## Master of Science in Zoology (MSc Zoology)

**Duration:** 2 Years

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FUNCTIONAL MORPHOLOGY OF INVERTEBRATES AND CHORDATES, CELL & MOLECULAR BIOLOGY AND BIOPHYSICS

Unit I:

Origin and evolution of Metazoa - Theories - Symmetry and its significance in animal organization - Interrelationship between different phyla - Echinodermata phylogeny and evolution.

Unit II:


Unit III:

DNA and RNA - Structure, types & functions - Replication of DNA - DNA Repair mechanism - Gene action and protein synthesis - Biology of aging and cancer cells.

Unit IV:

Microscopy (Compound - Phase contrast - Electron (TEM & SEM) Microscopy) - Colorimetry - Spectrophotometry (Visible, UV, IR) -
Centrifuge (Ultra - centrifuge) - Electrophoresis (PAGE) - Chromatography (TLC)

Unit V:

Properties of Natural light - Biological applications of X rays, UV rays and Infra red rays - Isotopes and their uses in biological investigation - X-ray diffraction and Autoradiography and their applications in Biology.

ADVANCED GENETICS, BASIC CONCEPTS OF MICROBIOLOGY AND IMMUNOLOGY

Unit I:


Unit II:


Unit III:

Application of genetics in plant and animal breeding - Application of genetics in crime & law - DNA finger printing - Genetic basis of intelligence - Studies on twins.

Unit IV:

Morphology - Types - Cell wall of gram positive and gram negative bacteria - Structure and life cycle of DNA (T₄ phase) and RNA Virus (HIV) and bacteria (eg. Lysogenic and Lytic cycles) - Sterilization techniques - Culture of bacteria - Types of media and conditions for culturing.
Study of causative organisms - Modes of transmission and control of common bacteria and viral agents of man - Polio, HIV, HBV A and B, Tuberculosis, Leprosy, Diphtheria, Typhoid, Gonorrhea and Cholera, (Balantidium, Streptococcus, Staphylococcus).

Unit V:

Cells of immune systems - Origin and differentiation of T, B cells and macrophage - Antigens - Class determinants - Relative sites and receptor site.

Vaccines - Types - Mode of action and vaccines for various diseases. Antibody - Immunoglobulin - Types - Subtypes - Properties and functions.

Major histocompatibility complex (MHC) and its products in man. Disease and immune response - Viral bacterial diseases parasitic infections - Tumour immunology Immune deficiency diseases - AIDS.

Auto immune diseases - examples

Types of hypersensitivity - concept (Type I - IV).

BIO STATISTICS AND COMPUTER APPLICATIONS

UNIT-I: CLASSIFICATION AND PRESENTATION OF DATA.

Definition – Statistics and its application in Biology – Collection of data.

Classification: Qualitative and Quantitative.


UNIT-II: DESCRIPTIVE AND INFERENTIAL STATISTICS

Measures of Central tendency: Arithmetic mean – Median – mode.

Probability distribution – Binomial and Poisson distributions – Student ‘t’ Test – estimation and hypothesis. Test of significance – small samples and large samples-X^2 distribution and its uses.

UNIT-III: CORRELATION AND REGRESSION
Correlation: Correlation of Karl Pearson’s Co-efficient of correlation – testing its significance – interpretation.


UNIT-IV: BASIC CONCEPT ON COMPUTERS.
Introduction to computers – characteristics of computers – Classification of digital computer systems – Anatomy of a digital computer – Number system (Basic Concept only) – memory units – Input and output devices – Auxiliary storage devices.

UNIT-V: COMPUTER APPLICATIONS:

ENVIRONMENTAL SCIENCE AND DEVELOPMENTAL BIOLOGY
UNIT-I:

Natural Resources – Renewable – Forest management – Deforestation and Aforestation – Protection of wild-life resources – Conservation projects.

Energy Resources – Non-Renewable resources (mineral) - Conventional (Coal, petroleum) – Renewable – Non-conventional (Solar,
wind) – Conventional – Hydel, tidal powers, salinity, energy, geothermal and nuclear Power – Programmes in India.

UNIT-II:

Pollution And Management - Sources, effects and control of air, soil and water pollution – Heavy metals – Ground water and marine pollution – Noise pollution – Radio active pollution – Bioaccumulation – Biomagnification.


UNIT-III:

Gametogenesis - Ultrastructural organization of mammalian spermatozoa and egg – Nuclear activities during Oocyte growth.

Fertilization – Sperm – Egg interaction – Gamete fusion – Activation of egg – Metabolism.

Cleavage – Patterns and factors influencing cleavage – Chemical changes – Polarity and gradient.

UNIT-IV:

Gastrulation – Morphogenetic movements – Fate maps – Principles, patterns and physiology of gastrulation. (Amphioxus, Amphibian, Chick and mammal)

Organogenesis – Eye, Heart, Kidney and Brain.

UNIT-V:

Foetal Membranes & Placenta – Classification and Physiology.

Metamorphosis – Morphological and biochemical changes during metamorphosis – Hormonal control of Amphibian metamorphosis.

Regeneration – Regeneration as developmental phenomenon - Polarity and gradient in regeneration.

Experimental Developmental Biology – Chemical basis of gene action in development - Genes and differentiation – Regulation of gene
action – Information genes and development – Inductors and organizers –
Genes and organizers.

**PRACTICAL I: RELEVANT TO PAPERS I TO IV**

1. Dissection of nervous system of prawn.
2. Dissection of aortic arches in frog.
3. Micrometry: Simple micrometric measurements of cells (diameter &
   height of cells).
4. Preparation of culture medium and culture of Drosophila – Methods
   of maintenance of Drosophila - Identification of mutans (wing & eye).
5. Identification of Human blood groups (ABO and Rh)
6. Squash preparation of Giant chromosomes (salivary gland of
   drosophila larva / chironomous larva)
7. Study of clinical and veterinary importance of Microorganisms
   (Bacteria, virus & protozoa)
8. Determination of amino acids in the body fluid of animals using
   paper chromatography (Cockroach / Grasshopper / Frog liver &
   muscle).
9. Hydrobiological studies of water samples with special reference to
   pollution – productivity (O₂, free Co₂, salinity and alkalinity & pH).
12. Submission of record.
BIO-CHEMISTRY

UNIT I : INTRODUCTION


BODY BUILDERS AND ENERGY PRODUCERS

Structure, Classification and functions of proteins, carbohydrates, lipids and nucleic – acids – Derivatives of carbohydrates and lipids.

UNIT II : ENZYMES


ENERGY TRANSFER

Flow of energy in biological world – Concept of free energy – Redox potential – coupling of chemical reactions in transfer of energy – Energy rich compounds and their significance.

UNIT III : METABOLISM

Protein and aminoacid metabolism – Oxidative deamination, transamination, decarboxylation, transmethylation reactions.


Lipid metabolism – Metabolism of fatty – acids, glycerol and Cholesterol – Theories of oxidation of fatty – acids.

BMR – Inborn errors of metabolism.
UNIT IV: REGULATORS:

Vitamins

Structure, sources, requirements, functions and deficiency manifestations of fat soluble and water soluble vitamins.

Minerals

Sources, requirements, functions, absorption and metabolism with reference to Iron, calcium, phosphorus, sodium, potassium, magnesium and other trace elements as iodine, copper, zinc and fluorine.

UNIT V: HORMONES

Chemical nature, properties and functions of hormones – Hormonal control of carbohydrate, protein and lipid metabolism - cyclic – AMP Occurrence, Structure, Synthesis, Degradation and Biological Functions.

BASIC CONCEPTS OF BIOTECHNOLOGY AND EVOLUTION AND TAXONOMY

UNIT I: HISTORICAL BACKGROUND AND TECHNIQUES OF GENETIC ENGINEERING

Biotechnology: Definition – Scope – Importance – Major areas of Biotechnology.

Genetic engineering: Vectors – Major steps involved – rDNA technology.


UNIT II: INDUSTRIAL BIOTECHNOLOGY


Food biotechnology: Single cell protein (SCP) – Production (bacterial, algal and fungal).

UNIT III: APPLIED BIOTECHNOLOGY:

Application of rDNA technology in the production of vaccines, hormones, monoclonal antibodies – Transgenesis in plants and animals – Gene therapy – DNA fingerprinting.

UNIT IV: SPECIATION AND PATTERNS OF EVOLUTION AND ADAPTATION


Adaptation: Adaptation and Evolution – Coloration of animals – Non adaptive characters – Animal distribution – Evolutionary significance

UNIT V: TAXONOMY:


ANIMAL PHYSIOLOGY AND MEDICAL LABORATORY TECHNIQUES

UNIT I: NUTRITION, RESPIRATION, CIRCULATION AND EXCRETION:

Nutrition: Carbohydrates, Proteins and Lipids – Physiology of absorption.

Respiration: Types of respiratory mechanisms (Integumentary, bronchial, tracheal and pulmonary) – Physiology of respiration in man – Respiratory pigments and their role in oxygen and carbon dioxide transport in men.

Circulation: Control of heart beat – Cardiac cycle – Electrocardiogram (ECG) - Coagulation of blood – Haemodynamics

Excretion: Patterns of excretion in relation to environment – Physiology of excretion in man – Regulation of excretion.
UNIT II: CO-ORDINATION (NERVOUS AND ENDOCRINE) AND MUSCLE PHYSIOLOGY:

**Nervous co-ordination:** Types of neurons – Transmission of nerve impulses – Synaptic transmission – Autonomic nervous system – Organization and functions – Reflex action.

**Chemical co-ordination:** Neurosecretion and its importance in insects – Hormones of vertebrates and their specific role in chemical coordination – Molecular mechanism of hormone action.

**Muscle physiology:** Molecular structure – Chemical composition – Mechanism of muscle contraction – Regulation of energetic of muscle contraction.

UNIT III: SENSORY PHYSIOLOGY AND BIOLUMINESCENCE:

**Sensory physiology:** Receptors – Classification and Functions – Mechanism of hearing – Physiology of vision in man.

**Biolumeniscence:** Types – Chemical and Physical aspects – Functional significance.

UNIT IV: LABORATORY SAFETY AND INSTRUMENTATION AND TECHNIQUES OF STERILIZATION:

**Laboratory:** Accidents – Universal work precautions (UWP) for lab personnel (especially in relation to HIV) – Laboratory instruments – Special applications of the microscope (Electron microscope – Centrifuge and other necessary equipments).


UNIT V: HAEMATOLOGICAL TECHNIQUES AND CLINICAL ANALYSIS:

**Haematological techniques:** Collection of blood samples – Analysis of blood and basic haematological techniques - Blood cell morphology in health and disease – RBC, WBC, (total count) and differential count, Haematocrit, PCV, MCH, MCHC, MCV, ESR, RBC - Fragility test – Platelet count – Reticulocytocrit – Haemorrhagic disorders – Clotting time - Bleeding time - Prothrombin time - Test for deficiency in blood clotting factors
Clinical analysis: Analysis of urine – Regular analysis of faeces, semen, CSF.

Examination of parasites relevant to human health (Protozoans and helminthes – Each 3) RIA, ELISA, Western Blot Techniques and WIDAL test.

OPTIONAL SUBJECTS I: APPLIED AND STORAGE ENTOMOLOGY II: SERICULTURE

UNIT I: PEST SURVEILLANCE AND INSECT PESTS OF CROPS AND THEIR MANAGEMENT:


Insect pests of crops and their management: Pests of cereals (Rice, Wheat and Maize) - Pests of commercial crop (sugar cane) - Pests of pulse (Red gram) - Pests of oil seed (groundnut) - Pests of fibre crop (cotton) - Pests of fruit (mango) and vegetables (solanaceae).

Pests of stored products: Sources of infestation – Internal and External feeders – Control and Management.

UNIT II: PRINCIPLES AND METHODS OF PEST MANAGEMENT:

Natural and applied / Artificial methods: Conventional methods (prophylactic, curative, cultural, physical, legal and biological) - Non conventional methods (Plant Products – Chemosterilants – Antifeedants – Pheromones – Insect repellants – Attractants).


UNIT III: INSECTS RELATED TO HUMAN WELFARE AND HEALTH AND HOUSEHOLD MATERIALS AND THEIR MANAGEMENT:

Insects related to public health and house hold materials: Insects related to public health (Mosquitoes, bed bug and human body louse) – Their control and management. Insects related to house hold materials (ants, termites, silver fish, cockroach and cloth moths) – Their control and management.

UNIT IV: MULBERRY CULTIVATION, GENERAL ASPECTS OF SILK WORMS AND SILK WORM REARING:


Silk worms: Types (Tasar, mulberry, Mega and Eri) – Morphology and life cycle of silk worms – Races of mulberry silkworms – Voltinism.


UNIT V: GRAINAGE TECHNIQUES AND SILK REELING:


PRACTICAL II – RELEVANT TO PAPERS V TO VIII

1. Qualitative study of digestive enzymes in cockroach.

2. Determination of rate of salt loss and salt gain in a fish using different media.
3. Qualitative analysis of excretory products (Ammonia, urea & Uric acid).

4. Preparation of Key for the identification of insects.

5. Study of various pests of paddy, sugar cane, cotton, pulses, vegetables, fruits and stored products (any five).


7. Assessment (quality) of leaves for feeding different stages of silk worm larvae.

8. Dissect and display the silk gland of *Bombyx mori* (V instar larva).

9. Micro technique
   a. Spreading of serial sections.
   b. Preparation of permanent mount of serial sections.

10. Submission of slide box.

11. Submission of Record.