SYLLABUS POST GRADUATE ZOOLOGY

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SYLLABUS OF M.SC. IN ZOOLOGY

PART-I

Full Marks

Paper I

Group A :	Structural organization of chordates and non-chordates	50
Group B :	Taxonomy, Biodiversity and Conservation	50

Paper II

Group A :	Ecology, Environmental Biology & Toxicology	50
Group B :	Ethology and Evolution	50

Paper III

Group A :	Physiology and Biochemistry	50
Group B :	Genetics and Molecular Biology	50

Paper IV

Group A :	Basic Physical and Chemical principles	50
Group B :	Laboratory Course	50

Paper V

Group A :	Laboratory Course	50
Group B :	Laboratory Course	50

PART -II

Paper VI

Group A	Quantitative Biology / Biotechnology	50
Group B	Immunology & Microbiology	50

Paper VII

Group A	Developmental Biology	50
Group B	Endocrinology, Cell & Tissue structure, function	50

Paper VIII

Group A	Parasitology & Public health	50
Group B	Agricultural entomology & Aquatic resource management	50

Paper IX

Group A	Review/Dissertation & Seminar	50
Group B	Laboratory course	50

Paper X

Group A	Laboratory course	50
Group B	Laboratory course	50

PAPER—I (100 Marks)

Group A (1/2) : Structure and functions of chordates

1.0 Origin of chordata

1.1 Concept of protochordata

2.0 The nature of vertebrate morphology

2.1 Definition, scope and relation to other disciplines

2.2 Importance of the study of vertebrate morphology

3.0 Origin and classification of vertebrates

4.0 Vertebrate integument and its derivatives

4.1 Development, general structure and functions of skin and its derivatives

4.2 Glands, scales, horns, claws, nails, hooves, feathers and hair

5.0 General plan of circulation in various groups

5.1 Blood

5.2 Evolution of heart

5.3 Evolution of aortic arches, and portal systems

6.0 Respiratory system

6.1 Characters of respiratory tissue

6.2 Internal and external respiration

6.3 Comparative account of respiratory organs

7.0 Skeletal system

7.1 Form, function, body size and skeletal elements of the body

7.2 Comparative account of jaw suspensorium, vertebral column

7.3 Limbs and girdles

8.0 Evolution of urinogenital system in vertebrate series

9.0 Sense organs

9.1 Simple receptors

9.2 Organs of olfaction and taste

9.3 Lateral line system

9.4 Electroreception

10.0 Nervous system

10.1 Comparative anatomy of the brain in relation to its functions

10.2 Comparative anatomy of spinal chord

10.3 Nerves— cranial, peripheral and autonomous nervous system

Group A (2/2) : Structure and function of non chordates

1.0 Organisation of coelom

1.1 Acoelomates

1.2 Pseudocoelomates

1.3 Coelomates: protostomia and deuterostomia

2.0 Locomotion

2.1 Flagella and ciliary movement in protozoa

2.2 Hydrostatic movement in Coelenterata, Annelida and Echinodermata

3.0 Nutrition and Digestion

3.1 Patterns of feeding and digestion in lower metazoa

3.2 Filter-feeding in Polychaeta, Mollusca and Echinodermata

4.0 Respiration

4.1 Organs of respiration: gills, lungs and trachea
4.2 Respiratory pigments
4.3 Mechanism of respiration

5.0 Excretion

5.1 Organs of excretion: coelom, coelomoducts, nephridia and malphigian tubules
5.2 Mechanisms of excretion
5.3 Excretion and osmoregulation

6.0 Nervous system

6.1 Primitive nervous system: Coelenterata and Echinodermata
6.2 Advanced nervous system: Annelida, Arthropoda (Crustacea and Insecta) and Mollusca (Cephalopoda)
6.3 Trends in neural evolution

7.0 Invertebrate larvae

7.1 Larval forms of free living invertebrates
7.2 Larval forms of parasites
7.3 Strategies and evolutionary significance of larval forms

Group B : (1/2) Taxonomy

1.0 Definition and basic concepts of biosystematics and taxonomy

1.1 Historical resume of systematics
1.2 Importance and applications of biosystematics in biology
1.3 Material basis of biosystematics— different attributes

2.0 Trends in biosystematics—concepts of different conventional and newer aspects

2.1 Chemotaxonomy
2.2 Cytotaxonomy
2.3 Molecular taxonomy

3.0 Dimensions of speciation and taxonomic characters

3.1 Dimensions of speciation— types of lineage changes, production of additional lineage
3.2 Mechanisms of speciation in panmictic and apomictic species
3.3 Species concepts— species category, different species concepts, sub-species and other intra-specific categories
3.4 Theories of biological classification, hierarchy of categories
3.5 Taxonomic characters - different kinds, origin of reproductive isolation — biological mechanism of genetic incompatibility

4.0 Procedure keys in taxonomy

4.1 Taxonomic procedures - taxonomic collections, preservation, curetting process of identification
4.2 Taxonomic keys - different kinds of taxonomic keys, their merits and demerits
4.3 Systematic publications - different kinds of publications

4.4 Process of typification and different zoological types
4.5 International Code of Zoological Nomenclature (ICZN) - its operative principles, interpretation and application of important rules, zoological nomenclature; formation of scientific names of various taxa

Group B (2/2) : Biodiversity and Conservation

1.0 The meanings of biodiversity
- 1.1 Biotic variations from genes to ecosystems, causes and consequences
- 1.2 Levels of species diversity and relationship, factors influencing biodiversity
- 1.3 Measuring biodiversity and scale of the problem of biodiversity extinction/changes in time and space

2.0 Threats to species diversity
- 2.1 Natural and human induced rarity
- 2.2 Over exploitation
- 2.3 Habitat disruption
- 2.4 Introduced species
- 2.5 Genetic considerations

3.0 Values and ethics of biodiversity
- 3.1 Ecological economics approach

4.0 Global pattern of biodiversity

5.0 Theories of biodiversity variations

6.0 Regional and National approaches to conservation of Biodiversity - megabiodiversity countries and biodiversity of hot spots of India

7.0 Biomes and Wildlife: characterisation, faunal make up and adaptations
- 7.1 Forest with special reference to tropical rain forest
- 7.2 Desert
- 7.3 Marine

8.0 Wildlife conservation
- 8.1 Necessity and objective of wildlife conservation
- 8.2 Categories of endangered animals and red data bank
- 8.3 Wildlife census:
  - 8.3.1 Objectives, comprehensive knowledge on direct and indirect census techniques
  - 8.3.2 Sample count, line transect method, pug marking

9.0 Special projects for endangered species
- 9.1 Himalayan musk deer
- 9.2 Sangai

10.0 Wildlife habitat management with special reference to Sunderbans

PAPER—II (100 Marks)

Group A : (1/2) Ecology

1.0 Ecology of population
- 1.1 Life tables
- 1.2 Generation time
- 1.3 Net reproductive rate

1.4 Reproductive value

2.0 Population growth

2.1 Growth of organisms with non-overlapping generations

2.2 Exponential growth, Verhulst-Pearl logistic growth model, case studies (field and laboratory)

2.3 Stochastic and time lag models of population growth

2.4 Stable age distribution

2.5 Population growth projection using Leslie Matrix

3.0 Life history strategies

3.1 Evolution of life history traits

3.2 Energy apportionment between somatic growth and reproduction

3.3 Parental investment and offspring

3.4 Reproductive strategies - ecology and evolution of sex and mating systems, optimal body size, r-and k-selection

4.0 Predation

4.1Models of prey-predatory dynamics

4.2 Optimal foraging theory (patch choice, diet choice, prey selectivity, foraging time)

4.3 Role of predation in nature

5.0 Competition and niche theory

5.1Intraspecific and interspecific competition

5.2 History of niche concepts

5.3 Theory of limiting similarity

6.0 Mutualism

6.1 Evolution of mutualism

6.2 Plant-pollinator and animal-animal interactions

6.3 Basic models

7.0 Population regulation - Extrinsic and intrinsic mechanisms

8.0 Ecological modeling - Fundamentals of constructing models and testing them

Group A (2/2) : Environmental Biology and Toxicology

1.0 Environmental factors and their impact on physiological processes

1.1Light

1.2Temperature

1.3 Pressure

1.4 Rainfall

1.5 Combination of environmental factors: interaction and significance - reproductive strategies

2.0 Individual and its interaction with environment

2.1 Resistance

2.2 Tolerance

2.3 Acclimatisation

2.4 Adaptation

3.0 Stress physiology

3.1Basic concepts of environmental stress and homeostasis

3.2 Physiology of oxygen deficiency
3.3 Oxygen toxicity

4.0 Environmental health problem

4.1Relation to air and water quality

5.0 Environmental laws and ethics

Group B (1/2) : Ethology

1.0 Introduction

1.1 Ethology as a branch of biology
1.2 Animal psychology- classification of behavioural patterns, analysis of behaviour (ethogram)

2.0 Innate behaviour

3.0 Perception of the environment

3.1 Mechanical
3.2 Electrical
3.3 Chemical
3.4 Olfactory
3.5 Auditory
3.6 Visual

4.0 Neural and hormonal control of behaviour

5.0 Genetic and environmental components in the development of behaviour

6.0 Communication

6.1 Chemical
6.2 Visual
6.3 Light
6.4 Audio
6.5 Species specifity of organs
6.6 Evolution of language (primates)

7.0 Ecological aspects of behaviour

7.1 Habitat selection, food selection; optimal foraging theory, anti-predator defenses
7.2 Aggression ; homing ; territoriality ; dispersal
7.3 Host-parasite relations

8.0 Social behaviour

8.1 Aggregations-schooling in fishes, flocking in birds, herding in mammals
8.2 Group selection, kin selection, altruism, reciprocal altruism, inclusive fitness
8.3 Social organization in insects and primates

9.0 Reproductive behaviour

9.1 Evolution of sex and reproductive strategies
9.2 Mating systems
9.3 Courtship
9.4 Sperm competition
9.5 Sexual selection
9.6 Parental care

10.0 Biological rhythms

10.1 Circadian and circannual rhythms
10.2 Orientation and navigation
10.3 Migration of fish, turtles and birds

11.0 Learning and memory

11.1 Conditioning
11.2 Habituation
11.3 Insight learning
11.4 Association learning
11.5 Reasoning
11.6 Cognitive skills

Group B (2/2) : Evolution

1.0 Concepts of evolution and theories of organic evolution with an emphasis on Darwinism

2.0 Neo-Darwinism

2.1 Hardy-Weinberg law of genetic equilibrium
2.2 A detailed account of destabilizing forces : (i) natural selection (ii) mutation (iii) genetic drift (iv) migration (v) meiotic drive

3.0 Quantifying genetic variability

3.1 Genetic structure of natural populations
3.2 Phenotypic variation
3.3 Models explaining changes in genetic structure of populations

4.0 Molecular population genetics

4.1 Patterns of change in nucleotide and amino acid sequences
4.2 Ecological significance of molecular variations
4.3 Emergence of Non-Darwinism - Neutral hypothesis

5.0 Genetics of speciation

5.1 Phylogenetic and biological concept of species
5.2 Patterns and mechanisms of reproductive isolation
5.3 Models of speciation (allopatric, sympatric, parapatric).

6.0 Origin of higher categories

6.1 Phylogenetic gradualism and punctuated equilibrium
6.2 Major trends in the origin of higher categories
6.3 Micro and macro-evolution

7.0 Molecular phylogenetics

7.1 How to construct phylogenetic trees
7.2 Phylogenetic inference-distance methods, parsimony methods, maximum likelihood method
7.3 Immunological techniques
7.4 Amino acid sequences and phylogeny
7.5 Nucleic acid phylogeny— DNA-DNA hybridizations, restriction enzyme sites, nucleotide sequence comparisons and homologies
7.6 Molecular clocks

PAPER—III (100 Marks)

Group A (1/2) : Animal Physiology

1.0 Aims and scope of comparative physiology

- 1.1 General physiological functions and principles
- 1.2 Validity of comparative approach
- 1.3 Organisms and cell physiology

2.0 Thermoregulation

- 2..1 Homeothermic animals
- 2.2 Poikilotherms
- 2.3 Hibernation

3.0 Communication among animals

- 3.1 Bioluminescence
- 3.2 Pheromones and other semiochemicals
- 3.3 Audio signals

4.0 Contractile elements, cells and tissues among different phylogenic groups

- 4.1 Muscle structure and function-correlation
- 4.2 Movements — amoeboid, ciliary and flagellar
- 4.3 Specialised organs (eg: electric organs and tisuues)

5.0 Adaptation

- 5.1 Levels of adaptation
- 5.2 Mechanisms of adaptation
- 5.3 Significance of body size

6.0 Physiological adaptations to different environments

- 6.1 Marine
- 6.2 Shores and estuaries
- 6.3 Freshwater
- 6.4 Extreme aquatic environments
- 6.5 Parasitic habitats

Group A (2/2) : Biochemistry

1.0 Glucose catabolism *via* EMP and MMP pathways; TCA cycle, 2-oxidation of saturated and unsaturated fatty acids. Catabolism of phenylalanine, purine; deamination, transamination, transdeamination

2.0 Biological oxidation with special reference to oxidative phosphorylation

3.0 Active transport - characteristics, mechanism and significance. Excitation - exocytosis coupling molecular mechanism of muscular contraction
Biosynthesis of i) urea ii) saturated fatty acid iii) glutathione iv) nonepinephrine v) epinephrine vi) serotonin vii) melatonin and viii) brief outline of prostaglandin synthesis; glucogenesis, glycogenesis

4.0 Specific activity of enzyme: enzyme-substrate complex, Km and its derivation for a single substrate enzyme reaction. Allosteric modulation of enzyme activity, covalents modification of enzyme activity, isozyme, ribozyme, rate-limiting enzyme

5.0 Induction and repression in enzyme synthesis. Translation and post-translation modification in the biosynthesis of proteins

6.0 Metabolism profile of adipose tissue

7.0 Genetic disorder of phenylalanine, tyrosine and glycogen metabolism

Group B (1/2) : Cytogenetics

1.0 Biology of chromosomes

1.1 Molecular anatomy of eukaryotic chromosomes
1.2 Metaphase chromosome : centromere, knietochore, telomere and its maintenance
1.3 Heterochromatin and Euchromatin
1.4 Giant chromosomes : polytene and lampbrush chromosome

2.0 Sex chromosomes, sex determination and dosage compensation in *C. elegans*, *Drosophila* and Humans

3.0 Imprinting of genes, chromosomes and genomes

4.0 Somatic cell genetics

4.1 Cell fusion and hybrids - agents and mechanism of fusion
4.2 Heterokaryon - Selecting hybrids and chromosome segregation
4.3 Radiation hybrids, hybrid panels and gene mapping

5.0 Human cytogenetics

5.1 Techniques in human chromosome analysis - molecular cytogenetic approach
5.2 Human karyotype - banding - nomenclature
5.3 Numerical and structural abnormalities of human chromosomes — syndromes
5.4 Human genome

6.0 Cytogenetic implications and consequences of structural changes and numerical alterations of chromosomes

7.0 Microbial genetics

7.1 Bacterial transformation, transduction, conjugation, bacterial chromosome
7.2 Bacteriophages: types, structure and morphology of T4 phage, morphogenesis

8.0 Cytogenetic effects of ionizing and non-ionizing radiations

9.0 Molecular cytogenetic techniques

9.1 FISH, GISH
92. DNA finger printing
9.3 Flow cytometry
9.4 Automated karyotyping
9.5 Chromosome painting

l0.0 Genome analysis

10.1 C-value paradox , detailed account of various models of prokaryotic genomes; viral genome and eukaryotic genomes, organization of genes in organelle genomes
10.2 Molecular analysis of genomic DNA in yeast
10.3 Transposable elements in prokaryotes and eukaryotes. Role of transposable elements in genetic regulation
10.4 Genome analysis - Humans, *Drosophila*, yeast, microbial genomes.

11.0 Linkage map, cytogenetic mapping

11.1 Physical maps and molecular maps
11.2 Strategies of different levels of genome mapping

I2.0 Genetics of cell cycle

12.1 Genetic regulation of cell division in yeast and eukaryotes
12.2 Molecular basis of cellular check points
12.3 Molecular basis neoplasia

Group B (2/2) : Molecular Biology

1. History and scope of molecular biology

2. DNA replication

2.1 Prokaryotic and eukaryotic replication
2.2 Mechanisms of DNA replication
2.3 Enzymes and accessory proteins involved in DNA replication

3 Transcription

3.1 Prokaryotic transcription
3.2 Eukaryotic transcription
3.3 DNA polymerases
3.4 General and specific transcription factors
3.5 Regulatory elements and mechanisms of transcription regulation

4. Post-transcriptional modification in RNA

4.1 5'-cap formation
4.2 Transcription termination
4.3 3'-end processing and polyadenylation
4.4 Splicing, editing
4.5 Nuclear export of mRNA

5. Translation

5.1 Genetic code
5.2 Prokaryotic and eukaryotic translation
5.3 The translational machinary
5.4 Regulation of translation

6. Antisense and Ribozyme Technology

6.1 Molecular mechanism of antisense molecules
6.2 Inhibition of splicing, polyadenylation and translation
6.3 Disruption of RNA structure and capping
6.4 Strategies for designing ribozymes
6.5 Application of antisense and ribozyme technologies

7. Recombination and repair

7.1 Holiday junction, gene targeting, gene disruption
7.2 DNA repail mechanism

8. Molecular mapping of genome

8.1 Genetic and physical maps
8.2 DNA cloning-mechanism, genomic/cDNA libraries
8.3 Genomic analysis
8.4 Chromosome microdissection and microcloning
8.5 Molecular markers in genomic analysis-RELP, RAPD and AFLP analysis

PAPER—IV (100 Marks)

Group A : Basic physical and chemical principles

1. Energetics

1.1 Concept of free energy
1.2 Energy metabolism

2. Chemical thermodynamics

2. 1 Laws of thermodynamics (1st, 2nd and 3rd law)

3. Idea of chemical bonds

3.1 Hydrogen bond and hydrophobic interactions
3.2 Energy rich bonds
3.3 Weak interactions
3.4 Biological energy transducers
3.5 Bioenergetics

4. Nuclear hazards

4.1 Principals and applications of tracer techniques in biology
4.2 Radiation dosimetry
4.3 Radioactive isotopes and half-life of isotopes
4.4 Effect of radiation on biological system

5. Ionic product

5.1 pH
5.2 Buffers
5.3 indicators

Group B : Laboratory Course

1. Major dissection

a) Nervous system of Crab and *Acatina*
b) Reproductive system in grasshopper and *Acatina*
c) Urinogenetal system, olfactory apparatus in tilapia
d) Arterial, autonomic nervous system in mouse

2. Minor dissections

a) Nephridia and spermatheca of earthworm
b) Otolith and pituitary gland in tilapia

3. Composition assessment of the taxonomic diversity in any habitat

4. Preparation of models showing the status of certain taxa or species in a particular habitat

PAPER—V (100 Marks)

Group A : Laboratory course

1. Identification and analysis of terrestrial and aquatic common groups
2. Estimation of primary productivity of a pond

3. Estimation of dissolve O_2 and dissolve CO_2, alkalinity and hardness of water bodies
4. Measurement of soil pH and organic carbon
5. Toxicity test- LC_{50}/LD_{50} determination
6. Study of structural organisation of bee hive
7. Study of adaptive modifications / animal behaviour by film shows

Group B : Laboratory course

1. Chromosome preparations from polytene chromosomes of *Drosophila*
2. Handling of *Drosophila*, chromosome mapping, *Drosophila* genetic crosses
3. DNA isolation from blood.
4. Determination of unknown proteins by Lowry's method
5. Determination of specific activity of an enzyme
6. Colorimetric estimation of RNA & DNA

PAPER VI : (100 marks)

Group A : Quantitative Biology & Biotechnology

Quantitative biology :

1. Basic mathematics: exponential functions
2. Biostatistics: general principals
3. Presentation & summarizing data, probability distribution and their properties
4. Statistical inference and estimated hypothesis testing, sampling theory
5. Analysis of variance
6. Correlation & regression
7. Probability theory

Biotechnology :

1. Principles of assay of DNA, RNA, Western, Southern, Northern blotting
2. Colorimeter, Spectrophotometer, Radioactivity, NMR & Raman spectroscopy
3. Fluorescence microscopy, confocal microscopy, scanning & transmission microscopy (working principal & application)
4. Biosensor-nature & application
5. Detection of apoptotic cell by commet assay, nuclear lamin assay, caspase activation, cytochrome C release assay, Annexin V assay
6. Elementary idea of cryotechniques
7. Molecular separation techniques-TLC, Ion exchange, SDS-PAGE, Affinity, HPLC
8. Immunological techniques
9. Application of flurochrome for antigen localization, flow cytometry, FASC
10. Elementary idea of bioinformatics

Group B : Immunology & Microbiology

1. Overview of immune system, components of immunity, innate & adaptive immunity
2. Cells & organs of immune system
3. Antigenecity & immunogenecity: immunogen properties, adjuvant, epitope, hapten
4. Complement system, MAC mediate lysis
5. Structure of MHC (elementary idea)
6. Structural diversity of immunoglobulin
7. Hypersensitivity
8. Elementary concept of invertebrate immunity
9. Epidemiology of microbe-related disease
10. Host-microbe interaction, immune response to protozoa, bacteria & virus

PAPER VII : (100 Marks)

Group A : Developmental Biology

1. Differentiation of primordial germ cell & structure of mature gamete in *Drosophila*. Role of polyplasm, influence of oskar gene, effect of grand childness mutation
2. Composition of semen, seminal protein, accessory reproductive structure of *Drosophila*
3. *In vitro* & *in vivo* capacitation of mammalian sperm
4. Role of fertilizine & ZP protein in fertilization
5. Role of nurse cell & follicular cell in yolk production in *Drosophila*
6. Teratogenesis— genetic & induced by drug thalidomide
7. Immunocontraception an overview
8. Role of thyroxin in metamorphosis in amphibians
9. Role of juvenile hormone & ecdysone in insect metamorphosis
10. Significance of totipotency & pleuropotency of cells during animal development
11. Role of maternal effect gene, segment polarity gene, zygotic gene, homeotic gene in development of *Drosophila*
12. Elementary idea of stem cell & its importance

Group B : Endocrinology, Cell & Tissue Structure, Function

1. Hormone as messenger & their role in metabolic regulation
2. Thyroid hormone biosynthesis & function
3. Anterior pituitary structure, hormone & function
4. Adrenal cortical hormone, biosynthesis & function
5. Biosynthesis & function of epinephrine & nor-epinephrine
6. Biosynthesis of sex steroid hormone
7. GI hormone

8. Biomembrane
9. Basic mechanism of cell signaling pathway
10. Cell surface receptor, second messenger system, MAP kinase pathway
11. Apoptosis
12. Synthesis, sorting, trafficking of protein

PAPER VIII : (100 Marks)

Group A : Parasitology & Public Health

1. Introduction: Public health & parasites
2. Vectors and their importance in transmission of parasites
3. Biology and importance of *Entamoeba histolytica, Naegleria, Acanthamoeba, Giardia, Leishmania, Ancylostoma, Xenopsylla, Rhipicephalus, Pediculus, Phlebotomus, Glossina,* Anopheles, Culex, Aedes
4. Epidemiology: classification, epidemiology of malaria, kala azar, filariasis
5. Zoonosis and its significance
6. Myiasis
7. Antigenic variation: molecular basis and diversity in parasites
8. Antigen-antibody reaction and its role in clinical parasitology ; common methods in parasitology-GDP, CIEP, ELISA, Immunoblot, IFA, MCAB
9. Structure and functional expression of antibody, other various types of body cells and organs in immune response
10. Outline knowledge of prevention and control of parasitic diseases in poultry and livestock

Group B : Agricultural Entomology & Aquatic Resource Management

1. Diversity, structure and functions of insects with reference to their pest status

1.1 Major insect orders of agricultural importance
1.2 External structures : head including mouth parts, thorax and abdomen, wings, genitalia — basic knowledge
1.3 Anatomy : cuticle and sensory system
1.4 Physiology: Feeding strategies, nervous integration, gas exchange, blood and circulation, excretion and water balance
1.5 Reproduction and development: a) reproductive system, oviposition

b) types of development, types of eggs, larva and pupae, endocrine regulation of development
1.6 Special features : sound production, pheromones, polymorphism, insect-host plant interactions

2. Life history, population structure and management of insect pests

2.1 Pests: Definition, causes of outbreak, types, assessment of pest status, EIL
2.2 Methods of estimation of pest populations
2.3 Strategies of pest management: chemical, biological, cultural, behavioral, microbial, sterile male technique, other strategies; Integrated Pest Management: philosophy and its application

2.4 Types of insecticides according to mode of entry and mode of action
2.5 Types of pesticides: chemical, biopesticides, pheromone trap, bioagents
2.6 Appliances for the use of insecticides
2.7 Life history studies of pests (including its importance): selected pests of cereals, vegetables, fiber crop, fruits, oil seeds, plantation crop, stored products etc
2.8 Insecticide Acts and Rules: registration of insecticides, packing and labeling, enforcement machinery

3. Non-insect pests of agricultural products

3.1 Non-insect pests with special reference to acarine fauna: diversity of species and crops attacked, nature of damage, symptoms of attack and management
3.2 Nematode pests: diversity of species and crops attacked, nature of damage symptoms of attack and management

4. Aquatic resource

4.1 Reverine, lacustrine and reservoirs. Pond systems in India
4.2 Ecological characteristics of different aquatic systems
4.3 Productive potentials

5. Culture of aquatic organisms

5.1 Methods of culture from extensive to ultra-intensive system and comparative account
5.2 Culturable sources - different species of fin fish and shell fish; criteria of selection for culture; economic importance of culturable species

6. Fish culture

6.1 Monoculture and polyculture
6.2 Hypophysation technique for sustained fish production
6.3 Management of fish farm
6.4 Hatchery technology for fish farming

7. Prawn culture

7.1 Farming method
7.2 Life cycle and larval rearing techniques
7.3 Hatchery techniques and harvesting

8. Integrated fish culture

8.1 Principles of integration
8.2 Integration of paddy and fish culture - methods
8.3 Integration of livestock-fish culture - methods

9. Innovative culture methods

9.1 Culture in re-circulatory systems
9.2 Cage and pen culture
9.3 Wastewater recycling through aquaculture

PAPER IX : (100 marks)

Group A : Review/Dissertation & Seminar

Group B : Laboratory Course (Developmental Biology & Immunology)

1. Studies of activated chick egg of different hours
2. Studies of egg & sperm of mice or grasshopper
3. Macrophage isolation from potential fluid of mice
4. Identification of thymus, bursa, spleen
5. Antigen-antibody reaction by blood group test

PAPER X : (100 marks)

Group A : Laboratory Course (Endocrinology, Cell & Tissue Structure)

1. Staining & identification of different endocrine tissues
2. Identification of stages of estrous-cycle in rat
3. Identification of neurosecretory cell in cerebral ganglia (cockroach), demonstration of neurosecretory centres
4. Identification of different blood cell types

Group B : Laboratory Course (Quantitative Biology & Biotechnology)

1. Correlation, regression, ANOVA
2. Gel electrophoresis of serum protein
3. Analysis & interpretation of southern, northern & western blotting from gel photograph
4. Data (protein & gene) bank analysis

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