NORTH MAHARASHTRA UNIVERSITY, JALGAON

M.Sc. Part-II

ZOOLOGY SYLLABUS

Note :- It is suggested that the Students offering Applied Parasitology will not offer ZOO-321 (b) Parasitology. It is also suggested that for affiliation and continuation of the the course ZOO-312 & ZOO-412 Applied Parasitology the following conditions should be fullfilled before the commencement of the course.

The adequate museum facilities (speciments, slides, Instruments, chemicals etc.) should be made available as per syllabus.

The Practical courses ZOO-312 & ZOO-412 of above should be included in ZOO-346 and ZOO-461 respectively.

ZOO-312 : APPLIED PARASITOLOGY (Spl.)

Paper-I (Course - ZOO-312)

1. Parasitism : Concept, Origin, evolution, advantages and disadvantages in the parasitic life.
2. Classification of Parasites according to habital, Micro-environment, degree, host specificity, association with host, behaviour, evolution, taxonomy, etc.
3. Kind of host : definative, intermediate, primary, secondary, specific, paratenic, carrier, susceptible, resistant, accidental, reservoir, vector.
4. Modes of parasitic invasion : Passive, mechanical, active, contact, transovarial, pathways of entry, sites of habitation.
5. Host specificity : defination, origin, types, structural, physiological, ethological, tissue response, ecological, phylogenetic.
6. Habitats and environments of parasites : Vertebrate digestive system environmental conditions in different parts of the system; Blood; reficulo endothelial system ; tissues and other microhabitats, invertebrate; intra and interspeafic

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competition in the micro environment.

7. Structural, Physiological and biological adaptations of parasites for infectionsness, establishment and transmission; shape, size, attachment and protective devices, feeding aids, locomotion, respiration, metabolism, reproduction, life cycles, regressive changes, resistant and quiescent free ~~livi~~ living stages; parasitism - specialization or degeneracy?

8. Host - parasite system : effects of parasites on hosts - mechanical, nutritional, destructive, toxic, biological etc. Host's reactions to parasites : resistance, compatability, immunity; cellular and tissue reaction e.g. Phagocytosis, inflammation, repair, abnormal growth, humoral reactions (Physiological resistance, immune response); premunition, avoidance of parasites by hosts; influence of hosts on parasite life cycle.

9. Hyper in festation : Infection, disease, crowding effect, self cure. Hyper parasitism; multistage complex, hyper-parasitic transmission, multiparasitism, parasitic mix.

10. Classification of parasitic protozoa : Sarcomastigophora, Apicomplexa, Myxozoa, Microspora and ciliophora.

11. Patterns of life cycle in parasitic protozoa.

12. Flagellates of digestive system and urinogenital tract of human and domestic animals.

13. Geographical distribution, habits, habitat, life cycle, transmission, pathogenicity, diagnosis, prevention and treatment of trypanosomes and Leishmania of human and domestic animals.

14. Geographical distribution, habits, habital, life cycle, transmission, pathogenicity, diagnosis, prevention and treatment of Naeglaria Fowleri.

15. Types of malaria, clinical features, diagnosis, immunity, prevention and treatment.

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16. Life cycle, transmission and pathogenicity of Coccidia of poultzy, sheep, goat and cattles.
17. Life cycle, transmission and pathogenicity of Plasmodiidae.
18. Piroplasmia, Toxoplasmia, Sarcocystis, Isospora, Balantidium and Pneumocystis infections.
19. Outline classification of Monogenes and Trematoda.
20. Biology of the eggs in trematodes.
21. Biology of the larvae of trematodes.
22. Patterns of life cycle in trematodes.
23. Geographical distribution, Habits, Habital, Morphology, Life cycle, Pathogenicity, Diagnosis and treatment of following representative types.
    a) Clonorchis sinensis
    b) Fasciolopsis buski
    c) Paragonimus westermani
    d) Schistosoma mansoni.

ZOO : 346 Practicals - I (W.R.T. ZOO : 312)

1. Study of skeletal structures and locomotor organelle in parasitic protozoa.
2. Study of protozoan parasites (Permanent slides) : Leishmania, Trypanosoma, Herpetomonas, Leptomonas, Chilomastix, Giardia, Histomonas, opalina, Trichomonas, Trichonympha.
3. Endolimax, Entamoebae, Naegleria, Eimeria, Gregarina, Monocystis, Plasmodia, Sarcocystis, Toxoplasma, Myxosoma, Nosema, Balantidium, Ichthyopthirius, Nyctotherus.
4. Host autopsy and recovery of parasites from a suitable host.
5. Preparation of specimens for the study.
6. Blood smear preparations (Thin and thick) for the protozoan parasites.
7. Smears of parasitic protozoa - from alimentory tract, gall bladder, urinary bladder etc.
8. Fecal smear technique for protozoan cysts and trematode eggs.
9. Zinc sulphate flotation technique for protozoan cysts and trematode eggs.

10. Formalin - ether centrofugation technique for schistosoma eggs.
11. Study of holdfast organs and alimentory canals in Trematodes.
12. Study of Uteri, eggs and larvae in Trematodes.
13. Exmination of cercaria from the snails, by vital staining method.
14. A Visit to a pathological laboratory and submission of the report.

Applied Parasitology - II (Zoo-412)

1) Disease cycles : Concept of diffusion (dissemination), Principles of protection of hosts; control in and outside the host.

2) Measures of control of parasites : Chemical, biological, cultural and therapeutic.

3) Economic importance : Direct effects on human and animal life, economic losses in agriculture, poultry, farm animals, fisheries etc.

4) Population biology : Parasite host, predator - prey interactions; Pyramid of numbers; seasonal variation of parasite population; influence of host age on parasite population, effect of host migrations on parasitic populations.

5) Parasites and Zoonosis : Viral, rickettsial, bacterial, protozoan, helminthic and arthropod diseases.

6) Outline classification of cestoidea.

7) Biology of eggs and larvae of cestoidea.

8) Geographical distribution, Habits, Habital, Morphology, life cycle, Pathogenicity, Biognosis and treatment of following representative types.

   a) Diphyllobothrium latum.
   b) Taenia Pisiformis.
   c) Echinococcus granulosus.
   d) Hymenolepis diminuta.

9) Outline classification of Nematohelminthes.

10) General morphology and biology of Nematoda.

11) Biology of eggs and larvae of Nematoda.

12) Geographical distribution, Habits, Habitat, Morphology, life cycle, pathogenicity, Diagnosis and treatment of following representative types.

   a) Trichuris trichiura.
   b) Strongyloides ratti.
   c) Ancylostoma caninum.
   d) Necator americanus.
   e) Toxocara canis.
   f) Enterobius vermicularis.
   g) Dracunculus sp.

13) Parasitic acanthocephala and annelida.

14) Outline classification of Arthropod parasites.

15) Parasitic crustacea and Acari.

16) Parasitic Siphonoptera, Anopleura and Mallophaga.

17) Parasitic Diptera.

18) Parasitic Hemiptera and pentastomida.

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ZOO : 461 Practicals - II (w.r.t. ZOO : 412)

1. Morphology and life cycle stages of following parasites (permanent slides) : Diphyllobothrium, Proteocephalus, Taenia, Echinococcus, Diphyllidium, Hymenolepis.
2. Trichinella, Trichuris, Strongyloides, Ancylostoma, Necator, Nematospiroides.
3. Ascaris, Toxocara, Enterobius, Syphacea, Gnathostoma, Physaloptera, Dirofilaria, Loa, Wuchereria.
4. Sapero and Lawless Fixative Stain for helminth eggs.
5. Preparation of specimens of tapeworm for the study.
6. Collection of soil nematodes by Baermann funnel.
7. Mounting of nematodes and preparation of En Face Veiws.
8. Trisodium Phosphate method for softning cysts, helminths and insects.
9. Pottasium Hydroxide method for clearing arthropods.
10. Life cycle exercise - infecting a suitable host by suitable parasite and following development.
11. Study of leptorhynchoides, Monitiformes, Piscicola, Hirudo, Lernaea, Argulus, Sacculina, Dermacentor, Argas, Sarcoptes.
12. Study of Xenopsylla, Pulex, Pediculus, Phthirus, Haematopinus, Trichodectes, Porocephalus.
13. Study of mouth parts of vectors : Phlebotomus, Culicoides, Simulium, Anopheles, Culex, Aedes, Glassina, Melophagus, Panstrongylus, Triatoma, Rhodnius, and Cimex
14. Visit and report of Veternary clinic and or Pharmaceutical in dustry manufacturing antihelminthic drugs.

REFERENCE BOOKS :

1. Introduction to parasitology - Chandler and Read.
2. General Parasitology - Cheng.
3. Clinical Parasitology - Faust and Russel.
4. Parasitism - Cameron.
5. Animal parasitism - Read.

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6. Biochemistry of parasites - Van Brand.

7. Parasitic Protozoa - Baker.

8. Protogoan parasites of domestic animals and Man - Levine.

9. Nematode parasites of domestic animals and man - Levine.

10. Medical parasitology - K.D. Chatterjii.

11. A Textbook of parasitology - Kelkar and Kelkar.

12. Esentials of parasitology - Schmidt.

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॥ अंतरी पेटवू ज्ञानज्योत ॥

NORTH MAHARASHTRA UNIVERSITY, JALGAON

M.Sc. PART-II

ZOOLOGY SYLLABUS (From June,1994)

Note : The adequate museum facilities (specimens, slides, Instruments, chemicals etc.), and fish acquaria should be made available as per syllabus.

The above mentioned conditions should be fullfilled before the commencement of the course.

APPENDIX 'B'

ZOO : 313 : FISHERY SCIENCE-I

1) Food and feeding habits of freshwater fishes and prawns.
2) Reproduction, embryonic and larval development of fresh-water fishes and prawns. Spawning habits, Gono-somatic index, fecundity and breeding.
3) Age and growth :- Length-weight relationships, vital ponderal index, condition factor.
4) Migration - for feeding, breeding and development.
5) Population studies :- Unit stock, recruitment age & size composition of stocks.
6) Mortality, Survival and fishing gear and conventional fishing methods :-

Rate of survival, fish martality and its causes, fishing effort of a gear and its measurement, principle types of nets.

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ZO : 413 : FISHERY SCIENCE - II

1) Importance of marine, esturine and inland fisheries of India with reference to the commercially important fisheries such as :-

i) Mackerel fishery ii) Sardine fishery.
iii) Bombay duck fishery iv) Sole fishery.
v) Hilsa fishery. vi) Prawn fishery and.
vii) Molluscan fishery.

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2) Aquaculture scope and importance :- Fresh water brackish water and marine aquaculture resources of India.
   a) Induced breeding, hatcheries & their management.
   b) fish culture, composite culture, monoculture.
   c) Pond, fertilization and management.

3) Fishing boat and gears.

4) Fishery technology :- i) Fish preservation & curing.
   ii) Fish processing - Freezing, canning and smoking etc.
   iii) Fish Oil & Fish liver oil.

5) Aquatic weeds & their control :- Introduction methods of control mannal and mechanical control.

6) Common diseases of fish and their cure.

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LIST OF THE BOOKS 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 Inland Fisheries.
4. Neoduhan Neodham	A guide to the study of Fresh water biology.
5. Bardach J.E.	Aquaculture the farming 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.
11. Chander S.L.	Hypophysation of Indian Major carps by pituitary Harmone injection.
12. Pillary T.V.R.	Advance in Aquaculture.

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13.	Brown E.E.	World fish farming, cultivation and Economics.
14.	Lackey R.T.	Fishery Management.
15.	Shang Y.C.	Aquaculture economics.
16.	Reid G.K.	Ecology of Inland water and estuaries.
17.	Brown E.E.	Fish farming handbook.
18.	Shigene K.	Problems in Prawn culture.
19.	Shrivastava U.K.	Stategy for Development of Inland fishery Resource in India.
20.	Royce W.F.	Fishery development.
21.	Royce W.F.	Blackish water fisheries in India.
22.	Reid word	Ecology of Inland water and Esturaries.
23.	Hiralal Chandhari	Induced breding of carps.
24.	C.F. Mason.	Biology of freshwater polluction.
25.	Dowing J.S.	A monual of methods for the assessment of secondary productivity in fresh water.
26.	Chakreff, M.	Freshwater fish pond cultuream Management.
27.	K.C. Jayraman	Fishes of India.
28.	Sir Francis Dey	Fishes of India. Vol. I & II
29.	R Santhanam	A manual of freshwater aquaculty
30.	R.K. Trivedy P.K. Gool	Chemical and Biological methods for water pollution studies.
31.	D.K. Belsare	Tropical fish farming.
32.	P.S. Rao	Fishery Economics and Management in India.
33.	D.V. Bal K Virabhandra Rao.	Marine Fisheries.
34.	Arun G. Ghingran & V.V. Sugunan	Conservation and management of Inland copture fishery resource of India.
35.	Agarwal	Management of Aquatic Ecosystem.
36.	Agarval S.C.	Management of fishery Resource Development.

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37.	Beveridge M.	Cago Aquaculture.
38.	Das S.M.	Handbook of Limnology & water polluction.
39.	Lagler K.F.	Ichthyology.
40.	Misra S.R.	Fisheries in India.
41.	Matty A.J.	Fish endocrinology.
42.	Martyshev F.G.	Pond fisheries.
43.	Mishra S.N.	Cost benefit Analysis.
44.	Rounsecfoll	Fishery Science its methods and application.
45.	Sihna B.M.	Wallago attu fresh water shark of India.
46.	Sharma V.	An Introduction to Indian fisheries.
47.	Trivedi R.K.	Ecology and Pollution of Indian rivers.
48.	Warshney C.K.	Water Pollution and Management.
49.	Day F.	The fishes of India.
50.	Berg L.S.	Classification of fishes, Recent fossils.
51.	Norman J.R.	History of fishes
52.	Nikolsky G.V.	The ecology of fishes.
53.	Hoer and Randall	Fish physiology Vol. I to V.
54.	Jordon D.R.	The genera of fishes and a Classification of fishes.
55.	Gorbman A.	Comparative endocrinology.
56.	Ricker	Marine productivity in the sea.
57.	John E, Bardach J.H, Rhyther and W.D. Mclarney.	Aquaculture.
58.	A.D.E. Merindol	Fish Processing.
59.	R.V. Nair	Indian Sardines.
60.	Brandl A.V.	Fish catching methods of the world.
61.	Milne P.H.	Fish and shellfish farming in coastal waters.
62.	W.E. Ricker	Methods for assessment of fish production in freshwater.
63.	U.K. Srivastava and M.Dharma Reddy.	Fisheries Development in India, Some aspects of policy management.

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64.	P.K. Talwar & A.G. Jhingran.	Inland fisheries Vol.I & II
65.	R.P. Parihar	A text book of fish Biology and Indian fisheries.
66.	S.S. Khanna	An introduction of fishes.
67.	C.B.L. Srivastava	A textbook of fishery science and Indian fisheries.

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ZOO-346 :- 14 Practicals corresponding to ZO-312 - Fishery Science-I

1 to 3 study of some herbivorous, Carnivorous and larvivorous, Omnivorous and detritus feeders.

4) Analysis of contents of stomach of fishes.

5) Study of gonads based on microscopic, study ova a diameter obervations.

6) Study of life histories of selected food fishes.

7) Observation of different types of scales.

8) Observation of different types of fins in fishes.

9) compulation of length - Weight-relationship and indices on the basis of observations on fish populations.

10. Demonstration of different types of gears and nets.

11. Fish parameter.

12. Adaptations of fishes.

13. Observation of oto-liths from the point of view of estimation of growth & age of fishes.

14. Field trip.

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ZOO-461 :- 14 Practicals corresponding to

ZOO-413 :- Fishery Science-II

1 & 2. Identification of important food fishes, prawns, molluscs and culturable fishes.

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3) Study of different types of boats.

4 & 6. Biochemical estimation of protein, fat and glycogen.

7) Water analysis, chemical analysis of water, estimation of O_2, CO_2, PO_4 BO_3 and PH.

8) Plankton fresh water and marine.

9) Control of Pistia, Utricularia, Vallisneria, Potamogeton, Pectinatus, Nelumbo nucefera etc.

10) Study of test the estimation of population formulae of Peterson, schnabel & Echmnyer.

11) Estimation of water content and dry ratio of a sample of local fishes.

12) Fish fecundity (egg counting)

13) Visit to centre where induced breeding is performed.

14) Visit to fish preservation, curing and freezing plant.

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APPENDIX "C"

ZOO-335 : Taxonomy, distribution and bionomics of fishes.

1) Classification.

2) Fossil and pedigree.

3) Origin.

4) Distribution and habitat.

5) Exoskeletion and Jaw syspension.

6) Hill stream fishes.

7) Larvivorous fishes.

8) Colouration.

9) Diseases.

10) Aquarium maintanance.

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ZOO-336 :- Aquaculture

1) Ecology and productivity of fish ponds & lakes.
   a) Physical condition of water, Depth, temperature, Turbidity, light.
   b) Chemical conditions of water :- Dissolved gases ●2, CO2, total alkalinity.
2) Biological conditions of water :- Aquatic vegetation, plankton, Benthos.
3) The soil a) Type of soil b) Soil fertility c) Chemical conditions of soil d) calcium carbonate-phosphorous system e) Iron-phosphorous system.
4) Productivity of fish pond.
   a) Food chain b) Caoncept of productivity.
   c) Methods of measuring productivity.
   d) Classification of water bodies.
5) History and principles of aquaculture comparison of aquatic productivity with land productivity. Foophic levels in aquatic environment and their significance in productivity.

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ZOO-451 : FISH ENDOCRINOLOGY

1) Introduction.
2) Pituitary gland :- General structure, adeno hypophysis Histophysiology, neurohypophysis in teleosts, stainable and nonstainable fibers.
3) Adrenal cortex :- Physiological role of adrenal cortex.
4) Prolactin :- Osmoregulation, melanogenesis & epidermal mucos cells.
5) Hormonal control of chromatophores.
6) Pituitary gonadotropins.
7) Gonadal steroids.

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8) Sex differentiation modified by sex hormones.

9) Secondary sexual characters.

10) Thyroid gland :- Thyrotropic function of fish pituitary gland function and thyroid hormone synthesis.

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ZOO-347 :- 7 Practicals corresponding to

ZOO-335 Taxonomy, distribution and binomics of fishes.

1 & 2 Identification of bony fish & Cartilaginous fish up to species level.

3) Aquarium setting.

4) Preparation of permanent slides of different types of Scales.

5 & 6 Identification of Hill stream fishes and Larvivorous fishes.

7) Study of some fossil fishes.

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ZOO-347 : 7 Practicals corresponding to

ZOO-336 -Aquaculture

1) Study of methods of estimation of various tropic levels.

2) Study of organism constituting and utilising various tropic levels.

3) Study of energy flow through the tropic levels in aquatic environment.

4) Certain important measurements Para-meters and conversion tables for workers.

5 & 6 Aquaculture instrumentation :-

Nensen's bottle, Reversing thermometer, Secchidisc, BOD incubator and peterson dredge.

7) Visit to any fishery pond or reservoir.

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Zo-462 - 7 Practicals corresponding to
Zo-451 Fish Endocrinology.

1) Pituitary gland and gonads - Section cutting and staining.
2) Chromatophores :- Experiment to demenstrate aggregation & dispersion of chromatopheres.
3) Study of secondary sexual characters.
4) Dissection :- Urinogenital system.
5) Gonadectomy.
6 & 7 Induce breeding :- Extraction of pituitary and preparation of injection, doses of injection and indentification of breeders.

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APPENDIX "D"

(M.Sc. ZOOLOGY SEMESTER IV)

ZOO-462.

LIST OF PRACTICALS CORRESPONDING TO
ZOO-437 - Histochemistry

1) Detection of Alkaline Phosphatase
2) Detection of Acid Phosphatase.
3) Detection of Esterases.
4) PAS reaction for detection of Neutral Mucopolysaccharides.
5) Detection of Acid muco substances by Alcian blue technique.
6) Detection of metachrom asia by Azur-A/Toluidine blue technique.
7) Detection of Lipids by sudan Black-B or any suitable technique.
8) Detection of Proteins - Millons reaction for Tyrosine.

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APPENDIX - E

M.Sc. - ZOOLOGY SEMESTER-IV

LIST OF PRACTICALS CORRESPONDING TO ZOO-421 (a) - TERRESTRIAL ECOLOGY

1) Study of different terrestrial adaptations.
2) Study of different aerial adaptations.
3) Estimation of Primary Productivity.
4) Study of fauna in different types of soils.
5) Determination of chloride in the given soil samples.
6) Determination of P^H of different soil samples.
7) Field trip to study different terrestrial Biomes.

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BIOPHYSICS PRACTICALS APPENDIX "G"

lists of experiments :(any seven expt)

ZOO-321 (b) BIOPHYSICS : ZOO-347

1) Membrane transport across frog skin.
2) Beer's Lamberts Law. (Photo colorimeter)
3) Chlorophyll Absorption.
4) Characteristics of G.M. Counter.
5) Recording and analysis of E.C.G.
6) Micro Electrophoresis.
7) Methyl orange Radiation Dosimetry.
8) Recording and analysis of AEP/VEP. (Auditory Evoked Potential) OR Visual Evoked Potential
9) Electroretinogram of cockroach.
10) Protein Estimation.
11) Instrumentation amplifier - Filter for ECG.
12) Recording of Phonocardiogram using an Electronic Stetoscope OR Audiogram recording and interpretation (Audiometry).

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