

Class		M.Sc. Zoology (Previous)	
Semester/Year		I Year	
Subject & Paper Code		Zoology - MZOOL20Y101	
Paper		Invertebrates and Principles of Animal Taxonomy - I	
Max. Marks		60 (ETE) + 40 (IA) =100	
Credit		Total Credits	
L	T	P	4
4	0	0	
<p>Course Objectives: At the end students should be able to:</p> <ol style="list-style-type: none"> 1. Describe and explain the basic principles of animal classification, form and function among invertebrate phyla. 2. Identify and classify the main groups of invertebrates. 3. Describe the main elements of the biology and evolutionary relationships of the major groups of invertebrates. 			
<p>Course Outcome: At the end of the course, learners will be able to:</p> <ol style="list-style-type: none"> 1. Provides students with an in-depth knowledge of the diversity in form, structure and habits of invertebrates. 2. Learn basics of systematics and understand hierarchy of different categories. 3. Learn diagnostic characteristics of different phyla through brief studies of examples. 4. Obtain overview of economically important invertebrates. 5. Classify all the invertebrate phyla up to class. 			
<p>Student Learning Outcomes (SLO): Students will be able to:</p> <ol style="list-style-type: none"> 1. Describe unique characters of protozoa, porifera, coelenterate and helminthes. 2. Recognize life functions of protozoa, porifera, coelenterate and helminthes. 3. Recognise the ecological role of phylum protozoa, porifera, coelenterate and helminthes. 4. Recognise the diversity from protozoa, porifera, coelenterate and helminthes. 			

Sharma

Nirdhi

Okung

Okung

Unit	Syllabus	Periods
UNIT - I	<p>A study of the classification of invertebrates with distinguishing features & examples of various subdivisions.</p> <p>Locomotory mechanisms:</p> <p>a) Amoeboid movements, ultra structure of cilia and flagella: ciliary and flagellar movements; molecular and physiological mechanisms involved in the three kinds of movements.</p> <p>b) Myonemes and muscle fibers in invertebrate structure and their role in locomotion.</p> <p>c) Locomotion in relation to hydrostatics, coelome, metamerism, arthropodization.</p> <p>d) An outline of flight mechanism in insects.</p> <p>Feeding mechanisms:</p> <p>a) Amoeboid feeding.</p> <p>b) Ciliary feeding.</p> <p>c) Filterfeeding</p> <p>d) Parasitic mode of feeding.</p> <p>e) Feeding mechanisms in insect and echinoderms.</p>	15
UNIT - II	<p>Respiration:</p> <p>a) Respiration in lower invertebrates (Protozoans to helminthes).</p> <p>b) Gills and Lophophores. c) Gills and lungs in Mollusca.</p> <p>d) Gills, trachea and lung like structures in Arthropods.</p> <p>e) Physiology of respiratory pigments in invertebrates.</p> <p>Excretion:</p> <p>Study of structural and functional organization of excretory systems in various invertebrate groups and a survey of various excretory products met with in them. Osmoregulation and ionic regulation: a survey of principal mechanisms in fresh water, marine and terrestrial forms.</p>	15
UNIT - III	<p>Structural and functional organization of nervous systems and receptors :</p> <p>a) Plan of nervous systems in the Coelenterates, Platyhelminthes, Annelids, Arthropods, Molluscs and Echinoderms: structural and functional complexities of brain and ganglionic structures.</p> <p>b) Receptors : Structural and functional organization of the mechanoreceptors, chemoreceptors and photo receptors. Endocrine system: a survey of endocrinal structures and their hormones: role of neurosecretions and hormones in developmental events of insects and crustaceans.</p> <p>Reproduction:</p> <p>a) Reproduction in Protozoa</p> <p>b) Reproduction in Porifera</p> <p>c) Reproduction in Metazoa: Sexual reproduction; Parthenogenesis.</p> <p>d) Reproduction in Metazoa: Asexual reproduction in Coelenterata and Polychaeta.</p> <p>e) Larval forms and their significance.</p>	15

Shama

Akush

Nirchi



UNIT - IV	Criteria for phylogenetic inter relationships between Invertebrate phyla. Origin of Parazoa, Mesozoa and Metazoa. Origin of Radiata (Coelenterata and Ctenophora). Origin of Bilateria from Radiata (Importance of Planula larva and Ctenophores) Phylogenetic significance of Rhynchocoela. Inter relationship of important Pesudocelomate groups, Rotifera. Gastrotricha, Kinorhynca, Nematomorpha and Entoprocta. Affinities and evolutionary significance of the unsegmented lesser protostome phyla (Priapulida, Echiuroidea and Sipunculida. Phylogenetic relationship between the coelomatephyla (Annelida, Onychophora. Arthropoda & Mollusca). Affinities and evolutionary significance of the Lophophorate, coelomatephyla (Brachiopoda, Phoronida & Ectoprocta). Affinities of the invertebrate deuterostomephyla (Chaetognatha, Echinodermata, Pogonophora & Hemichordata).	15
UNIT - V	Introduction to the Science of taxonomy; Rules of nomenclature. Principles of classification theories of biological classification & their history; the species category; the polytypic species; population systematic intraspecific categories. Methods of classification: taxonomic collection & the processes of identification, taxonomic characters; types of variations (qualitative and quantitative) with in a single population, methods of arriving at taxonomic decisions on species level; preparation and use of taxonomic keys. Cytotaxonomy: importance of cytology and genetics in taxonomy.	15

References:

- 1 Elements of Taxonomy by E-Mayer .
- 2 Principle of animal taxonomy oxford IBH publication company by G.G. –Simpson.
- 3 Mathematical Biology-Springer,Verlag, Berlin by Murry J.D.
- 4 Ptinciple of animal taxonomy, by Ashok Verma.
- 5 A Text Book of invertebrates,by N.Arumujan,T.Murugan,M.G.Ragunathan.
- 6 Hyman,L.H. The invertebrates,Nol. I Protozoa through Ctenophora.
- 7 Barrington,E.J.W. Invertebrate Structure and Function by Thoomas Nelson. Anmd sons Ltd. London.
- 8 Read ,C.P. Animal Parasitism,

Shamg

Shweta Shweta Shweta
Shweta Shweta Shweta
Shweta Shweta Shweta

Class			M.Sc. Zoology (Previous)		
Semester/Year			I Year		
Subject & Paper Code			Zoology - MZOOL20Y102		
Paper			Biological Chemistry, Physiology & Immunology - II		
Max. Marks			60 (ETE) + 40 (IA) =100		
Credit		Total Credits			
L	T	P	4		
4	0	0			
<p>Course Objectives: The course aims to provide an advanced understanding of the core principles and topics of Biochemistry and their experimental basis, and to enable students to acquire a specialised knowledge and understanding of selected aspects by means of a stem/branch lecture series and a research project.</p>					
<p>Course Outcome: At the end of the course, learners will be able to:</p> <ol style="list-style-type: none"> 1. Identify the five classes of polymeric biomolecules and their monomeric building blocks. 2. Explain the specificity of enzymes (biochemical catalysts), and the chemistry involved in enzyme action. 3. Integrate Understanding of physiological mechanisms. 4. Outline the key components of the innate and adaptive immune responses. 5. Describe about cell types and organs which are involved in an immune response. 					
<p>Student Learning Outcomes (SLO): Students will:</p> <ol style="list-style-type: none"> 1. Understand of the overview of immune system including cells, organs and receptors. 2. Learn structure and functions of different classes of immunoglobulins, the genetic. 3. Know the basis of antibody diversity and the importance of humoral, cell-mediated and innate immune responses in combating pathogens. 4. Get acquainted with the importance of antigen-antibody interaction in disease diagnosis. 5. Get acquainted with the discovery of antibiotics and their targets, drug/antibiotic resistance, preventive and therapeutic approaches of infectious diseases, hospital acquired infections. 					

Shawa

Akash

Nidhi

Dr

Unit	Syllabus	Periods
UNIT - I	Basic chemical concepts : a study of the chemical bonds and functional groups. Biocatalysts: Classification and nomenclature of the enzymes; nature of enzymes, enzyme specificity; factors affecting enzyme activity; enzymatic and non-enzymatic catalysts; coenzymes and their functions. Energy considerations: Biological oxidation & reduction. Fundamental reactions of biological oxidation; redox potential and electron transport system, enzymes and prosthetic groups. Metabolic pathways of protein, carbohydrates, lipids and nucleic acids (including sequence determination).	15
UNIT - II	Physiology of the nervous system: (a) Nerve impulse: Molecular physiology of nerve impulse. (b) Synapse physiology and integration of information; coding in the neural information processing. Neuro transmitters. (c) Reflexion: Various types of central and peripheral reflexes in mammalian nervous system. Physiology of the receptor system: (a) General mechanism involved in stimulus transduction at receptor sites. (b) Functional architecture and stimulus processing in retina, organ of Corti and olfactory, epithelium.	15
UNIT - III	Physiology of Respiration: Regulation of breathing and transport of O ₂ and CO ₂ . An elementary idea of emphysema, asthma, occupational disorders and spirometry. Stress Physiology: A general idea of stress physiology with special reference to elastic and plastic strain, stress resistance, avoidance and tolerance. Physiological response to oxygen deficient stress and body exercise. Concept of homeostasis, adaptations and acclimatization.	15
UNIT - IV	Innate and Acquired Immunity, phylogeny and ontogeny of Immune system, organization and structure of lymphoid organs, cells of the immune system and their differentiation. Nature of Immune responses, Nature of antigens and factors influencing Immunogenicity, epitopes and haptens.	15
UNIT - V	Structure and functions of Antibodies, Antigen-Antibody interactions in-vitro and in-vivo complement system, Major histocompatibility complex in mouse and HLA system in humans. Organization and expression of Ig genes. T-cell and B-cell generation, activation and differentiation. Cytokines cell mediated effector functions. Immunological tolerance and Anti-immunity; Hypersensitivity and immune responses to infection agents especially intracellular parasites.	15

References:

- 1 Anatomy, Physiology and Biochemistry by Anjula Vij.
- 2 Anatomy, Physiology and Biochemistry by N.Arumurugan.
- 3 A Text Book of Immunology by Dr.B.Anandurai.
- 4 A Text Book of Immunology by Dr. P.Madhavelatha.

Shama

Anjula Vij

Dr. B. Anandurai

Dr. P. Madhavelatha

Shama

Class			M.Sc. (Previous)		
Semester/Year			I Year		
Subject & Paper Code			Zoology - MZOOL20Y103		
Paper			Cell Biology, Genetics and Biotechnology - III		
Max. Marks			60 (ETE) + 40 (IA) =100		
Credit		Total Credits			
L	T	P	4		
4	0	0			
Course Objectives:					
<ol style="list-style-type: none"> 1. To understand the structure of cell and its various organelles. 2. To understand the various aspects of structure and functions of living cells. 3. To acquire broad knowledge on basic and recent trends of genetics . 					
Course Outcomes:					
At the end of the course, learners will be able to:					
<ol style="list-style-type: none"> 1. Get overview of cell. 2. Describe the structure and function of plasma membrane. 3. Learn about Structure, functions and interactions of cell organelles and inclusions. 4. Describe gene action. 5. Describe mutation, mutagenesis and repair. 					
Student Learning Outcomes (SLO):					
Students will:					
<ol style="list-style-type: none"> 1. Understand the structure and function of cell and its organelles. 2. Acquire combined knowledge on Cell division and cell cycle. 3. Analyse the various factors determining the heredity from one generation to another. 4. Acquire knowledge with special emphasis on molecular mechanism of heredity. 					

Shama

Shama

Nidhi

Shama

Unit	Syllabus	Periods
UNIT - I	<p>1. A general idea of properties of light, lenses and magnification power. An elementary knowledge of principles and functioning of light (dissecting and compound), interference, polarising, fluorescence, phase contrast, UV and electron (SEM and TEM) microscopes.</p> <p>2. Cytological techniques: Centrifugation and ultracentrifugation, intravital and supravital staining, preparation of cell cultures, isolation and fractionation of cell.</p> <p>3. Plasma membrane and intracellular compartments: Structure and functions of membrane, principles of membrane transport, carrier proteins, ion channels. Structure and functions of endoplasmic reticulum. Signal recognition particles, ER signal peptides; signal transduction.</p> <p>4. Vesicular traffic organelles: Structure and functions of Golgi complex and lysosomes, transport from Golgi bodies to lysosomes. Endocytosis and exocytosis; structure and functions of microbodies, glyoxysomes, peroxysomes, and spherosomes.</p> <p>5. Energy transducers and other organelles: Structure, functions and evolution of mitochondria and plastids; their role as energy transducers. Structure and functions of ribosomes; structure of cilia, flagella, vacuoles and cytoskeleton.</p>	15
UNIT - II	<p>1. Nucleus: Structure of interphase nucleus, pore complex, nucleoplasm and nucleolus.</p> <p>2. Chromosomes: Chromatin organisation in dividing and nondividing cells, structure of chromosomes, solenoid model, importance of C-value paradox, centromere and telomere, karyotype, banding techniques, FISH, GISH, Mc FISH, cytometry ; giant and mini chromosomes.</p> <p>3. Cell cycle and mitosis: Stages of cell cycle (G1, S, G2 and M stage), centriole cycle, mechanism of mitosis, anaphasic movements.</p> <p>4. Mechanism of meiosis, nondisjunction.</p> <p>5. Regulation of cell division and abnormalities: Genetic regulation of cell cycle, check points, cyclins, MPF, chalones, mitotic poisons; molecular origin of cancer; apoptosis.</p>	15
UNIT - III	<p>1. Basics: Definitions of heredity, variation, gene, allele, autosomes, allosomes, homologous chromosomes, locus, homozygous, heterozygous, hemizygous, dominant, recessive, phenotype, genotype, filial generations, test cross, back cross, reciprocal cross, probable gamete formation for cross, use of symbols.</p> <p>2. Laws of heredity and their variations: Works of Mendel and Morgan; incomplete dominance, multiple allele, pleiotropy, genetic interactions.</p> <p>3. Linkage and crossing over: Mechanism of crossing over, linkage groups, linkage maps; accessory genetic elements (plasmids, transposons and reteroelements).</p> <p>4. Genetics of sex: Sex linkage, sex influenced and sex limited traits, sex determination, effects of environment on sex determination.</p> <p>5. Human genetics: Abnormalities in chromosome structure and number, Inborne errors of metabolism, eugenics, euphenics and euthenics, genetic counselling.</p>	15

Shama

Shweta

Dr

Nedko

Atulya

Dr

UNIT - IV	<p>1. DNA: Structure and types of DNA; DNA as a genetic material, gene structure, replication of DNA, enzymes and accessory proteins involved in DNA replication, DNA damage and repair, gene mutation and its molecular mechanism.</p> <p>2. RNA: Structure and types of RNA (r-RNA, m-RNA, t-RNA, Hn-RNA, Sn-RNA, antisense- RNA); types of RNA polymerase, transcription, step initiation, chain elongation and termination; post transcriptional modification, cap and tail formation, RNA splicing.</p> <p>3. Translation: Mechanism of prokaryotic and eukaryotic translation, protein folding; role of chaperons.</p> <p>4. Gene regulation: Gene regulation in Prokaryota, positive and negative regulation- Lac operon, tryptophan operon; gene regulatory proteins (motifs); gene regulation in Eukaryota.</p> <p>5. Applied Molecular Biology: RNA interference, molecular mechanism of antisense molecules, ribozymes, molecular mapping- RFLP analysis and its application in forensic, disease diagnosis and generic counselling.</p>	15
UNIT - V	<p>1. Basics: Genetic engineering, culture media, culture methods, restriction enzymes, cloning vectors, cell fusion, somatic hybridisation.</p> <p>2. Recombinant DNA technology: Isolation of genetic materials gel-electrophoresis, amplification by PCR, insertion of r-DNA in host.</p> <p>3. Bioreactors and downstream processing.</p> <p>4. Biotechnology in agriculture: BT cotton, pest resistant and virus resistant plants, golden rice, flavr savr transgenic tomato.</p> <p>5. Biotechnology in medicine: Humulin production, gene therapy, molecular diagnosis (DNA fingerprinting, ELISA), transgenic animals; liposomes (spheroplasts) in biomedical science.</p>	15

References:

- 1 Cell Biology Genetics and Biotechnology, by Saras Publications.
- 2 Basic of Cell Biology and Biotechnology, by Dr. Arvinder Singh.
- 3 Cell Biology Genetics, by P.K. Gupta.
- 4 Cell and Molecular biology, by P.K. Gupta.
- 5 Gene Biotechnology, by Jogdand.

Shama

Shweta

[Signature]

Nirdw [Signature]

[Signature]

Class		M.Sc. Zoology (Previous)	
Semester/Year		I Year	
Subject & Paper Code		Zoology - MZOOL20Y104	
Paper		Evolution and Statistical methods in biology - IV	
Max. Marks		60 (ETE) + 40 (IA) =100	
Credit		Total Credits	
L	T	P	4
4	0	0	

Course Objectives:

1. To provide comprehensive overview of Concept of Evolution.
2. To explain Origin of Life especially Prokaryotes as well as Eukaryotes in detail.
3. To explore salient features of various theories of evolution comprising of Lamarckism, Darwinism and Neo-Darwinism.
4. To impart detailed understanding of Analogy, Homology, Paleontological Evidences, Embryological Evidences and Molecular Phylogeny.
5. To provide adequate information about Geological Time Scale and Neutral Theory of Molecular Evolution.
6. To develop comprehensive knowledge regarding various Sources of Variations and their role in evolution, Introduction to biostatistics.

Course Outcomes:

At the end of the course, learners will be able to:

1. Trace the Origin of life.
2. Established theories of evolution.
3. Correlate the theories with the evidences.
4. Explain the genetic basis of evolution.
5. Explain descriptive statistics.
6. Explain correlation and regression.
7. Explain graphical representation of data.
8. Fundamental concept of Hypothesis testing.

Student Learning Outcomes (SLO):

Students will:

1. Understand and describe fundamental processes of evolutionary change, including genetic drift, natural selection, recombination (especially involving gene duplication), and mutation.
2. Understand how these processes interact and are modified by extrinsic factors, including mutagens, interactions among species, and changing ecosystems.
3. Understand how these processes lead to small- and large-scale patterns of evolutionary change, including diversification, adaptation, and complexity .
4. Interpret phylogenetic trees and understand how they are reconstructed.
5. Use perturbations of Hardy-Weinberg equilibrium to infer activity of specific evolutionary processes.
6. Read and comprehend evolutionary biology advances described in contemporary primary literature.

Shaw

Chush

Nidh

Sh

Unit	Syllabus	Periods
UNIT - I	1. Concepts of evolution and theories of organic evolution, Darwinism, Neo-Darwinism. 2. Geological time – scale 3. Hardy-Weinberg law of genetic equilibrium. A detailed account of destabilizing forces : (i) Natural selection (ii) Mutation (iii) Isolation and its role in species formation (iv) Genetic drift (v) Migration (vi) Meiotic drive.	15
UNIT - II	1. Quantifying genetic variability. (i) Genetic structure of natural populations (ii) Phenotypic variation (iii) Models explaining changes in genetic structure of populations 2. Molecular population genetics (i) Patterns of change in nucleotide and amino acid sequences (ii) Ecological significance of molecular variations (iii) Emergence of Non-Darwinism-Neutral Hypothesis 3. Genetics of quantitative traits in populations (i) Genotype-environment interactions (ii) Inbreeding depression and heterosis (iii) Molecular analysis of quantitative traits (iv) Phenotypic plasticity 4. Genetics of speciation. (i) Phylogenetic and biological concept of species (ii) Patterns and mechanisms of reproductive isolation (iii) Models of speciation (Allopatric, sympatric, parapatric).	15
UNIT - III	1. Molecular Evolution (i) Gene Evolution (ii) Evolution of gene families, Molecular drive (iii) Assessment of molecular variation 2. Origin of higher categories (i) Micro-and Macro-evolution 3. Characteristic of evolution Extinction, replacement, irreversibility of specialization etc. 4. Adaptation diversity & nature of adaptation : adaptive radiations & occupation of new environments & niches : mimicry and coloration.	15
UNIT - IV	1. Biostatistics Objective & significance : important terms & symbols, graphs (bar diagrams, histograms, frequency polygons, line diagrams) 2. Frequency distributions & centering constants (Mean, Median and Mode). 3. Measures of variation (standard deviation, variance, standard error of the Mean). 4. Rates and ratios. 5. Sampling variation of proportions, Significance of difference in proportions. 6. Chi-square test.	15
UNIT - V	1. Correlation and regression. 2. Analysis of Variance (ANOVA). 3. Probability distributions : Binomial, Poissons and normal. 4. Computer Applications in Zoological study: fundamentals of computer, History and generation of Computer. Computer Paripherals and architecture. Elementary idea, about operating system. DOS and window environment, elementary idea of MS-Office. Software used in biomedical science (image analysis system automation). 5. Bioinformatics : Elementary idea of bioinformatics and proteomics and Genomics	15

References:

- 1 Cochran Statistical Methods of affiliated-East-West Press ,New Delhi by Sneedor. G.W. and W.G.
- 2 Bastcheler –F- Introduction to Mathematics for life scientists by Springer Verlas, Berling.
- 3 Murry J.D. Mathematical Biology by Springer, Verlag, Berlin.
- 4 Evolution and development biology, by Sastry, Tomar.
- 5 The origin of species, by Charles Darwin.

Shama

Nedw.

Sharma

Sharma

Sharma

Class	M.Sc. Zoology (Previous)	
Semester/Year	I Year	
Subject & Paper Code	Practical Zoology - MZOOL20Y105	
Paper	Paper- I and II, Practical I- Sitting	
Max. Marks	60 (ETE) + 40 (IA) =100	
L	2	
T		
P		
0	0	2

PRACTICALS

- I. Invertebrates :** I Identification, classification & study of distinguishing features of important representatives (Protozoa to Hemichordata).
- II.** Study of permanent prepared slides (Protozoa to Hemichordata).
- III. Anatomy :**
 - 1 Reproductive, excretory, nervous & heamocoelomic systems of leech.
 - 2 Nervous system and general anatomy: Patella, lamellidens, Mytilus and Aplysia.
 - 3 General Anatomy, reproductive and nervous system of Cockroach, Grasshopper.
 - 4 Study of sections of the arm of a starfish: water vascular system of starfish;
- IV. Permanent preparations and their study :**
 - 1 Preparation of cultures of Amoeba, Paramecium and Euglena. Study of these protozoans using vital dyes.
 - 2 Permanent preparations of Amoeba, Paramecium and Euglena from cultures, vorticella from the pond water; flagellates from the gut of white ant; Rectal ciliates, Trypanosomes in the blood of house rat; lifecycle stages of Monocystis from the seminal vesicle of earthworm.
 - 3 Collection, fixation & permanent preparations of trematodes, cestodes & nematodes found in sheep and pig and in the stool of infected persons.
 - 4 Permanent preparations through various parts of Animals mentioned in III (i-iv) anatomy section and study of the structure.
 - 5 Permanent preparations of different materials provided for study using microtome.

Shama

Atulya

Nidhi

[Signature]

V. Biological Chemistry :

- 1 Identification of protein, carbohydrates and Lipid in various tissues.
- 2 Identification of different kinds of mono, di and poly saccharides in biological and chemical materials.
- 3 Quantitative estimation of the following by spectrophotometric / semiautoanalyser method in various tissues.
(a) Carbohydrates : Glycogen and glucose. (b) Proteins: Total proteins. (c) Lipid: Phospholipids and cholesterol. (d) Nucleic acids: DNA and RNA. (e) Enzymes: Acid and alkaline phosphatase.
- 4 Paper chromatography and Thin Layer Chromatography: Unidimensional chromatography using amino acids from purified samples and biological materials.
- 5 Study of digestive enzymes in different parts of alimentary canal.

VI. Physiology :

1. Elementary idea of Kymographic recording of muscle twitch, summation of twitches, chronic contractions, tetanus, fatigue & staircase phenomenon from the sciatic nerve muscle preparation of rat.
2. Study of ECG. Heart beat, Blood pressure.
3. Photometric determination of haemoglobin in blood sample.
4. Demonstration of the following in blood; clotting time. Bleeding time, erythrocyte sedimentation rate, haemolysis & crenation, differential count of leucocytes. 5. Determination of blood urea and blood sugar value.

Sharma
Modi
Sharma
Sharma
Sharma

