NEW/REVISED SYLLABUS FOR
M.Phil/Ph.D. Course Work: ZOOLOGY
(Introduced from June 2011 onwards)

Paper - I  Total Marks - 100

Title of Paper - Research Methodology in Zoology

Specific Objectives, if any: To develop technical skill in Research students.

UNIT 1 –  No. of Lectures – 15

An Insight into Research

Biostatistics

UNIT 2 –  No. of Lectures – 15

Cell and Tissue Staining Techniques
a) Elements of microtomy- pre-microtomy processes, microtomy process, post microtomy process.
b) In situ and histological staining techniques- Whole mount (In situ) staining techniques, microbial staining techniques.
c) Histochemistry- General histochemistry, enzyme histochemistry, immunochemistry.
d) Microscopy- Light microscopy, electron microscopy, three dimensional microscopy, camera lucida.

Physiological and biochemical techniques
a) Hematological Techniques- Blood composition, hematological techniques.
b) Biochemical methods- Centrifugation, spectroscopy, chromatography, electrophoresis.
c) Detection of carbohydrates and lipids- Chemistry and classification, qualitative and quantitative detection.
d) Detection of enzymes- Chemistry and classification, qualitative and quantitative detection.
UNIT 3 –

Recent trends in biotechniques

a) Nucleic acid biotechniques- Salient features, laboratory biotechniques.
b) Immunological techniques- Elements of immunology, immune reaction, immunological techniques.
c) Radioimmunoassay of hormones- Principle of radioimmunoassay, chemistry and classification of hormones, radioimmunoassay (RIA) techniques for hormones.
d) Animal cell and tissue culture- Salient features, cell culture techniques, cell culture and immunocytochemistry.

UNIT 4 –

Computer applications

a) Applications of computer in Taxonomy and biodiversity study
b) Use of computer in biostatistics
c) Collection, preservation and maintence of animals for biodiversity study
d) Proteomics- proteomic analysis by mass spectrometry and genomics-genome wide analysis of gene structure and expression.

Recommended Reading:

NEW/ REVISED SYLLABUS FOR
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Paper - II Total Marks - 100

Title of Paper - Research Advances in Zoology

Specific Objectives, if any: i. To develop skill in Research students.

ii. To popularize and adopt newer and recent trends in research activities.

UNIT 1 – No. of Lectures – 15

The development of Animal form.
   i) Ontogeny
   ii) Morphology
   iii) Evolution

Chemical signaling in the body.
   i) Signaling molecules and their control.
   ii) Target Cells.
   iii) Response to signals.
   iv) Extrinsic signal.

Molecular phylogeny genome mapping and Immune system in insects.

UNIT 2 – No. of Lectures – 15

Medical Zoology.
   i) Brief introduction to pathogenic microbes.
      a) Viruses, Rickettsiae, Spirochetes and bacteria.
   ii) Pathogenic protozoans.
   iii) Pathogenic helminths.
   iv) Arthropods as a vector agents.
   v) Biodiversity of vector mosquitoes.
   vi) Trends in diagnosis of Malaria, JE and Dengue.
   viii) Genomics of Dengue virus and virus-host interactions.
   ix) Insect vector control strategies.

Enzymic protective Mechanisms in the body.
   i) Blood clotting.
ii) Protection against ingested foreign chemicals.
iii) Protection of the body against its own proteases.
iv) Protection against reactive oxygen species.

UNIT 3 –
Biotechnology.
i) Enzymology of Genetic engineering.
ii) Cloning Vehicles.
iii) Analysis and expression of cloned genes in host cell.
iv) Gene libraries.
v) Changing genes.
vi) Application and impact of recombinant DNA technology.
vii) Ethical issues and biosafety regulation.
viii) Vermiwash production and applications.
ix) Production of transgenic insects and other animals.

Insect Biotechnological Approaches
i) Mulberry Silkworm rearing: Chowki rearing, Late age, Shoot feeding and Branch feeding
ii) Wild Silk Technology: Silkworm diversity and Silk Production.
iii) Bee Keeping: Pollination and Crop yield.
iv) Production technique for Microbial Control agents.

UNIT 4 –
Aquaculture.
i) Philosophy and history of aquaculture.
ii) Different aquaculture practices in the world.
iii) Aquaculture in India, its potential and future.
iv) Economics of aquaculture in India.
v) Problems of aquaculture.

Applied Limnology – Measurement.
i) Case studies of lake Washington, Lake Tahose, Shagawa Lake.
ii) Case studies of Thames River, Nile River, Ganga river.
iii) Nutrient diversion, weed control.
iv) Management of water bodies.
v) Pisces and Biological control of mosquitoes.
Recommended Reading:

NEW/ REVISED SYLLABUS FOR  
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Paper - III (Elective Paper)        Total Marks – 100

(80 Marks for theory exam and for 20 Marks for presentation of review of published papers in National/ Internationals Journals for Ph.D. course work and 10 + 10 marks seminar and review of papers respectively for M.Phil Course.)

Title of Paper – ADVANCES IN PEST MANAGEMENT
Specific Objectives, if any: To control pest insects.

To develop new control measures for insects.

UNIT 1 –            No. of Lectures – 15

1. Natural determinants of growth and metamorphosis 
2. Insect behavior and physiological interpretations: 
   a. Mating 
   b. Oviposition 
   c. Parental care 
3. Genetic control of insect pests and recent advances 
4. Pheromonal and hormonal pest control of insect pests 

UNIT 2 –            No. of Lectures – 15

1. Ecological Pest Management 
2. Components of Biological control 
   a. Biodiversity of biocontrol agents: Parasitoids, Predators and microbial agents 
   b. Biology and habitat of BCA 
   c. Mass production of BCA 
   d. Utilization of BCA in Biological Pest Control 
3. Advances in Integrated Pest Management. 

UNIT 3 –            No. of Lectures – 15

1. Crop resistance to pest insects: Pest suppression by harmonious, coordinated and fortuitous biological means 
2. Insecticides: Organic insecticides, mode of action of insecticides, metabolism of insecticides 
3. Haemolymph proteins of insects and sex specific proteins of insects 
4. Industrial Entomology: 
   a. Sericulture: Commercial Silk Production, Recent Trends, Marketing.
b. Apiculture: Modern methods of bee keeping, Role in pollination and crop yield.
d. Insect as a human food: Insect Diversity, preparation of food, marketing.

UNIT 4 –  

No. of Lectures – 15

1. Insect hormones and pheromones: Chemistry and functions of hormones and pheromones.
3. Insect development: Embryonic and post embryonic development: Morphological, biochemical and physiological basis.
4. Insect parasitism, Insect host parasite relation and crop pest biocontrol agents interactions.

Recommended Reading:
1. Agrochemicals and Pest Management By T. V. Sathe: 2003
3. The Principles of Insect Physiology By U. B. Wigglesworth
4. Biological Insect Pest Suppression By Coppel and Martins: 1971
5. Insect Pest Predators By Sathe and Bhosale: 2001
7. Biological Pest Control By Sathe and Bhoje 2000
8. Indian Pest Parasitoids By Sathe et al., 2001
10. Introduction to Sericulture By Ganga and Chetty
12. Physiology of Insecta Vol 1 to 5 By Morris Rockstein
13. Comprehensive Insect Physiology, Biochemistry and Pharmacology Vol. 1 to 12 By Kerkut and Gilbert
14. Modern Entomology By D. B. Tembhare
15. Entomology By Gillot, C.
16. Imms General Text Book of Entomology By Richards and Davis
18. Insects Pest Management Ecological Approach by T.V.Sathe and Jyoti Oulkar. 2010. DPH,NewDelhi
NEW/ REVISED SYLLABUS FOR
M.Phil/ Ph.D. Course Work : ZOOLOGY
(Introduced from June 2011 onwards)

Paper - III (Elective Paper) Total Marks – 100

(80 Marks for theory exam and for 20 Marks for presentation of review of published papers in National/ International Journals for Ph.D. course work and 10 + 10 marks seminar and review of papers respectively for M.Phil Course.)

Title of Paper – BIOLOGICAL INSECT PEST CONTROL
Specific Objectives, if any: To control insect pests ecofriendly.

UNIT 1 – No. of Lectures – 15

1. Historical account:
   Early history, mid history and recent developments.
2. General aspects of biological pest control, significance and scope (national, international).
3. Identification, habitats, distribution and morphological features of biological pest control agents.
   b. Predators: Insects (Coleoptera, Neuroptera, Hemiptera, Odonata, Lepidoptera, Thysanoptera), Invertibrates and Vertibrates.

UNIT 2 – No. of Lectures – 15

4. Biology of Biocontrol agents:
   Trichogramma, Ichneumonids, Braconids, Tachinids and Chalcids.
5. Rearing Techniques for following biocontrol agents:
   a. Parasitoids: 
      Trichogramma spp., Chelonus blackburni, Bracon brevicornis, Meteorus dichomeridis, Copidosoma koehleri, Campoletis chlorideae.
   b. Predators: 
      Lady bird beetle: Cryptolaemus montrouzieri, Hemipterans, Lace wing: Crysoperla carnea, Menochilus sp., Dragonflies, Toad, Shrews and Guppy fish.
   c. Bacteria: Bacillus thurienginesis
   d. Viruses: NPV.
UNIT 3 – No. of Lectures – 15

6. Use of parasitoids and predators in classical biological insect pest control programmes (case studies in India and Abroad at least 3 cases from each group).
7. Economics and marketing of Biopesticides (Biocontrol agents)

UNIT 4 – No. of Lectures – 15

10. Recent advances in biological pest control programmes

Recommended Reading:
1. Agrochemicals and Pest Management By T. V. Sathe: 2003
2. Biological Insect Pest Suppression By Coppel and Martins: 1971
3. Insect Pest Predators By Sathe and Bhosale: 2001
5. Biological Pest Control By Sathe and Bhoje 2000
6. Indian Pest Parasitoids By Sathe et al., 2001
8. Entomology By Gillot, C.
9. Imms General Text Book of Entomology By Richards and Davis
11. Insects Pest Management Ecological Approach by T.V.Sathe and Jyoti Oulkar. 2010. DPH, NewDelhi
NEW/REVISED SYLLABUS FOR
M.Phil/Ph.D. Course Work: ZOOLOGY
(Introduced from June 2011 onwards)

Paper - III (Elective Paper)        Total Marks – 100

(80 Marks for theory exam and for 20 Marks for presentation of review of published papers in National/Internationals Journals for Ph.D. course work and 10 + 10 marks seminar and review of papers respectively for M.Phil Course.)

Title of Paper – INSECT PARASITOIDS

Specific Objectives, if any: To control insect pests ecofriendly.

UNIT 1 –        No. of Lectures – 15

1. Definition of parasite, parasitoid and predator.
2. Insect parasitoid taxonomic relationships
3. Insect parasitoid biological relationships
4. Life cycle studies in selected parasitoids: Braconids, Ichneumonids, Chalcids and Trichogrammatids.
5. Mass production techniques for above representative parasitoids.
6. Case studies of pest suppression utilizing parasitoids in India and abroad.

UNIT 2 –        No. of Lectures – 15

7. Host finding and selection by Parasitoids:
   i. Habitat selection
   ii. Host location
   iii. Patch time allocations
   iv. Host age selection
   v. Host specificity
   vi. Host density
   vii. Parasitoid density
   viii. Intrinsic rate of increase in parasitoids.

UNIT 3 –        No. of Lectures – 15

8. Physiological and Molecular Interactions of Parasitoids with their Hosts:
   i. Influence on reproductive strategies
   ii. Defence
9. Effect of parasitoids on Phytophagus Insect Communities.

UNIT 4 –        No. of Lectures – 15
10. Insect Nematode Parasites:
   i. Taxonomic relationships
   ii. Biological relationships
   iii. Examples of insect pest suppressions
   iv. Utilizing Nematodes

11. Insect protozoan parasites
   i. Taxonomic relationships
   ii. Biological relationships
   iii. Examples of insect pest suppressions
   iv. Utilizing Nematodes

Recommended Reading:
4. Biological Insect Pest Suppression By Coppel and Martins: 1971
5. Insect Pest Predators By Sathe and Bhosale: 2001
7. Biological Pest Control By Sathe and Bhoje: 2000
8. Indian Pest Parasitoids By Sathe et al., 2001
10. Entomology By Gillot, C.
11. Imms General Text Book of Entomology By Richards and Davis
13. Insects Pest Management Ecological Approach by T.V. Sathe and Jyoti Oulkar. 2010. DPH, New Delhi
NEW/ REVISED SYLLABUS FOR
M.Phil/ Ph.D. Course Work : ZOOLOGY
(Introduced from June 2011 onwards)

Paper - III (Elective Paper)                           Total Marks – 100

(80 Marks for theory exam and for 20 Marks for presentation of review of published papers in National/ Internationals Journals for Ph.D. course work and 10 + 10 marks seminar and review of papers respectively for M.Phil Course.)

Title of Paper – Biopesticides

Specific Objectives, if any: Sustainable and Eco- friendly insect pest Management.

Unit -I                                                                                      15 hrs
Pests, Pesticides and Biopesticides

Pest problems in agriculture, Pesticides paradox: Insecticides resistance, Insect resurgence, Pesticide poisoning, Contamination of food commodities, Effect on non – target organisms.

Unit-II                                                                                      15 hrs
Predators and Parasitoids

Introduction, Historical perspective, Biological control agents : predators and parasitoids, Biological control approaches, Augmentation, conservation, integrated Biological control.

Unit- III                                                                                     15 hrs
Microbial control

Introduction, Historical perspective, Bacterial pathogens: Bacillus thuringiensis, Bacillus spaericus, Viral pathogens: Baculovirus, Fungal pathogens and protozoan pathogens.

Unit-IV                                                                                      15 hrs
Botanical pesticides

Introduction, Historical perspective, promising plant, Major botanical pesticides, insecticidal phytochemicals, Behavior and physiology affecting phytochemicals, Hormonal mimics and antagonists, pest resistance to
phytochemicals. Biological origin of IPM concept, IPM: A Paradigm shift, Biotechnological approaches Sustainable pest management.

**Recommended reading:**

NEW/REVISED SYLLABUS FOR
M.Phil/Ph.D. Course Work : ZOOLOGY
(Introduced from June 2011 onwards)

Paper - III (Elective Paper) Total Marks – 100

(80 Marks for theory exam and for 20 Marks for presentation of review of published papers in National/Internationals Journals for Ph.D. course work and 10 + 10 marks seminar and review of papers respectively for M.Phil Course.)

Title of Paper – BIODIVERSITY
Specific Objectives, if any: Sustainable and eco-friendly use of Biodiversity.

UNIT I 15 hrs

BIODIVERSITY SCIENCE: Concept & definition, scope and constraints of biodiversity science. Evolution of biodiversity, factors promoting high diversity, global biodiversity.
MEASURES OF BIODIVERSITY: Diversity indices, information statistic indices, biodiversity values.

UNIT II 15 hrs

SPECIES DIVERSITY: Species inventory, history and origin, species richness, future of species diversity studies, threats to species diversity.
Taxonomical, Biological, Ethological, Biochemical and Molecular Approches
GENETIC DIVERSITY: Nature and origin of genetic variation, methods based on DNA chromosomes and determinants of genetic diversity.
ECOSYSTEM DIVERSITY: Classification, Measuring ecosystem diversity, megabiodiversity centers, hot spots.

UNIT III 15 hrs

THREATS TO BIODIVERSITY: Issues relating to threats to biodiversity, approaches to combat threats to biodiversity, values and uses of biodiversity, loss of biodiversity
carbon dating
Biodiversity and adaptation: Morphological, Physiological, Molecular.
UNIT IV                                                                                                      15 hrs

BIODIVERSITY CONSERVATION: Goals, In-situ and Ex-Situ conservation, role of universities and colleges in conservation, biodiversity awareness programmes, biodiversity education resources, media and sustainable development.
Recent Trends in insect biodiversity conservation, protection and utilization

Recommended readings:

1. An advanced Textbook on Biodiversity by K.V.Krishnamurti.
2. Biodiversity and biotechnology by Ray and Ray.
3. Biodiversity by Mandal and Nandi
NEW/ REVISED SYLABUS FOR

M.phil/ Ph.D Course Work: ZOOLOGY

(Introduced from June 2011 onwards)

Paper – III (Optional paper)       Total Marks -100

Comparative Animal Physiology

(80 Marks for theory exam and 20 Marks for Presentation of review of published papers in National / International Journal’s for Ph.D course Work and 10 + 10 Marks seminar and review of papers respectively for M.Phil Course.)

Title of Paper – EXERCISE AND OCCUPPATIONAL PHYSIOLOGY

Unit-I       Nutrition for human Performance.       15 hrs

i) Carbohydrates, Fat and Proteins – Biochemical reaction and molecular interpretations
ii) Vitamin, mineral and water.
iv) Energy expenditure during Hot and Physical activity.
v) System of Energy delivery and Utilization.
vi) Food and Nutrition relating to work exercise and Environmental Stress.
vii) Diet Therapy

Unit-II      Applied and Exercise Physiology       15hrs

i) Energy for Exercise
ii) Enhancement of Energy capacity- Aerobic and Anaerobic power.
iii) Obesity
iv) Muscular strength
v) Fundamentals of Physical exercise
vi) Responses of body to exercise
vii) Recovery from exercise
viii) Special aids to performance and conditioning.
ix) Weight control through Exercise and Diet- Physiological and Molecular Approach.
x) Physical fitness and Risk Factors.
xii) Effect of Exercise on Health and Fitness.
xii) Sport and Recreation
xiii) Doping- Biochemical and Molecular Interpretation.

Unit-III Work performance and Environmental stress.

i) Exercise at medium to high altitude.
i) Exercise and physico-chemical stress.
ii) Exercise and Biological stress.
iv) Environmental factors: Biotic and Abiotic (with Biochemical and Molecular interpretation.

Effect of physical Training
i) Physiological profiles, training and adoption.
ii) Physiological and Biochemical changes.

Unit-IV Ergonomics and Occupational Physiology.

ii) Man at work.
iii) Women at work.
iv) Aging Occupational stress.
(Fundamental, Physiological, Biochemical and Molecular Approaches of above i-iv).

Recommended Reading:
NEW/ REVISED SYLABUS FOR

M.phil/ Ph.D Course Work: ZOOLOGY

(Introduced from June 2011 onwards)

Paper – III (Optional paper) Total Marks -100

Comparative Animal Physiology

(80 Marks for theory exam and 20 Marks for Presentation of review of published papers in National / International Journals for Ph.D course Work and 10 + 10 Marks seminar and review of papers respectively for M.Phil Course.)

Title of Paper- PHYSIOLOGY OF REPRODUCTION

Unit- I Reproductive System. 15hrs

i) Male reproductive system.
ii) Role of epididymis in Male fertility.
iii) Female reproductive System.
iv) Capacitation of spermatozoa in the Female.
v) Birth control- Natural, Artificial and Environmental components.
vi) Aging and reproductive system.

Unit-II Development and Inheritance. 15hrs

i) Development during pregnancy.
ii) Biology of Myometrium and Cervix.
iii) Prenatal Diagnostic test and advantages and disadvantages
iv) Endocrinology of Pregnancy and Parturition, control of parturition.
v) Physiology of Lactation inheritance.

Unit- III Reproductive Technology. 15hrs

i) Artificial insemination, semen analysis sperm preparation for ICSI.
ii) Invitrofertilization. (IVF)
iii) Cryopreservation.
iv) H.Y. Antigen and Sex Determination.

Unit-IV Endocrinology and reproduction. 15 hrs

i) Pituitary hormones.
ii) Thyroid metabolic hormones.
iii) Male sex hormones.
iv) Female sex hormones.

Physiological, Biochemical and Molecular Approches in above (i-iv).

v) Pregnancy and Neonatal Physiology

Recommended Reading:

NEW/REVISED SYLLABUS FOR
M.Phil/Ph.D. Course Work : ZOOLOGY
(Introduced from June 2011 onwards)

Paper – (Optional Paper)  Total Marks – 100

**Comparative Animal Physiology**
(80 Marks for theory exam and for 20 Marks for presentation of review of published papers in National/Internationals Journals for Ph.D. course work and 10 +10 marks seminar and review of papers respectively for M.Phil Course.)

**Title of Paper – Toxicology**

**Unit –I**  **Scope of Toxicology.**  15 hrs

i)  History, Definition, Disciplines of toxicology.

ii) General concept of toxicology.

iii) Toxicants and their classification.

iv) Cardio toxicants, Immunotoxicants : Types, Biochemical and Molecular mechanisms.

**Unit –II**  **Environmental pollution and public healt**  15 hrs

i)  Principal consequences of Environmental pollution.

ii) Impact of Air, Water and Soil Pollution on Human Health : Physiological, Biochemical and Molecular components.

iii) Air, water and soil pollution.

iii) Radioactive and noise pollution : Physiological and Molecular interpretation.

iv) Bioaccumulation and Biomagnification.

**Unit –III**  **Toxicological testing methods and Pesticide Metabolism**  15hrs

i)  Toxic metals – Principal of metal toxicity, important toxic metals, effect on human kand animals.

ii) Toxicity tests – Based on number and condition, Based on exposure period, Acute toxicity test, Chronic toxicity test, toxic effects.

iii) Toxicological testing methods – Behavioral, respiratory, Kidney, Liver, Skin fuction tests.
iv) Metabolism of Pesticides of following group: Chlorinated Hydrocarbons, O.P., Carbamates, Dinitrophenols, Synthetic pyrathroids and Biopesticides.

Unit – IV Dose-response relationship 15 hrs

i) Selection of doses, Types of dose-response relationship, cumulative response, threshold limit.
ii) Mode of action of toxicants – Protein, Lipid and Carbohydrates at cellular level.
iii) Modifying factors of toxicity of xenobiotic chemical.
iv) Biotransformation of toxicants – oxidation, reduction, hydrolysis, conjugation reaction.

Recommended Reading:

New/ Revised Syllabus for
M. Phil. / Ph. D. Course Work: Zoology
(Introduced from June 2011 onwards)
Paper III (Elective Paper) Total Marks: 100

(80 marks for theory exam and 20 marks for presentation of review of published papers in international and national journals for Ph. D. course work and 10+10 marks for seminars and review of papers respectively for M. Phil. course)

Title of Paper: Biology of Aging

Specific objectives if any: To impart knowledge of phenomenon of aging form organ to molecular level.

Unit-I Aging at whole animal level
   a) Pathobiolgy- influence of age on life expectancy
   b) Abnormal cell growth (Neoplasia) and aging
   c) Nutrition and aging
   d) Physiological stress of exercise, environmental stress and aging

Unit- II Aging at tissue level and organ level
   a) Neuronal and Autonomic aspects of aging
   b) Aging in salivary glands
   c) Aging of reproductive systems
   d) Immunity and aging

Unit- III Aging at Cellular level
   a) Cell division and the cell cycle
   b) Cell longevity: In vivo
   c) The cellular basis for biological aging
   d) Cellular transformation and in vivo aging

Unit- IV Aging at molecular level
   a) Damage by free radicals to macromolecules
   b) Macromolecular metabolism during aging
c) Metabolic changes and their significance in aging

d) Lipid peroxidation and antioxidants

**Recommended Readings:**

- Handbook of: The Biology of Aging. Edited by C. E. Finch and L. Hayflick
- The Biology of Aging: Observations & Principles by Robert Arking
- Genes and Aging by M. S. Kanungo
- Senescence, Longevity, and the Genome by Caleb Finch
- Evolutionary Biology of Aging by Michael Rose
- Molecular Biology of Aging Edited By Leonard P. Guarente, Linda Partridge, Douglas C. Wallace
- Ageing Research Reviews
- Biogerontology
- Experimental Gerontology
- Journal of Gerontology
New/ Revised Syllabus for  
M. Phil. / Ph. D. Course Work: Zoology  
(Introduced from June 2011 onwards)  
Paper III (Elective Paper)  
Total Marks: 100  

(80 marks for theory exam and 20 marks for presentation of review of published papers in international and national journals for Ph. D. course work and 10+10 marks for seminars and review of papers respectively for M. Phil. course)  

Title of Paper: Secretory Cells  
Specific objectives if any: To impart the knowledge regarding the phenomenon of cell secretion  

Unit- I  
A. Overview of cell secretion and its activity  
   i. Endocrine  
   ii. Exocrine  
   iii. Paracrine  
   iv. Autocrine  
B. Types of ligands and receptors  
   i. Membrane receptors  
   ii. Cytoplasmic receptors  
   iii. Nuclear receptors  
C. Molecular mechanism of ligand- receptor interaction.  
D. Ligand turnover  

Unit- II Secretory pathways  
A. Translocation of secretory proteins across ER membrane  
B. Molecular mechanisms of vesicular traffic  
C. Techniques for studying the secretory pathway  
D. Secretory pathways in polarized cells
Unit- III Histochemical and immunocytochemical approaches to study secretory product

A. Detection of glycoproteins
B. Detection of Mucopolysaccharides
C. Detection of secretory product by fluorescent tagged antibody
D. Detection of secretory product by enzyme tagged antibody

Unit- IV Specialized secretory cells

A. Salivary gland cells light microscopic structure, Electron microscopic structure: salivary flow, major polypeptides secreted by salivary acini,
B. Neurosecretory cells
C. Neurons as unique and unusual cells: Vesicular transport of neurotransmitter, Release of neurotransmitter, Inactivation of neurotransmitter, Reuptake of neurotransmitter by presynaptic neuron.
D. Pancreatic cells, Plasma cells and Goblet cells:
  i. Pancreatic cells: Light microscopic and electron microscopic structure of acinar cells and Endocrine cells- Alpha cells, Beta cells, Delta cells
  ii. Plasma cells: Light microscopic and electron microscopic structure, secretion of antibodies
  iii. Goblet cells: Light microscopic and electron microscopic structure, secretory activity and functions

Recommended Readings:

- Molecular cell biology by Lodish, Baltimore et al.
- The cell: A molecular approach- Cooper
- Cell and molecular biology by Gerald Karp
- The cell by Bruce Albert
- Immunology by Kuby
- Regulated Exocytosis in Mammalian Secretory Cells: Supplement 31: Handbook of Physiology Cell Physiology  Dola Sengupta, Jack A. Valentijn, James D. Jamieson


- Archives of immunology Edited by British Society of Immunology
New/ Revised Syllabus for  
M. Phil. / Ph. D. Course Work: Zoology  
(Introduced from June 2011 onwards) 
Paper III (Elective Paper) Total Marks: 100

(80 marks for theory exam and 20 marks for presentation of review of published papers in international and national journals for Ph. D. course work and 10+10 marks for seminars and review of papers respectively for M. Phil. course)

**Title of Paper: Cell Biology**

**Specific objectives if any:** To impart the knowledge of various cell processes at molecular level

Unit I
1) Compartmental diversity within the cell and its maintenance.
   i) Molecular mechanisms of vesicular transport.
   ii) Maintenance of compartment identity.
2) Bioenergetics:
   i) Cellular metabolisms.
   ii) Energy transformations.
3) Molecular Motors.
   i) P - loop N TPase super family
   ii) Myosins.
   iii) Kinesin & Dynein.
   iv) A rotary motor (in bacteria).

Unit II
1) Signal transduction pathways in cell.
   i) G-proteins
   ii) Cyclic AMP.
   iii) Ca+2 as messenger.
   iv) Protein kinases.
2) Ionic basis of membrane excitability.
   i) Ionic channels.
   ii) Electrical properties of membrane.
3) Control of gene expression.
   i) Organization of gene.
   ii) Role of gene regulatory proteins.
iii) Role of DNA-binding proteins.
iv) Chromatin structure & control of gene expression.

Unit III
1) Garbage disposal unit inside the cell.
   i) Lysosomes.
   ii) Peroxisomes.
2) Cell and Defense.
   i) Cellular basis of immunity.
   ii) SER and Biotransformation.(Biotics & xenobiotics)
3) Cell renewal:
   i) By simple duplication.
   ii) By stem cells.
   iii) By pluripotent stem cells.
4) Cell death.
   i) Apoptosis Type I
   ii) Apoptosis Type II

Unit IV
1) Evolution of cellular organization of life.
   i) First form of life.
   ii) RNA world.
   iii) DNA world.
   iv) Prokaryotic & Eukaryotic cellular evolution.
2) Genomics and Evolution.
   i) Principles of genome annotation.
   ii) Evolution of macromolecular sequences.
   iii) Building phylogenetic trees.
   iv) Phylogenetic, cladistics and ontology.
3) Proteomics and Drug designing.
   i) Conceptual models of protein structure.
   ii) Three dimensional structure classification and protein function.
   iii) Structural alignment.
   iv) Pharmainformatics & drug designing.

Recommended Readings:
- Molecular cell biology by Lodish, Baltimore et al.
- The cell: A molecular approach- Cooper
- Cell and molecular biology by Gerald Karp
- The cell by Bruce Albert
Aquaculture and Fisheries

(80 Marks for theory exam and 20 Marks for presentation of review of published papers in National /International Journals for Ph.D. course work and 10 + 10 mark seminar and review of papers respectively for M.Phil Course)

Title of Paper: Advances in Fisheries and Aquaculture

Specific Objectives, if any: To provide nutrition to human population
To develop international marketing to fishers and aquaculture

Unit –I 15 hrs

1) Freshwater Resources and their Conservation.
   i) Proper use of freshwater resources.
   ii) Restoration of freshwater ecosystem.
   iii) Large man-made lakes: Present controversy in India.
   iv) Management of ponds & Village tanks.

2) Lakes and Reservoirs
   i) Important physico-chemical processes.
   ii) Evolution of ecosystem.

Unit –II 15hrs

Eutrophication of aquatic systems.
   i) Causes, consequences and control.
   ii) Important parameters & indicators.
   iii) Eutrophication of flowing waters.

   i) Potential of fishing and fish production in the freshwaters.
   ii) Role of fish in human nutrition.

Freshwater fisheries:
   i) Riverine fisheries of India.
   ii) Reservoir fisheries and its potential in India.
   iii) Craft and gears used in inland fisheries.
iv) Extension program and Fishermens co-operative societies.

Unit-III

i) Riverine fisheries and pollution problems.
ii) Biological monitoring of pollutants in aquatic ecosystems.
iii) Fisheries resources of large lakes and reservoirs.
iv) Management and conservation.
v) Fish Byproducts and Marketing.

Unit-IV

Aquaculture:
i) Recent advances in Inland Fisheries developments in India.
ii) Polyculture of Indian and Exotic carps.
iii) Culture techniques for freshwater prawns.
iv) Culture of brackishwater finfish and shellfish and their economics.
v) Aquaculture: Marketing and Economics in India.

Major capture fisheries & their potential in India.
i) Coastal fishery.
ii) Off shore fishery.
iii) Crustacean fishery.
iv) Molluscan fishery.

Recommended readings:
1. Prasad B. (1962)- The wealth of India- Fish and Fisheries. CSIR, New Delhi
NEW/REVISED SYLLABUS FOR  
M.Phil/Ph.D. Course Work: Zoology 
(Introduced from June 2011 onwards) 

Paper III (Optional Paper)  
Total Marks – 100

Aquaculture and Fisheries

(80 Marks for theory exam and 20 Marks for presentation of review of published papers in National /International Journals for Ph.D. course work and 10 + 10 mark seminar and review of papers respectively for M.Phil Course)

Title of Paper: Fish Physiology

Specific Objectives, if any: To provide understanding of fish physiology

Unit I Digestive system  
1 Food and Feeding 
2 Gastromatic index 
3 Physiology of digestion 
4 Adaptive modifications in digestive tract of fishes

Unit II Excretion and Osmoregulation  
1 Fish kidney 
2 Physiology of excretion 
3 Osmoregulation and ionic balance 
4 Endocrine control of excretion and osmoregulation

Unit III Reproductive system  
1 Male and female reproductive organs 
2 Seasonal changes in testicular and ovarian cycles 
3 Hormonal regulation of fish reproduction 
4 Environmental influence on fish reproductive cycle
Unit IV Specialized organs in fishes  

1. Light producing organs
2. Electric organs in fishes
3. Electric organs in fishes
4. Poison glands in fishes

Recommended readings:
1. Fish Physiology by Hoar and Randal (Vol I to XII)
2. Encyclopedia of Aquaculture by RR Stickney
3. An introduction to fishes by SS Khanna
4. Fish and Fisheries by K Pandey and JP Shukla
5. Aquaculture research needs for 2000 AD by JK Wang and PV Dehadrai
Aquaculture and Fisheries

(80 Marks for theory exam and 20 Marks for presentation of review of published papers in National /International Journals for Ph.D. course work and 10 + 10 mark seminar and review of papers respectively for M.Phil Course)

Title of Paper: Environmental Biology
Specific Objectives, if any: To Protect Environment

Unit –I 15 hrs

1) Population Ecology:
   ii) Population age distribution.
   iii) Population growth.
   iv) Cyclic Oscillations in Population.
   v) Carrying Capacity of Population.
   vi) Environmental resistance.

2) Wildlife:
   i) Causes of threatening the wildlife.
   ii) Wildlife distribution in India.
   iii) Endangered fauna from India.
   iv) Protected areas – National Parks, Sanctuaries & Biosphere reserves.
   vi) Wildlife management techniques.
   vi) Special wildlife conservation projects- Project tiger, Crocodile breeding project, Musk deer breeding project & Gier lion sanctuary project.

Unit-II 15 hrs

3) Natural Resources:
   i) Classification of resources.
   ii) Need of conservation of natural resources.
   iii) Renewable natural resources – Water, Fishery, Wildlife, Forest & Grass lands.
   iv) Non-renewable natural resources – Top Soil, Land, Mineral resources.
v) Conservation of water resources.

4) Human Ecology:
   i) Man and his environment.
   ii) Humans impact on nature.
   iii) Degradation of environment due to – Mining, Industries, Agriculture & Urbanization.
   iv) Environmental problems – Global warming, Eutrophication.
   v) Socio-economic aspects of environmental problems.

5) Limnology:
   i) Types of aquatic ecosystems – Fresh water & Marine water.
   iv) Planktons forms – Freshwater & marine water.
   v) Conservation of aquatic ecosystems.

**Unit III**                                  15 hrs

6) Biodiversity:
   i) Introduction – Species diversity, Genetic diversity & Ecosystemic diversity.
   ii) Economic importance of biodiversity.
   iii) Priorities of biodiversity conservation.
   iv) Need of biodiversity conservation.
   v) Conservation of biodiversity.
   vi) Biodiversity hot spot from India.
   vii) Conventions on biodiversity.

7) Toxicology:
   i) Toxicity evaluation methods.
   ii) Bioaccumulation and biomagnification of pollutants in aquatic ecosystem.
   iii) Resistance development in organisms to pollutants.

**Unit- IV**                               15 hrs

8) Limiting Factors:
   i) Lebigs law of minimum.
   ii) Shelfords law of tolerance.
   iii) Combined concept of limiting factors.

9) Environmental Education & Sustainable Development:
   i) Formal education system.
   ii) Non-formal education systems.
   iii) Importance of environmental education in solving environmental problems.
   iv) Role of NGO in minimising environmental crises.
   v) Concept of sustainable development.
   vi) Resource conservation & sustainability.
   vii) Sustainable use of natural resources.

**Recommended readings:**

1. Usher – Biological management and conservation
2. Hanson – Animal Diversity
3. Saharaia – Wildlife in India
4. Duffy – Grassland Ecology and Wildlife management
5. Odum – Fundamentals of Ecology
NEW/REVISED SYLLABUS FOR
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Paper III (Optional Paper) Total Marks – 100

SERICULTURE
(80 Marks for theory exam and 20 Marks for presentation of review of published papers in National /International Journals for Ph.D. course work and 10 + 10 mark seminar and review of papers respectively for M.Phil Course)

Title of Paper: Trends in sericulture
Specific Objectives, if any: To encourage Sericulture Industries

Unit –I 15 hrs

1. Eri Silk Production:
   a. Historical account
   b. Caster cultivation
   c. Pests and diseases of caster
   d. Seed technology of Philasomia ricini
   e. Rearing Technology for Philasomia ricini
   f. Pests and diseases of P. ricini

Unit- II 15 hrs

2. Tropical Tasar Sericulture:
   a. Historical account
   b. Tasar silkworm food plants
   c. Pests and diseases of tasar silkworm
   d. Eco-races and diversity of tasar silkworms
   e. Seed Technology of worms and pests and disease of Antheraea mylitta

3. Muga Sericulture:
   a. Historical account
   b. Food plants of Antheraea assama and their cultivation
   c. Pests and diseases of A. assama food plants
   d. Seed Technology
   e. Rearing Technology of worms and pests and diseases of worms

Unit- III 15 hrs

4. New Trends in Bivoltine mulberry silkworm:
a. Scope  
b. Seed Technology  
c. Rearing Technology

5. (i) Structure and development of silk gland  
(ii) Silk synthesis and factors controlling silk synthesis  
(iii) Silk Technology: Reeling and weaving of mulberry silk  
(iv) Reeling and weaving of non mulberry silk

Unit – IV  
15 hrs

6. Newer Trends in Sericulture:
   a. Mulberry silkworm hybrids: Scope and Status  
   b. Use of DNA recombinant Technology  
   c. Use of RELF Technology in Sericulture  
   d. Use of PCR Technology in Sericulture  
   e. Geomagnetism and silk production  
   f. Vermiwash use in sericulture for crop productivity  
   g. Sericulture and epidemiology  
      i. Usthama/Bronchitis  
      ii. AIDS  
      iii. Allergy etc

Reference Books:

1. FAO Manual on Sericulture  
5. Mohanti, P. K.: Tropical Cocoon Production  
6. M. S. Jolly: Bivoltine Grainage for tropics  
7. M. S. Jolly: Economics of Sericulture under irrigated conditions  
8. CSR & TI, Mysore: Tips for successful silkworm cocoon crops  
11. Annual Report of Central Muga Research Institute, Assam  