

# UNIVERSITY OF KOTA

Syllabus and Scheme of  
Semester Examination for the  
Academic Year

**2024-25**



**Master of Science**

**ZOOLOGY**

**Course Code: ZOO12200**

**UNIVERSITY OF KOTA**

**MBS MARG, NEAR KABIR CIRCLE, KOTA (RAJASTHAN) 324 005**

**Syllabus Edition: 2024 (as per NEP 2020)**

**UNIVERSITY OF KOTA, KOTA**  
MBS Marg, Near Kabir Circle, KOTA (Rajasthan)-324 005

**Master of Science**

**ZOOLOGY**

**Course Code: ZOO12200**

**Faculty of Science**

**SCHEME OF EXAMINATIONS AND SYLLABUS**

**M. Sc. First and Second Semester Examinations**

1. The M.Sc. Course in Zoology is a two-year full-time curriculum offered in the form of Choice-based Credit System organized in **Four Semesters**. The number of papers and maximum marks for each theory paper/practical has been shown in the syllabus. It will be necessary for a candidate to pass in the theory part as well as in the practical part (wherever prescribed) separately.
2. The course of study for M.Sc. (Zoology) examination shall be spread over a period of two years with examination at the end of each semester. There shall be **Four Semesters** in all.
3. Every semester will have four Theory papers and one practical. Syllabus of every theory paper of each semester will be divided into 5 units.
4. Scheme of examination:

<b>Each Semester</b>	<b>Maximum Marks</b>	<b>Minimum Marks</b>	<b>Internal Assessment</b>
Paper I	70	28	30
Paper II	70	28	30
Paper III	70	28	30
Paper IV	70	28	30
Practical	200	100	---

**M Sc ZOOLOGY (2024-25)**

**(Course Code-ZOO12200)**

**Semester I**

**ZOO12201T: Z-1.1 INVERTEBRATE: STRUCTURE AND FUNCTIONS**

**ZOO12202T: Z-1.2 BIOCHEMISTRY**

**ZOO12203P: Z-1.5-I PRACTICAL LAB COURSE I (Z-1.1 & Z-1.2)**

**ZOO12204T: Z-1.3 CELL BIOLOGY**

**ZOO12205T: Z-1.4 EVOLUTION AND BIostatISTICS**

**ZOO12206P: Z-1.5-II PRACTICAL LAB COURSE II (Z-1.3 & Z-1.4)**

**ZOOLOGY Practical:** Duration 12 Hrs; MM 200, Min 100.

**Day 1:** 6 Hrs. (Z-1.1 & Z-1.2) and **Day 2:** 6 Hrs (Z-1.3 & Z-1.4).

Each **theory paper:**

Teaching Hrs for each paper	Credit Points for each paper	Continuous assessment		Semester assessment		Max marks	Min. Pass marks	Paper Duration
		MM	Pass	MM	Pass			
04	04	30	12	70	28	100	40	3 Hrs.

For **Practical (Lab Course-I & Lab Course-II):** Teaching Hrs/week 16, Credit pt: 8; Max. Marks 100, Min. pass marks 50 for each day (Two days Practical Exam).

**Total (I Semester):** Teaching Hrs 32, Credit pt 24, Continuous assessment (MM 120, Min 48) Semester Assessment (MM 480, Min 212) Total **Max. Marks 600** (120+480) **Min. Pass Marks 260** (48+212).

**M Sc ZOOLOGY (2024-25)**  
**(Course Code-ZOO12200)**  
**Semester II**

**ZOO12211T: Z-2.1 IMMUNOLOGY AND BIOTECHNOLOGY**

**ZOO12212T: Z-2.2 ANIMAL TAXONOMY**

**ZOO12213P: Z-2.5- I PRACTICAL LAB COURSE I (Z-2.1 & Z-2.2)**

**ZOO12214T: Z-2.3 GENETICS**

**ZOO12215T: Z-2.4 ANIMAL PHYSIOLOGY**

**ZOO12216P: Z-2.5- II PRACTICAL LAB COURSE I (Z-2.3 & Z-2.4)**

**ZOOLOGY Practical:** Duration 12 Hrs; MM 200, Min 100.

**Day 1:** 6 Hrs (Z-2.1 & Z-2.2) and **Day 2:** 6 Hrs (Z-2.3 & Z-2.4).

For each **theory paper:**

Teaching Hrs	Credit point	Continuous Assessment		Semester Assessment		Max Marks	Min. Pass Marks	Paper Duration
		Max. Marks	Pass	Max. Marks	Pass			
04	04	30	12	70	28	100	40	3 Hrs.

For **Practical**: Teaching Hrs 16, Credit pt: 8; Max. Marks 100, Min. pass marks 50 for each day (Two Days Practical).

**Total**: Teaching Hrs 32, Credit pt 24, Continuous assessment (MM 120, Min 48) Semester Assessment (MM 480, Min 212) Total **Max. Marks 600** (120+480), **Min. Pass Marks 260** (48+212).

**Continuous Assessment or Internal or Mid Term Assessment:**

(a) The continuous or internal or mid-term assessment (30% weightage of the maximum marks) for each theory paper shall be taken by the faculty members in the Department during each semester. There will be two internal assessment tests (i.e. First Internal Assessment Test or First Mid Term Test and Second Internal Assessment Test or Second Mid Term Test) each of 15% weightage for each theory paper. Each internal assessment test shall be of one-hour duration for theory paper and shall be taken according to academic calendar which will be notified by the Department / University.

(b) For practical papers, there will be only one external or semester or end term assessment (100% weightage of maximum marks) and there will be no continuous or internal or midterm assessment.

(c) A student who remains absent (defaulter) or fails or wants to improve the marks in the internal assessment may be permitted to appear in the desired paper(s) (only one time) in the same semester with the permission of the concerned Head of the Department. A defaulter / improvement fee of Rupees 250/- per paper shall be taken from such candidates. Duly forwarded application of such candidates by the teacher concerned shall be submitted to HOD who may permit the candidate to appear in the internal assessment after production of satisfactory evidence about the reason of his/her absence in the test(s) and deposition of the defaulter / improvement fee. A record of such candidates shall be kept in the Department.

(d) Regular attendance of the student shall be considered in the internal assessment. If the attendance / regularity factor is similar for all the students, then it may be merged with the weightage of second internal assessment test (class test / home assignment / quiz, seminar, etc.).

(e) Paper wise consolidated marks for each theory paper and dissertation / seminar (i.e. total marks obtained during various modes of internal assessment) obtained by the students (out of the 30% weightage of the maximum marks of the paper) shall be forwarded by the Head of the Department (in two copies) to the Controller of Examination of the University within a week from the date of last internal assessment test for incorporation in the tabulation register.

(f) The consolidated marks obtained by the students will also be made known to them before being communicated by the Head of the Department concerned to the University for final incorporation in the tabulation register. If any discrepancies are discovered or pointed out by the students, the same shall be looked into by the concerned faculty member and corrections made wherever necessary. The decision of the Head of the Department before the communication of marks to the University shall be final. No

corrections shall be made in the internal assessment marks after the declaration of the result by the University.

(g) Consolidated marks communicated to the University shall be in whole number and not in fraction. Marks awarded for the various internal assessments in each paper shall be added up and then round off to the next whole to avoid any fraction.

**University of Kota, Kota**

**M.Sc. Zoology (Course Code: ZOO12200)**

**Semester wise Consolidated Common Scheme of Examinations for the Academic Sessions 2024-2025**

Semester	Number, Code or ID and Nomenclature of Paper			Nomenclature of Paper	Duration of Exam (in Hrs)	Teaching Hrs/Week		Credit Point	Distribution of Assessment Marks					
	Number of Paper	Code/ID Paper				Th	Pr		Max Mark	Min Mark	Max Mark	Min Mark	Max Mark	Min. Mark
<b>Semester I</b>	Paper- 1.1	ZOO12201T	DCC	INVERTEBRATE: STRUCTURE AND FUNCTIONS	3	4		4	30	12	70	28	100	40
	Paper- 1.2	ZOO12202T	DCC	BIOCHEMISTRY	3	4		4	30	12	70	28	100	40
	Paper- 1.3	ZOO12204T	DCC	CELL BIOLOGY	3	4		4	30	12	70	28	100	40
	Paper- 1.4	ZOO12205T	DCC	EVOLUTION AND BIostatISTICS	3	4		4	30	12	70	28	100	40
	Paper-1.5- I	ZOO12203P	DCC	Practical Lab Course I	6		8	4			100	50	100	50
	Paper-1.5- II	ZOO12206P	DCC	Practical Lab Course II	6		8	4			100	50	100	50
	<b>TOTAL (SEMESTER I)</b>					<b>24</b>	<b>32</b>		<b>24</b>	<b>120</b>	<b>48</b>	<b>480</b>	<b>212</b>	<b>600</b>
<b>Semester II</b>	Paper- 2.1	ZOO12211T	DCC	IMMUNOLOGY AND BIOTECHNOLOGY	3	4			30	12	70	28	100	40
	Paper- 2.2	ZOO12212T	DCC	ANIMAL TAXANOMY	3	4			30	12	70	28	100	40
	Paper- 2.3	ZOO12214T	DCC	GENETICS	3	4			30	12	70	28	100	40
	Paper- 2.4	ZOO12215T	DCC	ANIMAL PHYSIOLOGY	3	4			30	12	70	28	100	40
	Paper- 2.5- I	ZOO12213P	DCC	(Lab Course I)	6		8				100	50	100	50
	Paper- 2.5- II	ZOO12216P	DCC	(Lab Course II)	6		8				100	50	100	50
	<b>TOTAL (SEMESTER II)</b>					<b>24</b>	<b>32</b>		<b>24</b>	<b>120</b>	<b>48</b>	<b>480</b>	<b>212</b>	<b>600</b>

**M Sc ZOOLOGY (2024-25)**  
**(Course Code: ZOO12200)**  
**SCHEME OF EXAMINATION**  
**(Semester Assessment)**

Duration of Examination: 3 hours

Semester Assessment

Max. Marks – 70

*Note: The question paper will contain two sections as under –*

There will be two sections A and B in the paper.

**Section-A:** There will be one question with 10 parts having two parts from each unit with no internal choice. The weight-age of each part is 2 marks; hence the total weight-age of this section is 20 marks (10 x 2= 20 marks).

**Section-B:** There will be 5 questions with one question from each unit with internal choice (may have sub-division), the weight of each question is of 10 marks, hence the total weight-age of the section is 50 marks (10 x 5= 50 marks).

**UNIT WISE DETAILED SYLLABUS**

**M. Sc. Zoology Semester I**  
**Course Code: ZOO12200**

**ZOO12201T: Paper- Z-1.1 INVERTEBRATE: STRUCTURE AND FUNCTIONS**

**UNIT I**

1. **Introduction:** The concept of “Invertebrate” and “Vertebrate” animal groups, a study of the general body plan of invertebrates. Elementary idea of the animal diversity in marine, estuarine and fresh water environments.
2. **Locomotory mechanisms:** a) Amoeboid movements, ultra-structure of cilia and flagella: ciliary and flagellar movements; molecular and physiological mechanisms involved in the three kinds of movements. b) Myonemes and muscle fibers in invertebrate structure and their role in locomotion. c) Locomotion in relation to hydrostatics, coelom, metamerism, arthropodization. d) An outline of flight mechanism in insects.
3. **Feeding mechanisms:** a) Amoeboid feeding. b) Ciliary feeding. c) Filter feeding. d) Parasitic mode of feeding. e) Feeding mechanisms in insect and echinoderms.

## UNIT - II

1. **Respiration:** a) Respiration in lower invertebrates (Protozoans to helminthes). b) Gills and Lophophores. c) Gills and lungs in Mollusca. d) Gills, trachea and lung like structures in Arthropods. c) Physiology of respiratory pigments in invertebrates.
2. **Excretion:** a study of structural and functional organization of excretory systems in various invertebrate groups and a survey of various excretory products met with in them.
3. **Osmoregulation and ionic regulation:** a survey of principal mechanisms in fresh water, marine and terrestrial forms.

## UNIT – III

1. **Structural and functional organization of nervous systems and receptors:** a) Plan of nervous systems in the Coelenterates, Platyhelminthes, Annelids, Arthropods, Molluscs and Echinoderms: structural and functional complexities of brain and ganglionic structures. b) Receptors: Structural and functional organization of the mechanoreceptors. chemoreceptors and photoreceptors.
2. **Endocrine system:** Endocrine organs: Structure, functions and their hormones. Role of neurosecretions and hormones in developmental events of insects and crustaceans.
3. **Reproduction:** a) Reproduction in Protozoa b) Reproduction in Porifera c) Reproduction in Metazoa: Sexual reproduction; Parthenogenesis. d) Reproduction in Metazoa: Asexual reproduction in Coelenterata and Polychaeta. e) Larval forms of invertebrates and their significance.

## UNIT - IV

1. Criteria for phylogenetic interrelationships between Invertebrate phyla.
2. Origin of Parazoa, Mesozoa and Metazoa. Origin of Radiata (Coelenterata and Ctenophora). Origin of Bilateria from Radiata (Importance of Planula larva and Ctenophores).
3. Phylogenetic significance of Rhynchocoela. Interrelationship of important Pseudocelomate groups, Rotifera. Gastrotricha, Kinorhynca, Nematomorpha and Entoprocta.

## UNIT - V

1. **Affinities and evolutionary significance** of the unsegmented lesser protostome phyla (Priapulida, Echiuroidea and Sipunculida).

2. **Phylogenetic relationships** between the coelomate protostome phyla (Annelida, Onychophora, Arthropoda & Mollusca). Affinities and evolutionary significance of the Lophophorate coelomate phyla (Brachiopoda, Phoronida & Ectoprocta).
3. **Affinities** of the invertebrate deuterostome phyla (Chaetognatha, Echinodermata, Pogonophora & Hemichordata).

## ZOO12202T: Paper-Z-1.2 BIOCHEMISTRY

### UNIT I

1. **Introduction:** Basic chemical concepts: a study of the chemical bonds and functional groups.
2. **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. Enzymes and prosthetic groups.
3. **Energy considerations:** Biological oxidation & reduction. Fundamental reactions of biological oxidation; redox potential and electron transport system.

### UNIT II

1. **Carbohydrate** – Classification, structure, general properties and functions of polysaccharides and complex carbohydrates; amino sugars, proteoglycans and glycoproteins.
2. **Lipids** – Classification, structure, properties and functions of fatty acids, essential fatty acids, fats, phospholipids, sphingolipids, cerebrocides, steroids, bile acids, prostaglandins, lipoproteins and lipopolysaccharides.
3. **Nucleic acids** – Classification, structure, properties and functions of nucleic acids. Primary, secondary and tertiary structure of nucleic acids, DNA forms and conformations, Denaturation of DNA.

### UNIT III

1. **Proteins** – Peptide synthesis: chemical and Merrifield synthesis. Primary (peptide conformation, N- and C- terminal, peptide cleavage), Secondary ( $\alpha$ -helix, sheet, random coil, Ramachandran plot), Tertiary and Quaternary structures of proteins.
2. **Vitamins** – Classification, structure, properties and functions of vitamins.
3. **Hormones** – Classification, structure, properties and functions of Hormones.



#### UNIT IV

1. **Metabolic pathways** of protein (General reactions of amino acid metabolism - Transamination, decarboxylation, oxidative & non-oxidative deamination of amino acids.)
2. **Metabolic pathways** of carbohydrates (Glycolysis, various forms of fermentations in micro-organisms, citric acid cycle, its function in energy generation and biosynthesis of energy rich bond, pentose phosphate pathway and its regulation. Gluconeogenesis, glycogenesis and glycogenolysis, glyoxylate and Gamma aminobutyrate shunt pathways, Cori cycle, Entner-Doudoroff pathway, glucuronate pathway. Metabolism of disaccharides.)
3. **Metabolic pathways** of lipids (hydrolysis of tri-acylglycerols,  $\alpha$ -,  $\beta$ -,  $\omega$ - oxidation of fatty acids. Oxidation of odd numbered fatty acids – fate of propionate, role of carnitine, degradation of complex lipids. Fatty acid biosynthesis & Lipid biosynthesis) and nucleic acids (Biosynthesis and degradation of purine and pyrimidine nucleotides and its regulation).

#### UNIT V

1. **Bioanalytical Techniques:** Spectroscopy – Concepts of spectroscopy, Visible and UV spectroscopy, Laws of photometry. Beer-Lambert's law, Principles and applications of colorimetry.
2. **Bioanalytical Techniques:** Chromatography – Principles of partition chromatography, paper, thin layer, ion exchange and affinity chromatography, gel permeation chromatography, HPLC and FPLC.
3. **Bioanalytical Techniques:** Electrophoretic techniques – Principles of electrophoretic separation: Continuous, zonal and capillary electrophoresis, different types of electrophoresis including paper, cellulose and gel. Electroporation, SDS-PAGE gel electrophoresis.

#### ZOO12204T: Paper-Z-1.3 CELL BIOLOGY

#### UNIT I

1. **Microscopy:** A general idea of properties of light, lenses and magnification power. An elementary knowledge about principles and functioning of microscopes: - light (dissecting and compound), interference, polarizing, fluorescence, phase contrast, UV and electron (SEM and TEM).

2. **Cytological techniques:** Centrifugation and ultracentrifugation, intravital and supravital staining, preparation of cell cultures, isolation and fractionation of cell.
3. **The evolution of the Cell:** - From molecules of the First Cell; From Prokaryotes to Eukaryotes; From Single Cell to multi-cellular Organisms.

## UNIT II

1. **Plasma membrane** and intracellular compartments: Structure and functions of membrane, Endocytosis and exocytosis; principles of membrane transport, carrier proteins, ion channels.
2. **Structure and functions** of endoplasmic reticulum. Signal recognition particles, ER signal peptides; signal transduction.
3. **Vesicular traffic organelles:** Structure and functions of Golgi complex and lysosomes, transport from Golgi bodies to lysosomes.

## UNIT III

1. **Structure and functions** of microbodies, glyoxysomes, peroxysomes, and spherosomes. Structure and functions of ribosomes.
2. **Energy transducer organelles:** Structure, functions and evolution of mitochondria and plastids; their role as energy transducers.
3. **Structure** of cilia, flagella, vacuoles and cytoskeleton – Microtubules, Actins filaments.

## UNIT IV

1. **Nucleus:** Structure of interphase nucleus, pore complex, nucleoplasm and nucleolus.
2. **Chromosomes:** Chromatin organization in dividing and non-dividing cells, structure of chromosomes, solenoid model, importance of C-value paradox, centromere and telomere,
3. **Karyotype banding techniques**, FISH, GISH, Mc FISH, cytometry; giant and mini chromosomes.

## UNIT V

1. **Cell cycle** and mitosis: Stages of cell cycle (G1, S, G2 and M stage), centriole cycle,
2. **Mechanism** of mitosis, anaphasic movements. Mechanism of meiosis, nondisjunction.
3. **Regulation** of cell division and abnormalities: Genetic regulation of cell cycle, check points, cyclins, MPF, chalones, mitotic poisons; molecular origin of cancer; apoptosis.

## **ZOO12205T: Paper-Z-1.4 EVOLUTION AND BIOSTATISTICS**

### **UNIT – I**

1. Concepts of evolution and theories of organic evolution, Geological time – scale.
2. Lamarckism and Darwinism, New concepts regarding Lamarckism & Darwinism.
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. Patterns and mechanisms of reproductive isolation, Models of speciation (Allopatric, Sympatric, Parapatric).

### **UNIT – II**

1. Molecular population genetics, Patterns of change in nucleotide and amino acid sequences, Ecological significance of molecular variations, Emergence of Non-Darwinism Hypothesis.
2. Genetics of quantitative traits in populations, Genotype-environment interactions, Inbreeding depression and heterosis, Molecular analysis of quantitative traits, phenotypic plasticity
3. Genetics of speciation. Phylogenetic and biological concept of species.

### **UNIT – III**

1. Molecular Evolution: Gene Evolution, Evolution of gene families, Molecular drive, Assessment of molecular variation. Origin of higher categories: Micro-and Macro-evolution
2. Characteristic of evolution Extinction, replacement, irreversibility of specialization etc.
3. Adaptation diversity & nature of adaptation: adaptive radiations, occupation of new environments & niches, mimicry and coloration.
4. Role of Remote Sensing for sustainable development.

### **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). Sampling variation of proportions, Significance of difference in proportions.

### **UNIT - V**

1. Student t-test, Chi-square test. Rates and ratios
2. Correlation and Regression. Analysis of Variance (ANOVA)
3. Probability distributions: Binomial, Poissons and normal.

## **M.Sc. ZOOLOGY PRACTICAL Semester I**

**ZOO12203P: Paper-Z-1.5-I Practical Lab Course I: Practical Work Based on Paper Z-1.1 & Z-1.2 (Total No. of laboratory hrs. 240)**

- I. **Invertebrates:** 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.
- 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. Permanent preparations through various parts of Animals mentioned in III (i-iv) anatomy section and study of the structure. 4. Permanent preparations of different materials provided for study using microtome.
- V. **Biochemistry:** 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 / semi-autoanalyzer 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. Visit to NP/Museum/Institute/Medical College.

*\*Note: Use of animal for dissection and practical work is subject to the conditions that they are not banned under the wildlife protections act.*

## **M.Sc. ZOOLOGY PRACTICAL Semester I**

### **Scheme of Practical Examination and Distribution of Mark**

<b>Max. Marks: 100</b>	<b>Duration - 6 hrs.</b>
(a) Microscopic study and identification of permanent slides 5x3	15 marks
(c) Identification & comments on spots (5x3)	15 Marks
(d) Invertebrate major dissection / demonstration	08 Marks
(e) Invertebrate minor dissection / demonstration	06 Marks
(f) Permanent preparation	08 Marks
(g) Exercise in Biochemistry	08 Marks
(h) Seminar	10 Marks
(i) Viva-voce	10 Marks
(j) Class record	10 Marks
(k) Report on field trip	10 Marks
<b>Total</b>	<b>100 Marks</b>

**ZOO12206P: Paper-Z-1.5-II Practical Lab Course II: Practical Work Based on Paper Z-1.3 & Z-1.4 (Total No. of laboratory hrs. 240)**

- I. **Cell biology:** 1. Squash & smear preparations of testis of cockroach / grasshopper: Acetocarmine & Feulgen staining of these preparations. 2. Study of mitosis in onion root tip/ mammalian bone marrow cells. 3. Study of giant chromosomes in the salivary gland of Chironomus larva or Drosophila larva. 4. Vital and supra-vital staining (with neutral red and Janus Green B) of cells of the testis of an insect or mammal to study the mitochondria. 5. Chromosomal study of the testis of an insect or mammal or cells of the bone marrow of a mammal. 6. Study of permanent slides of various stages of Mitosis, Meiosis and Giant Chromosomes. 7. Preparation of Vital stains and Dye.
- II. **Biostatistics:** 1. Preparation of frequency tables, histogram, bar diagram and line graphs (Computer based exercise). 2. Calculation of standard deviation, variance and standard error of the mean. 3. Correlation and rank of correlation. 4. Probability & Test of

significance. 5. Calculation of significance using Chi-square test. 6. Plotting the slope of a line on a graph: calculations of the slope of a line, coefficient and regression.

III. Field Trip: 1. Study of animals in their natural habitats.

*\*Note: Use of animal for dissection and practical work is subject to the conditions that they are not banned under the wildlife protections act.*

### **M.Sc. ZOOLOGY PRACTICAL I Semester**

#### **Scheme of Practical Examination and Distribution of Mark**

<b>Max. Marks:100</b>	<b>Duration - 6 hrs.</b>
(a) Preparation and study of testis of Cockroach/Grasshopper	10 Marks
(b) Study & identification of Mitosis	10 Marks
(c) Biostatistics Problem based on Frequency tables & Graphs	10 Marks
(d) Exercise on statistical methods	10 Marks
(e) Permanent preparation	05 Marks
(f) Seminar	10 Marks
(g) Viva-voce	10 Marks
(h) Class record	10 Marks
(i) Report on field trip	25 Marks
<b>Total</b>	<b>100 Marks</b>

### **M. Sc. ZOOLOGY Semester II** **I Year: Semester II** **Course Code: ZOO12200**

**ZOO12211T: Paper Z-2.1 IMMUNOLOGY AND BIOTECHNOLOGY**

**ZOO12212T: Paper Z-2.2 ANIMAL TAXONOMY**

**ZOO12214T: Paper Z-2.3 GENETICS**

**ZOO12215T: Paper Z-2.4 ANIMAL PHYSIOLOGY**

#### **ZOO12211T: Paper-Z-2.1 IMMUNOLOGY AND BIOTECHNOLOGY** **UNIT - I**

1. Innate and Acquired Immunity; phylogeny and ontogeny of Immune system.
2. Organization and structure of lymphoid organs, cells of the immune system and their differentiation.

3. Nature of Immune responses, Nature of antigens and superantigens, factors influencing Immunogenicity, epitopes and haptens.

#### **UNIT - II**

1. 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.
2. Organization and expression of Ig genes. T-cell and B-cell generation, activation and differentiation. Cytokines, cell mediated effector functions.
3. Immunological tolerance and Anti-immunity; Hyper sensitivity and immune responses to infection agents especially intracellular parasites.

#### **UNIT – III**

1. Basics: Definition, Biotechnology – an Interdisciplinary science. It's brief history, scope, significance, and limitations.
2. Genetic engineering, culture media, culture methods, restriction enzymes, cloning vectors, cell fusion, somatic hybridisation.
3. Recombinant DNA technology: Isolation of genetic materials gel-electrophoresis, amplification by PCR, insertion of r-DNA in host. Bioreactors and downstream processing.

#### **UNIT IV**

1. Animal tissue culture: Introduction, Primary culture, cell lines and cloning. Tissue and Organ Culture, IVF, embryo- transfers.
2. Brief discussion on the chemical, Physical and metabolic functions of different constituents of culture medium. Basic techniques of mammalian cell cultures in – vitro. Microcarrier culture, cell Synchronization and cell culture.
3. Application of animal cell culture. Hybridoma technology and monoclonal antibodies.

#### **UNIT – V**

1. Biotechnology in Industry: Food, dairy, beverages, etc.
2. Biotechnology in agriculture: BT cotton, pest resistant and virus resistant plants.
3. Biotechnology in medicine: Humulin production, gene therapy, molecular diagnosis (DNA fingerprinting, ELISA), transgenic animals.

## **ZOO12212T: Paper-Z-2.2 ANIMAL TAXONOMY**

### **UNIT - I**

1. Introduction to the science of taxonomy; stages in Taxonomy, importance of taxonomy.
2. Rules of nomenclature. Linnaean hierarchy.
3. Principles of classification: theories of biological classification & their history.

### **UNIT - II**

1. Concept of species; typological, biological, evolutionary and recognition species concepts. Concepts of superspecies and subspecies.
2. The species category; the polytypic species; population systematic intraspecific categories.
3. Methods of classification: taxonomic collection & the processes of identification.

### **UNIT - III**

1. Taxonomic characters; types and use of taxonomic characters; concept of key characters, types of variations (qualitative and quantitative) within a single population,
2. Methods of arriving on taxonomic decisions at species level; preparation and use of taxonomic keys.
3. Newer trends in taxonomy: Cytotaxonomy - importance of cytology and genetics in taxonomy. Sonotaxonomy - importance of sound, call and sonogram in taxonomy. Molecular taxonomy – importance of macromolecular composition in taxonomy.

### **UNIT – IV**

1. Classification of Invertebrates upto order with salient characteristics and examples of each group.

### **UNIT – V**

2. Classification of Vertebrates upto order with salient characteristics and examples of each group.

## **ZOO12214T: Paper-Z-2.3 GENETICS**

### **UNIT-I**

1. Basics: Definitions of heredity, variation, gene, allele, autosomes, allosomes, haploid, diploid.
2. Homologous chromosomes, locus, homozygous, heterozygous, hemizygous, dominant, recessive, phenotype, genotype, filial generations.



3. Types of cross: monohybrid, dihybrid, test cross, back cross, reciprocal cross, probable gamete formation for cross, use of symbols.

#### **UNIT-II**

1. Laws of heredity and their variations: Works of Mendel and Morgan.
2. Incomplete dominance, multiple allele, pleiotropy, genetic interactions.
3. Linkage and crossing over: Mechanism of crossing over, linkage groups, linkage maps; accessory genetic elements (plasmids, transposons and retroelements).

#### **UNIT-III**

1. Genetics of sex: Sex linkage, sex influenced and sex-limited traits, sex determination, effects of environment on sex determination.
2. Human genetics: Abnormalities in chromosome structure and number,
3. Inborn errors of metabolism, eugenics, euphenics and euthenics, genetic counselling.

#### **UNIT-IV**

1. Molecular basis of inheritance. DNA: Structure and types of DNA; DNA as a genetic material, gene structure,
2. Replication of DNA, enzymes and accessory proteins involved in DNA replication, DNA damage and repair, gene mutation and its molecular mechanism.
3. 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.

#### **UNIT-V**

1. Translation: Mechanism of prokaryotic and eukaryotic translation, protein folding; role of chaperons.
2. Gene regulation: Gene regulation in Prokaryota, positive and negative regulation- Lac operon, tryptophan operon; gene regulatory proteins (motifs); gene regulation in Eukaryota.
3. 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.

**ZOO12215T: Paper-Z-2.4 ANIMAL PHYSIOLOGY**  
**UNIT I**

1. Digestion and Absorption of food in gastrointestinal tract.
2. Regulation of gastrointestinal processes.
3. Obesity and Starvation.
4. Common disorders of digestive tract.

**UNIT II**

1. Physiology and regulation of respiration.
2. Homeostasis, prevention of blood loss.
3. Cardiac cycle.
4. Blood pressure and common cardiovascular diseases.

**UNIT III**

1. Structure and mechanism of Kidney function.
2. Ionic and Osmotic balance.
3. Osmoregulation in aquatic and terrestrial environments.
4. Homeostasis.

**UNIT IV**

1. Structure and function of muscle fibers in vertebrates.
2. Molecular theory of contraction.
3. Muscle fatigue
4. Skeletal muscle disorder- Tetany, Cramps, Muscular dystrophy.

**UNIT V**

1. Electrochemical potential and membrane excitation.
2. Impulse conduction via myelinated, non-myelinated fibres and synaptic junctions.
3. Neurotransmitters and Neuromodulators.
4. Sense organs: eye and ear.

**M.Sc. ZOOLOGY II Semester**

**ZOO12213P: Z -2.5- I Practical Lab Course I: Practical Work Based on Paper Z-2.1 to Z-2.2 (Total No. of laboratory hrs. 240)**

**I. Biotechnology/Immunology**

1. To determine the ABO blood groups by slide agglutination.
2. To conduct/demonstrate ELIZA Test
3. Demonstration of Immunological tests WIDAL, VDRL, Pregnancy.

4. To conduct Radio Immuno-diffusion.

## II. Invertebrate Taxonomy

1. Identification of Invertebrates using taxonomic keys.
2. Field Trip: Study of animals in their natural habitats.

**\*Note: Use of animal for dissection and practical work is subject to the conditions that they are not banned under the wildlife protections act.**

## M.Sc. ZOOLOGY PRACTICAL Semester II

### Scheme of Practical Examination & Distribution of Mark

Duration - 6 hrs.	Max. Marks 100
(a) Exercise based on Biotechnology	10 Marks
(b) Exercise based on Immunology	10 Marks
(c) Exercise in Invertebrate Taxonomy (5x5) (Using Taxonomic Key)	25 Marks
(d) Seminar based on any topic from Theory	10 Marks
(e) Report on Field Visit	25 Marks
(f) Vivo-Voce	10 Marks
(g) Record	10 Marks
<b>Total -</b>	<b>100 Marks</b>

**ZOO12216P: Z -2.5 II Practical Lab Course II: Practical Work Based on Paper Z-2.3 to Z-2.4 (Total No. of laboratory hrs. 240)**

### I. Genetics:

1. Culture and identification of male and female *Drosophila* through prepared culture.
2. Identification of wild and mutant forms of *Drosophila*.
3. Problems based on Mendel's and gene interaction.
4. Identification of blood groups in man.
5. Demonstration of sex chromatin (Barr Bodies).

### II. Animal physiology

1. Determination of osmotic potential by tissue weight method.
2. Study of ECG, Heart beat and Blood pressure.
3. Determination of hemoglobin in blood sample by haemoglobinometer/ Photometric (preferably).

4. Demonstration of the following in blood; Clotting time (CT), Bleeding time (BT), erythrocyte sedimentation rate (ESR), haemolysis and crenation, differential count of leucocytes.
5. Determination of blood urea and blood sugar value.
6. Determination of peroxide activity.
7. To carryout differential leukocyte count in human blood sample.
8. Blood film preparation and identification of cells.
9. To conduct serum preparation.
10. Separation of amino acids by Paper chromatography / Thin Layer Chromatography and calculating Rf value.
11. Visit to Pathology Lab/Medical Institute

## **M.Sc. ZOOLOGY PRACTICAL Semester II**

### **Scheme of Practical Examination & Distribution of Mark**

<b>Duration - 6 hrs.</b>	<b>Max. Marks 100</b>
(a) Exercise on Culture and identification of Drosophila variants	10 Marks
(b) Exercise in Genetics	10 Marks
(c) Exercise on Blood related	15 Marks
(d) Exercise in physiology	10 Marks
(e) Seminar	10 Marks
(f) Field work/Assessment	25 Marks
(g) Viva-voce	10 Marks
(h) Class record	10 Marks
<b>Total</b>	<b>100 Marks</b>

***\*Note: Use of animal for dissection and practical work is subject to the conditions that they are not banned under the wildlife protections act.***