



NETAJI SUBHAS OPEN UNIVERSITY

Master of Science (M.Sc.) Post Graduate Zoology Course (PGZO)

Syllabus of M. Sc. in Zoology (PGZO)

Programme Objectives:

The specific objective of PGZO is to provide knowledge in the subjects to the learners at its basic and advanced levels and help to create insights about the facts and processes of the subject. The course will provide information about the frontier areas of development in the subject both at global and regional scale to generate keenness to learn more and motivate learners to proceed towards more difficult areas of the subject to understand and work on it. It is aimed that the theoretical and practical parts of the course will help them to enhance the skills and command on the subject, which in turn also develop their research aptitude and contributive participation.

Expected Programme Outcome:

By obtaining the M.Sc degree in Zoology this course enable students to obtain knowledge and skills to obtain wider chances of employability with quality. This course will enable students for teaching and research including M.Phil and Ph.D courses by qualify NET or GATE or other similar examinations. Provide the opportunity and capability to get jobs through School or College or Public Service Commissions. It may also help workforce learners to continue and progress in their educational and/or professional fields. Overall, this will produce students who will serve the subjects with their thinking and understanding and contribute in the progress of the subject through the process of science and for the society.

Curriculum Design of PGZO

M.Sc. Part-I

Paper	Group	Broad Heading	Marks	Credit
Paper- I	Group A	Structural organization of chordates and non-chordates	50	4
	Group B	Taxonomy, Biodiversity and Conservation	50	4
Paper -II	Group A	Ecology, Environmental Biology & Toxicology	50	4
	Group B	Ethology and Evolution	50	4
Paper-III	Group A	Physiology and Biochemistry	50	4
	Group B	Genetics and Molecular Biology	50	4

Paper - IV	Group A	Basic Physical and Chemical principles	50	4
	Group B	Laboratory Course	50	4
Paper -V	Group A	Laboratory Course	50	4
	Group B	Laboratory Course	50	4

M.Sc. Part-II

Paper	Group	Broad Heading	Marks	Credit
Paper- VI	Group A	Quantitative Biology & Biotechnology	50	4
	Group B	Immunology & Microbiology	50	4
Paper - VII	Group A	Developmental Biology	50	4
	Group B	Endocrinology, Cell & Tissue Structure, Function	50	4
Paper- VIII	Group A	Parasitology & Public Health	50	4
	Group B	Agricultural Entomology & Aquatic Resource Management	50	4
Paper- IX	Group A	Review/Dissertation & Seminar	50	4
	Group B	Laboratory Course	50	4
Paper -X	Group A	Laboratory Course	50	4
	Group B	Laboratory Course	50	4

Total Marks/	Part-I (500/ 40) + Part-II (500/ 40)	500+500 = 1000 Marks/ 80 Credits
Distribution of Theory & Practical papers	Part-I (Theory 350 Marks: 28 credit) (Practical 150 Marks: 12 credit)	Part-II (Theory 350 Marks: 28 credit) (Practical 150 Marks: 12 credit)
	Part-I (40) + Part-II (40)	40+40 = 80 Credit
Evaluation System	Internal Assessment: Theory: 20%	Term End Examination: (Theory):80%
	NA	Practical: 100%
Pass marks	No assignment for practical Papers. Pass marks of any theory and practical paper is 40%.	
Examination System	Total 2 Term End Examination	1000 Marks

Programme Duration: *Course duration is 2 years.* However, the students have the liberty to complete its course *within 5 years.*

Detailed Syllabus of PGZO

PAPER—I (100 Marks)

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

- 1.0 Origin of chordate
- 2.0 The nature of vertebrate morphology
- 3.0 Origin and classification of vertebrates
- 4.0 Vertebrate integument and its derivatives
- 5.0 General plan of circulation in various groups
- 6.0 Respiratory system
- 7.0 Skeletal system
- 8.0 Evolution of urogenital system in vertebrate series
- 9.0 Sense organs
- 10.0 Nervous system

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

- 1.0 Organization of coelom
- 2.0 Locomotion
- 3.0 Nutrition and Digestion
- 4.0 Respiration
- 5.0 Excretion
- 6.0 Nervous system
- 7.0 Invertebrate larvae

Group B : (1/2) Taxonomy

- 1.0 Definition and basic concepts of biosystematics and taxonomy
- 2.0 Trends in biosystematics—concepts of different conventional and newer aspects
- 3.0 Dimensions of speciation and taxonomic characters
- 4.0 Procedure keys in taxonomy

Group B (2/2) : Biodiversity and Conservation

- 1.0 The meanings of biodiversity
- 2.0 Threats to species diversity
- 3.0 Values and ethics of biodiversity
- 4.0 Global pattern of biodiversity
- 5.0 Theories of biodiversity variations
- 6.0 Regional and National approaches to conservation of Biodiversity - mega biodiversity countries and biodiversity of hot spots of India
- 7.0 Biomes and Wildlife: characterization, faunal make up and adaptations
- 8.0 Wildlife conservation
- 9.0 Special projects for endangered species
- 10.0 Wildlife habitat management with special reference to Sundarbans

PAPER—II (100 Marks)

Group A : (1/2) Ecology

- 1.0 Ecology of population
- 2.0 Population growth
- 3.0 Life history strategies
- 4.0 Predation
- 5.0 Competition and niche theory
- 6.0 Mutualism
- 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
- 2.0 Individual and its interaction with environment
- 3.0 Stress physiology
- 4.0 Environmental health problem
- 5.0 Environmental laws and ethics

Group B (1/2) : Ethology

- 1.0 Introduction
- 2.0 Innate behaviour
- 3.0 Perception of the environment
- 4.0 Neural and hormonal control of behaviour
- 5.0 Genetic and environmental components in the development of behaviour
- 6.0 Communication
- 7.0 Ecological aspects of behaviour
- 8.0 Social behaviour
- 9.0 Reproductive behaviour
- 10.0 Biological rhythms
- 11.0 Learning and memory

Group B (2/2) : Evolution

- 1.0 Concepts of evolution and theories of organic evolution with an emphasis on Darwinism
- 2.0 Neo-Darwinism
- 3.0 Quantifying genetic variability
- 4.0 Molecular population genetics
- 5.0 Genetics of speciation
- 6.0 Origin of higher categories
- 7.0 Molecular phylogenetics

PAPER—III (100 Marks)

Group A (1/2) : Animal Physiology

- 1.0 Aims and scope of comparative physiology
- 2.0 Thermoregulation
- 3.0 Communication among animals

4.0 Contractile elements, cells and tissues among different phylogenetic groups

5.0 Adaptation

6.0 Physiological adaptations to different environments

Group A (2/2) : Biochemistry

1.0: - Glucose catabolism *via* EMP and MMP pathways; TCA cycle, 2oxidation 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; gluco-genesis, glycogenesis

4.0: - Specific activity of enzyme: enzyme-substrate complex, K_m 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 posttranslation 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

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

5.0 Human cytogenetics

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

7.0 Microbial genetics

8.0 Cytogenetic effects of ionizing and non-ionizing radiations

9.0 Molecular cytogenetic techniques

10.0 Genome analysis

11.0 Linkage map, cytogenetic mapping

12.0 Genetics of cell cycle

Group B (2/2) : Molecular Biology

1. History and scope of molecular biology

2. DNA replication

3 Transcription

4. Post-transcriptional modification in RNA

5. Translation

6. Antisense and Ribozyme Technology

7. Recombination and repair

8. Molecular mapping of genome

PAPER—IV (100 Marks)

Group A : Basic physical and chemical principles

1. Energetics
2. Chemical thermodynamics
3. Idea of chemical bonds
4. Nuclear hazards
5. Ionic product

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 O₂ and dissolve CO₂, alkalinity and hardness of water bodies
4. Measurement of soil pH and organic carbon
5. Toxicity test- LC₅₀/LD₅₀ 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 comet 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 fluochrome 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. Antigenicity & immunogenicity: 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

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
2. Life history, population structure and management of insect pests
3. Non-insect pests of agricultural products
4. Aquatic resource
5. Culture of aquatic organisms
6. Fish culture
7. Prawn culture
8. Integrated fish culture
9. Innovative culture methods

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