S Y L L A B U S

Master of Science

ZOOLOGY- SY
(Fourth Semester)

Semester Pattern

w.e.f June 2009
### M.Sc. in Zoology
#### Semester System 2009
#### Course Codes and Titles
#### M.Sc. Zoology – Fourth Semester

<table>
<thead>
<tr>
<th>Paper No./ Course Code</th>
<th>Title of the Paper</th>
<th>Periods/ Practical</th>
<th>Marks</th>
<th>Time Duration of Examination</th>
</tr>
</thead>
<tbody>
<tr>
<td>ZOOL-401</td>
<td>Genetics and Genetic Engineering</td>
<td>48</td>
<td>50</td>
<td>03 Hours</td>
</tr>
<tr>
<td>ZOOL-402</td>
<td>Endocrinology</td>
<td>48</td>
<td>50</td>
<td>03 Hours</td>
</tr>
</tbody>
</table>

*Students should opt. any one following specialization.*

<table>
<thead>
<tr>
<th>Paper No./ Course Code</th>
<th>Title of the Paper</th>
<th>Periods/ Practical</th>
<th>Marks</th>
<th>Time Duration of Examination</th>
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</thead>
<tbody>
<tr>
<td>ZOOL-403A</td>
<td>Entomology-I Economic Entomology</td>
<td>48</td>
<td>50</td>
<td>03 Hours</td>
</tr>
<tr>
<td>ZOOL-404A</td>
<td>Entomology-II Agriculture Entomology and Pest Management</td>
<td>48</td>
<td>50</td>
<td>03 Hours</td>
</tr>
<tr>
<td>ZOOL-403B</td>
<td>Fishery Science – I Fisheries and Fish Culture - I</td>
<td>48</td>
<td>50</td>
<td>03 Hours</td>
</tr>
<tr>
<td>ZOOL-404B</td>
<td>Fishery Science – II Fisheries and Fish Culture – II</td>
<td>48</td>
<td>50</td>
<td>03 Hours</td>
</tr>
<tr>
<td>ZOOL-403C</td>
<td>Applied Parasitology – I Trematodes and Cestodes</td>
<td>48</td>
<td>50</td>
<td>03 Hours</td>
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<tr>
<td>ZOOL-404C</td>
<td>Applied Parasitology – II Animal Nematodes and Plant Nematodes</td>
<td>48</td>
<td>50</td>
<td>03 Hours</td>
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<tr>
<td>ZOOL-403D</td>
<td>Animal Physiology – I Mammalian Physiology – I</td>
<td>48</td>
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<tr>
<td>ZOOL-404D</td>
<td>Animal Physiology – II Mammalian Physiology – II</td>
<td>48</td>
<td>50</td>
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<tr>
<td>LC-401 + 402</td>
<td>Genetics and Genetic Engineering + Endocrinology</td>
<td>--</td>
<td>50</td>
<td>06 Hours</td>
</tr>
<tr>
<td>LC-403A + 404A</td>
<td>Economic Entomology + Agriculture Entomology and Pest Management</td>
<td>--</td>
<td>50</td>
<td>06 Hours</td>
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<tr>
<td>Paper No./Course Code</td>
<td>Title of the Paper</td>
<td>Periods/Practical</td>
<td>Marks</td>
<td>Time Duration of Examination</td>
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<td>-----------------------</td>
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<tr>
<td>LC-403B + 404B</td>
<td>Fisheries and Fish Culture - I + Fisheries and Fish Culture - II</td>
<td>--</td>
<td>50</td>
<td>06 Hours</td>
</tr>
<tr>
<td>LC-403C + 404C</td>
<td>Trematodes and Cestodes + Animal Nematodes and Plant Nematodes</td>
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<td>50</td>
<td>06 Hours</td>
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<tr>
<td>LC 403D + 404D</td>
<td>Mammalian Physiology - I + Mammalian Physiology - II</td>
<td>--</td>
<td>50</td>
<td>06 Hours</td>
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</tbody>
</table>
| Project Work and Internal Assessment | a) Project Work ........... 60  
b) Viva on Project Work ...... 20  
c) Seminar Assessment ........ 20 | 100               |       | (Each Candidate should present 04 seminars during 3rd & 4th Semester) |
# Swami Ramanand Teerth Marathwada University, Nanded

## SYLLABUS FOR M.Sc. ZOOLOGY

### FOURTH SEMESTER

w.e.f. June 2009

**Course Code** – ZOOL 401

**Title of the Paper – Genetics and Genetic Engineering**

<table>
<thead>
<tr>
<th>Maximum Marks - 50</th>
<th>Total Periods - 48</th>
</tr>
</thead>
</table>

## UNIT – I

1.0 Mendel’s law of inheritance  
1.1 Law of Dominance  
1.2 Law of Segregation  
1.3 Law of independent assortment  

2.0 Interaction of genes and modifying genes  
2.1 Complementary gene factors  
2.2 Supplementary gene factors  
2.3 Inhibitory factors  
2.4 Lethal gene factors  
2.5 Epitasis  

3.0 Sex chromosomes and sex linked inheritance  
3.1 Types of sex chromosomes and sex chromatin  
3.2 Sex linkage in Drosophila  
3.3 Sex linkage in man  
3.4 Sex linked lethal genes  

4.0 Chromosomal methods of sex determination  
4.1 Heterogametic Males  
  i) xx–xo type  
  ii) xx–xy type  
4.2 Heterogametic Females  
  i) zo–zz system  
  ii) zw–zz system  

## UNIT – II

1.0 Linkage and crossing over  
1.1 Kinds of linkages and significance  
1.2 Mitotic and meiotic crossing over  
1.3 Mechanism of meiotic crossing over  
1.4 Kinds of crossing over  

2.0 Mutations  
2.1 Gene mutation  
2.2 Chromosome mutation – Autopolyploidy, Aneuopolyploidy
2.3 Induced mutation & CIB method
2.4 Mutagenic agents

3.0 Multiple Alleles and Inheritance
3.1 Multiple allelism A–B–O blood groups
3.2 Inheritance of A–B–O blood groups and medico–legal applications
3.3 Rh–factor and Erythroblastosis foetalis

UNIT – III

Human Genetics
1.0 Numerical abnormalities of human chromosomes and related syndromes
1.1 Non–disjunction, Aneuploidy
1.2 Patau syndrome
1.3 Down syndrome
1.4 Sex chromosomes – Turner’s syndrome
                     Klinefelter’s syndrome

2.0 Structural abnormalities of human chromosomes and related syndromes
2.1 Cri–du–chat syndrome
2.2 Robert–Sonian translocation
2.3 Prader–Willi Syndrome
2.4 William’s Syndrome

3.0 Human metabolic disorder
3.1 Phenylketouria
3.2 Alcaptoneuria, Tay–Sach’s disease
3.3 Glucose–6–phosphate dehydrogenase deficiency, Emphysemia

UNIT – IV

1. Introduction to recombinant DNA technology
2. Enzymes used in DNA technology
3. Cloning vectors – Plasmids, Phages, Cosmids
4. Cloning techniques – Isolation and purification of genomic and plasmid DNA and RNA, Gel electrophoresis of nucleic acids
5. Gene transfer techniques – Electroporation and microinjection
List of the Practical Exercises for Laboratory Course (LC-402)

1. Preparation of pedigree chart of some phenotypic characters of human
2. Study of sex–chromatic from buccal smear or hair root cells
3. Identification and preparation of human karyotype
4. DNA sequencing
5. Estimation of DNA by spectrophotometer
6. Study of mitosis using onion root tip cells
7. Study of meiosis in grasshopper testis
8. Study of polytene chromosomes in chironomous larval salivary glands
9. Sugar estimations in normal and diabetic patients
10. Study of monohybrid, dihybrid crosses and interaction of genes with suitable examples
12. Isolation of DNA/RNA from blood
13. Plasmid isolation from bacterium
14. Transformation experiment
15. Restriction digestion of DNA
### Scheme of Practical Examination

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Study of sex chromatin from buccal smear / study of Mitosis / Meosis / Polytene chromosomes using biological material.</td>
<td>10</td>
</tr>
<tr>
<td>2</td>
<td>Estimation of DNA / Estimation of sugar from normal &amp; diabetic patients / Gel electrophoresis of nucleic acids</td>
<td>10</td>
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<tr>
<td>3</td>
<td>Study of identification &amp; preparation of human Karyotype / DNA sequencing</td>
<td>10</td>
</tr>
<tr>
<td>4</td>
<td>Study of monohybrid, dihybrid crosses and interaction of genes</td>
<td>10</td>
</tr>
<tr>
<td>5</td>
<td>Record book</td>
<td>05</td>
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<tr>
<td>6</td>
<td>Viva–voce</td>
<td>05</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>50</strong></td>
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</table>
UNIT – I
1.0 Introduction to Endocrinology
1.1 Hypophysiotropic hormones (TRH, SST, GHRH, GhRH, CRH, PRF, PIF, MIF) and their functions.
1.2 Hypothalamo – Hypophysial portal system.
1.3 Structure and histology of pituitary gland, pituitary hormones – TSH, ACTS, GH, FSH, LH, ProLactin, MSN (Hormones of Adenohypaphysis)
1.4 Hormones of Neurohypophysis – Oxytosin and Vasopressin (ADH)
1.5 Biosynthesis of protein and peptide hormones and mechanism of hormone action

UNIT – II
2.1 Structure and histology of Adrenal gland, Adrenal cotex hormones – Mineralocorticoids and Glucocorticoids, Renin – Angiotensin system
2.2 Hormones of Adrenal Medulla – Epinephrine and Norepinephrine
2.3 Hormones of Pancreas – Insulin and Glycogen, Types of Diabetes; IDDM, IIDM
2.4 Structure and histology of parathyroid gland, Parathyroid hormone – Parathormone and calcium metabolis.

UNIT – III
3.1 Hormones of Female Reproductive Physiology – Estrogens and Progesterone
3.2 Placenta, Hormones of Placenta – HCG & functions
3.3 Hormones of Male Reproductive Physiology – Androgens – Testosterone, Dihydrotesteronc.
3.4 Gastrointestinal Hormones – Gastrin, Secretin, Cholecystokinin (CCK), Gastric Inhibitory Peptide (GIP), Vasoactive Intestinal Peptide (VIP), Substance – P, Somatostatin

UNIT – IV
4.2 Endocrine Role of Pineal Gland – Melatonin
4.3 Neurohormones – NO, CO, Endorphins, CCK
4.4 Hormones of Thyroid – Thyroxine (T4, T3 & Calcitonin) Biosynthesis of T3 & T4 mechanism of steroid hormone action, Positive feedback and negative feedback of hormones
List of Practical Exercises for Laboratory Course (LC-402)

1) Dissection of Endocrine glands in Rat or any other vertebrate
2) Determination of protein and glycogen in endocrine material (using spectrophotometer)
3) Determination of sugar level in diabetic and non-diabetic blood samples
4) Microtomy of Endocrine glands (Tissue fixation, Parafin block preparation, sectioning, staining and Mounting).
5) Histology of Rat / Rabbit / Mammal Endocrine glands – Observation of histological section of different endocrine glands.
6) Hypophysectomy, Thyroidectomy, Adrenalectomy, Ovariectomy, in Rat / Mammal, Hysterectomy, Vasectomy.
7) Effect of Thyroxin on oxygen consumption of a fish.
8) Separation of plasma proteins by electrophoresis.
9) RIA and ELISA for any hormone or second messenger.
10) Estimation of at least one hormone.
11) Preparation of vaginal smear, staining and identification of reproductive phase in Rat.
12) Identification of chemical structure of steroid hormone.


**Suggested Reading**

Swami Ramanand Teerth Marathwada University, Nanded
SYLLABUS FOR M.Sc. ZOOLOGY (ENTOMOLOGY)
FOURTH SEMESTER
w.e.f. 2009
Paper–Zoo–403(A)
ECONOMIC ENTOMOLOGY

Maximum Marks - 50
Total Periods - 48

UNIT – I:

i. Sericulture: Mulberry silkworm: life history, seed production, silkworm rearing, silk glands and silk production, cocoon formation, cocoon harvesting and reeling, silkworm diseases and management, non–mulberry sericulture, sericulture as a cottage industry.

ii. Lac culture: Biology of lac insects, lac cultivation and economic importance of lac.

UNIT – II:

i. Apiculture: types of honey bees, life cycle, apiary products, bee keeping and techniques, bee rearing management, movable frame hive; economic importance of honey, wax and apiary products.

ii. Insects as pollinators

iii. Insects as food

iv. Insect as a source of drugs and dyes

v. Insects in research

vi. Butterfly farming

vii. Insects in forensic entomology

UNIT – III:

i. Medical entomology: Morphology, Vectorship, Pathogenicity & Control of: Mosquito, housefly, Rat fleas, head louse.

ii. Morphology, Vectorship, Pathogenicity & Control of: Pests of domestic animals, Horse and Cattles.

UNIT – IV:

i. Household pests: Morphology, damage caused & Control measure of: Cockroach, Cricket, Carpet beetle, Ants and termites, Bed bugs, Lepisma, Wasps.
Swami Ramanand Teerth Marathwada University, Nanded
SYLLABUS FOR M.Sc. ZOOLOGY (ENTOMOLOGY)
FOURTH SEMESTER
w.e.f. 2009
Paper–Zoo–404(A)
AGRICULTURE ENTOMOLOGY & PEST MANAGEMENT

Maximum Marks - 50  Total Periods - 48

UNIT – I:

i. Concept of pest; origin of pest; types of pests; nature of damage; pest resurgence.
ii. Classification, Morphology, bionomics, damage and control measures of
   a) Pests of cotton: Cotton Bollworms; Red cotton bug; Cotton whitefly.
   b) Pests of sugarcane: sugarcane leafhopper.
   c) Pests of paddy: Yellow stem borer.

UNIT – II:

i. Classification, Morphology, bionomics, damage and control measures of
   a) Pests of Jowar: Jowar stem borer, Jowar shoot fly, Jowar midge fly; armyworm.
   b) Pests of fruit crops: Lemon butterfly, mango stem borer, coconut borer.
   c) Pests of oil seed crops: Safflower aphid.
   d) Pests of stored grains: Rice weevil, Red flour beetle, pulse beetle.
   e) Defoliators, sap suckers & fluid sucker pests of forest trees.

UNIT – III:

Pest Management:

i. Physical and mechanical control, cultural control, legal control.
ii. Chemical control: Insecticidal formulations, classification of insecticides, mode of
    action of insecticide, merits and demerits of chemical control, plant protection
    equipments.

UNIT – IV:

i. Biological control: Principles, procedure, Biological agents; success and limitations.
ii. Hormonal control of insect pests.
iii. Genetic control of insect pests.
iv. Integrated pest management (IPM) Principles, modeling and application.
PRACTICLES FOR THIRD SEMESTER
LC 303 A
INSECT: STRUCTURE & FUNCTION.

1) Study of external morphology of locally available insect.
2) Study and mounting of antennae, mouth parts, wings and legs of insects.
3) Study of wing venation and modification of wings in insects.
4) Study of genetalia and ovipositor in insects.
5) Dissection of a) digestive system b) nervous system c) reproductive system of one of the following insect i) Grasshopper, ii) Honey bee, iii) Nepa
6) Mounting of sting apparatus of honey bee
7) Physiological experiments:
   a) Quantitative survey of digestive enzymes present in salivary glands and gut.
   b) Detection of uric acid as' end product of excretion in terrestrial insects.
8) Study of microtomy of 5 insect organs.

   Students should submit at least 10 slides of mounting and microtomy at the time of examination.

LC 304A
INSECT TAXONOMY, INSECT DEVELOPMENT AND ECOLOGY

i. Insect collection, preservation, curation and identification of insects belonging to different insect orders.
ii. Study of eggs larvae and pupae of insects.
iii. Rearing and study of metamorphosis steps of insects (Rearing of at least one insects to be studied)
iv. Collection and study of plant galls.
v. Study of different castes of honey bee and termite.
vi. Study of effect of factors like temperature and moisture on egg laying and egg hatching of insect.

   Study of insect host plant relationship, host range.

   Candidates should submit at least 25 locally available insects at the time of examination.
List of Practicals for Fourth Semester

LC-406A : ECONOMIC ENTOMOLOGY

1) Study of silk worm adult, caterpillar and cocoon, sericulture practices, equipments used in sericulture.
2) Study of honey bees and their castes; apiculture equipments.
3) Study of lac insects, lac cultivation, lac products.
4) Study of household pests *viz.* House fly, Cockroach, Lepisma, Ants, termites, Cricket.
5) Study of insect vectors like Mosquito, bed bug, flea, body louse, Rat flea.
6) Study of beneficial insects (predatory and parasite insects) and their importance.
7) Study & rearing of biological control agents (At least one)

LC-404A : AGRICULTURE ENTOMOLOGY & PEST MANAGEMENT

2) Collection and study of insect infested / damaged parts of plants.
3) Collection and study of parasactisc, predatory, pollinater insects & biological control agents.
4) Study of life history stages of different pests.
5) Study of plant protection equipments.
# LC303(A) + 304(A)

**Insect: Structure & Function & Insect Taxonomy, Insect Development And Ecology**

**SCHEME OF MARKING**

<table>
<thead>
<tr>
<th>Duration 6 Hrs.</th>
<th>Marks – 50</th>
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<tbody>
<tr>
<td>1) Dissection of ....... system from insect provided ........................................ 08</td>
<td></td>
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<tr>
<td>2) Temporary mounting of ................................................................. 04</td>
<td></td>
</tr>
<tr>
<td>3) Staining and identification of microtomy slides ......................................... 04</td>
<td></td>
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<tr>
<td>4) Quantitative survey of digestive enzymes from salivary gland/ gut of ....... 05</td>
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<tr>
<td>5) Identification and comment on 5 insects (Insect taxonomy) .............................. 10</td>
<td></td>
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<tr>
<td>6) Spotting from insect ecology &amp; development (3 Spots) ................................. 06</td>
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<tr>
<td>7) Submission of insects and slides .............................................................. 04</td>
<td></td>
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<tr>
<td>8) Viva voce ........................................................................................................ 04</td>
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<tr>
<td>9) Record books .................................................................................................. 05</td>
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# LC403(A) + 404(A)

**ECONOMIC ENTOMOLOGY + AGRICULTURE ENTOMOLOGY & PEST MANAGEMENT**

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<th>Marks – 50</th>
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<tbody>
<tr>
<td>1) Identification &amp; comments on house hold pests (Any 2) ......................... 06</td>
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<tr>
<td>2) Identification &amp; comments on insect vectors (Any 2) ............................. 08</td>
<td></td>
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<tr>
<td>3) Identification &amp; comments on spots from sericulture, Apiculture and Lac culture (Any 2) ................................................................. 06</td>
<td></td>
</tr>
<tr>
<td>4) Identification &amp; comments on insect pests and insect damaged parts (Any 5) .... 15</td>
<td></td>
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<tr>
<td>5) Identification and comment on beneficial insects (Predatory &amp; Parasatic insects, Biological control agents) (Any 2) ............................. 06</td>
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<tr>
<td>6) Viva voce ........................................................................................................ 04</td>
<td></td>
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<tr>
<td>7) Record books .................................................................................................. 05</td>
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### RECOMMENDED BOOKS

1) Nayer, K.K., T. Anant Krishnan and B.W. David: *General and Applied Entomology*
2) Metcalf, G.L. and W.P. Fling: *Destructive and Useful Insect*
3) Hemsingh Pruthi: *A Text Book of Agricultural Entomology*
4) Wigglesworth: *Principles of Insect Physiology*
5) ESSIG: *College Entomology*
6) M.S. Mani: *A Text Book of General Entomology*
7) Government of Maharashtra Publication: *Crop Pests and How to Fight Them*
8) Oldoyd, N.: *A Collection, Preserving and Studying Insects*
9) Roger P. and Anderson: *Forest and Shade Tree Entomology*
10) Tembhare, D.B.: *Modem Entomology*
11) Fradt, R.E.: *Fundamentals of Applied Entomology*
12) Smith, K.G.V.: *Insects and Other Arthropods of Medical Importance*
13) Ray, D.N. and A.W.A. Brown: *Entomology Medical & Veterinary*
14) Chandler, A.C. and Read, C.P.: *Introduction of Parasitology*
15) Debach, R.: *Biological Control of Natural Enemies*
16) Apple, J.L. and Smith, R.F.: *Integrated Pest Management*
17) Cheny: *General Parasitology*
18) Corbet, J.R.: *The Biochemical Mode of Action of Pesticides*
19) Champaman, R.F.: *Insects – Structure and Function*
20) Richards, O.W. and R.G. Davies, IMMS: *Text Book of Entomology*
21) Bursel, E.: *An Introduction to Insect Physiology*
22) Rockstein M.: *The Physiology of Insects (Vol. 1–VI)*
24) Johnson, O.A.: *Embryology of Insects and Myriopods*
25) Ross, H.A.: *Text Book of Entomology*
26) Roddick: *Insect Physiology*
General Plan of study of specialization papers of Fishery Science during M.Sc. (Zoology) 3rd and 4th semesters.

1) Third Semester

<table>
<thead>
<tr>
<th>Paper Numbers</th>
<th>Title of Paper</th>
<th>Marks</th>
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<tbody>
<tr>
<td>a) Zoo 303 (B)</td>
<td>Fish Morphology, Anatomy and Physiology-I</td>
<td>50</td>
</tr>
<tr>
<td>b) Zoo 304 (B)</td>
<td>Fish Morphology, Anatomy and Physiology-II</td>
<td>50</td>
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<tr>
<td>c) Lc 303 (B) + 304 (B)</td>
<td>Fish Morphology, Anatomy and Physiology-I &amp; Fish Morphology, Anatomy and Physiology-II</td>
<td>50</td>
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2) Fourth Semester

<table>
<thead>
<tr>
<th>Paper Numbers</th>
<th>Title of Paper</th>
<th>Marks</th>
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<tbody>
<tr>
<td>a) Zoo 403 (B)</td>
<td>Fisheries and Fish culture - I</td>
<td>50</td>
</tr>
<tr>
<td>b) Zoo 404 (B)</td>
<td>Fisheries and Fish culture - II</td>
<td>50</td>
</tr>
<tr>
<td>c) Lc 403 (B) + 404 (B)</td>
<td>Fisheries and Fish culture - I &amp; Fisheries and Fish culture - II</td>
<td>50</td>
</tr>
</tbody>
</table>
| d) Project work and Internal Assessment | a) Project work …….. 60  
   b) Viva on project work ….. 20  
   c) Seminar assessment …….. 20  
   (Each candidate should present 4 seminars during 3rd & 4th semester) | 100   |
SYLLABUS FOR M. Sc. ZOOLOGY (FISHERY SCIENCE)
FOURTH SEMESTER
w.e.f. 2009
Paper-Zoo-403 (B)
FISHERIES AND FISH CULTURE - 1

Unit-I
1. Introduction, Scope and importance of Fisheries and Fish culture :
2. Fish culture
   - Study of commercially important cultivable fresh water Fishes
     (Characters, Growths, Food and Feeding habits, Maturity, Spawning etc.)
   - Indian major carps - Rohu, Catla, Mrigal
   - Exotic Carps - Common Carp, Grass Carp, Silver Carp
3. Monoculture and Composite Fish culture , Polyculture

Unit-II
1. Fish Farm Engineering
   - Topography
   - Soil type
   - Water supply
   - Design
2. Fish Farm Management
   - Types of Ponds required
   - Management of Hatcheries
     - Types of Hatcheries
       1. Hatching pits
       2. Hapa
       3. Chinese Hatchery System
       4. D-82 Hatchery System
- Management of Nursery, rearing and stocking pond (Pre stocking, Stocking and Post stocking management)

3. Aquatic weeds and their Control
   - Types of Aquatic Weeds
   - Advantages and Disadvantages of Aquatic Weeds
   - Weed Control by manual, mechanical, chemical and Biological methods

Unit-III
1. Induced breeding by hormones
   - Collection of glands
   - Preservation and storage
   - Preparation of extract
   - Selection of breeders
   - Injection and dosage
   - Breeding happa and spawning
   - Uses of other natural and Synthetic hormones
2. Collection of breeders from natural Bundh
   - Bundh breeding - Wet and Dry bundh

Unit - IV
1. Fish Pathology
   - Symptoms and treatment of
     - Parasitic diseases
     - Non Parasitic diseases
     - Miscellaneous diseases
2. Fish Preservation
   - Causes of Fish spoilage
   - Various methods of Fish preservation

3. Fish by products
SYLLABUS FOR M. Sc. ZOOLOGY (FISHERY SCIENCE)

FOURTH SEMESTER

w.e.f. 2009

Paper-Zoo-404 (B)

FISHERIES AND FISH CULTURE - II

Unit-I

1. Scope and importance of Aquaculture
2. Extensive and Intensive Aquaculture
3. Culture methods :
   - Cage Culture
   - Pen Culture
   - Race way Culture
4. Integrated Fish Farming
   - Paddy cum Fish Culture

Unit-II

1. Sewage Fed Fish Culture
2. Mussel Culture
3. Prawn Culture
4. Pearl oyster Culture

Unit-III

1. Man made hazards and Aquaculture
2. Methods of Fishing
   - Crafts and Gears used
   - Electrical Fishing, Light Fishing, Fish finder
Unit-IV

Principle Fisheries of India

1) Reverine Fisheries
2) Reservoir Fisheries
3) Marine Fisheries
   i) Mackeral Fishery
   ii) Oil Sardine Fishery
   iii) Bombay Duck Fishery
   iv) Prawn Fishery
LIST OF PRACTICALS FOR FOURTH SEMESTER

LC 403 (B)

FISHERIES AND FISH CULTURE - I

1) Identification of Indian Major Carps and Exotic Carps
2) Layout of Fish Farm
3) Identification of Hatcheries (Model Study)
4) Identification of Aquatic weeds, Predatory Fishes, Weed Fishes, Aquatic insects.
5) Identification of Spawn, Fry and fingerlings of culturable Fishes
6) Collection and preservation of Pituitary gland
7) Preparation of Pituitary extract and injection of Pituitary extract - by demonstration
8) Identification of parasites and their control
9) Visit to Fish Farm
10) Preparation of by products like Fish manure, Fish meal, Issinglass etc.
PRACTICALS FOR FOURTH SEMESTER
LC 404 (B)
FISHERIES AND FISH CULTURE - II

1) Study of Cage, Pen and Race way (Model Study)
2) Identification Mussels, Prawn and Pearl oyster
3) Study of crafts and gears: Hooks, Line-Gear, Cast net, Gill net, Drag net, Trawl net, Catameron, Masula, Coracle, Trawler
4) Identification of Food Fishes from Rivers, Reservoir and Sea
5) Visit to Rivers, Reservoirs to Study Riverine & Reservoir Fisheries.
Unit 1:
1. General organization of Trematodes and its classification upto family level.
2. General organization of Monogenea, Aspidobothria and Digenea.
3. Functional anatomy of Male and Female reproductive system in Digenea.

Unit 2:
5. Larval forms in Trematodes
6. Immunology, Basic concept, Antigen Antibody reaction, Innate and Acquired resistance.
7. Study of Morphology, Life cycle, Pathogenicity, Prophylaxis of following parasites:
   1. *Fasciolopsis buski*
   2. *Schistosoma Japonicum and Schistosoma mansoni.*
   3. *Clonorchis sinensis*
   4. *Paragonimus wetermani.*

Unit 3:
8. General organization of cestodes and its classification upto order level.
10. General important features of the following orders:
    a) Proteocephalidea
    b) Tetraphyllidea
    c) Davaineidea
    d) Hymenolepidea
11. Hold fast organs in Cestodes.
Unit 4:

13. Larval forms in Cestodes.

14. Study of following important parasites with respect to their geographical distribution, habitat, morphology, Life cycle, Pathogenicity, Diagnosis, Treatment and Prophylaxis.

   a) *Taenia Solium*
   b) *Echinococcus granulosus*
   c) *Diphyllobothrium latum*
   d) *Hymenolepis nana*
   e) *Dipylidium caninum*

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Suggested Reading:

1. An Introduction to Parasitology – By Chandler
2. General Parasitology – By Cheng T.C..
3. Biology of Parasites – By Cheng
4. Systema Helminthum – By S. Yamaguti
6. Clinical Parasitology – By Faust
7. Medical Helminthology – By Watson
8. Parasitology – By K.D. Chatterjee
1. Preparation of stains: Haematoxylin, Acetocarmine, Borax caramine and Bouins fluid.
2. Preparation of Different Grades of Alcohols.
3. General principles of Collection, Preservation, Staining and Mounting of Trematodes and Cestodes.
4. Collection of Trematodes and Cestode parasites from locally available different hosts.
5. Preparation and identification of collected helminth parasites (Trematodes and cestodes) At least Ten.
6. Study of permanent mounts of Trematodes and cestodes viz.
   1. Polystoma
   2. Gyrodactylus
   3. Paramphistomum
   4. Fasciola hepatica
   5. Gastrothylax
   6. Fasciolopsis buski
   7. Schistosoma Japonicum
   8. Schistosoma mansoni.
   9. Clonorchis sinensis
   11. Taenia solium & Taenia saginata
   12. Moniezia expansa
   13. Railletina
   14. Cotugnia
   15. Echinococcus granulosus
   16. Diphyllobothrium latum
   17. Dipylidium caninum
   18. Hymenolepis nana
   19. Dipylidium caninum
   20. Gyrocotyle
Unit 1:
1. General organization of Nematode body.
2. Ultra structure of Cuticle-Chemical Composition and Organization
4. Carbohydrate and Protein Metabolism in Nematodes.
6. Functional anatomy of reproductive system of Nematodes.

Unit 2:
7. Larval forms in Nematodes with special reference to pathogenicity.
8. Study of following important parasites with respect to their Geographical Distribution, Habitat, Morphology, Life-cycle, Pathogenicity, Diagnosis, Treatment and Prevention.
   a) *Ancylostoma duodenale*
   b) *Wuchereria bancrofti*
   c) *Dracunculus medinensis*
   d) *Trichinella spiralis,*
   e) *Strongyloides stercoralis.*
   f) *Enterobius vermicularis.*
9. Nematode as models and model nematodes (Toxicity, Gerntology, Parasitic, Genetic)
Unit 3:

10. Plant parasitic Nematodes – General account

   a) Above ground symptoms
   b) Below ground symptoms.


13. Chemical Control.
   a) Nematicidal chemicals
   b) Application of Nematicides
   c) Procedure in soil fumigation

Unit 4:

14. Structure, Life cycle and Control of the following Nematodes.
   a) *Anguina (Seed Gall- nematode)*
   b) *Meloidogyne (Root knot nematode)*
   c) *Heterodera (cyst nematode)*
   d) *Tylenchulus (citrus nematode)*
   e) *Pratylenchus (Lesion nematode)*

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Suggested Reading:

1. An Introduction to Parasitology – By chandler
2. General Parasitology – By Cheng T.C..
3. Biology of Parasites – By Cheng
4. Systema Helminthum – By S.Yamaguti
6. Clinical Parasitology – By Faust
7. Medical Helminthology – By Watson
8. Parasitology – By K.D. Chatterjee
10. Nematode Parasites – N.D. Levine
11. Structure of Nematodes – A.F. Bird
12. An Introduction to Nematology – Chitwood
13. Essentials of Nematodology – Skrjabin, Shikhobalova & Shults
1. General principles of collection, preservation, staining and mounting of Animal parasitic Nematodes.

2. Collection of Animal and plant parasitic Nematodes from locally available different hosts/sources.


   1. *Ascaris lumbricoides*
   2. *Oxyuris*
   3. *Ancylostoma duodenale*
   4. *Wuchereria bancrofti*
   5. *Dracunculus medinensis*
   6. *Trichinella spiralis,*
   7. *Strongyloides stercoralis.*
   8. *Enterobius vermicularis.*
   9. *Anguina (Seed Gall-nematode)*
   10. *Meloidogyne (Root knot nematode)*
   11. *Heterodera (cyst nematode)*
   12. *Tylenchulus (citrus nematode)*
   13. *Pratylenchus (Lesion nematode)*
   14. *Ditylenchus dipsaci*
   15. *Tylenchorhynchus*
   16. *Belonolaimus gracilis*
   17. *Hoplolaimus coronatus*
   18. *Radopholus similis*
   19. *Trichodorus christiei*
   20. *Xiphinema americanus*

5. Collection Techniques
   - Baereman’s funnel techniques
   - Oostenbrinks elutriator
   - Sieving, Fixation, Dehydration.
UNIT – I

1. Digestive System
   1.1 Digestive Tract
   1.2 Histological structure of stomach, small intestine
   1.3 Liver – Structure and Functions
   1.4 Pancreas – Structure and secretion of enzymes
   1.5 Gall Bladder – Physiology
   1.6 Gastro Intestinal Hormones and their role
   1.7 Physiology of protein, carbohydrate and lipid, Digestion, Brush Border Enzymes
   1.8 Physiology of Absorption of Proteins, Carbohydrates and Lipids
   1.9 Disorders – i) Peptic Ulcers ii) Cirrhosis iii) Hepatitis iv) Gallstones
   1.10 Secretion of HCl by parietal cells – Mechanism

UNIT – II

2. Respiratory System
   2.1 Structure of Respiratory System – Nose, Pharynx, Larynx, Voice Production, Trachea, Bronchi, Lungs
   2.2 Pulmonary ventilation – Inspiration and expiration (Mechanism of respiration)
   2.3 Lung volume and capacities
   2.4 Transport of oxygen and carbon dioxide
   2.5 Exchange of oxygen and carbon dioxide between blood and tissues
   2.6 Chemical and nervous control of respiration.
   2.7 Disorders – Asthma, Bronchitis, Emphysema, Pneumonia, Cystic Fibrosis

UNIT – III

3. The Cardiovascular System
   3.1 Composition of Blood – Plasma and Formed elements of blood, composition of plasma, structure and functions of RBC, WBC, Platelets.
   3.2 Functions of blood
   3.3 Formation of blood cells – Erythropoiesis, Leucopoiesis
   3.4 Disorders – Anaemia, Leukaemia
   3.5 Location and size of the heart – Structure of heart – External structure and internal structure
3.6 Anatomy of blood vessels
   a) Arteries, Capillaries and Veins
   b) Artherosclerosis and Arteriosclerosis
   c) Angina pectoris and coronary angioplasty

3.7 Conduction system, pacemaker and heart beat and regulation of cardiac

3.8 Cardiac cycle, cardiac output, ECG, Cardiac Arrhythmias, Heart Block, Blood Pressure, Hyper Tension, Hypotension

3.9 Risk factors in heart disease

3.10 Plasma lipids and heart disease – Lipoproteins in Blood, Blood Cholesterol

3.11 Lymph -- Composition, Formation and Function, Structure and Functions of Lymph nodes

3.12 Disorders – Coronary Artery Disease (CAD)

UNIT – IV

4. Kidney's
4.1 Kidney-- External and internal anatomy
4.2 Structure of Nephron (Uriniferous Tubule), Histology of Nephron
4.3 Blood supply to kidney
4.4 Renal Physiology – Glomerular filtration – Net filtration rate, glomerular filtration rate, filtration pressure
4.5 Tubular Reabsorption – Reabsorption of Na\(^+\) in PCT, Reabsorption of Nutrients in PCT, Reabsorption in the loop Henle, Reabsorption in the DCT and collecting ducts, water reabsorption.
4.6 Tubular Secretion – Secretion of H\(^+\), secretion of K\(^+\), secretion of NH\(_3\) and NH\(_4^+\)
4.7 Ultraformation and mechanism of urine dilution
4.8 Counter – Current mechanism
4.9 Dialysis therapy
4.10 Uterus-- Anatomy, Histology, Physiology
4.11 Urinary Bladder-- Anatomy, Histology and Physiology
4.12 Urethra-- Anatomy, Histology, Physiology
4.13 Disorders-- Urinary tract infections, Acute and Chronic Renal Failure
1) Estimation of serum amylase
2) Estimation of SGOT / SGPT
3) Estimation of serum / plasma glucose by GOD / POD method or colarimetric method
4) Estimation of total cholesterol in blood
5) Estimation of proteins in blood
6) Lipid profile – Estimation of Cholesterol, LDL, HDL and Triglycerides in blood
7) Microscopic examination of urine
8) Estimation of serum urea
9) Detection of normal and abnormal constituents of urine
10) Recording of normal cardiogram of Frog’s heart
11) Estimation of total oxygen consumption and rate of oxygen consumption by using Cockroach/Fish/Crab.
SYLLABUS FOR M.Sc. ZOOLOGY (ANIMAL PHYSIOLOGY)
FOURTH SEMESTER
w.e.f. June 2009
Paper – ZOOL–404(D)
Mammalian Physiology – II

Maximum Marks - 50                          Total Periods - 48

UNIT – I

1. Nervous System
   Division of Nervous System – CNS and PNS
   1.1 Brain principal parts, protection and covering, CSF, Blood supply
   1.2 Cerebrum – Lobes, white matter, basal ganglia, limbic system
   1.3 Cerebellum
   1.4 Diencephalon – Pineal gland, Thalamus, Hypothalamus
   1.5 Brain Stem – Medulla oblongata, pons, midbrain, reticular foramen
   1.6 Spiral Cord – Menings, external anatomy, internal anatomy
   1.7 Sensory and Motor Tracts
   1.8 Physiology of Vision
       Accessory structure of the Eye, Anatomy of the Eyeball
   1.9 Image Formation – Refraction of light rays, accommodation of nearpoint vision, constriction of the pupil

UNIT – II

2. Male Reproductive System
   2.1 Scrotum, External morphology and histological structure of testis
   2.2 Spermatogenesis – Sperm, Hormonal, Control of spermatogenesis
   2.3 Accessory sex glands
   2.4 Semen
   2.5 Penis
   2.6 Female Reproductive System – Ovaries, External Morphology and Histological Structure
   2.7 Oogenesis
   2.8 Uterine tubes, Uterus, Vagina, Vulva
   2.9 Mammary glands – Anatomy and histology, physiology breast cancer
   2.10 Female Reproductive Cycle – Phases of female reproductive cycle – Menstrual phase, Pre-ovulatory phase, Ovulation, Post-ovulatory phase.
   2.11 Hormonal regulation of menstrual cycle
   2.12 Birth control measures – Sterilization in male and female
   2.13 Hormonal Methods
   2.14 Intra Uterine Devices
   2.15 Barrier Methods
   2.16 Chemical Methods
   2.17 Physiological Methods
   2.18 Abortion
UNIT – III

3. Muscle Physiology
   3.1 Types of muscle tissue, functions of muscle tissue, Characteristics of muscle tissue
   3.2 Ultrastructure of skeletal muscle and protein activities
   3.3 The connective tissue components, nerve and blood supply, neuromuscular junction
   3.4 Microscopic anatomy of skeletal muscle – myofibrils, sarcoplasmic reticulum and transverse tubules
   3.5 Contraction of muscle – Sliding filament mechanism
   3.6 Role of calcium and regulator proteins
   3.7 Power stroke and the role of ATP
   3.8 Twitch contraction, Tetanus, Staircase effect CT
   3.9 Muscle metabolism – Phosphagen system, Glycogen – Lactic acid system, Aerobic system
   3.10 Oxygen consumption after exercise, muscle fatigue
   3.11 Disorders – Muscular Dystrophies, Myasthenia Gravis

UNIT – IV

4. Auditory sensation and equilibrium
   4.1 External Ear
   4.2 Middle Ear
   4.3 Internal Ear
   4.4 Sound Waves
   4.5 Physiology of Hearing
   4.6 Physiology of Equilibrium – Otolithic organs – Saccule and Utricle, Semicircular canals, Equilibrium pathways
   4.7 Disorders – Deafness
   4.8 The Autonomic Nervous System (ANS) – The anatomy of autonomic motor pathways
   4.9 Pre–ganglionic neurons, Autonomic ganglia, Postganglionic neurons
   4.10 Sympathetic Division
   4.11 Parasympathetic Division
   4.12 Physiological effect of ANS – Ans Neurotransmitters cholinergic and adrenergic receptors
   4.13 Parasympathetic and sympathetic responses
LIST OF PRACTICAL EXERCISE FOR LABORATORY COURSE
Mammalian Physiology – Practical – II

1) Preparation of simple muscle curve
2) To study the effect of fatigue on muscle contraction
3) Dissection of male reproductive system of Rat
4) Dissection of female reproductive system of Rat
5) Separation and identification of Amino Acids (in plasma, tissue extracts) by paper chromatography (one dimensional and two dimensional) and thin layer chromatography
6) Separation of plasma proteins / tissue proteins by paper electrophoresis by Gel Electrophoresis
7) Histochemical demonstration of proteins, Glycogen and lipids (in tissue paraffin sections) by Nile Blue Sulphate, Best Carmine and Sudan Black method or any other histochemical staining method
8) Quantitative estimation of Na, k, Ca and phosphorus
9) Pregnancy Test (using commercial available pregnancy test kits)
10) Estimation serum creatinin, serum urea and CPK
SUGGESTED READINGS
Mammalian Physiology (Paper – I & II)

Scheme of Practical Examination

Subject – Mammalian Physiology (Practical – I & II)
Marks – 50
Time – 11.00 am to 5.00 pm

Q.1. Experiment on practical physiology – 1 Major – 12 Marks
Q.2. Experiment on practical physiology – 1 Minor – 08 Marks
Q.3. Experiment on practical physiology – 2 Major – 12 Marks
Q.4. Experiment on practical physiology – 2 Minor – 08 Marks
Q.5. Practical Record – 05 Marks
Q.6. Viva–voce – 05 Marks