Hindi Vidya Prachar Samiti's

Ramniranjan Jhunjhunwala College

of Arts, Science & Commerce

(Empowered Autonomous College)

Affiliated to

UNIVERSITY OF MUMBAI

SYLLABUS FOR M.Sc-I.

SEMESTER : I & II

PROGRAM : M.SC. ZOOLOGY

PROGRAM CODE : RJSPGZOO

NATIONAL EDUCATION POLICY (NEP 2020)

LEVEL 6.0

(CBCS 2023-2024)

M.Sc. ZOOLOGY SEMESTER I

DISTRIBUTION OF TOPICS AND CREDITS

Courses	Course title	Course code	Credits
Paper- I Systematics, phylogeny of non-chordates and Developmental Biology-I	1. Basics of systematics 2. Phylogeny, systematics of non-chordates-I 3. Phylogeny, systematics of non-chordates-II 4. Developmental Biology-I	RJSPGZOO101	04
Paper-II Biochemistry-I	1. Carbohydrates 2. Carbohydrate metabolism 3. Proteins 4. Protein metabolism	RJSPGZOO102	04
Paper-III Instrumentation	1. Microscopy 2. Spectroscopy 3. Structure Analysis I 4. Structure Analysis II	RJSPGZOO103	04
PRACTICAL	Practicals based on RJSPGZOO101,102 & 103.	RJSPGZOOP101	02
			14

M.Sc. ZOOLOGY SEMESTER II

DISTRIBUTION OF TOPICS AND CREDITS

Courses	Course title	Course code	Credits
Paper- I Systematics, Phylogeny of chordates and Developmental biology -II	1. Systematics 2.Protochordates, Agnatha and Lower Vertebrates 3. Phylogeny, Systematics of Chordates and Assorted topics- II 4. Developmental biology - II	RJSPGZOO201	04
Paper-II Biochemistry-II	1. Enzymes and Enzyme kinetics 2. Lipids. 3. Nucleic acids. 4. Lipid and nucleic acid metabolism	RJSPGZOO202	04
Paper-III Genetics, Cell signalling, toxicology and chromatography	1. Genetic linkage and gene mapping 2. Cell signalling and pathways 3. Advances in Toxicology 4. Principles and application of chromatography	RJSPGZOO203	04
PRACTICAL	Practicals based on RJSPGZOO201, 202 & 203.	RJSPGZOOP201	02
			14

SEMESTER-I (THEORY)		**L**	**Cr**
Paper-I : Systematics, phylogeny of non-chordates and Developmental Biology-I **Paper Code: RJSPGZOO101**		**60 hrs**	**4**
	UNIT I	**15**	
	Basics of Systematics		
1	1.1. Principles of systematics, importance of taxonomic studies in Biology, use of morphometric studies, Osteological studies, use of homologous organs. 1.2. Taxonomic Procedures-collection, preservation, curetting and process of identification. 1.3 Process of typification, different zoological types (holotype, paratype etc) and their significance. 1.4. Taxonomic keys: Different kinds of taxonomic keys, their merits and demerits. 1.5. International code of zoological nomenclature, its operative principles, Implication and application of important rule		
	UNIT II	**15**	
	Phylogeny, Systematics of non-chordates-I		
2	2.1. Phylogeny, salient features, classification up to classes (wherever applicable) of the following phyla- 2.1.1 Porifera 2.1.2 Coelenterata 2.1.3 Platyhelminthes 2.1.4 Aschelminthes		
	UNIT III	**15**	
3	**Phylogeny, Systematics of non-chordates-II**		
	3.1 Phylogeny, salient features, classification (wherever applicable) up to classes of the following phyla- 3.1.1 Annelida 3.1.2 Arthropoda 3.1.3 Mollusca 3.1.4 Echinodermata 3.2 Systematic position and affinities of Hemichordata.		
	Unit IV	**15**	
	Developmental Biology-I		
4	4.1 Basic concepts of development, gametogenesis-Spermatogenesis, Oogenesis 4.2 Fertilization: Process of sperm activation in mammals. 4.3 Sperm-egg interaction, cortical reaction, egg activation and calcium release. 4.4 Electrical events and prevention of polyspermy.		

M.Sc-I	**Semester I Theory**
RJSPGZOO101 **Paper-I** Systematics, phylogeny of non-chordates and Developmental Biology-I	**Course Objectives:** 1. To acquaint learners with the detail of principles of Systematics and taxonomy for animal classification. **2.** To introduce learners with systematic position of non chordates and hierarchy of classification along with their phylogeny . **3.** To give insight to the learners about aspects of developmental biology. **Learning Outcomes:** 1.Learners will get an idea of principles of systematics & animal taxonomy. 2.Learners will be able to understand systematic position of non chordate and hierarchy of classification along with their phylogeny . 3.Learners will be able to understand complexity of developmental biology

	SEMESTER-I (THEORY)	L	Cr
	Paper- II Biochemistry-I **COURSE CODE: RJSPGZOO102**	**60 hrs**	**4**
	UNIT I	**15**	
	Carbohydrates		
1	1.1 Classification: mono-, oligo- and poly-saccharides. 1.2 Monosaccharides- structure, classification, D- and L- isomers, Anomers and mutarotation, open chain and ring forms, pyranose and furanose forms, reactions of monosaccharides, glycosidic bonds and nomenclature. 1.3 Oligosaccharides. 1.4 Polysaccharides- homo- and hetero-polysaccharides. 1.5 Biological role of carbohydrates Case Study: Role of dietary fibres		
	UNIT II	**15**	
	Carbohydrate metabolism		
	2.1. Introduction to Metabolism: Concept; Catabolism; Anabolism, intermediary metabolism, Control of metabolic flux, coupled reactions, Allosteric regulation. 2**.2.Glycolysis**: Reaction sequence, anaerobic glycolysis and energetics of glycolysis. Regulation of glycolysis. **2.3. Gluconeogenesis**: Reaction sequence and regulation. 2**.4. Glycogen metabolism**: Pathway and regulation of Glycogenesis and Glycogenolysis. **2.5.** Hexose monophosphate shunt as a multifunctional pathway.		
	UNIT III	**15**	
	Protein		
3	**3.1** Amino acids: structure, classification based on structure, polarity, nutritional requirement and metabolic fate; properties of amino acids; derivatives of amino acids, non-transcribed amino acids as protein constituents, D-amino acids. 3.2. Conjugate proteins- haemoglobin, cytochromes, myoglobin. 3.3 Bonds involved in protein organization, Ramchandran plot. 3.4. Biologically important peptides: glutathione, octa-, nona-, and deca-peptides. **Case Study: Proteomics, Protein supplements.**		
	Unit IV	**15**	
	Protein metabolism		
4	4.1. Metabolism of amino acids: Amino acid pool, transamination; oxidative and non- oxidative deamination; 4.2 Metabolism of branched chain amino acids; fate of carbon skeleton of amino acids.		

M.Sc-I	Semester I Theory
RJSPGZOO102 **Paper- II** **Biochemistry-I**	**Course Objectives:** 1. To acquaint learners with the details of carbohydrates and Proteins. 2. To introduce the learners to metabolism of carbohydrates. 3. To comprehend the learners to metabolism of proteins. **Learning Outcomes:** 1. Learners will get an idea of the details of carbohydrates and proteins. 2. Learners will be able to understand the metabolism of carbohydrates. 3. Learners will be able to understand the intricate processes involved in metabolism of proteins.

SEMESTER-I (THEORY)		**L**	**Cr**
Paper- III Instrumentation COURSE CODE: RJSPGZOO103		**60 hrs**	**4**
UNIT I		**15**	
Microscopy			
1	Principle, working and applications of Confocal microscopy, fluorescent microscopy, scanning tunnelling microscopy, Scanning probe microscopy, High resolution TEM, atomic force microscopy.		
	UNIT II	**15**	
	Spectroscopy		
2	Introduction, principle and analysis using UV/visible Spectrophotometer, Fourier Transform IR, Raman IR spectroscopy, circular dichroism, ORD, MR and ESR spectroscopy		
	UNIT III	**15**	
	Structure Analysis I		
3	Molecular structure determination using X-ray diffraction, Molecular analysis using Dynamic light scattering.		
	Unit IV	**15**	
	Structure Analysis II		
4	Mass spectrometry and LC-MS, GC-MS, and surface plasmon resonance methods		

M.Sc-I	**Semester I Theory**
RJSPGZOO103 Paper- III Instrumentation	**Course Objectives:** 1. To acquaint learners with working principle and SOP of microscopy and spectroscopy. 2. To introduce the learners to various techniques of structural analysis. **Learning Outcomes:** 1. Learners will get an idea of the details of microscopy and spectroscopy. 2. Learners will be able to understand the various techniques of structural analysis

SEMESTER -I PRACTICALS BASED ON RJSPGZOO101,102 & 103.	**Cr**
CODE: RJSPGZOOP101	**2**
1**. Study of systematic and major features of:** a. Porifera (Leucosolenia, Grantia, Euplectella, Euspongia); b. Coelenterata(Obelia colony,Physalia, Porpita, Sea-anemone, Madrepora, Aurelia); c. Helminthes (Planaria, Liverfluke, Tapeworm, Ascaris, Trichinella); d. Annelida (Nereis, Earthworm, Leech); e. Arthropoda (Lobster, Balanus, Crab, Lepas, Scorpion, Spider, Limulus, Centipede, Millipede, Beetle). f. Mollusca (Chiton,Dentalium,Patella,Aplysia,Achatina,Mytilus,Loligo/ Octopus, Nautilus); g. Echinodermata (Starfish,Brittle star,Sea urchin,Sea cucumber,Feather star); **2. Study of Larval forms:** Larvae of Helminthes- Miracidium, Redia, Cercaria, Metacercaria; Trochophore larva, Crustacean larvae, Echinoderm larvae and Tornaria larva. 3. Determination of glucose by Benedict's method(volumetric). 4.Determination of reducing sugars by 3,5-dinitrosalicylic acid (colorimetric)method. 5. Acid & enzyme hydrolysis of glycogen and colorimetric estimation of the products by 3,5-DNSA method. 6. Quantitative estimation of amino acids using ninhydrin reagent. 7. Detection of conformation of BSA by viscosity measurement and effect of varying concentration of urea on viscosity of BSA.	

M.**Sc I**	**Semester-I Practical**
PRACTICALS BASED ON RJSPGZOO101,102 & 103. **CODE: RJSPGZOOP101**	**Course Objectives:** 1. To familiarize the learner to understand various characteristic features of non chordates. 2. To make the learner understand different types of non-chordate larval forms. 3. To enhance the learner's skill on analysis of different biochemical parameters. 4. To equip the learner with hands-on training of different methods of biochemical analysis. **Learning Outcomes:** 1. The learner will be able to apply the knowledge of taxonomy to identify various animals **2.** The learner can understand larval forms and metamorphosis process during development 3. Learner will understand the analysis of biochemical parameters. 4. Learner will be able to use the different methods and techniques for biochemical analysis

M.Sc - I NEP Zoology General paper Syllabus Semester I & II

	SEMESTER-I (THEORY)	L	Cr
	Research Methodology **COURSE CODE: RJSPGRM**	**60**	**4**
	UNIT I	**15**	
	Research Methodology And Research Problem		
1	1. Meaning of Research; Objectives of Research: Motivation in Research. 2. Types of Research; Research Approaches: Significance of Research. 3. Research Methods versus Methodology: Research Process; Criteria of Good Research; Problems Encountered by Researchers in India. 4. What is a Research Problem? Selecting the Problem: Necessity of Defining the Problem; Technique Involved in Defining a Problem		
	UNIT II	**15**	
	Research Design And Data Collection		
2	1. Meaning of Research Design; Need for Research Design; Features of a Good Design; Important Concepts Relating to Research Design. 2. Different Research Designs; Basic Principles of Experimental Designs; Developing a Research Plan 3. Collection of Primary Data; Observation Method; Interview Method; Collection of Data through Questionnaires; Collection of Data through Schedules; Other Methods of Data Collection 4. Collection of secondary Data, Selection of Appropriate Method for Data Collection, Case Study Method		
	UNIT III	**15**	
	Interpretation and Report writing		
3	1.Meaning of Interpretation, Why Interpretation? 2.Technique of Interpretation, Precautions in Interpretation 3.Significance of Report Writing, Different Steps in Writing Report 4.Layout of the Research Report, Types of Reports, Oral Presentation 5.Mechanics of Writing a Research Report, Precautions for Writing Research Reports.		
	Unit IV	**15**	
	Research Ethics		
4	1.Introduction to Research Ethics and Scientific Conduct; Ethics in Writing Academic Integrity. Research Misconduct/Fabrication/Unethical Practices. Academic/Research: Falsification, Manipulation or Tempering of Data. 2.Literature Review and Proper Use of E-Resources, Scientific Reading. Cite and Write, Style Manuals and Bibliographies 3.Understanding Plagiarism and Types of Plagiarism; Publication Misconduct and Publication; Ethics and Ways to avoid Plagiarism; Regulations on Plagiarism in India. 4. Plagiarism Detection Software; Features and Functionalities of Anti- Plagiarism Software; Plagiarism Policies, Penalties and Consequences		

M.Sc-I	Semester I RM
RJSPGRM Research methodology	**Course Objectives:** 1. To acquaint learners with Methodology and problems related to Research 2. To understand the technique for research design and data collection. 3. To acquire the skill of interpretation and research writing. **Learning Outcomes:** 1. Learners will understand the methodology and steps involved in research. 2. Learners will comprehend the research writing skill and imbibe the research ethics

SEMESTER -II

	SEMESTER-II (THEORY)	L	Cr
	Paper- I Systematics, Phylogeny of Chordates and Developmental biology-II **Paper Code: RJSPGZOO201**	**60**	**4**
	UNIT I	**15**	
	Systematics		
1	1.1. Species concept- species category, different species concepts, subspecies, deme and other intra specific categories, hierarchy of categories 1.2 Trends in systematic: Chemotaxonomy, Cytotaxonomy. 1.3. Molecular systematics: 1.3.1. Recent trends based on proteomics and genomics 1.3.2. DNA barcoding. 1.3.3 Phylogenetic tree		
	UNIT II	**15**	
	Protochordates, Agnatha and Lower Vertebrates-I		
2	2.1. Urochordata and its affinities. 2.2. Cephalochordata and its affinities 2.3. Cyclostomata and its affinities. 2.4 Class Pisces 2.5 Class Amphibia		
	UNIT III	**15**	
	Phylogeny, Systematics of Chordates and Assorted topics- II		
3	Salient features, classification and Phylogeny of; A. Class: Reptilia B. Class: Aves C. Class: Mammalia Case study: Origin of flight (theory of cursorial & arboreal origin). Birds as glorified reptiles. Dentition in mammals. Walking gait (Plantigrade, Digitigrade, and Unguligrade)		
	Unit IV	**15**	
	Developmental biology - II		
4	4.1. Morphogenesis and organogenesis 4.2. Pattern formation in *Drosophila*, amphibian and chick. 4.3. Organogenesis: a. Vulva formation in *Caenorhabditis elegans* b. Eye lens (any suitable example) c. Limb development in chick. 4.4 Metamorphosis in insect and amphibians. 4.5 Regeneration in Hydra, Planaria, and Urodels.		

M.Sc-I	Semester II Theory
RJSPGZOO201 **Systematics, phylogeny of chordates and Developmental biology**	**Learning objectives:** 1. To acquaint learners with the details of principles of taxonomy and modern systematics. 2. To introduce learners with systematic position of chordate phyla and hierarchy of classification along with their phylogeny. 3. To introduce the learners to the details of developmental biology **Course outcome:** 1. Learners will get an idea of principles of taxonomy and modern classification. 2. Learners will be able to understand systematic position of chordate phyla and hierarchy of classification in evolutionary hierarchy. 3. Learners will be able to comprehend the complexity of the process of embryonic development.

		L	Cr
SEMESTER-II (THEORY)			
Paper- II Biochemistry – II **COURSE CODE: RJSPGZOO202**		**60**	**4**
UNIT I		**15**	
Enzymes and Enzyme kinetics			
1	1.1 Enzyme Nomenclature and classification with numerical code. 1.2 Mechanism of enzyme action: Fischer's Lock and Key Theory, Koshland's Induced fit model. 1.3. Enzyme kinetics: Michaelis Menten equation; Lineweaver-Burk plot; significance of Vmax and Km; factors affecting enzyme activity; kinetics of enzyme inhibition. 1.4. Regulatory enzymes: a) covalently modulated, b) allosteric regulation, c) Isoenzymes 1.5. Non-protein enzymes- Ribozymes. Case study: Advanced enzymes in human healthcare (e.g. fungal lactase, Hemicellulase, Trypsin chymotrypsin mix)		
	UNIT II	**15**	
	Lipids		
2	**2.1. Classification**: simple and complex lipids. **2.2. Fatty acids**- Even and odd carbon fatty acids, numbering the carbon atoms, saturated and unsaturated fatty acids, cis- and trans-configuration, nomenclature and short hand representation of fatty acids. **2.3. Acylglycerols**- Mono-, di- and tri-glycerides, stereospecific numbering of glycerols in glycerides, properties of triacylglycerol. **2.4. Complex lipids** A) Phospholipids, Sphingolipids, Sterols and waxes. B) Glycolipids: Gangliosides, C) Lipoproteins: Classification and functions- chylomicrons, VLDL, LDL, HDL, and free fatty acid-albumin complex **2.5**. Biological functions of lipids.		

	UNIT III	**15**	
	Nucleic acids		
3	3.1 Nucleic acids: Types- RNA and DNA. 3.2. Components of nucleotides: Pentose sugar, Nitrogenous bases, Nucleosides, 3.3 Tautomeric forms of purines and pyrimidines. 3.4 Structure of DNA: Watson and Crick model; different forms of DNA double helix. 3.5 RNA: Structure, types and functions.		
	Unit IV	**15**	
	Lipid and nucleic acid metabolism		
4	**4.1**. Dynamics of body lipids, mobilization of fats, regulation of hormone sensitive TG-lipase, fate of glycerol and free fatty acids. **4.2. Fatty acid metabolism**: Oxidation of even-carbon and odd-carbon atom fatty acid, oxidation of unsaturated fatty acids, biosynthesis of fatty acids including desaturation, metabolism of phospholipids, cholesterol and alcohol. Formation and significance of Ketone bodies. **4.3 Metabolism of nucleic acids**: 4.3.1 Synthesis of ribonucleotides- a brief idea of de novo pathway and salvation pathway. 4.3.2 Conversion of ribonucleotides to deoxyribonucleotides. 4.3.3 Degradation of nucleotides.		

M.Sc-I	**Semester II Theory**
RJSPGZOO202 **Biochemistry II**	**Learning objectives:** 1. To introduce the learners to the basics of enzymology and enzyme kinetics 2. To introduce various metabolic pathways which operate at cellular and subcellular level. 3. To acquaint learners with concepts related to lipids & nucleic acids. 4. To introduce the metabolism of lipids and nucleic acids. **Course outcome:** 1. Learners will be able to understand enzyme kinetics in detail 2. Learners will be able to understand the intricate processes involved in metabolism of the body. 3. Learners will be able to comprehend the complexities in structure of lipids and nucleic acids. 4. Learners will understand different pathways of lipid and nucleic acid metabolism.

SEMESTER-II (THEORY)		**L**	**Cr**
Paper- III: Genetics, Cell signalling, Toxicology and Chromatography COURSE CODE: RJSPGZOO203		**60**	**4**
UNIT I		**15**	
Genetics- Extension of Mendelian genetics and non-Mendelian inheritance -I			
1	1.1 Chromosomal theory of linkage, lod score for linkage testing. 1.2. Mapping in prokaryotes and bacterial viruses 1.3. Gene mapping in eukaryotes (three point cross) 1.4. Genetic mapping in humans- A) Physical chromosome mapping: deletion mapping, somatic cell hybridization mapping, mapping by in situ hybridization; correspondence of genetic and physical maps. B) Practical application of chromosome mapping- tracking the inheritance of an allele with coupled DNA markers. 1.5. Microbial genetics: Transformation, conjugation, Transduction. Case study: Complementation analysis, Penetrance and expressivity		
	Unit II	**15**	
	Cell signalling and pathways		
2	**2.1 Cell signalling**: Cell signalling Hormones & their receptors, cell surface receptors, signalling through G-protein coupled receptors, second messengers. **2.2 Cell signalling pathways** 2.2.1 Signal transduction pathways, 2.2.2 Regulation of signalling pathways, 2.2.3 Bacterial and plant two-component systems. 2.2.4 Bacterial chemotaxis and quorum sensing.		
	Unit III	**15**	
	Advances in Toxicology		
3	3.1 Biotransformation of Xenobiotics: Principles, Phase transformation reactions 3.2 Toxicity testing: Acute, Subacute, Chronic toxicity testing 3.3 Nanotoxicology: Mechanisms of Nanotoxicology, Assays in Nanotoxicology 3.4 Introduction to Evidence based toxicology *Case study: Toxicology of Sunscreen, OECD guidelines for toxicity testing		

	Unit IV	**15**	
	Principles and application of chromatography		
4	4.1 Planar chromatography (Paper and Thin layer): Preparation of stationary support, solvent, detection and measurement of components, applications. 4.2 Ion exchange chromatography: Ion exchange resins, selection of ion-exchanger, choice of buffers, preparation and use of ion-exchangers, storage of resins. 4.3. Gel chromatography: Physical characteristics of gel chromatography, chemical properties of gel, selection of gel, gel preparation and storage, operation of gel column, application 4.4 Affinity chromatography: Chromatography media, immobilized ligands, attachment of ligands to the matrix, experimental procedures and application.		

M.Sc-I	**Semester II Theory**
RJSPGZOO203 **Genetics, Cell signalling, Toxicology and Chromatography**	**Learning objectives:** 1. To acquaint the learners with some advanced concepts in genetics along and to develop their problem-solving abilities. 2. To introduce learners with few advanced topics in toxicology. 3. To introduce various cell signalling pathways in detail. 4. To acquaint learners with the detail of various types of chromatography techniques. **Course outcome:** 1.Learners will be able to work out on genetic problems and relate them to Mendelian inheritance. 2. Learners would get ideas about toxicity testing, biotransformation of toxicants and some advances in the field of toxicology. 3. Learners will be able to understand different cell signalling pathways at molecular level. 4. Learners will understand basic principles and applications of various types of chromatography techniques.

SEMESTER-II PRACTICAL PRACTICALS BASED ON RJSPGZOO201, 202 & 203.	**Cr**
Course Code- RJSPGZOOP201	**2**
1**. Study of systematic and major features of:** a) Urochordata (Simple Ascidian, Doliolum); b) Cephalochordata (Amphioxus) c) Agnatha(Petromyzon, Myxine); d) Pisces(Shark, Stingray, Hippocampus, Rohu and any lung fish); e) Amphibia (Caecilian, Salamander, Frog, Toad); f) Reptilia (Turtle, Tortoise, Chameleon, Draco, Phrynosoma, Viper, Hydrophis, Crocodile, Gharial. g) Aves (Ostrich, Kite, Owl, and Duck); h) Mammals (Duck billed platypus, Kangaroo, Bat, Loris, Pangolin, Dolphin, Sea Cow, Giant panda, Tapir, Camel, Guinea pig, Porcupine, Rabbit) 2) Observation of morphogenetic movements in chick embryo (24HRS and 36HRS) 3) SDH specific activity 4) Determination of total cholesterol and HDL cholesterol from serum. 5) Determination of acid value of fats/oils. 6) Separation of pigments from leaves or flowers by adsorption column chromatography. 7) Separation of amino acids by ion exchange chromatography using cation exchanger. 8) Separation and identification of amino acids by 2D paper chromatography	

M.Sc-I	Semester II Theory
Paper Code: RJSPZOOP121	**Learning objectives:** 1. To familiarize the learner to understand various characteristic features of chordates. 2. To make the learner understand the basics of enzymology. 3. To make the learner understand the technique of embryonic experimentation using chick as model. 4. To make the learner understand the quantitative analysis of lipid. 5. To acquaint learners of various chromatographic techniques. **Course outcome:** 1. The learner will be able to apply the knowledge of taxonomy to identify various animals 2. The learner would learn to perform enzyme assays. 3. The learner will be able to design experiments on embryonic development of other model systems. 4. The learner will be able to apply the knowledge of different biochemical tests for analysis of lipids. 5. Learners will get trained in various chromatographic techniques.

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Research methodology References

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EVALUATION SCHEME AND SKELETON PAPERS

EVALUATION: **Total marks :100**
Internal component : **40M (Seminar/assignment/mini project)**
Semester End Examination : **60M (Question paper based on theory units)**

M.Sc. ZOOLOGY- THEORY EXAMINATION
Semester I/Semester II

Maximum Marks: 60 **Duration: 2 Hours**

Instructions:
i. All questions are compulsory.
ii. All questions carry equal marks.
iii. Draw neat and labelled diagrams wherever necessary.

1A. Answer <u>any two</u> questions from the following (Based on Unit I)
i. 06
ii.06
iii.06
iv.06

1B. Answer <u>any one</u> question from the following.
i.03
ii.03

2A. Answer <u>any two</u> questions from the following (Based on Unit II)
i. 06
ii. 06
iii.06
iv.06

2B. Answer <u>any one</u> question from the following.
i.03
ii.03

3A. Answer <u>any two</u> questions from the following (Based on Unit III)
i. 06
ii. 06
iii.06
iv.06

3B. Answer <u>any one</u> question from the following.
i.03
ii.03

4A. Answer <u>any two</u> questions from the following (Based on Unit IV)
i. 06
ii. 06
iii.06
iv.06

4B. Answer <u>any one</u> question from the following.
i.03
ii.03

M.Sc. ZOOLOGY Semester I
PRACTICAL EXAMINATION
CODE: RJSPGZOOP101 **Total Marks: 50**

Q1.Identification of slides and specimens. (2 Marks each) 16M
a, b, c, d, e, f, g, h

a. Porifera (Leucosolenia, Grantia, Euplectella, Euspongia);
b. Coelenterata(Obelia colony,Physalia, Porpita, Sea-anemone, Madrepora, Aurelia);
c. Helminthes (Planaria, Liverfluke, Tapeworm, Ascaris, Trichinella);
d. Annelida (Nereis, Earthworm, Leech);
e. Arthropoda (Lobster, Balanus, Crab, Lepas, Scorpion, Spider, Limulus, Centipede, Millipede, Beetle).
f. Mollusca (Chiton,Dentalium,Patella,Aplysia,Achatina,Mytilus,Loligo/ Octopus, Nautilus);
g. Echinodermata (Starfish,Brittle star,Sea urchin,Sea cucumber,Feather star);

Q2.Determination of glucose by Benedict's method(volumetric). 12M

OR

Q2.Determination of reducing sugars by 3,5-dinitrosalicylic acid (colorimetric)method.

OR

Q2. Acid and enzyme hydrolysis of glycogen and colorimetric estimation of the products by 3,5-DNSA method.

Q3. Quantitative estimation of amino acids using ninhydrin reagent. 12M

OR

Q3. Detection of conformation of BSA by viscosity measurement and effect of varying concentration of urea on viscosity of BSA.

Q4. Viva 5M

Q5. Journal 5M

• Candidates are required to present certified journal on the day of practical examination.

M.Sc. ZOOLOGY Semester I
PRACTICAL EXAMINATION
CODE: RJSPGZOOP201 **Total Marks: 50**

Q1.Identification: 2 MARKS EACH

*Slides and specimens (**a,b,c,d,e,f,g,h)**
(i) Identification of morphogenetic movements in chick embryos (24HRS /36 HRS) 18M

Q2.Determination of specific activity of SDH. 12M
OR
Q2. Determination of total cholesterol and HDL cholesterol from serum.
OR
Q2. Determination of acid value of fats/oils.

Q3. Separation of pigments from leaves/flowers by adsorption column chromatography. 10M
OR
Q3. Separation of amino acids by ion exchange chromatography using cation exchanger.
OR
Q3. Separation and identification of amino acids by 2D paper chromatography

Q4. Viva 5M

Q5. Journal 5M

Candidates are required to present certified journal on the day of practical examination.

IDENTIFICATION
*

a) Urochordata (Simple Ascidian, Doliolum);
b) Cephalochordata (Amphioxus)
c) Agnatha(Petromyzon, Myxine);
d) Pisces(Shark, Stingray, Hippocampus, Rohu and any lung fish);
e) Amphibia (Caecilian, Salamander, Frog, Toad);
f) Reptilia (Turtle, Tortoise, Chameleon, Draco, Phrynosoma, Viper, Hydrophis, Crocodile, Gharial.
g) Aves (Ostrich, Kite, Owl, and Duck);
h) Mammals (Duck billed platypus, Kangaroo, Bat, Loris, Pangolin, Dolphin, Sea Cow, Giant panda, Tapir, Camel, Guinea pig, Porcupine, Rabbit).
i) Identification of morphogenetic movements in chick embryos (24HRS /36 HRS)