combridge University Press.
4] M.C. Shelesnyak and G.J. Marcus, eds, 1969 –
5] G.E. Lamming and E.C. Amorose, eds, 1967 – Reproduction in the Female Mammal, Butterworths, London.
6] P. Gibian and E.J. Platz, eds, 1970 – Mammalian Reproduction, Springer Verlag.
7] P.G. Crosingani and D.R. Mishell, eds, 1976 ovulations in the Human, Academic Press.
8] J.C. Daniel, ed. 1978 – Methods in Mammalian Reproduction, Academic Press.
9] M.H.Johnson, Ed. 1977 – Development in Mammalian, North Holland.
10] S. Patton and R.G. Jenson, 1976 – Biochemical Aspects of Lactation, Pergamon Press.
11] W.D. Odell and D.L. Moyer, 1971 – Physiology of Reproduction, C.V. Mosby Company.
12] Cohen, 1977 – Reproduction, Butterworths.
13] A. McLearn, ed. 1966 onwards – Advances in Reproductive physiology, Academic Press.
14] A. Van Tienhoven, 1968 – Reproductive physiology of Vertebrates.
15] Nalbandov, A.V. : Reproduction Physiology.

ZOO 425 : PRCTICALS CORRESPONDING TO ZOO 411 : PHYSIOLOGY OF REPROUCTION

(Any Seven Practicals)

1] Dissection of male reproductive system of Rat/Mice and its description.
2] Dissection of female reproductive system of rat/mice and its description.
3] Location and study of different endocrine glands in rat.
4] Surgical operation in rat/mice :- Ovariectomy.
5] Surgical operation in rat/mice :- Tubectomy
6] Surgical operation in rat/mice :- Orchectomy.
7] Vaginal smear – Vaginal cytology in relation to oestrous cycle.
8] Histological study of male and female reproductive organs.

Zoo 412 Pest Control

- Pests and their importance. Damage caused by pests.
- Chemical pesticides, classification of pesticides on the basis of chemical nature and their use. Acavicides, Fungicides, Nematicides, Molluscocides herbicides, Pesticides for vertebrate pests.
- Methods of pests control, chemical control, Biological control, Autocidal methods of control, Sterile male technique, Genetic control, Pheromones in pests control, Attractions Repellents and Antifeedants, resistant varieties and Integrated pest Management.
- Pesticides of plant origin.
- Pesticide toxicity – LD50 & LC50 Values, Acute, Chronic, Dermal, Inhalation toxicity, Hazards of pesticides, Mode of entry, Antitodes & safety measures.
- Pesticidal formulations and their types.

Reference Books :

1] Pest control – A survey – By A. Woods (Mc. Graw. Hill London, 1974_
2] Pest control – By W.W. Kilgore & R.L. Doutt (Academy Press, New York)
3] Insect pest Management – David Dent.
4] Insect pest of their control – J.W. Evans.
5] Agricultural insect pests of tropics & their control – D.S. Hill.
6] Agriculture pests – Biology and control measures – B.M. Deore and T.B. Nikam.
7] Chemistry of Insecticides & Fungicides. U.S. Shree Ramulu

8] Fungicides in plant Disease control – Y.L. Nene, P.N. Thapliyal.
9] Fundamentals of plant pests control – D.A. Roberts.
10] All about weeded control - S. Subramanian.
11] Chemistry of Herbicides – U.S. Shree Ramulu.
12] Principles & Procedures of plant protection – Chattopadhyay.

Zoo 425 : Practical Corresponding to Zoo 412 : Pest Control

1] a] Study of the effect of contact insecticides on the behavior insects.
b] Determination of the percentage mortality of insects treated.
2] a] Study of the effect of fumigants on the behavior of insect
b] Determination of the percentage mortality of insect treated.
3] Determination of the effects of orally administered zinc phosphate on liver, Kidney and intestine of mouse.
4] Screening of certain plant extracts as prospective attractants.
5] Screening of certain chemicals as prospective repellents/ antifeedants.
6] Screening of certain chemical as prospective molluscocides.
7] Filed trip.
8] Collection and preservation of insect pests.
9] Determination of Biological activity of any available compounds (pesticides) on insect pests.
10] Estimation of phosphomedon by volumetric differential methods.
11] Estimation of dichlorovos by volumetric differential method.
12] Determination of acidity/alkalinity of wettable powder by volumetric methods.
13] Determination of bulk density before and after compacting.
14] Estimation of chlorine content in bleaching powder.

M.Sc. Zoo 413
Animal Behavior

1.0 Introduction
- 1.1 Ethology as a branch of biology
- 1.2 Animal psychology – classification patterns, analysis of behavior (ethogram).

2.0 Innate behavior

3.0 Perception of the environment
- 3.1. Mechanical
- 3.2. Electrical
- 3.3. Chemical
- 3.4. Olfactory
- 3.5. Auditory
- 3.6. Visual

4.0 Neural and hormonal control of behavior

5.0 Genetic and environmental compounds in the development of behavior

6.0 Communication
- 6.1. Chemical
- 6.2. Visual
- 6.3. Light
- 6.4. Audio
- 6.5. Species specificity of songs
- 6.6. Evolution of language (primates)

7.0 Ecological aspects of behavior.
- 7.1. Habitat selection, food selection; optimal foraging theory, anti-predator defenses.
- 7.2. Aggression, homing; territoriality; dispersal
- 7.3. Host-parasite relations.

8.0 Social behavior
- 8.1. Aggregations-schooling in fishes, flocking in birds, herding in mammals.
- 8.2. Group selection, Kin selection, altruism, reciprocal altruism, and inclusive fitness.
- 8.3. Social organization in insect and primates.

9.0 Reproductive behavior
- 9.1. Evolution of sex and reproductive strategies
- 9.2. Mating systems.
- 9.3. Courtship.
- 9.4. Sperm competition

9.5. Sexual selection
9.6. Parental care

10.0 Biological rhythms
10.1. Circadian and circannual rhythms
10.2. Orientation and navigation
10.3. Migrations of fish, turtles and birds.

11.0 Learning and memory
11.1. Conditioning
11.2. Habituation.
11.3. Insight learning
11.4. Association learning
11.5. Reasoning
11.6. Cognitive skills

Suggested Reading Material

1. Alcock, J. Animal behavior: an evolutionary approach. Sinauer Assoc., Sunderland, Mass. USA.
2. Bradury, J.W., and S.L. Vehrencamp. Principles of animal communication. Sinauer Assoc. Sunderland, Mass. USA
3. Clutton-Brock, T.H. the evolution of parental care. Principles Univ. Press, Princeton, NJ, USA.
4. Eibl-Eibesfeldt, I. Ethology. The biology of behavior. Holt, Rinehart & Winston, New York.
5. Gould, J.L. the mechanisms and evolution of behavior.
6. Hauser, M. the evolution of communication. MIT Press, Cambridge, Mass. USA.
7. Hauser, M. Hinde, J.R. animal behavior: A synthesis of ethology and comparative psychology MC Graw-Hill, New York.
8. Krebs, J.R. and N.B. Davies: Behavioral ecology. Blackwell, Oxford, UK
9. Wilson, E.O. Sociobiology: the new synthesis. Harvard Univ. Press, Cambridge, Mass. USA.

List Of The Practical Of Animal Behavior

(Corresponding To Zo.413 of Theory Paper)

(Use models, if necessary, to carry practical)

1 Study of honey bee dance with reference to food location
2 Study of following individual behaviors
   a Preening in Birds.
   b Dusting in birds and mammals.
   c Oiling in birds.
   d Cleaning of eyes and antenna in insects.
3 Study of following comfort movements.
   a Stretching in body in mammals.
   b Yawning in mammals.
   c Feather setting in birds.
   d Pecking actions in young birds.
4 Study of ways of ultrasonic communications among animals.
   a In bats.
   b In elephants.
5 Study of territorial marking in animals.
   a Dogs.
   b Tigers/lions.
6 Socials organization in honeybees, white ants, monkeys.
7 Mating display in birds and mammals
8 Study of migratory routes in birds/mammals using maps.

ZOO 414 INSECT ENDOCRINOLOGY

Histological structure of the following endocrine organs : Brain, ventral ganglia, corpora cardiaca, corpora allata, ecdysial gland.

Chemical structure of hormones regulation of metamorphosis, reproduction, diapause, intermediary metabolism, and osmoregulation. Physiology of burs icon and pheromones,

REFERENCE BOOKS

1] Insect Hormones – by Novek V.J.A. – 1975 edn 4 Chapman and Hall, London
2] Insect Neurohormones – by Rabbe, M 19082 Plenum Press, New York
3] Insect Hormones – By Wigglesworth, Oliver and Boya.

4] A Text Book of Insect morphology, Physiology and Endocrinology, by Tembhere, D.B. 1990 II Edn – S. Chand and Co. New Delhi.

Zoo 425 : Practicals Corresponding to Zoo 414 : Insect Endocrinology (7 Practicals)

Dissection of endocrine organs of cockroach – Brain, Corpora cardiaca Carpora allata. Effect of extracts of corpora allata and or carpora cardiaca on heart beats of cockroach. Mounting of ecdysial gland of cockroach. Whole mount of Brain showing Neursecretary cells.section of Brian to study different types of neuresecretory cells.

Zoo 415 Insect Toxicology

1] History principles and Scope.
2] Evaluation of Toxicity of Insecticides: Toxicity Tests against Insect: - Bioassay, calculation of LD 50 or LC50.
3] Classification of Insecticides:
   i. Classification based on mode of entry.
   ii. Classification based on mode of action.
   iii. Classification based on chemical mature: Inorganic compounds, organs compounds synthetic organic compounds = Paris green, DDT, BHC, Aldrin, Malathion.
   iv. Chemistry of Insecticides :- Reactions of organo – phosphorous insecticides.
      a. Reactions between carbonate insectisides and cholinesterase enzyme
      b. Synergism and antagonism.
4] Physico – chemical factors in relation to toxicity.
5] Entry and mode of action of insecticides.
   a. Penetration through cell, through cuticle and through skin.
   b. Mode of Action: Neurobiology and transmission of impulses.
6] Metabolism of Insecticides.
   i) Phase I and Phase II reactions.
   ii) Metabolism of Chlorinated hydrocarbons. Organophosphates, carbonates.
7] Selectivity and Resistance : Selectivity :- Ecological, Physiological. resistance :- origin and development of resistance : Cross resistance and multiple resistance : monogenic and polygenic resistance.

Reference Books

1] A text book of Insect toxicology: - R.P. Shrivastava and R.C. Saxena Himanshu Publication Udaipur.
2] Text Book of toxicology. Oxford University press, Oxford.
3] The chemistry and action of insecticides – H.H. Shepard, Mac Grow Hill, New York.
4] Concepts of Insect control :- M.R. Ghosh Willey Eastern Ltd. Daryanganj New Delhi.

Practical Corresponding to Zoo 415

1] Structure Test :- Calculation of LC50 and LD 50
2] Effect of insecticide on cholinesterase enzyme.
3] Chemical assay by any one method spectrophotometcy, chromatography.
4] Analysis of insecticides.- Bioassay test – method.
5] Isolation of insecticides from plant material.
6] Effect of Biological and physical factors on Insecticides – sunlight, temp., moisture, soil types, cover crops, etc.
7] Insecticides contamination :- Bioaccumulation, Susceptibility of Biological material.
8] Insecticides poisoning :- symptoms of poisoning and treatment to nay insect by any insecticides.

Zoo 416 ICHTHYOLOGY

1] Diagnostic Characters. Classification. Origin and evolution.
2] Endoskeleton – Jaw suspension.
3] Musculature – Locomotion i) Swimming ii) Non swimming.
4] Food and feeding habitats, digestive system, nutrition.
5] Structure and function of gills, metabolic rate, air bladder.
6] Reproduction – Sexuality, reproductive systems and cycles, Spawning, parental eare.

7] Nervous system – General organization and special features, intelligence, behavioural patterns.
8] Sense organs – Eye, internal ear, lateral line system, chemo receptors.
9] Migration.
10] Fish venom and toxins, electrogenic luminscent organs.
11] Ecological classification of fishes, factors governing distribution in marine, estuarine and fresh water habitat.
12] Zoogeography of India fishes.
13] Home aquaria

Reference Books.

1] Alexander R. MCN (1970) Functional design in fishes. B.I. Publication, Bombay.
2] Axle rod, H.R. and L.P.Schultz(1955). Handbook of Tropical Aquarium fishes, McGraw Hill, New York.
3] Brown, M.E.Ed. 1957 – the Physiology of fishes Vol. I and II. Academic Press. New York.
4] Chandy, M. 1970 – Fishes in "India – The land and People". National Book Trust New Delhi.
5] Day, F. 1958 – The Fishes of India. Vol. I and II, William Dawson and Sons Ltd, London.
6] Harden Jones, F.R. (1968). Fish migration, Edward Arnold, London.
7] Lagler, K.F., J.E. Bardach, R.R. Miller, and D.R.M. Passiao (1977) Ichthyology :- 2nd Edn John Willey and sons New York.
8] Love M.S. and G.M. Cailliet Eds (1979). Reading in Ichthyology, Indian edn, Prentice – Hall of India, New Delhi.
9] Poznanin, L.P. Ed. 1977. Ichthyology, Amernd New Delhi, Bombay.
10] Nikolskey, g.v. 1963 – The Ecology of fishes. Academic press, London and New York
11] Sterba, G. 1962. fresh water fishes of the world vista Books London.
12] Hoar W.S. and D.J. Randall 1969. Fish physiology Vol. I to Vol. 15. Academic Press New York.

Zoo 426 : Practical Corresponding to Zoo 416

Ichthyology.

1] Study of different types of scales in fishes.
2] Study of different types of fins in fishes.
3] Dissection of any suitable fish for following systems :- a) Digestive System.
4] b) Respiratory system.
5] c)Reproductive system male and female.
6] d) Central nervous system. Brain and spinal cord.
7] Study and maintenance of aquaria in laboratory.
8] Demonstration of techniques of fish preservation and curing.
9] Identification of important food fishes and culturable fishes.
10] Study of different fish nets.
11] Visit to fish culture farm.

Zoo 417 Histochemistry

1. History of histochemistry
2. Fixatives & Fixation : Principles, Problems and effect on cell organelles.
3. Proteins Histochemistry classification, physical differentiation between classes of proteins. Determination of proteins –
   i. Million Reaction. ii) OTA – Technique
   iii DTO Technique. iv) DNFB Technique.
   v) Performic acid – Alcian Blue Technique.
   vi) Methyl Orange Technique.
4. Fluorescent Antibody Techniques – Direct staining, Sandwich technique, Multiple layer technique, Application.
5. Technique specific for DNA : Feulgen Reaction. technique specific for RNA : Methyl – Green Pyronin stain.
6. Detection of Lipids by Sudan Black.
7. Identification of Carbohydrates by PAS technique.
8. Histochemistry of Gram Reaction.

Reference Books

- Handbook of Histopathological & Histochemistry Techniques : by C.F.A. culling, Butter worth's & C. Ltd. London.
- Histochemistry : by Pease, A.G.E. 1976.
- Histopathological Techniques – Practical Histochemistry Ed. 1976 : Lillie, Press. London.
- Microscopic Histochemistry, 1952. by Gomori, G.

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Zoo 426 : Practical Corresponding to Zoo 417 Histochemistry.

1] Detection of proteins by any suitable method.
2] Detection of Neutral mucopolysaccharide by PAS method.
3] Detection of Nucleic acid by Feulgen method.
4] Detection of Lipid by any suitable method.
5] Detection of Acid Phosphatase by any suitable method.
6] Detection of Alkaline Phosphatase by any suitable method.
7] Detection of Acid mucopolysaccharide by any suitable method.

ZOO. 418 : BASIC BIOTECHNOLOGY

1] Fundamental and Principles. :
Introduction to biotechnology, public awareness, application areas, review of biochemical, pathways, and their control. Introduction to microbe, their growth kinetics, handling microorganisms in vitro.

2] Genetic Engineering and its Applications. :
Introduction to genetic engineering in microbes, gene structure and function transfer of genetic information, restriction and modification, construction of recombinant DNA molecules in vitro. Molecular cloning, Vector, plasmid, vehicles, PCR, site directed mutagenesis, DNA fingerprinting, Protein engineering.

3] Animal Biotechnology
Introduction animal cell and tissue culture, Laboratory facilities, Media and Procedures, primary culture, cell lines and cloning 8substrate, culture media for cells and tissues cells cultures as sources of valuable procedure. Tissue and organ culture, primary explanation techniques, transformation, Transfection. Methods and Transgenic animals.

4] Immunotechnology. :
Monoclonal antibody and hybridomas cells, Antigen-Antibody reactions, Hybridomas and preparation of monoclonal antibody, Lymphokines and application and utility of monoclonal antibodies

Enzyme technology. :
Microbial production of enzymes, Immobilization of enzymes and cells, use of enzymes in leather, textile and food industries, stabilization, Biocatalyst, reactors, application of biocatalysts.

5] Fermentation Technology. :
Introduction, stages of fermentation process – designing of fermenter, inoculums, sterilization of medium, selection of microorganisms, Down stream processing, purification and concentration of product. Industrial production of organic acid (citric acid), Ethanol, and antibiotics (e.g. Penicillin).

6] Biotechnology and Environment. :
Biomass production, Bioenergy, Biogas, use of microorganisms in pollution control, waste treatment, waste management, biohazards.

7] Biotechnology in Medicine. :
i] Viral Vaccines,
ii] Interferons, Plasminogen activator,
iii] Growth Hormone and insulin,
iv] Gene therapy,
v] Genetic counseling.

REFERENCE BOOKS

1] Bullock, J.D., Kristiansen, B. – basic Biotechnology, 1987. academic press, New York.
2] Prave, P. faust, V., Sitting, W.& Sukatsch, D.A. – Fundamental of Biotechnology, VCL Publishers, New York. 1987.
3] Spier, R.E. and Griffins, J.B. – Animal Cell Biotechnology, Vol. I & II, Academic Press, Orlande, 1985.
4] Schook, L.B. – Monoclonal Antibody Production Techniques and Applications. Marcel, Dekker, New York, 1986.

5] Trevan, M.D., Boffey, S.;Godulding, K.H. – Biotechnology Principles. Tata McGraw Hill Publishing Company Ltd. New York, 1987.
6] Gupta, P.K. – Elements of Biotechnology. Rustogi and Company Publishing, 1996.
7] Keshav Trehan – Biotechnology. Wiley Estern Limited, Bangalore, 1990
8] Dubey, R.C., - A Text Book of Biotechnology. S. Chand and Company Ltd. New Delhi, 1996.

ZOO 426 : Practical Correspond to ZOO 418 : Basic Biotechnology.

1] Transformation experiment.
2] Immobilization of enzyme.
3] ELISA – Demonstration.
4] Antigen – Antibody reaction simple and redial diffusion.
5] Immuno – Electrophoresis – Antigen, Antigen reaction.
6] Production of alcohol or citric acid or penicillin by fermentation.
7] Characterization of restricted fragment of DNA on a agarose gel – electrophoresis.
8] Metabolic rate, study – Yeast fermentation.

ZOO 419 FISH PHYSIOLOGY

1] Introduction to fish endocrinology.
2] Pituitary glands – General Structure, adenohypphysis, Histophysiology, Neurophypophysis in teleosts. Stainable and non stainable fibers.
3] Adrenal cortex – Physiological role of adrenal cortex.
4] Prolectin – Osmoregulation, melanogensis.
5] Hormonal control of chromatophores.
6] Pituitary gonadotrophius.
7] Gonadal steroids.
8] Sex differentiation modified by sex hormones.
9] Thyroid gland – Structure and function.
10] Immunology of fishes – Methods of immunology, Antibodies, immunoglobins of fish, specificity of fish antibodies.

Zoo 426 : Practical Corresponding To Zoo – 419 : Fish Physiology.

1) & 2) Pituitary gland and gonads – section cutting and staining.
3) Chromatophores – Experiment to demonstrate aggregation and dispersion of chromatophores.
4) Study of secondary sexual characters.
5) & 6) Induced breeding – Extraction of Pituitary and preparation of injection doses and identification of breeders.
7) Immunology of fish.

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