

Anekant Education Society's  
**TULJARAM CHATURCHAND COLLEGE OF ARTS,  
SCIENCE & COMMERCE, BARAMATI, DIST – PUNE.  
AUTONOMOUS**



**POST GRADUATE DEPARTMENT OF ZOOLOGY**

**SYLLABUS**

**M.Sc. Zoology Part-I, SEMESTER-I**

**ACADEMIC YEAR 2022-2023**

Anekant Education Society's  
**TULJARAM CHATURCHAND COLLEGE OF ARTS, SCIENCE &  
 COMMERCE, BARAMATI.  
 AUTONOMOUS**

**Scheme of Course Structure (CBCS) Faculty of  
 Science Post Graduate Department of Zoology  
 SEMESTER II**

**Class: M.Sc. I**

**Pattern: 40 (IA) + 60 (EA)**

Sr. No.	Code	Paper	Paper Title	Credit	Exam	Marks
1	PSZO 111	Theory	Biochemistry & Bioenergetics	4	I / E	40 + 60
2	PSZO 112	Theory	Cell Biology	4	I / E	40 + 60
3	PSZO 113	Theory	Fresh Water Zoology & Ichthyology	4	I / E	40 + 60
4	PSZO 114	Theory	Biostatistics & Genetics	4	I / E	40 + 60
5	PSZO 115	Zoology Practical-I	Practicals Corresponding to PSZO 111 and PSZO 112	4	I / E	40 + 60
6	PSZO 116	Zoology Practical-II	Practicals Corresponding to PSZO 113 and PSZO 114	4	I / E	40 + 60
7			Skill Development	2	-	
8			Certificate Course	2	-	

**IA\* - Internal Assessment**

**EA\*- External Assessment**

## SYLLABUS (CBCS) FOR M. Sc. ZOOLOGY (w. e. f. June, 2022)

**Name of the Program: M.Sc. Zoology**

**Class: M. Sc. I**

**Course Name: Biochemistry and Bioenergetics**

**Number of Credits: 04**

**Program Code: PSZO**

**Semester: I**

**Course Code: PSZO 111**

**Number of Lectures: 60**

### Learning Objectives:-

- To understand structures and functions of biomolecules.
- To understand the role in metabolic pathways of carbohydrates, proteins, lipids and nucleic acids.
- To understand the kinetics of Enzymes.
- The energetics of biomolecules.

### Learning Outcomes:-

- Understand structures and functions of biomolecules Such as carbohydrates, proteins, lipids and nucleic acids.
- Understand the role of biomolecules in metabolic pathways.
- Understand the Enzymes, kinetics and energetics.
- Get well prepared for research in life sciences.
- Students will gain proficiency in basic laboratory techniques and be able to apply the scientific method in the processes of experimentation and hypothesis testing.

### TOPICS:

Unit No.	Subunit No.	Details
<b>1. Biomolecules: Classification, Structure and Function (20L)</b>	1.1	Stabilizing Interactions in Biomolecules
	1.2	a. Water: Structure and Function b. pH and Buffers c. Biological Buffer System
	1.3	Carbohydrates: a. Classification of Carbohydrates b. Structure, general properties and functions
	1.4	Lipids: a. Classification b. Structure and function c. Major subclasses.
	1.5	Vitamins and coenzymes: a. Biochemistry b. Functions
	1.6	Proteins: a. General properties of proteins b. Structure of amino acid c. Structure of proteins: Primary structure and its importance, Secondary structure-alpha-helix, beta-helix, Ramachandran plot, X ray diffraction,

		Tertiary structure: Myoglobin, Forces stabilizing, unfolding and refolding Quaternary structure-haemoglobin. d. Biological Roles
<b>2. Enzymes (10L)</b>	2.1	a. Classification b. Types of enzymes c. Nomenclature d. Properties
	2.2	Enzyme Kinetics -One Substrate Reaction Michaelis-Menten Equation, Lineweaver-Burk plot
	2.3	Specific Activity
	2.4	Factors affecting enzyme activity
	2.5	Enzyme inhibition
	2.6	Allosteric Enzymes Isozymes (LDH)
<b>3. Bioenergetics: - Metabolic Pathways and its energetics (30L)</b>	3.1	Internal energy, enthalpy, entropy, concept of free energy, redox potentials, high energy compounds, structure and function of ATP.
	3.2	Concepts of metabolism: Metabolic Pathways- Catabolic and anabolic, Regulation of metabolic pathways.
	3.3	Carbohydrate metabolisms: a. Glycolysis b. TCA c. Glycogenesis, Glycogenolysis and Glyconeogenesis
	3.4	Electron transport chain and Oxidative phosphorylation.
	3.5	Lipid metabolism: Introduction, Biosynthesis of palmitic acid, Beta oxidation of fatty acid

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## SYLLABUS (CBCS) FOR M. Sc. ZOOLOGY (w. e. f. June, 2022)

**Name of the Program: M.Sc. Zoology**

**Class: M. Sc. I**

**Course Name: Cell Biology**

**Number of Credits: 04**

**Program Code: PSZO**

**Semester: I**

**Course Code: PSZO 112**

**Number of Lectures: 60**

### Learning Objectives:-

- Students will understand the structures and purposes of basic components of prokaryotic and eukaryotic cells, especially macromolecules, membranes and organelles.
- Students will understand how these cellular components are used to generate and utilize energy in cells
- Students will understand the cellular components underlying mitotic cell division.
- Students will apply their knowledge of cell biology to selected examples of changes or losses in cell function. These can include responses to environmental or physiological changes, or alterations of cell function brought about by mutation.

### Learning Outcomes:-

- Students will understand the structures, biochemical composition and Functions of basic components of prokaryotic and eukaryotic cells, especially macromolecules, membranes, and organelles
- Various Techniques of cell Study
- Students will understand the cellular components for mitotic cell division.
- Students will apply their knowledge of cell biology responses to environmental or physiological changes, or alterations of cell function brought about by mutation or Cancer
- Student understands cell apoptosis, necrosis and senescence
- Students will come to know about the intrinsic and extrinsic factors for causes of cancer.
- Understand types of cancer, biological entities responsible for it.
- How cells are newly form and the chromosome number is maintain for formation of gametes

### TOPICS:

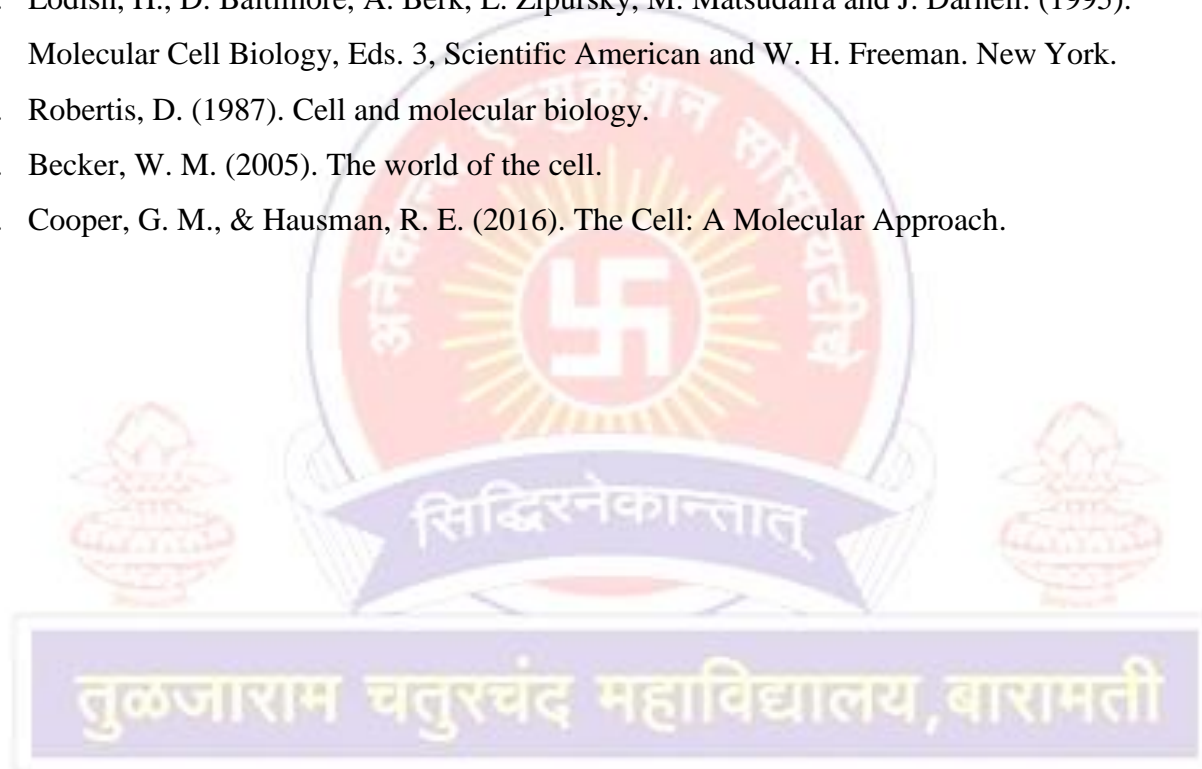
Unit No.	Subunit No.	Details
<b>1. Overview of Chemical Nature of the Cell (2L)</b>	1.1	Carbon as backbone of biologically important molecules.
	1.2	Macromolecules and their role in the living systems.
<b>2. Plasma Membrane (6L)</b>	2.1	Models of cell membrane structure
	2.2	Membrane Transport: Carrier proteins (uniporters, symporters and antiporters), Active and passive transport, Voltage and transmitter gated ion channels, energetics of transport
	2.3	Membrane potential and synaptic transmission
	2.4	Nernst equation
<b>3. The Endomembrane System and Peroxisomes (7L)</b>	3.1	Endoplasmic reticulum: Signal peptide hypothesis, protein folding, processing and secretion, lipid synthesis
	3.2	Golgi complex: Protein glycosylation and proteolytic processing
	3.3	Lysosomes: Structure, Role in intracellular digestion and Apoptosis, Lysosomal Storage Diseases

	3.4	Peroxisomes and Glyoxysomes: Structure and functions
	3.5	Intracellular Transport and protein trafficking
<b>4. Nucleus (3L)</b>	4.1	Ultrastructure, Nuclear pore complex
	4.2	Export and import of proteins
	4.3	Nucleolus, Nuclear lamina and its role in Cell Division
<b>5. Mitochondria and Chloroplast (3L)</b>	5.1	Structure, Genetic system, Functions, Protein Import and biogenesis of mitochondria and chloroplast
<b>6. Extracellular Matrix, Cell-Cell Junction and Adhesion (5L)</b>	6.1	Polarity proteins
	6.2	Cell junctions: tight junction, claudins, desmosome, hemidesmosome, gap junctions and Plasmodesmata
	6.3	Cell adhesion molecules: cadherins, integrins and selectins
	6.4	Extracellular matrix of animal and plant cell
<b>7. Cell Signaling and Transduction (7L)</b>	7.1	Categories of chemical signaling in multicellular organisms: paracrine signaling, autocrine signaling, endocrine signaling and juxtacrine signaling
	7.2	General structure of cellular receptors
	7.3	Second messengers in cell signaling: Types and their role
	7.4	G-Protein Coupled Receptors and its associated pathway
	7.5	Receptor tyrosine kinases and its associated pathway
	7.6	Hormonal Signaling
<b>8. Cell Cycle and its regulation (4L)</b>	8.1	Check points of cell cycle.
	8.2	Regulation of Cyclin and Cyclin dependent kinases (Cdk), Check points- role of Rb and p53
	8.3	Inhibitors of cell cycle
<b>9. Cytoskeleton and Motor Proteins (7L)</b>	9.1	Microtubules: Structure, MTOC's and functions of microtubules
	9.2	Intermediate filaments: Structure, types and functions of intermediate filaments.
	9.3	Microfilaments: Actin polymerization, role in cell movement.
	9.4	Dynein, Kinesin and Myosin
	9.5	Role of the Cytoskeleton in Cancer and its pharmaceutical applications
	9.6	Inhibitors of cytoskeleton organization
<b>10. Cancer Biology (7L)</b>	10.1	Cancer: Types and development
	10.2	Causes of cancer: Physical, Chemical and biological agents
	10.3	Characteristics of Cancer Cell
	10.4	Tumor viruses: Hepatitis B viruses, Adenoviruses, SV40, Papillomaviruses and Retroviruses
	10.5	Oncogene and Tumor suppresser gene
	10.6	Diagnosis, Screening and treatment of cancer

<b>11. Cell death mechanisms (4L)</b>	11.1	Autophagy
	11.2	Apoptosis
	11.3	Anoikis
<b>12. Stem Cell Biology (5L)</b>	12.1	Concept, types, self-renewal, pluripotency, differentiation
	12.2	Isolation and characterization of stem cells
	12.3	Use of stem cells in tissue repair

### REFERENCES

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## SYLLABUS (CBCS) FOR M. Sc. ZOOLOGY (w. e. f. June, 2022)

**Name of the Program: M.Sc. Zoology**

**Class: M. Sc. I**

**Course Name: Freshwater Zoology and Ichthyology**

**Number of Credits: 04**

**Program Code: PSZO**

**Semester: I**

**Course Code: PSZO 113**

**Number of Lectures: 60**

### Learning Objectives:-

- To understand the animal kingdom.
- To understand the taxonomic position of protozoa to helminths.
- To understand the general characteristics of animals belonging to protozoa to helminths.
- To understand the body organization of phylum from protozoa to helminths.
- To understand the origin and evolutionary relationship of different phylum from protozoa to helminths.
- To provide students with an interactive learning environment whereby critical thinking is developed and knowledge is acquired on various aspects of fish anatomy, function, biology and academic writing.
- The overall goals of this course are to: introduce students to fish diversity, appreciate the means through which fishes adapt to suit their challenging environments, provide an overview of fish anatomy, ecological environment, and behaviour.

### Learning Outcomes:-

- Students learn about the aquatic ecosystem, lentic and lotic habitat as well the ephemeral water bodies.
- Students learn about the different parameters of physical conditions of water.
- Students learn about the different parameters of chemical conditions of water and its importance to the aquatic life.
- Students learn the different physiological and protective adaptations.
- Students understand the relation of Amphibia and water with the life cycle of frog and the tadpole as important herbivores.
- Students learn different adaptations in turtles and crocodiles with economic importance.
- They can also understand the taxonomic and phylogenetic relationships of fish and fish-like vertebrates within the context of all vertebrate groups.

### TOPICS:

Unit No.	Subunit No.	Details
<b>Section A: Freshwater Zoology</b>		
<b>1. Types of Aquatic Environment (4L)</b>	1.1	Lotic Habitat: Major river in India
	1.2	Lentic Habitat: Lakes, Ponds and Swamps, Bogs lakes and succession of lakes
	1.3	Ephemeral water bodies (Temporary habitat).
<b>2: Physical Conditions of Water (4L)</b>	2.1	Movement of water, depth, viscosity, density, transparency turbidity and thermal stratification
<b>3: Chemical Conditions of Water (4L)</b>	3.1	Dissolved oxygen and carbon di-oxide, pH, phosphates, sulphate content, nitrates



	3.2	Acidity, alkalinity, Mg-hardness, Ca-hardness, dissolved solids
	3.3	Importance of chemical conditions to aquatic life.
<b>4: Physiological and protective adaptations of the following (2L)</b>	4.1	Protozoa, Rotifera, Crustaceans and Fishes.
<b>5: Diagnostic features and life cycle of temporary rainwater pool animals (3L)</b>	5.1	Fairy shrimps, Tadpole shrimps and Clam shrimps.
<b>6: Respiratory and locomotory adaptations (3L)</b>	6.1	Adaptations in freshwater insects and their larvae
<b>7: Adaptations in freshwater reptiles (3L)</b>	7.1	Terrapin and crocodiles
<b>8. Economic importance of fresh water animals (2L)</b>	8.1	Economic importance of freshwater molluscs
	8.2	Economic importance of reptiles
<b>9. Aquatic habitat (2L)</b>	10.1	Productivity of water bodies and its importance
<b>10. Zooplanktons (3L)</b>	10.1	General characters of zooplankton with special emphasis on the characters used in taxonomy: Rotifera, Copepoda, Cladocera and Ostracoda
<b>Section B: Ichthyology</b>		
<b>1. Classification and Diagnostic Characters (up to orders) (4L)</b>	1.1	Extant Cyclostomata, Chondrichthyes and Osteichthyes (9 major orders of fishes)
	1.2	Phylogeny of fishes
<b>2. External morphology (2L)</b>	2.1	Body form, appendages, pigmentation, skin and scales
<b>3. Endoskeleton (2L)</b>	3.1	Skull
	3.2	Axial Skeleton
	3.3	Appendicular skeleton.
<b>4. Digestion (2L)</b>	4.1	Food and feeding habits
	4.2	Digestive system and its anatomical modifications.
<b>5. Respiration (4L)</b>	5.1	Structure and functions of gills
	5.2	Adaptations for air breathing
	5.3	Role of air bladder in respiration and bouyancy
<b>7. Excretion and Osmoregulation (3L)</b>	6.1	Glomerular and aglomerular kidneys;
	6.2	Nitrogen (Ammonia, Urea and TMAO) excretions;

	6.3	Water and salt and balance in stenohaline and euryhaline fish
	6.4	Role of skin and gills in osmoregulation
<b>8. Migration in fish (1L)</b>		
<b>9. Reproduction (3L)</b>	9.1	Structure of gonads
	9.2	Gametogenic cycles
	9.3	Spawning and parental care
<b>10. Nervous System and Sense Organs (3L)</b>	10.1	Organization of the central and peripheral nervous systems.
	10.2	Eye, lateral line organs and chemoreceptors
<b>11. Endocrine Organs (3L)</b>	11.1	Functions of the pituitary, thyroid, inter-renal and chromaffin tissues,
	11.2	Functions of ultimobranchial gland and corpuscles of Stannius
<b>12. Fish Diseases (3L)</b>	12.1	Protozoan diseases in fish
	12.2	Fungal diseases in fish
	12.3	Bacterial diseases in fish

### REFERENCES:

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## SYLLABUS (CBCS) FOR M. Sc. ZOOLOGY (w. e. f. June, 2022)

**Name of the Program: M.Sc. Zoology**

**Class: M. Sc. I**

**Course Name: Genetics and Biostatistics**

**Number of Credits: 04**

**Program Code: PSZO**

**Semester: I**

**Course Code: PSZO 114**

**Number of Lectures: 60**

### Learning Objectives:-

- Understanding the principles of genetics to produce a family pedigree from a family history and to distinguish patterns of inheritance for single gene disorders linked to autosomes, sex chromosomes and mitochondrial genes.
- Understanding the methods to determine the relative contribution of genes and environment to common disorders with complex inheritance and to provide genetic counselling based on empirically derived risk tables.
- Perform a literature search on a specific genetic disease and inform other students of the findings in a written abstract and an oral presentation.
- Understanding of numerical data analysis.
- Analysis tabular, diagrammatic and graphical representation of data.
- Understanding the correlation between variables for making conclusions.
- Understanding the importance of statistical tests for scientific communications like research papers.

### Learning Outcomes:-

- Chemical basis of heredity.
- Comprehensive and detailed understanding of genetic methodology and how quantification of heritable traits in families and populations provides insight into cellular and molecular mechanisms.
- Understanding of how genetic concepts affect broad societal issues including health and disease, food and natural resources, environmental sustainability, etc.
- Understanding the role of genetic mechanisms in evolution.
- The knowledge required to design, execute, and analyse the results of genetic experimentation in animal and plant model systems.
- Analyse and represent the numerical data.
- Parametric and non-parametric tests and distributions of data.
- Statistical tests for comparison of data.

### TOPICS:

Unit No.	Subunit No.	Details
<b>Section-I: Genetics</b>		
<b>1. Gene Interactions and Deviations from Mendelian Inheritance (4L)</b>	1.1	Introduction to Mendelian principles
	1.2	Incomplete and co-dominance
	1.3	Dominant Epistasis & Recessive Epistasis
	1.4	Duplicate Dominant Epistasis, Duplicate recessive epistasis
<b>2. Multiple alleles (2L)</b>	2.1	Coat colour in mice

<b>3. Linkage and crossing over (4L)</b>	3.1	Linkage, linkage groups, types of crossing over
	3.2	Models of molecular basis of recombination
	3.3	3-point test cross for diploids
<b>4. Inheritance of qualitative and quantitative traits (4L)</b>	4.1	QTL Mapping
	4.2	Quantitative Genetics: Concepts of penetrance, expressivity and variance, Heritability
	4.3	Genetic basis and influence of environment on quantitative inheritance
<b>5. Principles of Population Genetics (4L)</b>	5.1	Genetic structure of populations –Gene pool, Genotype Frequency, Allelic frequency
	5.2	Hardy-Weinberg law and its application
<b>6. Somatic Cell Genetics (3L)</b>	6.1	Its applications, Gene Therapy, Gene transfer technology
<b>7. Human genetics (5L)</b>	7.1	Dominant and recessive disorders,
	7.2	Pedigree Analysis
	7.3	Physical and physiological traits
<b>8. Gene Mutation (3L)</b>	8.1	Types, Causes and Detection
<b>9. Introduction to epigenetics (1L)</b>		
<b>Section-II: Biostatistics</b>		
<b>1. Introduction to Biostatistics (2L)</b>	1.1	Applications and Uses of Statistics
	1.2	Definition of Population, sample, sample sizes, Different types of Samples in scientific experiments
	1.3	Exercise and problems related to various sampling datasets
<b>2. Data Classification (3L)</b>	2.1	Some important terms (Class frequency, class-limits, Class-width, class –mark)
	2.2	Frequency distribution, Cumulative frequency
	2.3	Graphical representation of data (Histogram, Pie-Diagram, Ogive-curve.)
	2.4	Exercise and Problems.
<b>3. Measures of central tendency (4L)</b>	3.1	Concept of central tendency, Types of central tendency (Arithmetic mean, Median and mode) combined mean.
	3.2	Partition values (Quartiles, Deciles, and Percentiles)
	3.3	Exercise and problems related to Mean mode median
<b>4. Measures of dispersion (3L)</b>	4.1	Concept of dispersion, absolute and relative measure of dispersion

	4.2	Different measures of dispersion (Range, Quartile-Deviation, Variance and standard deviation, Coefficient of Variation) combined variance
	4.3	Exercise and Problems
<b>5. Correlation and Regression (5L)</b>	5.1	Bivariate data, concept of correlation, Types of Correlation, Scatter plot
	5.2	Karl Pearson's coefficient of correlation and its properties.
	5.3	Concept of regression, linear regression, regression coefficients and its properties.
	5.4	Exercise and problems.
<b>6. Probability and probability distribution (5L)</b>	6.1	Some important terms (types of experiment, sample space and types of sample space, events and types of events.)
	6.2	Definition of probability (mathematical and classical) conditional probability.
	6.3	Concept of random variable, univariate probability distribution and its mathematical expectation.
	6.4	Some standard probability distributions (binomial, Poisson and normal) their probability distribution, mean, variance and properties of these distribution.
	6.5	Exercise and Problems.
<b>7. Test of hypothesis (8L)</b>	7.1	Some important terms (hypothesis, types of hypothesis, Test, Critical region, acceptance region, type I error, type II error, level of significance, p-value)
	7.2	Test for mean and equality of two population means, Test for proportion and equality of two population proportions.
	7.3	Chi-square test for goodness of fit, Unpaired and paired 't' test,
	7.4	F test for equality of two population variances.
	7.5	Exercise and Problems.

## REFERENCES:

1. William S Klug and Michael R Cummings. Concepts of Genetics. Edn. IX. Prentice Hall Internatl, Inc., New York, 2008.
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## SYLLABUS (CBCS) FOR M. Sc. ZOOLOGY (w. e. f. June, 2022)

Name of the Program: M.Sc. Zoology

Program Code: PSZO

Class: M. Sc. I

Semester: I

Course Name: Zoology Practical-I (Practicals Corresponding to PSZO 111, PSZO 112)

Course Code: PSZO 115

Number of Credits: 04

Number of Practicals: 10

### Learning Objectives:-

- Instrument handling
- Methodology for carbohydrates, proteins and vitamins estimation
- Effect of temperature, pH, activator and inhibitor on enzyme activity
- Methodology for DNA and RNA detection.
- Effect of chemicals on mitosis.

### Learning Outcomes:-

- Working of instruments.
- Basic and advance techniques in analysis.
- Estimation of concentration of carbohydrates, proteins and vitamins.
- Detection of DNA and RNA.
- Effect of Colchicine on mitosis.

<b>Section I –PSZO 111: Biochemistry and Bioenergetics</b>		
<b>Sr. No</b>	<b>Title of the Practical</b>	<b>E/D</b>
1	Preparation of standard Acid and Alkali solutions and acid-base titration.	E
2	Preparation of Buffers of known pH and molarity. Measurement of pH of Various samples and their buffering capacity	E
3	Estimation of inorganic phosphates from plasma	E
4	Estimation of Sugar (Glucose) by GOD-POD Method	E
5	Estimation of Tyrosine by Folin Ciocalteu Reagent	E
6	Estimation of vitamin 'C' by iodine method.	E
7	Estimation of amylase activity	E
8	Estimation of protein by Lowry et.al method.	E
9	Determination of optimum pH of enzyme	E
10	Effect of substrate concentration, pH, temperature, inhibitor and activator on enzyme activity	E
<b>Section II – PSZO 112: Cell Biology</b>		
1	Measurements of cell size using stage micrometer and ocular micrometer.	E
2	Differential centrifugation for harvesting subcellular molecules	D

3	Effect of Colchicine treatment on Mitosis from any suitable material.	E
4	Demonstration of collagen by Van Gieson's Stain in Liver/Tissue Sections.	E
5	Differential staining for DNA and RNA in human cheek epithelial cells.	E
6	Aseptic technique and good cell culture practice.	D
7	Short term culture of whole blood and preparation of metaphase chromosomes.	E
8	Cell viability assay by Trypan blue exclusion.	E
9	MTT assay for cell viability.	E
10	Feulgen staining for DNA.	E





## SYLLABUS (CBCS) FOR M. Sc. ZOOLOGY (w. e. f. June, 2022)

**Name of the Program: M.Sc. Zoology**

**Program Code: PSZO**

**Class: M. Sc. I**

**Semester: I**

**Course Name: Zoology Practical-II (Practicals Corresponding to PSZO 113, PSZO 114)**

**Course Code: PSZO 116**

**Number of Credits: 04**

**Number of Practicals: 10**

### Learning Objectives:-

- Instrument handling.
- Students learn the different physiological adaptations aquatic organisms.
- Students learn about the different parameters of chemical conditions of water and its importance to the aquatic life.
- To provide overview of morphology, anatomy and biology of fish.
- Understanding the principles of inheritance.
- Understanding the role of genetic mechanisms in evolution.
- Understanding of numerical data analysis.
- Understanding the methods for representation of data.
- Understanding the importance of statistical tests for scientific communications like research papers.

### Learning Outcomes:-

- Working of instruments.
- Adaptations in aquatic organisms.
- Importance of chemical conditions for aquatic life.
- Role of genetic mechanisms in evolution.
- Analyse and represent the numerical data.
- Statistical tests for comparison of data.

Section I –PSZO 113 Fresh Water Zoology		
Sr. No	Title of the Practical	E/D
1	A qualitative and quantitative analysis of Zooplankton from a given sample of water using Sedgwick rafter counting cell.	E
2	Study of locomotory and respiratory adaptations in aquatic insects and their larvae. ( <i>Ranatra</i> , <i>Notonecta</i> , <i>Gerris</i> , <i>Belostoma</i> , <i>Dytiscus</i> ).	D
3	Estimation of Chlorides in given sample of water.	E
4	Study of Bioindicators of pollution by insects, rotifers, algae, diatoms.	D
7	Water analysis with regards to hardness (Total and Calcium).	E
8	A Compulsory visit ZSI/ to local freshwater body and submission of report on physicochemical conditions and faunal organisms.	E
9	Estimation of primary productivity of water body with dark and light bottle method	E

## Section II – PSZO 113 Ichthyology

1	General external characters, fins and scales (permanent slides and temporary preparations) and morphometric measurements.	E
2	Length-weight relationship, conditions factors, gonosomatic and hepatosomatic indices of any one fish	E
3	Classification of locally available fish genus level with the use of diagnostic keys.	E
4	Adaptations of fish (adhesive organs, accessory respiratory organs, stomachless fish, spiral valve, rostral spines etc.	D
5	Anatomical observations and demonstration of Digestive and reproductive system of carp/ catfish/ Tilapia.	E
7	Visit to fish farm/fish market/any aquarium	E
8	Study of common diseases in fish their diagnosis and control strategies.	D

## Section III – PSZO 114 Genetics

1	Study of sex linked inheritance in <i>Drosophila</i> sp.	D
2	Determination of gene distances and gene order for a given three point test cross	E
3	Polytene chromosomes of <i>Drosophila</i> / Chironomous-examination of puff and bands	E
4	Study of Banding Pattern in Chromosome (G- Banding and/or C- Banding)	E
5	Estimation of allelic frequencies, heterozygote frequencies in human populations	E
6	Effect of toxicant on Hydra regeneration.	E

## Section IV – PSZO 114 Biostatistics

1	Construction of frequency distribution and its graphical representation.	E
2	Measures of Central Tendency and Dispersion.	E
3	Correlation and Regression.	E
4	Computation and application of normal, binomial and Poisson probabilities.	E
5	Test for means and proportions.	E
6	Chi-square test of goodness of fit, Paired and unpaired t- test, F-test	E
7	Statistical analysis with Computer software packages.	E