



Hindi Vidya Prachar Samiti's  
**Ramniranjan Jhunjhunwala College**  
**of Arts, Science and Commerce**  
**(Autonomous College)**

**Affiliated to**  
**UNIVERSITY OF MUMBAI**

**Syllabus for T.Y.B.Sc.**  
**Program: B.Sc. Zoology**  
**Program Code: RJSUZOO**  
**(CBCS 2021-22)**

## DISTRIBUTION OF TOPICS AND CREDITS

## T.Y.B.Sc. ZOOLOGY SEMESTER V

Course code	Nomenclature	Credits	Topic
RJSUZOO501	Animal type Study, Comparative anatomy, Developmental biology & Endocrinology	2.5	1. Type study-Sepia
			2. Comparative anatomy of vertebrates-I Skin, Digestive system and circulatory system
			3. Developmental biology of frog
			4. Endocrine glands and their regulation
RJSUZOO502	Haematology, Immunology & Physiology	2.5	5. Basic Haematology
			6. Basic Immunology
			7. Applied Haematology & Immunology
			8. Homeostasis- Feedback mechanism, thermoregulation & ionic regulation
RJSUZOO503	Molecular biology, Genetic engineering, Toxicology and Biostatistics	2.5	9. Molecular biology
			10. Genetic engineering
			11. Toxicology
			12. Biostatistics
RJSUZOO504	Osteology, Ethology, Epidemiology, National parks and sanctuaries	2.5	13. Human osteology
			14. Ethology
			15. Epidemiology-I
			16. National parks and sanctuaries
RJSUZOOP501, RJSUZOOP502 & RJSUZOOP503 RJSUZOOP504	Practical I , II, III & IV	06	Practicals based on Paper I, II, III & IV

**T.Y.B.Sc. ZOOLOGY SEMESTER VI**

Course code	Nomenclature	Credits	Topic
RJSUZOO601	Animal type Study, Comparative anatomy, Developmental biology & Histology	2.5	1. Type study-Shark
			2. Comparative anatomy of vertebrates II- respiratory system, urinogenital system and nervous system
			3. Developmental biology of chick
			4. Mammalian Histology
RJSUZOO602	Enzymology, Physiology and Pathology	2.5	5. Enzymology
			6. Chemical messengers and Cardiac physiology
			7. Aspects of human reproduction
			8. General pathology
RJSUZOO603	Cancer biology, Biotechnology, Genetics, and Bioinformatics	2.5	9. Cancer biology
			10. Animal tissue culture
			11. Human genetics
			12. Bioinformatics
RJSUZOO604	Environmental Biology, Zoopharmacognosy, Epidemiology & Wildlife management	2.5	13. Zoogeography
			14. Bioprospecting and Zoopharmacognosy
			15. Epidemiology-II
			16. Wildlife management
RJSUZOOP601, RJSUZOOP602 RJSUZOOP603 RJSUZOOP604	Practical I,II, III &IV	06	Practicals based on Paper I, II, III & IV

SEMESTER-V (THEORY)		L	Cr
<b>Paper- I Animal type Study, Comparative anatomy, Developmental biology &amp; Endocrinology</b>		<b>60</b>	<b>2.5</b>
<b>Paper Code: RJSUZOO501</b>			
<b>UNIT I</b>		<b>15</b>	
<b>Type study: <i>Sepia aculeata</i></b>			
1	<b>1.1: General characters</b> 1.1.1 External characters. 1.1.2 Locomotion. 1.1.3 Economic importance. <b>1.2: Organ systems:</b> 1.2.1 Digestive system. 1.2.2 Respiratory system. 1.2.3 Circulatory system. 1.2.4 Excretory system. 1.2.5 Nervous system and Sense organs. 1.2.6 Reproductive system.		
<b>UNIT II</b>		<b>15</b>	
<b>Comparative Anatomy of Vertebrates I</b>			
2	<b>2.1: Skin:</b> Functions, anatomy of vertebrate skin, epidermal and dermal derivatives, scales, claws, nails, hoofs, horns, antlers, beaks, feathers, hair and glands. <b>2.2: Digestive system:</b> Digestive tube and its evolution. Tooth structure & position, teeth in lower vertebrates, mammalian dentition. <b>2.3: Circulatory System:</b> Aortic arches and venous system in vertebrates.		
<b>UNIT III</b>		<b>15</b>	
<b>Developmental biology of frog</b>			
3	<b>3.1</b> Egg, spawn, cleavage, blastula, gastrula, neurula, morphogenesis and metamorphosis in Frog.		
<b>UNIT IV</b>		<b>15</b>	
4	<b>Endocrine glands and their regulation</b>		
	<b>4.1: Mammalian Endocrinology</b> Mammalian Endocrinology: Hormones, functions of hormones and hormonal disorders of the following endocrine glands: pituitary, adrenal, thyroid, parathyroid & pancreas.		

SEMESTER-V (THEORY)		L	Cr
<b>Paper- II Haematology, Immunology &amp; Physiology</b>		<b>60</b>	<b>2.5</b>
<b>Paper Code: RJSUZOO502</b>			
<b>UNIT I</b>		<b>15</b>	
<b>Basic Haematology</b>			
1	<p><b>1.1: Composition of plasma:</b> Water, respiratory gases, plasma proteins and other inorganic constituents.</p> <p><b>1.2: Haematopoiesis:</b> Erythropoiesis, leucopoiesis and thrombopoiesis.</p> <p><b>1.3: Erythrocytes:</b> Structure and functions, abnormalities in structure, total count, variation in number; ESR; types of anaemia.</p> <p><b>1.4: Haemoglobin:</b> Structure, formation and degradation; variants of haemoglobin (foetal, adult).</p> <p><b>1.5: Leucocytes:</b> Types and functions, total count and variation in number; leukaemia and its types.</p> <p><b>1.6: Thrombocytes:</b> Structure, factors and mechanism of clotting, failure of clotting mechanism.</p> <p><b>1.7: Blood volume:</b> Total quantity and regulation; haemorrhage.</p>		
<b>UNIT II</b>		<b>15</b>	
<b>Basic Immunology</b>			
2	<p><b>2.1: Overview of Immunology</b></p> <p>2.1.1: Concept of immunity.</p> <p>2.1.2: Innate immunity - Definition, factors affecting innate immunity, Mechanisms of innate immunity - First line of defence - physical and chemical barriers. Second line of defence - phagocytosis, inflammatory responses and fever.</p> <p>2.1.3: Adaptive or Acquired immunity, Antibody mediated, and cell mediated immunity; Active Acquired immunity - Natural and Artificial; Passive Acquired immunity - Natural and Artificial</p> <p><b>2.2: Cells and Organs of immune system</b></p> <p>2.2.1: Cells of immune system - B cells, T cells and null cells, macrophages, dendritic cells and mast cells</p> <p>2.2.2: Organs of immune system :Primary: Thymus and bone marrow Secondary: Lymph nodes and spleen</p> <p><b>2.3: Antigens:</b> Definition and properties; haptens</p> <p><b>2.4: Antibodies:</b> Definition, basic structure, classes of antibodies - IgG, IgA, IgM, IgD and IgE</p> <p><b>2.5: Antigen processing and presentation</b></p> <p>2.5.1: Endogenous antigens - cytosolic pathways.</p> <p>2.5.2: Exogenous antigens - endocytic pathways.</p>		

	<b>UNIT III</b>	<b>15</b>	
	<b>Applied Haematology &amp; Immunology</b>		
3	<b>3.1: Applied Haematology:</b> Introduction and scope. <b>3.2: Clinical significance of Diagnostic Techniques</b> 3.2.1 Haemoglobinopathies (sickle cell anaemia, thalassemia) 3.2.2 Coagulopathies: Haemophilia and purpura <b>3.3: Biochemical examination of blood:</b> 3.3.1 Liver function tests: Total and direct bilirubin 3.3.2. Kidney function test: Serum creatinine. 3.3.3. Carbohydrate metabolism tests: Blood sugar. <b>3.4.: Antigen-Antibody interactions and vaccines.</b> 3.4.1 : General features of antigen-antibody interaction 3.4.2 : Precipitation reaction - Definition, characteristics and mechanism. Precipitation in gels (slide test) - Radial immunodiffusion (Mancini method) Double immunodiffusion (Ouchterlony method) 3.4.3: Agglutination reaction definition, characteristics, and mechanism. Coomb's test 3.4.4: Immunoassay - ELISA		
	<b>UNIT IV</b>	<b>15</b>	
4	<b>Homeostasis- Feedback mechanism, thermoregulation and ionic regulation</b>		
	<b>4.1 Homeostasis:</b> External and internal environment; Control systems in Biology: Feedback mechanism; control of blood glucose level as an example. <b>4.2 Thermoregulation:</b> temperature balance; Heat production; Shivering and non-shivering thermogenesis, brown fat- special thermogenic tissues in mammals and heat loss; Acclimation and acclimatization; Adaptive response to temperature: Daily torpor, Hibernation, Aestivation. <b>4.3 Osmotic and Ionic regulation:</b> Maintaining water and electrolyte balance: ionic regulation in iso-osmotic, hypo-osmotic and hyper-osmotic environment, Problems of living in terrestrial environment: water absorption, salt water ingestion and salt excretion, metabolic water and behavioural adaptations.		

SEMESTER-V (THEORY)		L	Cr
<b>Paper- III Molecular biology, Genetic engineering, Toxicology and Biostatistics</b>		<b>60</b>	<b>2.5</b>
<b>Paper Code: RJSUZOO503</b>			
<b>UNIT I</b>		<b>15</b>	
<b>Molecular biology</b>			
1	<b>UNIT I: Molecular biology</b> <b>1.1 Types of mutation</b> 1.1.1: Point mutations - substitution, deletion and insertion mutations Types of Substitution mutations - silent, missense and nonsense mutations, transition and transversion. Deletion and Insertion mutations - frameshift mutations. 1.1.2: Trinucleotide repeat expansions - fragile X syndrome, Huntington disease 1.1.3: Spontaneous mutation - tautomeric shifts, spontaneous lesions <b>1.2 Induced mutation Types of mutation</b> 1.2.1 Physical agents: Ionizing radiation (X-rays, $\alpha$ , $\beta$ and $\gamma$ rays) Non-ionizing radiation (UV light) 1.2.2 Chemical agents: Base analogs (5-bromouracil); Intercalating agents (ethidium bromide); Deaminating agents (nitrous acid); Hydroxylating agents (hydroxylamine); Alkylating agents (mustard gas). 1.2.3 Biological mutagenic agents: transposable elements and viruses <b>1.3 Preventive and repair mechanisms for DNA damage</b> 1.3.1: Mechanisms that prevent DNA damage - superoxide dismutase and catalase 1.3.2: Mechanisms that repair damaged DNA - direct DNA repair (alkyl transferases, photoreactivation, excision repair) 1.3.3: Post replication repair - recombination repair, mismatch repair, SOS repair.		
<b>UNIT II</b>		<b>15</b>	
<b>Genetic engineering</b>			
2	<b>2.1: Tools in Genetic Engineering</b> 2.1.1: Enzymes involved in Genetic Engineering: Introduction, nomenclature and types of restriction enzymes with examples, Ligases - <i>E. coli</i> DNA ligase, T4 DNA ligase, polynucleotide kinase, phosphatases, DNA polymerases, reverse transcriptase, terminal transferase. 2.1.2: Vectors for gene cloning: General properties, advantages and disadvantages of cloning vectors - plasmid vectors (pBR322), phage vectors ( $\lambda$ Phage), cosmid vectors (c2XB). 2.1.3: Cloning techniques: Cloning after restriction digestion - blunt and cohesive end ligation, creation of restriction sites using linkers and adapters, cDNA synthesis (Reverse transcription), genomic and cDNA libraries. <b>2.2: Techniques in Genetic Engineering</b> 2.2.1: PCR techniques: Principle of polymerase chain reaction (PCR), Applications of PCR. 2.2.2: Detection techniques: Blotting techniques and their applications.		

## T.Y.B.Sc Zoology Syllabus Semester V &amp; VI

	<b>UNIT III</b>	<b>15</b>	
	<b>Toxicology</b>		
3	<p><b>3.1 Introduction to toxicology:</b> definition and scope.</p> <p><b>3.2 Natural toxins:</b> mycotoxins, microbial toxins, plant toxins (caffeine &amp; nicotine), animal toxins (honey bee sting, venoms of coelenterates, scorpion, snake).</p> <p><b>3.3 Dose response relationship:</b> Measurement of dose response relationship, dose response curves, LC50 and LD50, acute and chronic toxicity; margin and safety &amp; therapeutic index; threshold dose and no observed effect level (NOEL).</p> <p><b>3.4 Mechanism of absorption through membranes,</b> rates of penetration, routes of absorption in mammals, dermal, gastrointestinal and respiratory.</p> <p><b>3.5 Metabolism of toxicants:</b> Phase I reactions, Phase II reactions, metabolism of Paracetamol.</p> <p><b>3.6 Target organ toxicity</b> – hepatotoxicity; examples of hepatotoxicants, nephrotoxicity, examples of nephrotoxicants, neurotoxicity, examples of neurotoxicants.</p> <p><b>3.7 Regulatory Toxicology:</b> CPCSEA guidelines for animal testing centre, ethical issues in animal studies, Alternative methods in toxicology (<i>in vitro</i> tests).</p>		
	<b>UNIT IV</b>	<b>15</b>	
	<b>Biostatistics</b>		
4	<p><b>4.1: Measures of Variation:</b> Variance, standard deviation, standard error.</p> <p><b>4.2: Probability Distributions:</b> Normal, Binomial, p- value, Probability - Addition and multiplication rules and their applications.</p> <p><b>4.3: Testing of Hypothesis:</b> Basic concepts, types of hypothesis: Null hypothesis and Alternate hypothesis, Levels of significance and testing of hypothesis.</p> <p><b>4.4: Parametric and non-parametric test:</b> Parametric tests: two-tailed Z-test and t-test, Non-parametric test: Chi-square test and its applications.</p> <p><b>4.5: Correlation:</b> Correlation coefficient and its significance.</p>		



<b>SEMESTER-V (THEORY)</b>		<b>L</b>	<b>Cr</b>
<b>Paper- IV Osteology, Ethology, Epidemiology, Wildlife conservation</b>		<b>60</b>	<b>2.5</b>
<b>Paper Code: RJSUZOO504</b>			
<b>UNIT I</b>		<b>15</b>	
<b>Human Osteology</b>			
1	<b>1.1: Introduction:</b> Bone structure (Histology) and general functions of bones. Cartilage: General structure, functions <b>1.2: Axial skeleton</b> 1.2.1: Skull: General characteristics of skull bones - Cranial and facial bones 1.2.2: Vertebral column: General characteristics of a vertebra, structure of different types of vertebrae (cervical, thoracic, lumbar, sacrum and coccyx) 1.2.3: Ribs and sternum: General skeleton of ribs and sternum 1.2.4: Hyoid bone: Structure and function. <b>1.3: Appendicular skeleton</b> 1.3.1: Pectoral girdle and bones of forelimbs 1.3.2: Pelvic girdle and bones of hind limbs <b>1.4: Sexual dimorphism of human skeleton.</b>		
<b>UNIT II</b>		<b>15</b>	
<b>Ethology</b>			
2	<b>2.1: Social behaviour:</b> 2.1.1: Territoriality, Schooling in fishes, Herd migration, 2.1.2: Kin selection, Altruism, reciprocal altruism, 2.1.3: Social organization in insects and primates. <b>2.2: Reproductive Behaviour patterns:</b> 2.2.1: Mating systems in animals, 2.2.2: Courtship behaviour- characteristics of courtship, Examples of courtship- Invertebrate (Spider) and Vertebrate (Bower bird), Nest building- Baya weaver bird. 2.2.3: Parental care-Factors affecting parental care, Parental care in fishes and amphibians. <b>2.3: Biological clocks:</b> Circadian, Circalunar and Circannual rhythms.		
<b>UNIT III</b>		<b>15</b>	
<b>Epidemiology-I</b>			
3	<b>3.1: Scope of epidemiology:</b> Perspective of epidemiology; descriptive and analytical epidemiology; epidemiological triad; stages of diseases, screening for diseases. <b>3.2: Epidemiology of communicable diseases:</b> definition of common terms. <b>3.3: Dynamics of disease transmission:</b> Reservoir, route of transmission, incubation.		

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	<b>UNIT IV</b>	<b>15</b>	
	<b>National parks and sanctuaries</b>		
4	<b>4.1: India biodiversity; rare and endangered animals of India:</b> wildlife conservation projects; important national parks, sanctuaries (Sanjay Gandhi, Tadoba, Jim Corbett, Kaziranga, Nagarhole, Kanha, Bhitkarnika, Periyar) and tiger projects in India.		

T.Y.B.Sc	Semester V Theory
RJSUZOO501	<p><b>Course Objectives:</b></p> <ol style="list-style-type: none"> <li>1. To acquaint learners with the details of Sepia as a representative of invertebrates.</li> <li>2. To provide them with general idea of comparative anatomy of vertebrates.</li> <li>3. To introduce concept of endocrine glands and associated disorders to the learners.</li> </ol> <p><b>Learning Outcomes:</b></p> <ol style="list-style-type: none"> <li>1. Learner will get an idea of general characters and system details of Sepia.</li> <li>2. Learner will be familiarized with process of evolution trend which has occurred during vertebrate evolution.</li> <li>3. The learner will understand concept of hormones and its functions.</li> </ol>
T.Y.B.Sc	Semester V Theory
RJSUZOO502	<p><b>Course Objectives:</b></p> <ol style="list-style-type: none"> <li>1. To introduce the different aspects of human blood and its clinical significance.</li> <li>2. To introduce the topic of immunology with emphasis on building strong foundation about the immune system.</li> <li>3. To acquaint learners with knowledge of diagnostic techniques in haematology as well as immunology.</li> <li>4. To comprehend the physiological aspects of homeostasis and endocrinology.</li> </ol> <p><b>Learning Outcomes:</b></p> <ol style="list-style-type: none"> <li>1. Learner will be able to identify various components of blood and their importance.</li> <li>2. Learner will be familiarized with types of immunity and the significant role of immune system.</li> <li>3. Learner will be better equipped for further pathological courses or working in a diagnostic laboratory.</li> <li>4. Learner will be familiarized with adaptations of animals for regulation of heat and ionic balance.</li> </ol>

## T.Y.B.Sc Zoology Syllabus Semester V &amp; VI

T.Y.B.Sc	Semester V Theory
RJSUZOO503	<p><b>Course Objectives:</b></p> <ol style="list-style-type: none"> <li>1. To introduce molecular biology of gene alteration and its effects.</li> <li>2. To understand the tools and techniques used in genetic engineering.</li> <li>3. To introduce the learner basics of toxicology.</li> <li>4. To introduce the learner to the principles of toxicology, mechanisms of toxicants and regulatory affairs in toxicological studies.</li> <li>5. To make learner familiar with biostatistics as tool for analysis and application.</li> </ol> <p><b>Learning Outcomes:</b></p> <ol style="list-style-type: none"> <li>1. Learner will get an insight in the intricacies of chemical and molecular processes that alter the gene.</li> <li>2. Learner will be familiarized with vast arrays of techniques of gene manipulation.</li> <li>3. Learner will be familiarized with concepts of toxicology and will be able to apply it in pharmaceutical industry and allied branches</li> <li>4. Learner will be able to develop critical thinking and apply the knowledge in formulating hypothesis and research problems.</li> </ol>
T.Y.B.Sc	Semester V Theory
RJSUZOO504	<p><b>Course Objectives:</b></p> <ol style="list-style-type: none"> <li>1. To introduce the structure and function of human bones and muscles.</li> <li>2. To acquaint the learner with sociobiological behaviour and interaction of animals within population.</li> <li>3. To study the course, or natural history, of disease, determine the frequency of disease in populations.</li> <li>4. To introduce learner to the various national parks, sanctuaries and ecotourism.</li> </ol> <p><b>Learning Outcomes:</b></p> <ol style="list-style-type: none"> <li>1. Learner will be familiarized with the arrangement of bones in the human body. It will help in understanding nature of anatomical injuries.</li> <li>2. Learner will understand different aspects of social, reproductive and chronobiological behaviour in animals.</li> <li>3. Learners will get an idea of scope and dynamics of epidemiology.</li> <li>4. The learner will understand importance of national parks, sanctuaries and need of ecotourism.</li> </ol>

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		06
	<b>Practical Course Code: RJSUZOO501</b>	
1	<p>1. Study of Sepia with the help of diagram / Photograph / Simulation whichever possible. No animal shall be dissected.</p> <p>a) Digestive system, b) Reproductive system c) Nervous system d) Jaws e) Radula f) Chromatophores g) Spermatophores h) One demonstration of Sepia systems.</p> <p>2. Mounting of fish scales- Placoid, cycloid and ctenoid.</p> <p>3. Frog embryology- Egg spawn, cleavage, blastula, gastrula, tadpole stages.</p> <p>4. Study of slides of pituitary, adrenal, thyroid, parathyroid &amp; pancreas.</p>	
	<b>Practical Course Code: RJSUZOO502</b>	
2	<p>1. Enumeration of Erythrocytes - Total Count.</p> <p>2. Enumeration of Leucocytes - Total Count.</p> <p>3. Differential count of Leucocytes.</p> <p>4. Erythrocyte Sedimentation Rate by suitable method - Westergren or Wintrobe method.</p> <p>5. Estimation of haemoglobin by Sahli's acid haematin method.</p> <p>6. Estimation of total serum/ plasma proteins by Folin's method.</p> <p>7. Separation of plasma proteins by PAGE.</p> <p>8. Estimation of blood glucose by o-toluidine method.</p> <p>9. Estimation of serum/ plasma total triglycerides by Phosphovanillin method.</p> <p>10. Latex agglutination test - Rheumatoid Arthritis.</p> <p>11. Vidal Test- Typhoid detection.</p>	
	<b>Practical Course Code: RJSUZOO503</b>	
	<p>1. Quantitative Estimation of RNA by Orcinol method.</p> <p>2. Quantitative Estimation of DNA by Diphenylamine method.</p> <p>3. Separation of Genomic DNA by Agarose gel electrophoresis.</p> <p>4. Problems based on Restriction endonucleases.</p> <p>5. To study the effect of CCl<sub>4</sub> on the level of enzyme activity in liver on aspartate and alanine amino transferase, alkaline phosphatase (<i>in vitro</i> approach).</p> <p>6. Following biostatistics practicals will be done manually:</p> <p>a. Problems based on Z-test b. Problems based on t-test c. Problems based on Chi-square test</p> <p>(Learner is expected to identify appropriate test for the given problem)</p>	

## T.Y.B.Sc Zoology Syllabus Semester V &amp; VI

	<b>Practical Course Code: RJSUZOOP504</b>	
	<ol style="list-style-type: none"> <li>1. Study of Human Axial Skeleton - Skull (whole) and Vertebral column (axis, atlas, typical cervical, typical thoracic, typical lumbar, sacrum, coccyx).</li> <li>2. Study of Human Appendicular Skeleton - Pectoral and pelvic girdle with limb bones.</li> <li>3. Disorders associated with skeletal system-Tendonitis, foot rot.</li> <li>4. Study of social organization in termites, honey bee, elephants and hanuman langur.</li> <li>5. Study of parental care in sea horse, gourami, Tilapia, Caecilian, Mid-wife toad.</li> <li>6. To mark national parks and sanctuaries on map of India.</li> <li>7. To identify brand animals of various national parks, sanctuaries and comment on its IUCN status.</li> <li>8. Project or assignment on epidemiology (Group study on disease).</li> </ol>	

<b>SEMESTER-VI (THEORY)</b>		<b>L</b>	<b>Cr</b>
<b>Paper- I Animal type Study, Comparative anatomy, Developmental biology &amp; Histology</b>		<b>60</b>	<b>2.5</b>
<b>Paper Code: RJSUZOO601</b>			
	<b>UNIT I</b>	<b>15</b>	
	<b>Type Study : Shark</b>		
1	1.1: Habit, habitat, distribution, external characters including sexual dimorphism, classification and economic importance. 1.2: Skin, exoskeleton, endoskeleton and systems: 1.2.1 Digestive system. 1.2.2 Respiratory system. 1.2.3 Blood vascular system. 1.2.4 Nervous system and receptor organs. 1.2.5 Urinogenital system, copulation, fertilization and development.		
	<b>UNIT II</b>	<b>15</b>	
	<b>Comparative anatomy of vertebrates II- respiratory system, urinogenital system &amp; nervous system.</b>		
2	<b>2.1: Nervous system:</b> Development and differentiation of primary brain vesicles and their cavities, flexures of brain, evolution of cerebral hemispheres & cerebellum with reference to shark, frog, lizard, pigeon & rabbit.  <b>2.2: Urinogenital System:</b> Archinephros, pronephros, mesonephros, metanephros, structure of nephron, urinogenital ducts, urinary bladder in vertebrates.		
	<b>UNIT III</b>	<b>15</b>	
	<b>Developmental biology of chick</b>		
3	3.1.1: Structure of Hen's egg, physico-chemical nature and forms of yolk - granular, platelets and spheres; fertilization, cleavage, blastulation, gastrulation 3.1.2: Structure of chick embryo - 18hours, 24 hours, 33 hours, 48 hours & 72 hours 3.1.3: Extra embryonic membranes		
	<b>UNIT IV</b>	<b>15</b>	
	<b>Mammalian histology</b>		
	Histological structures of the following mammalian organs: stomach, intestine, liver, kidney, testes and ovary.		





## T.Y.B.Sc Zoology Syllabus Semester V &amp; VI

<b>SEMESTER-VI (THEORY)</b>		<b>L</b>	<b>Cr</b>
<b>Paper- II Enzymology, Physiology and Pathology</b>		<b>60</b>	<b>2.5</b>
<b>Course Code: RJSUZOO602</b>			
<b>UNIT I</b>		<b>15</b>	
<b>Enzymology</b>			
1	<p><b>1.1: Introduction and Nomenclature:</b> Definition; concept of activation energy; nomenclature and classification (based on IUB - Enzyme Commission) of enzymes; chemical nature of enzyme, co-factors and co-enzymes</p> <p><b>1.2: Enzyme Action and Kinetics:</b> Mechanism; Factors affecting enzyme activity - substrate, pH and temperature. Derivation of Michaelis-Menten equation and Lineweaver-Burk plot; Concept and significance of Km, Vmax</p> <p><b>1.3: Enzyme Inhibition:</b> Competitive and non-competitive inhibitors and their kinetics; therapeutic applications of enzyme inhibitors</p> <p><b>1.4: Regulation of Enzyme Activity:</b> Allosteric regulation and regulation by covalent modification of enzymes; Isozymes (LDH)</p> <p><b>1.5: Industrial applications of enzymes:</b> Food and detergents</p>		
<b>UNIT II</b>		<b>15</b>	
<b>Chemical messengers and Cardiac physiology</b>			
2	<p><b>2.1 Chemical Messengers:</b> Introduction, concept and classification; Neurotransmitters and Neurosecretory substances, acetyl catecholamine, gamma-amino butyric acid (GABA), aspartic acid, purine ATP, mode of working of transmitters.</p> <p><b>2.2 Cardiac Physiology:</b> Vascular pumps: Suction pump in open circulation and pressure pump in closed circulation; Cardiac output, Venous Return, Pace maker, Electrical activity in heart muscles: Electrocardiogram; Chemical and nervous regulation of heart.</p>		
<b>UNIT III</b>		<b>15</b>	
<b>Aspects of human reproduction</b>			
3	<p><b>3.1 Human Reproductive system and Hormonal regulation:</b> Anatomy of human male and female reproductive system, Hormonal regulation of Reproduction, Impact of age on reproduction-Menopause and Andropause.</p> <p><b>3.2 Contraception &amp; birth control:</b> Methods of Contraception- Natural Methods and Artificial methods, Sterilization, Termination, Abortion.</p> <p><b>3.3 Infertility-</b> Causes and treatment in females and males.</p> <p><b>3.4 Infertility associated disorders:</b> Endometriosis, Polycystic Ovarian syndrome (PCOS), POF (Primary ovarian failure).</p> <p><b>3.5 Assisted Reproductive Technology:</b> Sperm banks, cryopreservation of gametes and embryos, Surrogacy, Techniques of ART - In vitro fertilization (IVF), Embryo transfer (ET), Gamete intra-fallopian transfer (GIFT), intra-zygote transfer (ZIFT), Intracytoplasmic sperm injection (ICSI) with ejaculated sperm and with sperm</p>		

## T.Y.B.Sc Zoology Syllabus Semester V &amp; VI

	retrieved from testicular biopsies- Testicular sperm extraction (TESE) , Ethical Considerations of ART.		
	<b>UNIT IV</b>	<b>15</b>	
	<b>General Pathology</b>		
	<b>4.1: General Pathology:</b> Introduction and scope <b>4.2: Cell injury:</b> Mechanisms of cell injury: ischemic, hypoxic, free radical mediated and chemical. <b>4.3: Retrogressive changes:</b> Definition, types of degeneration (causes and effects): cellular swelling, fatty, mucoid and amyloid. <b>4.4: Disorders of pigmentation:</b> Endogenous: Brief ideas about normal process of pigmentation, melanosis, jaundice (causes and effects). <b>4.5: Necrosis:</b> Definition and causes; nuclear and cytoplasmic changes; types: coagulative, liquefactive, caseous, fat and fibroid. <b>4.6: Gangrene:</b> Definition and types - dry, moist and gas gangrene.		

<b>SEMESTER-VI (THEORY)</b>		<b>L</b>	<b>Cr</b>
<b>Paper- III - Cancer biology, Biotechnology, Genetics and Bioinformatics</b> <b>Paper Code: RJSUZOO603</b>		<b>60</b>	<b>2.5</b>
	<b>UNIT I</b>	<b>15</b>	
	<b>Cancer biology</b>		
1	<b>1.1: Biology of cancer:</b> Introduction, general properties of cancer cells. <b>1.2: Cell Cycle :</b> Eukaryotic Cell Cycle, Regulation of Cell cycle progression. <b>1.3: Cell Signaling:</b> Signaling molecules and their receptor; functions of cell surface receptors; Intracellular signal transduction pathway. Programmed Cell Death. <b>1.4: Causes of Cancer:</b> carcinogens – radiation, chemical and Viral , Oncogenes, Tumor Suppressor genes. <b>1.5: Prevention and treatment:</b> Prevention and regulation; Chemotherapy, radiation Therapy, Immunotherapy and gene therapy. <b>1.6: Tumor immunology :</b> Antitumor Effector Cells and Regulation of Tumor Immunity, Tumor-Associated Antigens, Mechanisms of Tumor Rejection.		
	<b>UNIT II</b>	<b>15</b>	
	<b>Animal tissue culture</b>		
2	<b>2.1: Aseptic techniques</b> 2.1.1: Sterilization - basic principles of sterilization, importance of sterility in cell culture 2.1.2: Sterile handling - swabbing, capping, flaming, handling bottles and flasks, pipetting, pouring of plates. <b>2.2: Culture media</b> 2.2.1: Types of media - Natural and Artificial media 2.2.2: Balanced Salt Solutions 2.2.3: Complete Media - amino acids, vitamins, salts, glucose, oxygen supplements, hormones and growth factors, antibiotics		

## T.Y.B.Sc Zoology Syllabus Semester V &amp; VI

	<p>2.2.4: Factors influencing cell culture - surface tension and foaming, viscosity, temperature, osmolality, pH, CO<sub>2</sub>, bicarbonate and O<sub>2</sub>.</p> <p><b>2.3:</b> Advantages of tissue culture –concept of HeLa cells and stem cells, control of the environment, <i>in vitro</i> modelling of <i>in vivo</i> conditions in tissue culture.</p> <p><b>2.4:</b> Limitations of tissue culture.</p> <p><b>2.5: Culture techniques</b></p> <p>2.5.1: Preparation of cells / organs for culture</p> <p>2.5.2: Cover slip, Flask and Tube culture</p> <p>2.5.3: Primary and established cell lines</p> <p>2.5.4: Hybridoma technology</p>		
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UNIT III		15	
Human Genetics			
3	<p><b>3.1: Chromosomal Aberrations:</b></p> <p>3.1.1 Numerical: Aneuploid and Polyploidy (Autopolyploidy and Allopolyploidy); Non-disjunction during mitosis and meiosis.</p> <p>3.1.2 Structural: Deletion: types, effects and disorders; Translocation: types, effects, disorders; Inversion: types, effects and significance; Duplication, types, effects and evolutionary significance (multigene families).</p> <p><b>3.2: Genetic Disorders:</b> Inborn Errors of Metabolism: Phenylketonuria, G-6-PD deficiency, Alkaptonuria, Albinism; Single gene mutation: Cystic fibrosis; Multifactorial: Breast cancer; Uniparental Disomy: Angelman Syndrome and Prader-Willi Syndrome.</p> <p><b>3.3: Diagnosis:</b> Prenatal Diagnosis: Amniocentesis and Chorionic villus sampling, Banding techniques (G, C, Q), FISH, Protein truncation test (PTT).</p>		
UNIT IV		15	
Bioinformatics			
4	<p><b>4.1: Introduction</b></p> <p>4.1.1: Introduction to Bioinformatics and Bioinformatics web resource (NCBI, EBI, OMIM, PubMed)</p> <p>4.1.2: Applications of Bioinformatics</p> <p><b>4.2: Databases - Tools and their uses</b></p> <p>4.2.1: Biological databases;</p> <p>Primary sequence databases: Nucleic acid sequence databases (GenBank, EMBL-EBI, DDBJ) Protein sequence databases (UniProtKB, PIR) Secondary sequence databases OR Derived databases - PROSITE, BLOCKS</p> <p>Structure databases and bibliographic databases</p> <p><b>4.3: Sequence alignment methods</b></p> <p>4.3.1: BLAST, FASTA</p> <p>4.3.2: Types of sequence alignment (Pairwise &amp; Multiple sequence alignment)</p> <p>4.3.3: Significance of sequence alignment</p>		

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	<b>4.4: Predictive applications using DNA and protein sequences</b> 4.4.1: Evolutionary studies: Concept of phylogenetic tree, convergent and parallel evolution 4.4.2: Pharmacogenomics: Concept and applications 4.4.3: Metabolomics: Concept and applications <b>4.5: Bioinformatics programme in India.</b>		
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	<b>SEMESTER-VI (THEORY)</b>	<b>L</b>	<b>Cr</b>
	<b>Paper- IV - Environmental Biology, Zoopharmacognosy, Epidemiology &amp; Wildlife management.</b> <b>Paper Code: RJSUZOO604</b>	<b>60</b>	<b>2.5</b>
	<b>UNIT I</b>	<b>15</b>	
	<b>Zoogeography</b>		
	<b>1.1: Introduction:</b> Plate tectonics and continental drift theory. <b>1.2: Animal Distribution and Barriers</b> 1.2.1: Isolating Mechanisms 1.2.2: Patterns of animal distribution - continuous, discontinuous and bipolar 1.2.3: Barriers of distribution -Topographic, climatic, vegetative, large water masses, land mass, lack of salinity and special characteristic habit (homing instinct). 1.2.4: Means of dispersal - land bridges, natural rafts and drift wood, favouring gales, migration by host, accidental transportation and by human agencies <b>1.3: Zoogeographical Realms:</b> Palearctic, Ethiopian, Oriental, Australian, Neotropical, Nearctic and Antarctic.		
	<b>UNIT II</b>	<b>15</b>	
	<b>Bioprospecting and Zoopharmacognosy</b>		
	<b>2.1: Bioprospecting</b> 2.1.1: Traditional and modern bioprospecting, economic value of bioprospecting 2.1.2: Bioprospecting and conservation, advantages and disadvantages <b>2.2: Zoopharmacognosy</b> 2.2.1: Definition and types. 2.2.2: Self-medication and its mechanism. 2.2.3: Methods of self-medication through: a) Ingestion - ants and mammals b) Geophagy - invertebrates and birds c) Absorption and adsorption 2.2.4: Applications - Social and trans-generational aspects of insects, birds and Mammals. 2.2.5: Contribution to human medicines.		

	<b>UNIT III</b>	<b>15</b>	
3	<b>Epidemiology-II</b>		
	<p><b>3.1: Prevention and control of communicable diseases-</b> Notification, isolation, quarantine, disinfection; concurrent, terminal, precurrent/ prophylactic methods of disinfection: natural, physical, chemical, immunization; general measures.</p> <p><b>3.2: Epidemiology of communicable diseases:</b> Diagnosis, transmission, prevention,</p> <p><b>3.3 WHO and its programme:</b> Malaria, Tuberculosis, Polio control programme, outcome with control measures and treatment of- a) Diseases of viral origin- dengue, swine flue b) Diseases of bacterial origin- TB, leprosy, leptospirosis c) Diseases of protozoan origin- Malaria d) Diseases of helminths origin- Ascariasis, dracunculosis, filariasis respect to India.</p>		
	<b>UNIT IV</b>	<b>15</b>	
	<b>Wildlife management</b>		
	<p><b>4.1: Habit, Habitat, Territory of Wild Animals:</b> Herbivores, carnivores, solitary, social, types of habitats and territories.</p> <p><b>4.2: Threats to Wildlife</b></p> <p>4.2.1: Poaching and hunting, deforestation, encroachment, competition (intra-specific and inter-specific), overgrazing and climate change, diseases (zoonosis and reverse zoonosis).</p> <p>4.2.2: Tourism and human animal conflict.</p> <p><b>4.3: Wildlife Conservation</b></p> <p>4.3.1: Techniques and methods used for wildlife census: Aerial counts, camera trap, line transect census and track surveys, capture mark recapture method, wildlife radio telemetry</p> <p>4.3.2: Forest management, policies and Acts: Management- Prescribed burning, Reforestation; Forest policy 1988; The Indian Forest Act, 1927; Indian Wildlife (Protection) Act, 1972 and Convention for International Trade of endangered species (CITES).</p> <p><b>4.4 Case studies</b> Community-based conservation and management in Namibia; Wolf reintroduction in Yellow Stone National Park; Silent Valley conservation- people's movement; Diclofenac and vulture population decline.</p>		

## T.Y.B.Sc Zoology Syllabus Semester V &amp; VI

T.Y.B.Sc	Semester VI Theory
RJSUZOOP601	<p><b>Course Objectives:</b></p> <ol style="list-style-type: none"> <li>1. To acquaint learners with the details of Shark as a representative of vertebrates.</li> <li>2. To provide them with general idea of comparative anatomy of vertebrates.</li> <li>3. To acquaint learners with knowledge of developmental biology with chick as a model.</li> <li>4. To make understand learner concept of histology.</li> </ol> <p><b>Learning Outcomes:</b></p> <ol style="list-style-type: none"> <li>1. Learner will get an idea of general characters and system details of Shark.</li> <li>2. Learner will be familiarized with process of evolution trend which has occurred during vertebrate evolution.</li> <li>3. Learner will understand the basics of chick embryo development and the practical applications of studying chick embryology.</li> <li>4. Learner will understand histology of various mammalian tissues.</li> </ol>

T.Y.B.Sc	Semester VI Theory
RJSUZOO602	<p><b>Course Objectives:</b></p> <ol style="list-style-type: none"> <li>1. To introduce concepts of enzyme biochemistry and applications of enzymes.</li> <li>2. To understand the working of neurotransmitters and basics of cardiac physiology.</li> <li>3. To comprehend the physiological aspects of homeostasis and endocrinology.</li> <li>4. To acquaint learner with the concept and details of tissue culture.</li> </ol> <p><b>Learning Outcomes:</b></p> <ol style="list-style-type: none"> <li>1. Learner will understand enzyme kinetics and therapeutic role of enzymes.</li> <li>2. The student will identify the role of neurotransmitters and appreciate the working of human heart.</li> <li>3. Learner will be familiarized with adaptations of animals for regulation of heat and ionic balance. They will understand the structure, function and disorders of endocrine glands.</li> <li>4. Learner will get an idea of tissue culture practices and its wide range of scope in allied industries.</li> </ol>

T.Y.B.Sc	Semester VI ( Theory)
RJSUZOO603	<p><b>Course Objectives:</b></p> <ol style="list-style-type: none"> <li>1. To impart the knowledge of cellular and molecular biology of cancer.</li> <li>2. To introduce molecular biology of gene alteration and its effects.</li> <li>3. To understand the tools and techniques used in genetic engineering.</li> <li>4. To acquaint learners with the fascinating world of human genetics and bioinformatics.</li> </ol> <p><b>Learning Outcomes:</b></p> <ol style="list-style-type: none"> <li>1. The student will understand at the cellular level the causes, preventive measures and treatment for cancer.</li> <li>2. Learner will get an insight in the intricacies of chemical and molecular processes that alter the gene.</li> <li>3. Learner will be familiarized with vast arrays of techniques of gene manipulation.</li> <li>4. Learner will get an idea on the significance of genetic health and the role of computational biology in present time.</li> </ol>

T.Y.B.Sc	Semester VI (Theory)
RJSUZOO604	<p><b>Course Objectives:</b></p> <ol style="list-style-type: none"> <li>1. Learner should understand the different factors affecting the environment and wildlife.</li> <li>2. To introduce the learner to concepts of bioprospecting and zoopharmacognosy.</li> <li>3. To acquaint learner with the distribution on animals around the world.</li> </ol> <p><b>Learning Outcomes:</b></p> <ol style="list-style-type: none"> <li>1. Learner will get sensitized to the issues concerning with environment, threats to wildlife and the different methods of conservation.</li> <li>2. Learner will become aware about commercialization of biological discoveries as well as ethological aspect of non-human self medication.</li> <li>3. Learner will get an idea about how and why animals got distributed on the earth.</li> </ol>



<b>SEMESTER-VI (Practical)</b>		<b>Cr</b>
	<b>Practical Course Code: RJSUZOOP601</b>	<b>06</b>
1	<p>1. Study of Shark with the help of diagram / Photograph / Simulation whichever possible. No animal shall be dissected.</p> <p>a) Digestive system b) Heart and Aortic arches c) Urinogenital System d) Endoskeleton of shark: i. Axial - Skull and vertebral column ii. Appendicular - Pelvic and pectoral fins, pelvic and pectoral girdle</p> <p>2. Brain: Comparative study of brains of shark, frog, lizard, bird (pigeon /fowl) &amp; rat. 3. Study of ontogeny of chick embryo using permanent slides - 18 hours, 24 hours, 33 hours, 48 hours and 72 hours. 4. Preparation of temporary mounting of chick embryo up to 48 hours of incubation. 5. Observation of Permanent slides: Mammalian Tissues- liver, kidney, testis, ovary, stomach and intestine.</p>	
	<b>Practical Course Code: RJSUZOOP602</b>	
2	<p>1. Effect of varying pH on activity of enzyme Acid Phosphatase. 2. Effect of varying enzyme concentration on activity of enzyme Acid Phosphatase. 3. Effect of varying substrate concentration on activity of enzyme Acid Phosphatase. 4. Effect of inhibitor on the activity of enzyme Acid Phosphatase. 5. Separation of LDH isozymes by agarose / polyacrylamide gel electrophoresis. 6. Study of stages of estrous cycle in mice by vaginal cytology. 7. Mounting of nerve cells and neurosecretory cells from cockroach brain. 8. Study of ECG and disorders of heart function. 9. Study of contraceptive devices- condom, diaphragm, contraceptive pills, copper-T 10. Study of pregnancy detection kit.</p>	
	<b>Practical Course Code: RJSUZOOP503</b>	
	<p>1. Study of slides and photographs: leukemia/ sarcoma/lymphoma/carcinoma 2 Calculation of mitotic index from the photograph or stained preparation of onion root tip or cancer cells. 3. Instruments for tissue culture – Autoclave, Millipore filter, CO2 incubator, Laminar air-flow. (Principle and use). 4. Packaging of glassware for tissue culture. 5. Aseptic transfer techniques( demonstration only) 6. Trypsinization and vital staining using Trypan blue stain (demonstration only) 7. Karyotype (Idiogram) analysis for the following syndromes with comments on numerical and / or structural variations in chromosomes .</p>	

## T.Y.B.Sc Zoology Syllabus Semester V &amp; VI

	<ul style="list-style-type: none"> <li>a. Turner's syndrome</li> <li>b. Klinefelter's syndrome</li> <li>c. Down's syndrome</li> <li>d. Cri-du-chat syndrome</li> <li>e. D-G translocation</li> <li>f. Edward's syndrome</li> <li>g. Patau's syndrome</li> </ul> <p>8. Interpretation of genetic formulae: Deletion, duplication, inversion and translocation.</p> <p>9. Explore BLAST for nucleotide sequence comparison.</p> <p>10. Explore the databases (Nucleotide, Protein) at NCBI for querying a nucleotide or protein sequence.</p> <p>11. Exploring bibliographic database PubMed for downloading a research paper on subject of interest with the use of operators.</p>		
	<b>Practical Course Code: RJSUZOOP504</b>		
	<p>1. Indicate the distribution of fauna in the world map with respect to its realm and comment on the pattern of distribution.</p> <ul style="list-style-type: none"> <li>a. Palearctic: Giant Panda and Japanese Macaque</li> <li>b. Ethiopian: Common ostrich and African bush elephant</li> <li>c. Oriental: Indian one-horned Rhinoceros and Gharial</li> <li>d. Australian: Platypus and Red Kangaroo</li> <li>e. Neotropical: Guanaco and South American Tapir</li> <li>f. Nearctic: Virginia opossum and Sea otter , Raccoon</li> <li>g. Antarctic: Emperor Penguin and Antarctic Minke Whale</li> </ul> <p>2. Excursion (Study tour / Visit) to Zoo / Sanctuary / National park / Research institute, etc. and submit a report. College may conduct more than one field visit for wide exposure, if feasible. However, at least one field visit should be such that it is affordable to every student.</p> <p>3. Study of bioprospecting:</p> <ul style="list-style-type: none"> <li>a. Tumour suppression compounds e.g. Sponge.</li> <li>b. Skin erythema treatment from gel - Aloe vera, Aloe ferox.</li> </ul> <p>4. Study of Zoopharmacognosy in ants, cats, elephants and dogs.</p> <p>5. Temporary preparation of head and mouth parts of mosquito.</p> <p>6. Identification of Diseases with the help of Photograph/ specimen</p> <ul style="list-style-type: none"> <li>a)TB</li> <li>b) Leprosy</li> <li>c)Ascariasis</li> <li>d)Dracunculosis</li> <li>e)Filariasis</li> </ul> <p>7. Study of population density by line transect &amp; quadrature method and calculate different diversity indices.</p> <p>8. Identification of animals with the help of pug marks.</p>		

## T.Y.B.Sc Zoology Syllabus Semester V &amp; VI

T.Y.B.Sc	Semester VI Practical
RJSUZOOP601 & RJSUZOOP602  Practical- I & II	<p><b>Course Objectives:</b></p> <ol style="list-style-type: none"> <li>1. To acquaint learners with the details of Shark as a representative of vertebrates &amp; to familiarize them with histological structure of some mammalian organs.</li> <li>2. To familiarize them with different stages of chick embryo development.</li> <li>3. To make the learner understand enzyme kinetics and other physiological aspects practically.</li> </ol> <p><b>Learning Outcomes:</b></p> <ol style="list-style-type: none"> <li>1. The learner will be able to understand about vertebrate organ systems and histology of mammalian organs.</li> <li>2. Students would be able to understand changes which occur in the chick embryo during development.</li> <li>3. The learner will be able to comprehend the kinetics of enzyme activity in a better way and they would understand how different factors can affect enzymatic reactions.</li> </ol>

T.Y.B.Sc	Semester VI Practical
RJSUZOOP603 & RJSUZOOP604  Practical- III & IV	<p><b>Course Objectives:</b></p> <ol style="list-style-type: none"> <li>1. To provide opportunity to learner to deal with some basic aspects of tissue culture.</li> <li>2. To introduce karyotype analysis and use of bioinformatics tool.</li> <li>3. To make them aware about Zoogeographical distribution of animals on earth. To familiarize them with some basic techniques of population analysis.</li> </ol> <p><b>Learning Outcomes:</b></p> <ol style="list-style-type: none"> <li>1. The learner will be able to understand importance of aseptic techniques in tissue culture and would get hands on experience of using computer for obtaining gene or protein sequences through bioinformatics tools.</li> <li>2. The learner will understand the different factors which affect Zoogeographical distribution of animals.</li> <li>3. Basic population analysis techniques would help the learner in environmental research projects.</li> </ol>

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### **SCHEME OF EXAMINATION ( FOR BOTH THE SEMESTERS)**

**1. Internal examination**

- Two internal class tests comprising of 20 marks each.
- Each class test shall consist of 20 multiple choice questions with equal weightage.

**2. External Examination**

- One External (Semester End Examination) of 60 marks. Duration 2 hours.

**3. Practical examination**

- One Practical at the end of each Semester.
- Practical I-50 marks and Practical II-50 marks but passing combined out of 100.
- Practical III-50 marks and Practical IV-50 marks but passing combined out of 100.
- Candidate will be allowed to appear for the practical examinations if he/she submits a certified journal of T.Y.B.Sc. Zoology or a certificate from the Head of the department / Institute to the effect that the candidate has completed the practical course of T.Y.B.Sc. Zoology as per the minimum requirements.
- In case of loss of journal, a candidate must produce a certificate from the Head of the department /Institute that the practicals for the academic year were completed by the student. However, such a candidate will be allowed to appear for the practical examination, but the marks allotted for the journal will not be granted.
- HOD's decision, in consultation with the Principal, shall remain final and abiding to all.

**Evaluation and Assessment**

**Question paper pattern for external theory**

Total: 60 marks

Q.1 Based on Unit I 12 M

Attempt any two questions out of three.

- a.
- b.
- c.

Q.2 Based on Unit II 12M

Attempt any two questions out of three.

- a.
- b.
- c.

Q.3 Based on Unit III 12M

Attempt any two questions out of three.

- a.
- b.
- c.

Q.4 Based on Unit IV 12M

Attempt any two questions out of three.

- a.
- b.
- c.

Q.5 Short notes (from all Units) 12M (3M each)

- a or a- Unit I
- b or b- Unit II
- c or c- Unit III
- d or d- Unit IV

**T. Y. B. Sc. Zoology: Semester V (Practical)**

**Skeleton of Practical Examination Question Paper- Practical I**

**Total Marks: 50**

Q1. Sketch, label and describe Digestive/ Nervous / Reproductive System of Sepia.	10M
Q2. Sketch and label jaws/ radula/ chromatophores/ spermatophores of Sepia.	05M
Q3. Mountings of scales any two— placoid/cycloid/ctenoid.	10 M
Q3. Identify and describe. (a,b,c based on frog embryology and d,e based on endocrinology).	15M
Q4. Viva voce	05M
Q5. Journal	05M

**Skeleton of Practical Examination Question Paper- Practical II**

**Total Marks: 50**

Q.1 Estimate total plasma proteins by Folin's method.	15 M
<b>OR</b>	
Estimate serum/plasma total triglycerides by Phosphovanillin method.	
<b>OR</b>	
Estimation of glucose by O-toluidine method.	
Q.2. Enumerate erythrocytes in the given sample and comment on clinical condition.	10 M
<b>OR</b>	
Enumerate leucocytes in the given sample and comment on clinical condition.	
<b>OR</b>	
Present a report on differential count of leucocytes and comment on clinical condition.	
Q.3. Estimate haemoglobin by Sahli's acid haematin method.	10 M
<b>OR</b>	
Record Erythrocyte Sedimentation Rate by Westergren / Wintrobe method.	
<b>OR</b>	
Perform separation of plasma proteins by PAGE.	
Q.4. Perform Latex agglutination test - Rheumatoid Arthritis.	05 M
<b>OR</b>	
Perform Vidal test.	
Q.5. Viva voce	05 M
Q.6. Journal	05 M



**Skeleton of Practical Examination Question Paper-Practical III**

**Total Marks: 50**

Q.1 Demonstrate the effect of CCl <sub>4</sub> on the level of enzyme activity of aspartate/alanine amino transferase / alkaline phosphatase in liver ( <i>in vitro</i> approach)	12M
Q.2 Estimate the amount of RNA by Orcinol method from the given sample.	10 M
or	
Estimate the amount of DNA by Diphenylamine method from the given sample.	
or	
Separation of Genomic DNA by Agarose gel electrophoresis.	
Q.3 Problems based on Restriction endonucleases.	08M
Q.4 Problems based on Biostatistics.	10 M
Q.5 Viva voce	05 M
Q.6 Journal	05 M

**Skeleton Question Paper for Practical Examination- Practical IV**

**Total Marks: 50**

Q.1 Identification	24 M
<b>Spot a) and b)</b> Based on osteology – (human axial skeleton ,skull (whole) and vertebral column (axis, atlas, typical cervical, typical thoracic, typical lumbar, sacrum, coccyx). Any two.	
<b>Spot c) and d)</b> Based on osteology - human Appendicular skeleton (Pectoral and pelvic girdle with limb bones.) Any two.	
<b>Spot e)</b> Based on social organization (termites, honeybee, elephants and hanuman langur.) Any one.	
<b>Spot f)</b> Based on of parental care (sea horse, gourami, Tilapia, Caecilian, Mid-wife toad.) Any one.	
Q.2 To mark national parks and sanctuaries on map of India and Describe about the identified National Park or Sanctuary. (Sanjay Gandhi, Tadoba, Gir, Jim Corbett, Bharatpur, Kaziranga, Bandipur-Mudumalai) Any one.	10M
Q. 3 To identify brand animals of national parks/sanctuaries & comment on its IUCN status.	06 M
Q.4 Viva Voce	05M
Q.5. Journal	05M

**Skeleton of Practical Examination Question Paper-Practical I**

**Total Marks: 50**

- Q1. Sketch and label and describe Digestive system, Heart and aortic arches, Urinogenital, Cranial nerves of Shark. 10M
- Q2. Sketch and label endoskeleton of Shark (Any one skull/ vertebra / pelvic fin/ pectoral fin/ pelvic girdle/ pectoral girdle) 05M
- Q3. Preparations of temporary mounting of chick embryo upto 48 hours of incubation. 10 M
- Q3. Identify and describe. (a,b, based on brains c,d based on chick embryology And e,f on mammalian histology) 15M
- Q4. Viva 05M
- Q5. Journal 05M

**Skeleton of Practical Examination Question Paper- Practical II**

**Total Marks: 50**

- Q.1 Demonstrate the effect of \_\_\_\_\_ on the activity of acid phosphatase (Substrate concentration / pH variation / Enzyme concentration / Inhibitor concentration). 15M
- Q.2 Separate LDH isozymes from the given sample by agarose / polyacrylamide gel Electrophoresis. 10M
- OR**
- Q.2 Mounting of nerve cells and neurosecretory cells from cockroach.
- OR**
- Q.2 Pregnancy detection using kit. 10M
- Q.3 Identify and describe a, b, c, d, e. 15 M
- a. Any one stage of Estrous cycle of mice
- b and c: ECG
- d and e: Contraceptive device.
- Q.4 Viva voce 05 M
- Q.5 Journal 05 M

**Skeleton of Practical Examination Question Paper- Practical III**

**Total Marks: 50**

Q.1 Arrange the chromosomes from the given karyotype and identify and describe the syndrome.	12M
Q.2 Prepare the given glassware for sterilization.	08M
Q.3 Identify and describe A and B A: slides or photographs: leukaemia / sarcoma/lymphoma/carcinoma B: Autoclave, Millipore filter, CO <sub>2</sub> incubator, Laminar air-flow. (Principle and use).	04 M
Q.4. a) Interpret the of genetic formula	03M
b) Calculation of mitotic index from the photograph.	05M
Q.5 Project based on bioinformatics	08M
Q.6 Viva voce	05M
Q.7 Journal	05 M

**Skeleton Question Paper for Practical Examination-Paper IV****Total Marks: 50**

Q1. Identify the given animals with respect to their realms and comment. (any two).	06M
Q2. Identification with the help of Photograph/ specimen based on a) Bioprospecting: (Sponge, Aloe vera, Aloe ferox.) (any one). b) Zoo pharmacognosy: (ants, cats, elephants and dogs) (any one). c) Epidemiology: (TB, Leprosy, Ascariasis, Dracunculosis, Filariasis) (any one)	09M
Q3. Temporary preparation of head and mouth parts of mosquito.	05M
Q4. Study of population density by line transect or quadrat method and calculate different diversity indices.	10M
Q5 Identification of animals with the help of pug marks.	02M
Q6. Study tour or field report Submission and discussion	08M
Q7. Viva Voce	05M
Q8 Journal	05M