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S.P. Mandali's
RAMNARAIN RUIA AUTONOMOUS COLLEGE

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Syllabus for: T.Y.B.Sc.

Program: B.Sc.

Course Code: ZOOLOGY (**RUSZOO**)

(Choice Based Credit System (CBCS) with effect from academic year 2019-20)

PREFACE

Science plays a key role in overall advancement and progress of the society. All Under Graduate and Post-Graduate students should be accordingly equipped with well-designed and structured knowledge, current evolvements and skills to contribute in all fields of science and technology. This approach has compelled us to include necessary modifications to syllabi of University of Mumbai. The subject board meeting was conducted to receive and include all the necessary suggestions for the benefaction and betterment of students. Here we present revised T.Y.B.Sc. syllabus for Semester V and Semester VI which emphasizes on development of students from scientific point of view. It is hoped that this curriculum document prepared would provide the expected level of competency.

T. Y. B. Sc. Zoology
Semester based Credit and Grading System
Semester V

Theory				
Paper Code	**Unit**	**Topic**	**Credits**	**Lectures/week**
Paper I RUSZOO501	I	Principles of Classification and Type study of Hydra	2.5	1
	II	Type study of Cockroach		1
	III	Type study of Sepia		1
	IV	Type study of Star fish		1
Paper Il RUSZOO502	I	Basic Hematology	2.5	1
	II	Applied Hematology		1
	III	Basic Immunology		1
	IV	Applied immunology		1
Paper Ill RUSZOO503	I	Molecular Biology	2.5	1
	II	Genetic engineering		1
	III	Human Genetics		1
	IV	Tissue culture		1
Paper IV RUSZOO504	I	Integumentary system and derivatives	2.5	1
	II	Endocrine glands and regulation		1
	III	Human Osteology		1
	IV	Chick Embryology		1
			10	**16**
Practical				
Practical **RUSZOOP501** And **RUSZOOP502**		Practicals of Course **RUSZOO501** and **RUSZOO502**	3	08
Practical **RUSZOOP503** and **RUSZOOP504**		Practicals of Course **RUSZOO503** and **RUSZOO504**	3	08
			06	**16**
Total			**16**	**32**

T. Y. B. Sc. Zoology
Semester V (Theory)

Paper: I
Paper Code: RUSZOO501
Levels of Organisation, Principles of Classification and Animal Type Study

Learning objectives: To introduce the learners to the principles and system of animal classification and to study invertebrate type from the Phylum Coelenterata, Arthropoda, Mollusca and Echinodermata.

Learning outcome: Learners will develop conceptual clarity with regard to the anatomy of animals at different levels and will get an idea of general characteristics and details of invertebrate animal systems. The understanding of working of organs and systems within a single animal would strengthen the learners' comprehension of biological systems. Learning of external morphology and physiology of systems of invertebrate animal will make easy to understand these animals when used in research

UNIT 1 Principles of classification and Study of Hydra (15 lectures)

1.1 Principles of classification

- **1.1.1.** Systematics -Linnaean hierarchy (Phylum, Class, Order, Family, Genus and Species)
- **1.1.2.** Binomial nomenclature

1.2 Study of Hydra

- **1.2.1.** Systematic position, Habit and habitat
- **1.2.2.** Structure and Histology of body wall
- **1.2.3.** Types of Locomotion
- **1.2.4.** Types of Nutrition
- **1.2.5.** Physiology of Respiration
- **1.2.6.** Physiology of Excretory system
- **1.2.7.** Physiology of Reproductive system
- **1.2.8.** Nervous system
- **1.2.9.** Regeneration

UNIT 2: Type Study Of Cockroach (15 lectures)

- **2.1.**Systematic position, Habit and habitat
- **2.2**. External characters
- **2.3.** Morphology and Physiology of Digestive system
- **2.4.** Physiology of Blood vascular system
- **2.5.** Physiology of Excretory system

2.6. Morphology and Physiology of Male and Female Urinogenital System
2.7. Anatomy of Nervous system and sense organs

UNIT 3: Type Study of Sepia **(15 lectures)**

3.1.Systematic position, Habit and habitat

3.2. External characters

3.3. Morphology and Physiology of Digestive system

3.4. Morphology and Physiology of Circulatory system

3.5. Morphology and Physiology of Excretory system

3.6. Morphology of Reproductive system

3.7. Morphology of Nervous system and sense organs

3.8. Economic importance

Unit 4:Type Study of Starfish **(15 Lectures)**

4.1. Systematic position, Habit and habitat

4.2. External characters, Endoskeleton, coelom

4.3. Digestive system, Physiology of Digestive system

4.4. Locomotion: Water Vascular System

4.5. Physiology of Circulatory system

4.6. Reproductive system

4.7. Fertilization and larval development

4.8. Nervous system

4.9. Regeneration

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T. Y. B. Sc. Zoology
Semester V (Theory)
Paper II
Paper Code:RUSZOO502
Basic and applied Haematology & Immunology

Learning objectives:
To introduce the learners to general and applied hematology. To give an overview of the immune system, concept of vaccines and vaccination. To familiarize the learners to immunological perspectives of organ transplant and tumor treatment.

Learning outcome:
Learners would be able to comprehend the fundamental concepts in haematology, different terminologies and diagnostic tests performed in a pathological laboratory. Learners would realize the significant role of immune system in giving resistance against diseases. Learners would understand the principle and applications of vaccines. Learners would develop basic understanding of immunology of organ transplantation and cancer treatment.

Unit 1: Basic Hematology **(15 lectures)**

1.1: Composition of blood -
Plasma & formed elements

1.2: Blood volume -
Total quantity and regulation, Haemorrhage

1.3: Plasmaproteins -
Inorganic constituents,respiratory gases, organic constituents other than proteins (include internal secretions, antibodies and enzymes)

1.4: RBCs
Structure and functions,abnormalities in structure, total count, variation in number; types of anaemia and genetic disorders; ESR

1.5: Hemoglobin - Structure, formation and degradation, role in transport of oxygen and carbon dioxide (Chloride shift and Bohr's effect);types of hemoglobin (foetal, adult and sickle)

1.6: WBCs -Types of leukocytes and function; total count and variation in number; leucopoiesis and leukemia and its types

1.7: Blood clotting -Thrombocytes; factors and mechanism of coagulation; anticoagulants; formation of blood platelets (thrombopoiesis); clotting mechanism; bleeding and clotting time; failure of clotting mechanism; haemophilia and purpura

Unit 2: Applied Hematology (15 lectures)

2.1: Introduction to Applied Hematology

Definition, scope and brief introduction of basic branches: clinical, microbiological and forensic hematology

2.2: Diagnostic techniques used in hematology

2.2.1: Microscopic examination of blood: For detection of blood cancers (Lymphoma, Myeloma); infectious diseases (Malaria, Filariasis, Leishmaniasis); hemoglobinopathies (Sicklecell, Thalassemia)

2.2.2: Coagulopathies: Diagnostic methods (hemophilia and purpura)

2.2.3: Microbiological examination: Blood culture: Method and application in Diagnosis of infectious diseases (Typhoid and TB)

2.2.4: Biochemical examinations ofblood for: **Liver function tests:**Albumin, AST, ALT, AST:ALT ratio, Total bilirubin,Direct bilirubin, Prothrombin time / International normalizedratio (PT/INR), Serumglucose, LDH and Alkaline phosphatase

Kidney function tests: Serum creatinine, blood urea nitrogen

Carbohydrate metabolism tests: Blood sugar, Glucose tolerance test, Glycosylated hemoglobin test

Other biochemical tests: Blood hormones (Thyroid, FSH, LH)

2.2.5: Blood Bank: Collection, storage, preservation of its components

2.2.6: Blood transfusion: Crossing matching,Transfusion of blood and bone marrow transplant .

Unit 3: Basic Immunology (15 lectures)

3.1: Overview of Immunology : Definition and scope

3.2: Components of immune system:

3.2.1: Innate immunity – Definition, Factors affecting innate immunity, Mechanisms of innate immunity – physical barriers, chemical barriers and cellular barriers

3.2.2: Adaptive or Acquired immunity – Active Acquired immunity – Natural and Artificial;Passive Acquired immunity – Natural and Artificial

3.3: Cells and Organs of immune system

3.3.1: Cells of immune system– B cells, T cells and null cells, macrophages, dendritic cells and mast cells

3.3.2: Organs of immune system– Primary – Thymus and bone marrow; Secondary - Lymph node and spleen

3.4: Antigens

Definition, properties of antigens; haptens

3.5: Antibodies

Definition, basic structure,classes of antibodies – IgG, IgA, IgM, IgD and IgE

3.6: Hypersensitivity, Autoimmunity and Immunodeficiency

3.6.1: Definition of Hypersensitivity; Classification of hypersensitivity reactions: Type-I, Type-II, Type-III and Type-IV (one example of each type)

3.6.2: Introduction and a brief account of autoimmunity and example, Rheumatoid arthritis

3.6.3: Introduction to immunodeficiency – Congenital, e.g. SCID; Acquired, e.g. AIDS

Unit 4: Applied Immunology **(15 lectures)**

4.1: Antigen-Antibody interaction

General features of antigen-antibody interaction; Precipitation reaction: Definition, characteristics and mechanism, precipitation in gels (slide test) - Radial immunodiffusion (Mancini method), Double immunodiffusion (Ouchterlony method)

Agglutination reaction: definition, characteristics and mechanism, Haemagglutination (slide and micro-tray agglutination), passive agglutination,Coomb's test and ELISA

4.2: Vaccines and Vaccination

Brief history of vaccination, principles of vaccines, Active and Passive immunization; Routes of vaccine administration

Classification of Vaccines: Live attenuated, Whole-Killed or inactivated,

Sub-unit vaccines: Toxoids, Protein vaccines,Viral-like particles, DNA vaccines

Adjuvants: Introduction and application; Adjuvants used for human vaccines (Alum, Virosomes and Liposomes, Saponins,Water-in-oil emulsions)
Vaccines against human pathogens:Polio; Hepatitis A and B; Rotavirus;Tuberculosis (BCG); Diphtheria, Tetanus and Pertussis (DPT); Typhoid (TAB) vaccines

4.3: Transplantation and Tumour Immunology

4.3.1.Transplantation: Introduction to transplantation; Types of grafts; Immunologic basis of graft rejection: MHC compatibility in organ transplantation,

4.3.2. Immunomodulator – only one example of drug.

4.3.3.Tumour immunology (Cancer immunology): Introduction to cellular transformation and cancer; Immunotherapy: Antigen-independent cytokine therapy, Passive immunotherapy

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T. Y. B. Sc. Zoology - Semester V (Theory)

Paper III (RUSZOO503)

Molecular Biology, Genetic Engineering, Human genetics and Tissue culture.

Learning objectives: To make learners understand the concept of DNA damage, it's causative agents and DNA repair and also to make learners comprehend the tools and techniques used to modify an organism's genome, human genetics disorder and diagnosis and fundamental concepts of cell culture.

Learning outcome:
The course will get learners acquainted with the vast array of techniques used to interfer genes which can be applied in research. The learners will become aware of the impact of changes occurring at gene level on human health and its diagnosis, new fields of genetic engineering and biotechnology. The knowledge of cell culture will equip them to work in upcoming fields of science and technology.

Unit 1: Molecular Biology (15 lectures)

1.1 Types of mutation

1.1.1 Point mutations – substitution, deletion and insertion mutations
Substitution mutations – silent (same-sense), 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

1.2 Induced mutations/mutagens/mutagenic agents/DNA damage

1.2.1 Physical agents – ionizing radiation (X-rays, α, β and γ rays), non-ionizing radiation (UV light)
1.2.2 Chemical agents – base analogs (5-bromouracil, 2-aminopurine), intercalating agents (acridine dyes, ethidium bromide and ICR compounds), deaminating agents (bisulfite compounds and nitrous acid), hydroxylating agents (hydroxylamine), alkylating agents (ethylmethanesulphonate, ethylethanesulphonate, mustard gas, nitrogen mustard, polycyclic aromatic hydrocarbons), aflatoxin (aflatoxin B1)

1.3 Preventative and repair mechanisms for DNA damage

1.3.1 Mechanisms that prevent DNA damage – superoxide dismutase andcatalase
1.3.2 Mechanisms that repair damaged DNA – direct DNA repair (alkyltransferase, photoreactivation, excision repair)

1.3.3 Postreplication repair – recombination repair, mismatch repair, SOS repair, transcription - repair coupling

1.4 Eukaryotic gene expression

1.4.1 Regulatory proteins – zinc fingers, helix-turn-helix domain and leucine zipper
1.4.2 DNA methylation

Unit 2: Genetic Engineering (15 lectures)

2.1 Tools in Genetic Engineering

2.1.1 Enzymes involved in Genetic Engineering: Introduction, nomenclature and types with examples, working mechanism, Ligases – Restriction enzymes, E.coli DNA ligase, T4 DNA ligase, polynucleotide kinase, phosphatases, DNA and RNA polymerases, reverse transcriptase, terminal transferase
2.1.2 Vectors for gene cloning: General properties, advantages and disadvantages of cloning vectors – plasmid vectors, phage vectors, cosmid vectors, phasmid vectors, BAC vectors
2.1.3 Cloning techniques: Cloning after restriction digestion - blunt and cohesive end ligation, creation of restriction sites using linkers and adapters, cloning after homopolymer tailing, cDNA synthesis (Reverse transcription), genomic and cDNA libraries
2.1.4 Transfection techniques: Liposome mediated gene transfer, calcium phosphate precipitation method,electroporation, virus mediated gene transfer - Retrovirus

2.2 Techniques in Genetic Engineering

2.2.1 PCR techniques: Principles, working and applications of thermocycler and introduction to RTPCR.
2.2.2 Sequencing techniques: DNA sequencing: Maxam-Gilbert method, Sanger's method – Manual and automated methods
2.2.3 Protein sequencing: Sanger's method, Edman's method, Applications of sequencing techniques
2.2.4 Separation and detection techniques: Blotting techniques: Southern blotting, Northern blotting and Western blotting Applications of blotting technique.
2.2.5 Microarray techniques: ESTs, DNA Microarray and Applications

Unit 3: Human Genetics (15 lectures)

3.1 Non-disjunction during mitosis and meiosis

3.1.1 Chromosomal Aberrations:Structural: Deletion: types, effects and disorders; Translocation: types:robertsonian and non-robertsonian, disorders; Inversion: types,

effects andsignificance; Duplication and their evolutionary significance (multigenefamilies)Numerical: Aneuploidy and Polyploidy (Autoploidy and Alloploidy)

3.2 Genetic Disorders

3.2.1 Inborn Errors of Metabolism: Phenylketonuria, G-6-PD deficiency, Alkaptonuria, Albinism, Niemann Pick syndrome
3.2.2 Single gene mutation: Cystic fibrosis, Muscular dystrophy
3.2.3 Multifactorial: Breast Cancer ,DiabetesMillitus,Ischemicheart.
3.2.4 UniparentalDisomy: Angelman Syndrome and PraderWilli Syndrome

3.3 Diagnosis

3.3.1 Prenatal Diagnosis (Amniocentesis) and chorio-villus sampling - Ultrasound scanning and Fetoscopy, Banding techniques (G, C, Q), FISH and M-FISH, Protein truncation test (PTT), Single Nucleotide Polymorphism and its applications
3.3.2 Genetic counselling: Psycho-social and ethical aspects for the individual and the family in connection with genetic investigations.

Unit 4: Tissue culture (15 lectures)

4.1 Introduction to animal cell culture

4.1.1 Advantages of tissue culture – control of the environment, characterization and homogeneity of sample, economy, scale and mechanization, *in vitro* modeling of *in vivo* conditions
4.1.2 Limitations of tissue culture – expertise, quantity, dedifferentiation and selection, origin of cells, instability

4.2 Aseptic techniques

4.2.1 Objectives of aseptic techniques – maintaining sterility
4.2.2 Sterilization – basic principles of sterilization, importance of sterility in cell culture
4.2.3 Sterile handling – swabbing, capping, flaming, handling bottles and flasks, pipetting, pouring

4.3 Culture media

4.3.1 Physicochemical properties – pH, CO2 and bicarbonate, buffering, O2, osmolality, temperature, viscosity, surface tension and foaming
4.3.2 Types of media – Natural and Artificial media
4.3.3 Serum – protein, growth factors, hormones, nutrients and metabolites, lipids, minerals and inhibitors
4.3.4 Balanced Salt Solutions
4.3.5 Complete Media– amino acids, vitamins, salts, glucose, oxygen supplements, hormones and growth factors, antibiotics

4.4 Primary and secondary culture and establishment of cell lines.

4.4.1 Establishment of primary and secondary cultures of normal, adult and embryonic sources.
4.4.2 Isolation of cells – enzyme digestion, perfusion, mechanical disaggregation, explants cultures
4.4.3 Substrate for attachment
4.4.4 Culture conditions – selection against some cell types, conditioned medium, feeder cells

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T. Y. B. Sc. Zoology
Semester V (Theory)

Paper IV
Paper Code: RUSZOO504

Integumentary and Endocrine system, Human Osteology & Chick Embryology

Learning objectives:
To introduce the learners to different integumentary structures, epidermal derivatives in the vertebrates.
To elaborate on structure, functions and regulation of mammalian endocrine glands.
To brief about different bones of human skeleton and their importance.
To acquire the knowledge about the basics of developmental biology with reference to chick as a model and also understand demonstration experiments related to it.

Learning outcome:
Learners will be able to understand the importance of epidermal and dermal derivatives and their functions.
Learners would comprehend the types & secretions of endocrine glands and their functions.
Learners will develop the conceptual clarity of the structure, types and functions of human skeleton.
Learners will become acquainted with the processes involved in embryonic development, comparative embryology and its application.

Unit 1: Integumentary system and derivatives (15 lectures)

1.1. Basic structure of integument: Epidermis and dermis; classification of keratinized and non-keratinized derivatives
1.2. Epidermal derivatives of Vertebrates: Hair, hoof, horn, claw, teeth, beak, epidermal scales (large scales, small scales, modified scales - spine), glands - types and functions (mucous, serous, ceruminous, poison, uropygial, salt), feathers
1.3. Dermal derivatives of vertebrates: Scales in fish; scutes in reptiles and birds; dermal scales in mammals - Armadillo, Antler – Caribou

1.4.Special derivatives of integument (Epidermal): Wart in toad; rattle in snake; horny beak in turtle, birds, monotremes; spur in male birds - jacana, fowl; whale bone - baleen whale; liliac callosities – African mandrill; kneepads – camel

Unit 2: Endocrine glands and regulation (15 lectures)

2.1.General organization of mammalian endocrine system

2.2.Hormones: Classification, properties, mechanism of hormone action, hormone secretion and transport

2.3.Histology, functions, regulation and disorders of the following endocrine glands: Pituitary, Thyroid, Parathyroid, Pancreas, Adrenal, Testis and Ovaries

Unit 3: Human Osteology (15 lectures)

3.1.Introduction: Cartilage and Bone

3.1.1. Chemical composition, Structure and Function of Cartilage.

3.1.2. Chemical composition, Structure and Functions of Bone.

3.2.Axial skeleton

3.3.Skull: general characteristics of skull bones 1) cranial bones 2) facial bones

3.4.Vertebral column: General characteristics of a vertebra, structure of different types of vertebrae (cervical, thoracic, lumbar, sacrum & coccyx)

3.5.Ribs & sternum (Thorax): General skeleton of ribs & sternum

3.6.Hyoid bone: General structure

3.7.Appendicular skeleton

3.8.Pectoral girdle and Pelvic girdle

3.9.Forelimbs and Hindlimbs

3.10.Sexual dimorphism of human skeleton

3.11.Sternum

3.12.Sacrum

3.13.Pelvis

Unit 4: Embryology (15 lectures)

4.1. Introduction to experimental embryology

Germplasm theory, Mosaic theory, Regulative theory, Gradient theory, Spemann's theory of organizers.

4.2. Basic concept and principles of experimental embryology - brief idea of morphogenesis and organogenesis, fate maps, cell adhesion, cell affinity and differentiation.

4.3. Development of Chick

Structure of chick embryo - 24 hours, 36 hours, 48 hours, 72 hours

4.4. Signaling pathways and intercellular communication during development: Induction and competence, epithelial-mesenchymal interaction

4.5. Recent trends in developmental biology

Methods to determine the role of genes during development (transgenic and chimeric mouse, "knockout" experiments), Genes contributing to developmental defects (oncogenes), multipotent and pluripotent stem cells and their niche

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T. Y. B. Sc. Zoology
Semester V (Practical)
Practicals based on Paper I (RUSZOO501)

1. Taxonomy of Protozoa to Hemichordata

A) Phylum Protozoa:

Class Rhizopoda, e.g *Entamoeba histolytica* amoeboid locomotion, asexual reproduction – binary fission

Class Ciliophora, e.g. Vorticella - ciliary locomotion, sexual reproduction – conjugation

Class Flagellata, e.g. Noctiluca - flagellar locomotion

Class Sporozoa, e.g. Monocystis - gliding locomotion

B) Phylum Porifera:

Class Calcarea - Canal system, e.g. Scypha - Sycon type Clalhrina - Ascon type

Class Demospongia - Canal system,
e.g. Spongilla larva- Rhagon type, Oscarella - Leuconoid type

Class Hexactinellida - Observation of sponge spicules (permanent slide/photograph), e.g. Hyalonemma

C) Phylum Cnidaria:

Class Hydrozoa, e.g. Vellela

Class Scyphozoa, e.g. Rhizostoma

Class Anthozoa, e.g. Corallium (Redcoral)

D) Phylum Platyhelminthes:

Class Turbellaria, e.g. Bipalium

Class Trematoda, e.g. Polystoma

Class Cestoda, e.g.Echinococcus

E) Phylum Nemathelminthes, e.g. Trichinella

F) Phylum Annelida:

Class Polychaeta, e.g. Arenicola

Class Oligochaeta, e.g. Tubifex

Class Hirudinea, e.g. Pontobdella

G) Phylum Arthropoda:

Class Merostomata, e.g. Carcinoscopius

Class Arachnida, e.g. Scorpion

Class Crustacea, e.g. Balanus

Class Myriapoda Chilopoda, e.g. Geophilus

Class Insecta, e.g. Coccinella (Ladybird beetle)

Class Onychophora, e.g. Peripatus

a) Observation and identification of planktonic crustaceans
b) Types of Metamorphosis in insects

H) Phylum Mollusca:

Class Aplacophora, e.g. Chaetoderma
Class Polyplacophora, e.g. Tonicella
Class Monoplacophora, e.g. Neopilina
Class Gastropoda, e.g. Achatina
Class Pelycypoda, e.g. Donax/ Unio
Class Scaphopoda, e.g. Cadulus
Class Cephalopoda, e.g. Octopus

I) Phylum Echinodermata:

Class Asteroidea, e.g. Asteropecten
Class Ophiuroidea, e.g. Ophiura
Class Echinoidea, e.g. Clypeaster
Class Holothuroidea, e.g. Cucumaria/Thyone
Class Crinoidea, e.g. Crinoid (Sea lily)

J) Phylum Hemichordata (Acorn worms):

Class Enteropneusta, e.g. Saccoglossus
Class Pterobranchia, e.g. Rhabdopleura
Class Planctosphaeroidea, e.g. Planctosphaera

K) Hydra

a) Preparation of culture media of Hydra culture.
b) Estimation of growth rate of Hydra depending on use of different culture media.
c) Study of regeneration in Hydra.

L) To study Digestive system, Excretory system, Reproductive system, Nervous system of **1) Cockroach, 2) Sepia** and 3) **Starfish** using charts/Model/video.

M) Note: Visit to local fish market to study available invertebrates.

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

Practicals based on Paper II (RUSZOO502)

1. Enumeration of erythrocytes - Total count
2. Erythrocyte Sedimentation Rate by suitable method – Westergren or Wintrobe method
3. Estimation of haemoglobin by Sahli's acid haematin method
4. Enumeration of leucocytes –Total Count
5. Differential count of WBC
6. Determination of Serum LDH
7. Estimation of total plasma proteins by Folin's method
8. Estimation of serum/ plasma total triglycerides by Phosphovanillin method
9. Latex agglutination test - Rheumatoid Arthritis
10. To demonstrate Immunodiffusion method by Ouchterlony technique/Radial immune diffusion.

T. Y. B. Sc. Zoology

Semester V (Practical)

Practical based on Paper III (RUSZOO503)

1. Isolation & Estimation of RNA by Orcinol method (formula method and standard graph)
2. Isolation & Estimation of DNA by Diphenylamine method (formula method and standard graph)
3. Separation of proteins by SDS-PAGE from the given sample (plasma proteins)
4. Colorimetric estimation of proteins from given sample by Bradford's method
5. Karyotype (Idiogram) analysis for the following syndromes with comments on numerical & structural variations in chromosomes (no cutting of chromosomes):
    a. Turner's syndrome
    b. Klinefelter's syndrome
    c. Down's syndrome
    d. Cri-du-chat syndrome
    e. D-G translocation
    f. Edward's syndrome
    g. Patau's syndrome
6. Problems in genetics based on abnormalities in chromosomes:
    a. Total number of chromosomes present = 46, male.Reciprocal translocation between chromosomes 2 and 5. Breakage and reunion has occurred between long arm of 2nd chromosome, band 21 and long arm of 5th chromosome, band 31
    b. Interpret the following formula: 46, XY, t (2;5) (q21; q31)
    c. Duplication:46, XX, dup (1) (q22qq25)
    d. Total number of chromosomes = 46, female. Duplication on chromosome number 1, long arm between band 1q22 and 1q25
    e. Turner's Syndrome: 45, X
    f. Klinefelter's Syndrome: 47, XXY
7. Stained preparation of Onion root tip and calculation of Mitotic index
8. Identification of contrasting traits in drosophila using photographs
9. Sterilization technique (Workplace, Glassware, Chemicals, Biological fluids or samples)
10. Use of autoclave for sterilization of equipments for tissue culture, Packaging of glassware
11. Trypsinization and vital staining using Trypan blue stain
12. Tissue culture media preparation, aseptic transfer & inoculation of culture

13. Streaking of butt, slant and plate (continuous and discontinuous methods) with E.coli (Demonstration only)

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

Practicals based on Paper IV ((RUSZOO504)

1.) To study T.S. of integument: amphibian, reptilian, avian, mammalian
2.) To study horns, antlers
3.) To study different types of scales: dermal, epidermal
4.) To study epidermal glands: mucous, sebaceous, sweat, poison, uropygial
5.) To study special integumentary derivatives
6.) To study the histology of glands: T.S. of pitutary, thyroid, pancreas, adrenal, ovary, testis
7.) To study human skeleton: A) Study of axial skeleton
Skull bone
Ossicles of middle ear
Hyoid bone
Rib cage
Sternum
B) Vertebral column
a) Cervical vertebrae
Typical cervical vertebrae (3-6)
Atlas or 1st cervical vertebra
Axis or 2nd cervical vertebra
7th cervical vertebra
b) Thoracic vertebrae (8-19)
c) Typical lumbar vertebra (20-24)
d) Sacral vertebrae and coccyx (synsacrum)
Sacrum (25-29)
Coccyx (30-33)
8.) Observation of developing chick embryo -18 hours, 24 hours, 36 hours, 48 hours, 72 hours
9.) To prepare temporary mounting of chick embryo up to 72 hours
10.)To study the effect of temperature in the development of chick embryo upto 48 hours/ 72 hours

T. Y. B.Sc. Zoology
Semester based Credit and Grading System
Semester VI

Theory				
Paper Code	**Unit**	**Topic**	**Credits**	**Lectures/week**
Paper I RUSZOO601	I	Type study: Shark		1
	II	Type study: Frog		1
	III	Type Study : Pigeon		1
	IV	Type Study : Rat	2.5	1
Paper Il RUSZOO602	I	Enzymology		1
	II	Homeostasis (Temperature and Ionic regulation)		1
	III	Histology		1
	IV	General Pathology	2.5	1
Paper Ill RUSZOO603	I	Zoogeography		1
	II	Toxicology		1
	III	Biostatistics		1
	IV	Bioinformatics	2.5	1
Paper IV RUSZOO604	I	Environment management		1
	II	Wildlife management		1
	III	Bioethics, Bioprospecting and Zoopharmacognosy		1
	IV	General Entomology	2.5	1
			10	16
		Practical		
Practical **RUSZOOP601** and **RUSZOOP602**		Practicals of Course **Paper I RUSZOO601**and **Paper Il RUSZOO602**	3	08
Practical **RUSZOOP603** and **RUSZOOP604**		Practicals of Course **Paper llI RUSZOO603 and Paper IV RUSZOO604**	3	08
			6	16
Total			**16**	**32**

T. Y. B. Sc. Zoology
Semester V (Theory)
Paper I
Paper Code: RUSZOO601
Animal Type Study: Chordates

Learning objectives: To study vertebrate animal types- shark, frog, pigeon and rat. To understand Anatomy and Physiology of vertebrates body system.

Learning outcome:

To enhance the knowledge about the habitat and economic importance of the Vertebrates. Learning of External morphology and physiology of systems of vertebrate animal will make easy to understand these animals when used in research.

UNIT 1: TYPE STUDY OF SCOLIODON (15 lectures)

1.1. Systematic position, Habit and habitat

1.2. External characters

1.3. Exoskeleton and Endoskeleton

1.4. Digestive system- food and feeding Physiology of digestion

1.5. Respiratory system, Mechanism of respiration

1.6. Circulatory system and its mechanism

1.7. Nervous system and sense organs

1.8. Male and Female Urinogenital System

1.9. Economic importance

UNIT 2: TYPE STUDY OF FROG (15 lectures)

2.1. Systematic position, Habit and habitat

2.2. External characters and sexual dimorphism

2.3. Endoskeleton

2.4. Digestive system, food and feeding, physiology of digestion

2.5. Respiratory system- Mechanism of respiration

2.6. Circulatory system and its mechanism.

2.7. Nervous system and Sense organs

2.8. Male and Female Urinogenital system

UNIT 3: TYPE STUDY OF PIGEON (15 lectures)

3.1. Systematic position, Habit and habitat

3.2. External characters
3.3. Exoskeleton and Endoskeleton
3.4. Muscular system
3.5. Digestive system, food, feeding and physiology of digestion
3.6. Respiratory system and its mechanism
3.7. Circulatory system and its mechanism
3.8. Nervous system and Sense organs
3.9. Male and Female Urinogenital system

UNIT 4: TYPE STUDY OF RAT (15 lectures)

4.1. Systematic position, Habit and habitat
4.2. External characters
4.3. Epidermal Derivatives
4.4. Digestive system, food, feeding and physiology of digestion
4.5. Nervous system and Sense organs
4.6. Respiratory system and its mechanism
4.7. Circulatory system and its mechanism
4.8. Excretory system and its mechanism
4.9. Male and Female Reproductive systems

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T. Y. B. Sc.Zoology
Semester VI (Theory)
Paper : II
Paper Code: RUSZOO602
Enzymology, Homeostasis, Histology and General Pathology

Learning objectives: To introduce the learners to the basic concepts of enzyme kinetics, homeostasis, thermoregulation, osmoregulation. To familiarize the learners with the cellular architecture of the various organs in the body and basics of general pathology.

Learning outcome: Learners will know variations in enzyme activity and kinetics and the therapeutic and clinical application of enzymes. Learners will comprehend the adaptive responses of animals to temperature and ionic changes. Learners would appreciate the organization of tissues and cells in the organ systems. Learners will be familiar with various medical terminologies pertaining to pathological condition of the body caused due to disease.

Unit 1: Enzymology (15 lectures)

1.1: Definition, nomenclature and classification (based on Enzyme Commission) of enzymes, cofactors and coenzymes, the concept and properties of active site, Enzyme Specificity, Mechanism of enzyme action.

1.2: Factors affecting enzyme activity- pH, temperature and substrate concentration; concept of activation energy.

1.3: Enzyme kinetics, Concept of steady state, Derivation of Michaelis-Menton equation and Lineweaver-Burk plot, concept and significance of k_m, V_{max} and k_{cat},

1.4: Enzyme inhibitors- competitive , non-competitive uncompetitive inhibitors and their kinetics; therapeutic applications of enzyme inhibitors

1.5: Regulation of enzyme activity: allosteric regulation and regulation by covalent modification of enzymes; Zymogen (pepsinogen); Isozymes (LDH)

1.6: Clinical significance and industrial applications of enzymes

Unit 2: Homeostasis,Temperature and Ionic regulation (15 lectures)

2.1: Homeostasis - External and internal environment; Acclimation and acclimatization; Control systems in biology: Feedback mechanism- negative feedback and positive feedback with suitable examples

2.2: Thermoregulation -Cold blooded, warm blooded, poikilotherms, homeotherms, ectotherms, endotherms,**,** relation between temperature and biological activities,

temperature balance; heat production- shivering and non shivering thermogenesis; brown fat – special thermogenic tissue in mammals,mechanisms of heat loss; adaptive response to temperature- daily torpor, hibernation, aestivation

2.3: Osmotic and Ionic regulation - osmoregulator, osmoconfomers, ionoregulators and iono confermers **,** Maintaining water and electrolyte balance; ionic regulation in iso-osmotic environment; living in hypo-osmotic and hyper-osmotic environment; problems of living in terrestrial environment: wate rabsorption, saltwater ingestion and salt excretion, salt glands, role of kidney in ionic regulation,metabolic water

Unit 3: Histology **(15 lectures)**

3.1: Vertical section of skin -Layers and cells of epidermis; papillary and reticular layers of dermis; sweat glands, sebaceous glands and skin receptors

3.2: Digestive System

3.2.1: Vertical Section of tooth – hard tissue – dentine and enamel; soft tissue – Dentinal pulp and periodontal ligaments
Transverse section of tongue – mucosal papillae and taste buds

3.2.3: Alimentary Canal – basic histological organization with reference to transverse section of oesophagus, stomach, duodenum, ileum and rectum of mammal

3.2.4: Glands associated with digestive system- histology with reference to transverse section of salivary glands,liver, pancreas

3.3: Respiratory organs –transverse section(T.S.)of trachea and lung

3.4. Excretory system- L.S. of Kidney

Unit 4: General pathology **(15 lectures)**

4.1: Infectious diseases: aetiology and its types. Cell injury – causes and types

4.2 Retrogressivec changes : Definition, cloudy swelling, degeneration: fatty, mucoid and amyloid (gross and microscopic changes)

4.2: Necrosis: Definition and causes; nuclear and cytoplasmic changes; Types: Coagulative, Liquefactive, Caseous, Fatand Fibroid. (gross and microscopic changes)

4.3: Gangrene: Definition and types-dry, moist and gas gangrene(gross and microscopic changes)

4.4: Disorders of pigmentation : Endogenous: Brief ideas about normal process of pigmentation, melanosis, Inhaled , ingested and injected pigments

4.5: Circulatory disturbances : Causes and effects of Hyperaemia, Ischaemia, Thrombosis, Embolism,Oedema and Infarction

4.6: Inflammation : Definition and causes, cardinals of inflammation; acute and chronic inflammation

4.7: Applied pathology and its application: Anatomical, clinical and molecular; investigating methods: biopsy and surgery (for pathological examination of tissue), autopsy, post mortem changes - Algor mortis - body cooling, Rigor mortis - stiffening of limbs, state of decomposition- autolysis (process of self-digestion) and putrefaction.

4.8: Tumor Pathology- Benin and Malignant

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Enzymology

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Histology

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General pathology

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- Essentials ofGeneral Pathology - Dr.Sudha Shivraj, Dr. Satish Kumar Amarnath, Dr. Sheela Devi; Exclusively distributedby CBS Publishers &Distributors
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AdditionalReading:

Prescott'sMicrobiology; Ninth Edition;JoanneM. Willey,Linda M. Sherwood & ChristopherJ. Woolverton; McGraw-Hill Education; 2014

T. Y. B. Sc. Zoology - Semester VI (Theory) - RUSZOO603

Learning objectives:

To introduce learners to the branch of science dealing with the geographic distribution of animals. Introduce the learners to principles of toxicology with particular emphasis on toxicresponses and toxicity testing. To make learners familiar with biostatistics as an important tool of analysis and its applications and to bioinformatics – a computational approach to learning the structure and organization of genomes, phylogeny.

Learning outcome:

The learners will become acquainted with how and why different animal species are distributed around the globe. The course will prepare learners to develop broad understanding of the various areas and significance of toxicology. The learners will be able to collect, organize and analyze data using parametric and non-parametric.

Unit 1: Zoogeography (15 lectures)

1.1 Introduction

1.1.1 Origins of Ocean and continents.

1.1.2 Plate Tectonics and continental drift.

1.2 Distribution of animals in space and time

1.2.1 In-Space –Horizontal and superficial

1.2.2 In Time geological or durational

1.2.3 Patterns of animal distribution –Continuous, discontinuous , isolation and bipolarity

1.2.4 Theories of animal distribution.

1.3 Barriers of distribution animals –

1.4.1 Topographic,,climate, vegetative, large water masses, land mass, lack of salinity,andspecialcharacteristics habits like homing, instincts etc.

1.4.2 Means of dispersal – land bridges,natural rafts and drift wood , favouring gales, migration by host , accidential transportation and by human agencies.

1.4 Zoogeographical realms

1.4.1 Palearctic
1.4.2 Ethopian
1.4.3 Oriental
1.4.4 Nearctic Australian
1.4.5 Neotropical and Antarctic.

Unit 2: Bacis Toxicology (15lectures)

2.1 Introduction of Toxicology- Brief history,different areas of toxicology ,Principles and scopes of Toxicology

2.2 Toxins and Toxicants

2.2.1 Phytotoxins (caffeine, nicotine)
2.2.2 Mycotoxins (aflatoxins)
2.2.3 Zootoxins
2.2.4 Cnidarian toxin
2.2.5 Bee venom
2.2.6 Scorpion venom
2.2.7 Snake venom

2.3 Characteristics of Exposure - Duration of exposure, Frequency of exposure, Site of exposure and Routes of exposure

2.4 Types of toxicity – Acute toxicity, subacute toxicity, subchronic toxicity, chronic toxicity, immediate toxicity, delayed toxicity, reversible toxicity, irreversible toxicity, local toxicity, systemic toxicity

2.5 Concept of LD50, LC50, ED50

2.6 Dose Response relationship

2.6.1 Individual/ Graded dose response
2.6.2 Quantal dose response
2.6.3 Shape of dose response curves
2.6.4 Therapeutic index

2.6.5 Margin of safe Dose translation from animals to human – Concept of extrapolation of dose

2.6.6 NOAEL (No Observed Adverse Effect Level), Safety factor, ADI (Acceptable Daily Intake)

2.7 Regulatory toxicology

2.7.1 OECD guidelines for testing of chemicals (an overview)

2.7.2 CPCSEA guidelines for animal testing centre

2.7.3 Ethical issues in animal studies

2.7.4 Animal models used in regulatory toxicology studies

2.7.5 Alternative methods in toxicology (*in vitro* test)

Unit 3: Biostatistics (15 Lectures)

3.1 Probability Distributions - Normal, Binomial, Poisson distribution, Z-transformation, p-value, Probability - Addition and multiplication rules and their application

3.2 Measures of Central Tendency and Dispersion - Variance, standard deviation, standard error

3.3 Parametric and non-parametric tests - Parametric tests: two-tailed Z-test and t-test, Non-parametric test: Chi-square test and its applications

3.4 Regression and Correlation - Simple linear regression: main features, applications**,** Correlation coefficient and its significance

3.5 Testing of Hypothesis: Basic concepts, types of hypothesis: Null hypothesis and Alternate hypothesis Levels of significance and testing of hypothesis

Unit 4: Bioinformatics (15 lectures)

4.1 Introduction to Bioinformatics and Bioinformatics web resource (NCBI, EBI,ExPASy, OMIM, PubMed, OMIA)

4.2 Applications of Bioinformatics

4.3 Databases – Tools and their uses

4.4 Biological databases: Primary sequence databases:Nucleic acid sequence databases (GenBank, EMBL-EBI, DDBJ)Protein sequence data bases (UniProtKB, PIR, PDB)

4.5 Secondary sequence databases:Derived databases - PROSITE, BLOCKS, Pfam/ Prodom, Structure databases and bibliographic databases.

4.6 Sequence alignment methods

4.6.1 BLAST, FASTA
4.6.2 Significance of sequence alignment
4.6.3 Pairwise sequence alignment (Needleman &Wunsch, Smith & Watermanmethods)
4.6.4 Multiple sequence alignment (PRAS, CLUSTALW)

4.7 Predictive applications using DNA and protein sequences

4.7.1. Evolutonary studies: Concept of phylogenetic trees, Parsimony and Bayesian approaches, synonymous and non-synonymous substitutions, convergent and parallel evolution
4.7.1 Pharmacogenomics: Discovering a drug: Target identification
4.7.2 Protein Chips and Functional Proteomics: Different types of protein chip, detecting and quantifying; applications of Proteomics
4.7.3 Metabolomics: Concept and applications

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T. Y. B. Sc. Zoology
Semester VI (Theory)

Paper IV
Paper Code: RUSZOO604

Learning objectives:
To introduce the learners to understand the importance of factors governing environment and its management. To create awareness among the learners about the importance of wildlife conservation. To introduce the learners the concept of ethics and prospecting in biology and importance of pharmacognosy. To make the learners aware about the importance of insects and their application in different fields of Agriculture.

Learning outcome:
Learners will be able to understand the different factors affecting environment, its impact and laws governing environmental management. Learners will be able to undertake the wildlife habitat projects for animal protection and create awareness about Wildlife Conservation. Learners would enhance the knowledge about the paradigms of discovery and commercialization of biological resources and knowledge gained by self-medication by animals.
Learners will be able to correlate the role of useful and harmful insects in human life and gain knowledge about its applications in diverse fields.

Unit 1: Environment management (15 lectures)

1.1. **Natural resources, their classification, modification and exploitation**: Forest resources, water resources (surface and ground), mineral resources, food resources, energy resources: Renewable and non-renewable resources, Impact on climate, flora, fauna & mineral resources.
1.2. Sustainable development: Ex-situ conservation (zoos, botanical gardens, cryogenics, seedbank, germplasm,gene bank), in-situ conservation (Bio-reserves, Sanctuaries & National parks)
1.3. Waste Management: 3 Rs (Reduce, Reuse & Recycle) of solid waste, e-waste, hazardous waste
1.4. Water management: Rain water harvesting, watershed management, effluent treatment, recycling plants, control and treatment of water
1.5. Laws governing environment
(Environment Protection Act), Air (Prevention and Control of Pollution) Rules - 1982, Water (Prevention and Control of Pollution) Rules - 1978, Hazardous Wastes (Management and Handling) Rules - 1989. EIA (Environmental Impact Assessment), ISO18001
1.6. Role of government, NGOs, International treaties and conventions in environmental protection & conservation

Unit 2: Wildlife Management (15 lectures)

2.1.'Forest Ecosystem' – Function and components of Forest ecosystem: Habit, habitat and niche of animals, (Herbivores, Carnivores, and Decomposers)

2.2.Threats to wildlife- Diseases (zoonosis and reverse zoonosis), hunting, poaching, Habitat loss (encroachment and deforestation), tourism, overgrazing, human animal conflict and climate change.

2.3.Techniques and methods of wildlife conservation Wildlife Census, conservation of wildlife - frozen zoo, schedules, rules, national and international conservation bodies; IUCN UNDP, FAO, ESA, INCPEN, CITES, CEEDS,WWF.

Unit 3: Bioethics, Bioprospecting and Zoopharmacognosy (15 lectures)

3.1.Bioethics

3.1.1. Intellectual property rights and patenting

3.1.2. Forms of protection, patents, copyrights, trade secrets, trademarks, patenting biological materials, live forms, genes and DNA sequences

3.2.Bioprospecting

- 3.2.1. Traditional, modern bioprospecting
- 3.2.2. Chemical prospecting
- 3.2.3. Genetic prospecting
- 3.2.4. Bionic prospecting
- 3.2.5. Economic value and benefit sharing
- 3.2.6. Bioprospecting and conservation, pros and cons of bioprospecting

3.3.Zoopharmacognosy

- 3.3.1. Definition, history and types
- 3.3.2. Self-medication and its mechanism
- 3.3.3. Methods of self-medication through - Ingestion – ants and mammals, Geophagy – invertebrates and birds
- 3.3.4. Absorption and adsorption
- 3.3.5. Topical application – birds and mammals
- 3.3.6. Applications of zoopharmacognosy - Social and trans generational zoopharmacognosy, Value to humans.

3.4. Applied Animal Ethology: Companion animals, Therapy dogs, Farm animals, Exotic animals, Animal training, Field of applied animal psychology, ISAE (International society for applied Ethology)

Unit 4: General Entomology (15 lectures)

4.1.Introduction, Importance & Scope of Entomology, Branches of Entomology:Definition, distinguishing features of insects, harmful and useful insects**,** Agricultural, Medical, Forest, Forensic & Industrial

4.2.General body structure of insects:

a) Head - Mouth parts: cutting, chewing, lapping, sucking, sponging.

b) Thorax – Structure and modification of wings, Modification of legs and wings in insects - e.g. honey bee, cockroach, beetle

c) Abdomen

4.3.Metamorphosis in insects-Definition, types, hormones

4.3.1. Insect Communication: Definitions, types, significance

4.3.2. Insect pheromones

4.3.3. Bioluminescence

4.3.4. Sound production

4.4. Significance of insects as biological tool

Biological weapon; tissue culture; gene study; Productive insects - honey bee, silk worm, lac insect; insect products; insects pests (general): bollworm, rice weevil, *tribolium sps*, flour moth, locust

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Environment management

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Wildlife Management

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Bioethics, Bioprospecting and Zoopharmacognosy

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- Pharmacognosy and Pharmaco biotechnology; Ashutosh Kar
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T. Y. B. Sc. Zoology
Semester VI (Practical)
Paper I Based on RUSZOO601

Taxonomical Studies

A.) Minor Phyla

Phylum Acanthocephala (Spiny headed worms), e.g. Echinorhyncus

Phylum Chaetognatha (Arrow worms), e.g. Sagitta

B.) Taxonomy of phylum Chordata

i) Subphylum Urochordata (Sea squirts)

Class Larvaceae, e.g. Oikopleura

Class Ascidiacea, e.g. Ciona and Herdmania

Class Thaliacea, e.g. Salpa/ Doliolum

ii) Subphylum Cephalochordata:

Class Leptocardii, e.g. Branchiostoma (Amphioxus) Epigonichthyes

iii) Subphylum Vertebrata:

Class Ostracodermi, e.g. Pharyngolepis

Class Cyclostomata, e.g. Myxine

C.) Group Gnathostomata

i) Superclass - Pisces:

Class Placodermi (Armoured fishes), e.g. Bothriolepis

Class Elasmobranchi (Chondrichthyes), e.g. Rhinobatos

Class Holocephali (Chimaera), e.g. Rabbit fish / Rat fish

Class Osteichthyes (Lung fishes), e.g. Protopterus (African lungfish)

Class Teleostomi, e.g. Latimera (Coelacanth), Catfish

ii) Superclass - Tetrapoda :

I) Class Amphibia

a.Order Apoda, e.g. Siphonops

b.Order Anura, e.g. Bufo

c.Order Urodela, e.g. Triton (Semi-aquatic salamander)

II) Class Reptilia:

a.Order Synapsida, e.g. Dimetrodon

b.Order Parapsida, e.g. Chasmosaurus (Dinosaur)

c.Order Testudines, e.g. Geochelone (Indian star tortoise) Chelonia

d.Order Diapsida, e.g. Mabuya (Skink)

III) Class Aves:

a.Subclass Archaeornithes, e.g. Archaeopteryx

b.Subclass Neornithes

- .Superorder Paleognathae (Flightless birds), e.g. Emu, Penguin
- Superorder Neognathae (Flying birds), e.g. Flamingo, Vulture

IV) Class Mammalia:

a.Subclass Prototheria (Egg laying mammals), e.g. Duck-billed platypus

b.Subclass Theria

o Infraclass- Metatheria (Marsupials/ Pouched mammals), e.g. *Dasyurus* (Tiger cat)

o.Infraclass – Eutheria (Placental mammals), e.g. Gangetic Dolphin, Gorilla

V) Study of endoskeleton of shark:

Axial (skull and vertebral column)

Appendicular (pelvic and pectoral fins, pelvic and pectoral girdle)

VI) To study Digestive system, reproductive, excretory, Nervous system of Shark, Frog, Pigeon and Rat using Models/charts/ videos.

Note: Visit to National Parks .

T. Y. B. Sc. Zoology
Semester VI (Practical)
Paper II Based on RUSZOO602

1 Effect of 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 Study of separation of LDH isozymes by agarose gel electrophoresis
6 To study the effect of enzymes in detergent.
7 Study of mammalian tissues:
    V. S. of Skin
    V.S. of Tooth
    T.S. of Stomach
    T.S. of Ileum
    T.S. of Liver
    T.S. of Pancreas
    T.S. of Lung
8. Identification of following diseases or conditions (from slides or pictures) – Melesma, Vitiligo, Psoriasis, Bed sores, Necrosis, Oedema, Malaria, Filariasis, Leishmaniasis

9..Widal's Test

10. Study and interpretation of pathological reports: Blood, Urine and Stool (feces).

T. Y. B. Sc. Zoology
Semester VI (Practical)
Paper III Based on RUSZOO603

1. To calculate LC-50 value
2. To study the effect of paracetamol on the level of enzyme activity in liver on aspartate and alanine amino transferase (in vitro approach)
3. Following biostatistics practicals will be done using data analysis tool of Microsoft Excel:
    a) From the given data derive mean, standard deviation
    b) Correlation, regression analysis using given data
    c) Problems based on Z test
    d) Problems based on t test
    e) Problems based on Chi square test
    f) Problems based on ANOVA
4. Exploring the integrated database system at NCBI server and querying(Querying a nucleotide sequence, querying a protein sequence, use of operators (AND, OR & NOT)
5. Exploring tools on ExPASy(Querying a nucleotide sequence, querying a protein sequence, use of operators (AND, OR & NOT)
6. Exploring BLAST tool (nucleotide sequence comparison)
7. Exploring Uniprot tool (protein sequence comparison)
8. Exploring bibliographic database PubMed (Data mining - Downloading a research paper on subject of interest, use of operators (AND, OR & NOT)
9. Indicate the distribution of genus/species/subspecies in the given world map w.r.t. to its realm and comment on the pattern of distribution
10. Indicate the realms and the fauna found in that realm on the given world map, justify

T. Y. B. Sc. Zoology
Semester VI (Practical)
Paper IV Based on RUSZOO604

1.) To estimate phosphate phosphorus from sample water
2.) To estimate COD, BOD from sample water
3.) To estimate Nitrite Nitrogen and Nitrate Nitrogen from sample water
4.) To study the intensity of sound by Decibel meter
5.) To study acidity and alkalinity of sample water by methyl orange and phenolphthalein
6.) To observe the animals in the chart and place them in endangered, vulnerable category
7.) To study different types of mouth parts: cutting, chewing, lapping, piercing and sucking, sponging
8.) Mounting of thoracic appendages-legs and wings (housefly, mosquito, cockroach)
9.) To study metamorphosis in insects: ametabolic - lepisma, hemimetabolic - cicada, holometabolic - butterfly, mosquito
10.) To study mechanism of bioluminescence in insects.
11.) Insect pests and control: rice weevil, flour moth, aphids, tribolium
12.) Report-Wildlife

RAMNARAIN RUIA AUTONOMUS COLLEGE
DEPARTMENT OF ZOOLOGY
MODALITY OF ASSESSMENT
T.Y.B.Sc.

A] Internal assessment - 40%

Sr. no.	Evaluation type	Marks
1.	One class test (Objective and Descriptive)	20
2.	Two Assignments/ Case study/ Group Discussion	20

CLASS TEST Duration-30min 20M

Q1.A) Fill in the blanks 05M

Q1.B) Match the Columns 05M

Q.2. Write short notes on (Any two) 10M

a)
b)
c)
d)

Paper Code	Title of the Assignment	Marking Break up
Paper I RUSZOO501	Model – Animal Systems	Selection of topic-01 Innovation-09 Details-10
Paper Il RUSZOO502	Model on Hematology/ Immunology topics	Selection of topic-01 Innovation-09 Details-10
Paper Ill RUSZOO503	Assignments- related to **RUSZOO503 any two topics**	Content -10 Presentation -05 Bibliography-05
Paper IV RUSZOO504	Permanent mounting of Two Embryology Slides (Any stages) along with report submission	Processing-10 Mounting -05 Report submission-05
RUSACMS501	Visit to Fishermen Village/Fish farm and Report submission	Visit -10 Report submission-10

B] External examination - 60%
Semester End Theory Assessment - 60 Marks

(Duration – These examinations shall be of **two hours** duration for each paper.)

Theory Question Paper Pattern –

- There shall be three questions each of 20 marks.
- On each unit there will be one question.
- All questions shall be compulsory with internal choice within the questions.
- Question may be subdivided into sub-questions a, b, c…

T.Y.B.Sc. Skeleton Question Paper Pattern
Three Units- Each Unit 12 Marks [Total marks = 60]

Q.1.	**Unit I** Answer **Any THREE** of the following: a) b) c) d)	1**2** Marks
Q.2.	**Unit II** Answer **Any THREE** of the following: a) b) c) d)	12 Marks
Q.3.	**Unit III** Answer **Any THREE** of the following: a) b) c) d)	12 Marks
Q.4.	**Unit IV** Answer **Any THREE** of the following: a) b) c) d)	12 Marks
Q.5.	**(Based on Each Unit)** **Write Short notes on: (Any THREE)** a) b) c)	12 Marks

	d)	

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