SCHOOL OF SCIENCES-ZOOLOGY

M.Sc. Zoology (Semester-I)

DSC-1: Taxonomy & Bio-Systematics (Theory)

Semester: I	Paper: Discipline Specific Course (Theory)
Credit: 04	Paper Title: **Taxonomy & Bio-Systemics (Theory)**
Instruction: 4hr/Wk	Paper Code: MSZY101CCT
Semester Exam: 70	Internal Assessment: 30
Course Objective	The course aims to provide an in-depth understanding of the principles, concepts, and methods of taxonomy and biosystematics. It emphasizes species identification, classification, nomenclature, and evolutionary relationships, integrating traditional and modern approaches to taxonomy, including molecular tools and biodiversity conservation.
Course Outcome	On completion of the course students will be able to describe a species, to test scientific hypotheses of species delimitation and to use phylogenetic tools to analyze and map evolutionary patterns at different taxonomic levels and in different biological processes.
UNIT-I Basic and Modern concepts of animal taxonomy	1.1: Basic concept of animal taxonomy. Classical taxonomy to systematic: A historical review.
	1.2: Taxonomic terms; taxonomy; classification and nomenclature; phenon, taxon and category; α, β and γ taxonomy.
	1.3: Modern concepts and recent trends: chemotaxonomy, cytotaxonomy, serotaxonomy and molecular taxonomy
	1.4: Importance of application of systematics in biology; Taxonomy vis-a-vis biodiversity conservation.
UNIT-II Zoological Nomenclature, and Taxonomy	2.1: Code of Zoological Nomenclature (ICZN), its operative principles; history of rules of Zoological nomenclature.
	2.2: Interpretation and application of important rules. Criteria of publication, criteria of availability of names, principles of priority.
	2.3: Homonymy, synonymy, type concept; Zoological nomenclature, formation of scientific names of different taxa.
	2.4: Regulations governing this code and code of ethics; Taxonomy, the present scenario and the global taxonomic initiatives.
UNIT-III Taxonomic procedures and typification	3.1: Procedure keys in taxonomy; Taxonomic procedures – taxonomic collections, preservation, curetting processof identification.
	3.2: Taxonomic keys- different kinds of taxonomic keys, their merits & demerits; Systematic publications – different kinds of publications.
	3.3: Process of typication and different Zoological types.
	3.4: International Code of Zoological Nomenclature (ICZN) – its operative principles, interpretation and application of important rules.
UNIT-IV Microtaxonomy, Polytypic and monotypic species.	4.1: Microtaxonomy: species concepts; typological species concept, nominalistic species concept, biological species concept and evolutionary species concept.
	4.2: Polytypic and monotypic species; species category; subspecies and other infra-specific categories; Infra-subspecific categories and intra-population variants.
	4.3: Origin of reproductive isolation and mechanism of speciation; Macrotaxonomy; Theories and practice of biological classification: some basic principles of classification:

	4.4: The three schools of macrotaxonomy: Phonetics, cladistics and phylogenetic classification and their comparison; Variations and their importance in systematic.

Taxonomy & Bio-Systemic Lab(Practical)

Semester: I	Paper: Discipline Specific Course (Practical)
Credit: 02	Paper Title: **Taxonomy & Bio-Systemic Lab**
Instruction: 4hr/Wk	Paper Code: MSZY151CCP
Semester Exam: 35	Internal Assessment: 15
Course Objective	The course aims to equip students with the knowledge and skills to assess and analyze biodiversity, understand the factors influencing species diversity in different habitats, and explore the impact of climatic conditions on ecosystems. It also emphasizes conservation and the application of ecological principles in biodiversity management.
Course Outcome	Upon completion, students will be able to assess taxonomic diversity, analyze biodiversity across various habitats, evaluate the effects of climatic factors on ecosystems, and design models to study species distribution. They will gain practical skills for biodiversity research and conservation efforts.
Practical	1: Composition assessment of the taxonomic diversity
	2: Biodiversity in a habitat (e.g. grassland, arid land, wet land, etc.)
	3: Influence of climatic conditions on taxonomic diversity in a given habitat.
	4: Preparation of models showing the status of certain taxa or species in a particular habitat.

References Books:

1. Mayr. E, et. al., Principles of Systematic Zoology, McGraw-Hill College.
2. Simpson G.G., Principles of Animal Taxonomy, Scientific Publishers India.
3. Principles of Animal Taxonomy by G. G. Simpson
4. Goto. H. E., Animal Taxonomy, Hodder Arnold H&S.

DSC-2: Bio-molecules and their functions (Theory)

Semester: I	Paper: Discipline Specific Course (Theory)
Credit: 04	Paper Title: **Bio-molecules and their functions(Theory)**
Instruction: 4hr/Wk	Paper Code: MSZY102CCT
Semester Exam: 70	Internal Assessment: 30
Course Objective	The course aims to provide an in-depth understanding of the structure, classification, and functions of biomolecules, including carbohydrates, lipids, proteins, and nucleic acids. It also focuses on the metabolic pathways associated with these biomolecules and the regulation of enzymes, alongside exploring key metabolic disorders.
Course Outcome	Upon completion, students will have a detailed understanding of the biochemical properties and metabolic pathways of biomolecules. They will develop an appreciation for the regulation of enzyme activity and gain insight into metabolic disorders, enabling them to connect biochemical concepts with real-world applications in health and disease.
UNIT-I Structure and Functions of Biomolecules	1.1:Carbohydrates – Classification (Monosaccharaides, Disaccharides and polysaccharides), Structure, and Functions
	1.2:Lipids – Classification, structure and functions of lipids, fatty acids
	1.3: Proteins – Classification and Structure of Amino Acids, Protein Structure: Structural characteristics of primary, secondary, tertiary andquaternary structure of proteins, Ramachandran plot, and Protein domains.
	1.4: Nucleic acids – purine, pyrimidine, nucleoside and nucleotide, structure of DNA (A, B and Z-DNA) and RNA.
UNIT-II Metabolic Pathways of Biomolecules	2.1: Carbohydrate Metabolism – Glycolysis, Kerb's Cycle, Pentose Phosphate Pathway, Glycogenesis, Glycogenolysis, Gluconeogenesis, Hexomonophosphate shunt.
	2.2: Lipid Metabolism – Fatty acid biosynthesis (saturated and unsaturated) and oxidation (beta, omega, even chain, odd chain fatty acids), Ketone bodies.
	2.3: Protein Metabolism – Transamination and Deamination, Incorporation of amino acids into TCA cycle, integration between urea cycle and TCA cycle.
	2.4: Nucleic Acid Metabolism – Biosynthesis and Degradation of purines and pyrimidine.
UNIT-III Enzymes	3.1: Nomenclature and Classification of Enzymes, Vitamins as coenzymes.
	3.2:Enzyme Kinetics: Michales- Mentons equation, Determination of Vmax and Km.
	3.3: Factors affecting the enzyme activity (substrate concentration, P^H. and Temperature), Enzyme Inhibition: competitive, non-competitive and un-competitive.
	3.4: Mechanism of enzyme action – Lock andkey model and induced Fit model, Regulation of Enzyme activity – allosteric enzyme, PFK, ATC (phosphofructokinase, Aspartate transcarbomylase).
UNIT-IV Inborn Errors of Metabolism	4.1:General Introduction to Metabolic Disorders – Defects in Metabolic Pathways,Carbohydrate metabolism – Galactosemia
	4.2:Lipid metabolism – Tay-sachs Disease
	4.3:Amino acid metabolism – Phenyl ketonuria
	4.4: Nucleic acid metabolism – LeschNyhan syndrome.

Bio-molecules and their functions Lab (Practical)

Semester: I	Paper: Discipline Specific Course (Practical)
Credit: 02	Paper Title:**Bio-molecules and their functions Lab**
Instruction: 4hr/Wk	Paper Code: MSZY152CCP
Semester Exam: 35	Internal Assessment: 15
Course Objective	The course aims to provide hands-on experience in the quantitative and qualitative analysis of biomolecules, focusing on techniques for analyzing carbohydrates, lipids, proteins, and nucleic acids.
Course Outcome	Upon completion of the course, students will develop practical skills in using colorimetry, UV spectroscopy, and chromatography for biomolecule analysis. They will also understand the chemical properties of biomolecules and their role in physiological processes, demonstrated through experiments like urine analysis for urea, sugar, protein, and ketone bodies.
Practical	1: Verification of Beer Lambert's Law by using any colour solution.
	2:Quantitative estimation of Carbohydrates, Lipids, Proteins, Nucleic acids by colorimeter / UV Spectroscopy
	3:Amino Acid Separation by Chromatography
	4:Chemical analysis of Urine for presence of urea, sugar, protein and ketone bodies

References Books:

1. Berg.et.al., Biochemistry, W.H. Freeman (8^{th} ed.)
2. Nelson. D.L. & Cox. M., Principles of Biochemistry, WH Freeman (8^{th} ed.)
3. Rodewell et. al., Harpers illustrated Biochemistry, McGraw Hill, (Int. ed.)
4. Satyanarayana, Biochemistry, Elseiver (5^{th} ed.)
5. Hoffmann. A., Wilson and Walker's Principles and Techniques of Biochemistry and Molecular Biology, Cambridge University press (8^{th} ed.)
6. Conn. EE., Outline of Biochemistry, Wiley, (5^{th} ed.)
7. West. ES., Text book of Biochemistry, Collier Macmillan Ltd, (Rev. 4^{th} ed.)

DSC-3: Cell Biology (Theory)

Semester: I	Paper: Discipline Specific Course
Credit: 04	Paper Title: **Cell Biology(Theory)**
Instruction: 4hr/Wk	Paper Code: MSZY103CCT
Semester Exam: 70	Internal Assessment: 30

Course Objective	The course aims to provide a comprehensive understanding of the structure, function, and regulation of cellular components in both prokaryotic and eukaryotic cells.
Course Outcome	Upon completion of the course, students will have a deep understanding of cell structure, function, and communication mechanisms. They will acquire practical skills in analyzing cellular components and processes, with an emphasis on understanding how cell signaling pathways contribute to both normal and pathological cellular functions, including malignant transformation.
UNIT-I Cellular Organisation	1.1 Prokaryotic and Eukaryotic cell characteristics.
	1.2:Structure and Function of Plasma Membrane (Lipid bilayer, fluid Mosaic model, Protein diffusion, Osmosis, Ion Channel, Active Transport, Membrane Pumps).
	1.3:Structure and Function of cellular organelles (Endoplasmic Reticulum, Golgi Complex, Lysosomes, inclusion bodies, peroxisomes, lysosomes, mitochondria, ribosomes, nucleus).
	1.4:Cytoskeleton and Extracellular Matrix (Microtubules, Intermediate filaments, microfilaments, integrin, focal adhesions, hemidesmosomes, selectins, cadherins, adherin junctions desmosomes, tight junctions, gap junctions).
UNIT-II Organisation of Chromosome	2.1:Morphology of chromosome, Different types of Staining (G-banding, R-banding, C-banding, Q-banding).
	2.2:Components of chromatin (Euchromatin and heterochromatin - facultative and constitutive heterochromatin, X- inactivation).
	2.3:Chromatin Organisation – Structure and Organisation of nucleosome in chromatin, solenoids, loops and scaffolds, Active and Inactive states of chromatin.
	2.4:Chromatin Modifications - Histone Modifications (methylation, phosphorylation, acetylation) and their effects.
UNIT-III Cell cycle and Cell Death	3.1:Cell Cycle – Mitosis, Meiosis and cytokinesis (Phases, G0 phase).
	3.2:Regulation of cell cycle – cell cycle checks points.
	3.3:Chromosome Segregation in Mitosis & Meiosis – Mitotic apparatus, distribution of microtubule organisingcentres, Formation of Synaptonemal complex.
	3.4: Cell Death - Apoptosis, Necrosis and Autophagy.
UNIT-IV Cell Signalling	4.1:Cell communication (autocrine, paracrine, Juxtacrine and contact inhibition).
	4.2:Components of cell signalling (growth factors, receptors, ligand, adaptors, signal transducers, secondary messengers).
	4.3:Signalling Pathways; calmodulin, GPCR, RTK, WNT, Jak-Stat, Toll-like receptor signalling pathway.
	4.4:Signalling Pathways in malignant transformation of cell (retinoblastoma).

Cell Biology Lab (Practical)

Semester: I	Paper: Discipline Specific Course (Practical)
Credit: 02	Paper Title: **Cell Biology Lab**
Instruction: 4hr/Wk	Paper Code: MSZY 153 CCP
Semester Exam: 35	Internal Assessment: 15
Course Objective	The course aims to provide practical knowledge and technical skills in cellular biology, focusing on essential techniques for studying cell viability, chromosomal dynamics, and organelle isolation.
Course Outcome	Students will acquire hands-on experience in assessing cell viability, analyzing chromosomal stages, and isolating organelles. They will develop a deeper understanding of cellular processes such as mitosis, meiosis, and mitochondrial function, while gaining proficiency in laboratory techniques used in cell biology research.
Practical	1:Cell Viability by Trypan Blue
	2:Metaphase chromosome
	3:Stages of Meiosis
	4:Isolation of mitochondria from mouse liver by differential centrifugation

Reference Books:

1. Lodish. H et. al., Molecular Cell Biology, W H Freeman & Co, (5th ed.)
2. Alberts, B et. al., (2008) Molecular Biology of Cell, Garland Science (5th ed.)
3. Sperelakis. N., Cell Physiology A Source Book, Academic Press Inc, (New ed.)
4. Bertoni. G et. al.,The World of Cell, Pearson (8th ed.)

DSE-1: Principles of Ecology and Biodiversity (Theory)

Semester: I	Paper: Discipline Specific Elective
Credit: 04	Paper Title: **Principles of Ecology and Biodiversity (Theory)**
Instruction: 4hr/Wk	Paper Code: MSZY101DST
Semester Exam:70	Internal Assessment: 30
Course Objective	The course aims to provide a foundational understanding of ecological principles, including the interactions between organisms and their environment, ecosystem dynamics, and biodiversity conservation. It emphasizes the importance of ecological balance and the role of biodiversity in maintaining ecosystem health.
Course Outcome	The students will be able to understand the impact of climatic factors on the distribution of organisms and how the animals cope up with extreme climatic changes to survive and propagate. The students will be able to learn how the populations of species are regulated due to predation and parasitism, how the species with overlapping niches tend to shrink their niche size to coexist and how the biodiversity can be conserved and mapped using GPS, GIS and remote sensing methods.
UNIT-I Ecology and Biogeography	1.1: Definition and scope of ecology in modern perspective. Climatic factors: Temperature, light, precipitation with special reference to biomes.
	1.2: Climate diagrams. Animals' adaptations and performance in response to extreme climatic variables (ecto-, endotherms; dark and light adaptations).
	1.3: Water budget; water conservation and regulation in terrestrial and aquatic environments.
	1.4: Biogeographical zones of India; theory of island biogeography.
UNIT-II Ecosystem: Stability and resilience	2.1: Ecosystem: components and types: terrestrial and aquatic ecosystems with special reference to India. Flux of matter (biogeochemical cycles) and energy in the ecosystem.
	2.2: Patterns of terrestrial and aquatic primary productions. Trophic levels and their interpretations.
	2.3:Feeding guilds. Community web: structure and complexity; keystone species.
	2.4: Stability and resilience of the ecosystem. Stable and unstable ecosystem. Ecosystem modeling and simulation.
UNIT-III Population Ecology	3.1:Population: Sampling methods. Characteristics: distribution (small and large scale distribution) and abundance.
	3.2: Organism size and population density. Birth and death rates. Patterns of survival and life tables.
	3.3: Age and sex ratio distribution. Factors regulating population dispersal and growth. Metapopulations, demes and interdemic extinction. Life history strategies: reproductive effort, offspring size and cost-benefit ratio.
	3.4: Patterns of population growth. Human population and carrying capacity.Changing relations of human and environment since prehistoric times.
UNIT-IV Community and Biodiversity	4.1: Community characteristics; interactions: Positive interactions: commensalism, proto-cooperation, and mutualism
	4.2: Negative interactions: parasitism and allelopathy; predation and predator-prey dynamics; herbivory, Interspecific competition and coexistence, Niche overlap and segregation Lotka–Voltera-competition theory.
	4.3: Principles of competition exclusion. Ecological succession. Biodiversity: status, monitoring and documentation; major drivers of biodiversity change
	4.4: Biodiversity mapping using GPS, GIS and remote sensing.

References Books:

l. Odum E. P., Basic Ecology, Saunders College Publishing (Rev. ed.)

2. Stiling. P. Ecology: Theories and Applications, Prentice Hall of India Pvt. Ltd, (4^{th} ed.)

3. Begon, M. et. al., Ecology. Blackwell Science Ltd (3^{rd} ed.)

4. Kormondy, E. J., Concepts of Ecology, Prentice-Hall (4^{th} ed.)