



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

Affiliated to
UNIVERSITY OF MUMBAI

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

DISTRIBUTION OF TOPICS AND CREDITS

F.Y.B.Sc. ZOOLOGY SEMESTER I

Course code	Nomenclature	Credits	Topic
RJSUZOO101	Animal Diversity-I, Ecology- I and Biodiversity & Conservation	02	1. Levels of organization and classification of animal kingdom-I
			2. Ecology-I
			3. Biodiversity and Conservation
RJSUZOO102	Biomolecules-I, Basic Biotechnology and Laboratory safety & Measurement	02	4. Biomolecules-I
			5. Basic Biotechnology
			6. Laboratory safety, Units and Measurement
RJSUZOOP101 & RJSUZOOP102.	Practical I & II	02	Practicals based on Paper I and II

F.Y.B.Sc. ZOOLOGY SEMESTER II

Course code	Nomenclature	Credits	Topic
RJSUZOO201	Animal Diversity II, Ecology-II & Ethology	02	7. Classification of Animal kingdom-II
			8. Ecology-II
			9. Basics of ethology
RJSUZOO202	Biomolecules-II, Health ,Hygiene and Health Hazards & Instrumentation	02	10. Biomolecules-II
			11. Health, Hygiene and Health hazards
			12. Instrumentation
RJSUZOOP201 & RJSUZOOP202.	Practical I & II	02	Practicals based on Paper I and II

SEMESTER-I (THEORY)		L	Cr
Paper- I Animal Diversity-I, Ecology- I and Biodiversity & Conservation		45	2
Paper Code: RJSUZOO101			
UNIT I		15	
Levels of organization and classification of animal kingdom-I			
1	<p>1.1: Levels of organization</p> <p>1.1.1: Unicellularity vs. multicellularity: Colonization and organization of germ layers (Diploblastic and triploblastic condition).</p> <p>1.1.2: Division of labour and organization of tissues (brief fate of ectoderm, mesoderm and endoderm).</p> <p>1.1.3: Development of coelom: acoelomate, pseudo coelomate and eucoelomate.</p> <p>1.1.4: Types of symmetry: Asymmetry, Radial and bilateral symmetry.</p> <p>1.1.5: Segmentation and cephalization.</p> <p>1.2: Salient features with examples of phyla, subphyla and classes mentioned below</p> <p>1.2.1: Multicellular organization: Colonization level- Phylum Porifera.</p> <p>1.2.2: Multicellular organization: Division of labour (cell differentiation)- Phylum Coelenterata.</p> <p>1.2.3: Acoelomate organization - Phylum Platyhelminthes.</p> <p>1.2.4: Pseudo coelomate organization - Phylum Nematelminthes.</p> <p>1.2.5: Triploblastic coelomate organization</p> <p>a) Animals with metameric segmentation- Phylum Annelida.</p> <p>b) Animals with jointed appendages- Phylum Arthropoda.</p> <p>c) Animals with mantle- Phylum Mollusca.</p> <p>d) Animals with enterocoel-Phylum Echinodermata.</p>		
	UNIT II	15	
	Ecology-I		
2	<p>2.1 Overview of Ecology</p> <p>2.2 Physical Factors:</p> <p>2.2.1 Edaphic: Soil formation, Components of Soil, Types of soil and Soil Profile.</p> <p>2.2.2 Light: Relation to terrestrial and aquatic habitat, photoperiodism, diurnal migrations, adaptations of animals to dark.</p> <p>2.2.3 Temperature: range, tolerance, Bergman's Principle, Allen's Rule, effects of temperature on living organisms.</p> <p>2.2.4 Biogeochemical Cycles: oxygen, carbon, sulphur, nitrogen, phosphorus, human activities affecting biogeochemical cycles.</p>		
	UNIT III	15	
	Biodiversity and Conservation		
3	<p>3.1: Introduction to Biodiversity - Definition, Concept and Scope.</p> <p>3.2: Levels of Biodiversity -Genetic, Species and Ecosystem Biodiversity.</p> <p>3.3: Biodiversity Hotspots- Western Ghats and Indo-Burma Border.</p>		

F.Y.B.Sc Zoology Syllabus Semester I & II

	3.4: Threats to Biodiversity - Habitat loss and Man-Wildlife conflict. 3.5: Biodiversity Conservation and Management: 3.5.1: Conservation strategies: <i>in situ</i> , <i>ex-situ</i> , National parks, Sanctuaries and Biosphere reserves. 3.5.2: International efforts : Convention on Biological Diversity (CBD), International Union for Conservation of Nature and Natural Resources (IUCN), United Nations Environment Program - World Conservation Monitoring Centre (UNEP-WCMC).		
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F.Y.B.Sc	Semester I Theory
RJSUZOO101 Paper- I Animal Diversity-I, Ecology- I and Biodiversity & Conservation	Course Objectives: 1. To introduce the basic structural organization and classification of living organisms. 2. To understand the concepts of ecology. 3. To familiarize the learners with the biodiversity and strategies of conservation. Learning Outcomes: 1. The learners will be able identify and associate the phylum with specific structural organization. 2. Learners will understand the interaction and effects of various biotic and abiotic factors. 3. Learners will perceive the significance of biodiversity and its conservation.

F.Y.B.Sc Zoology Syllabus Semester I & II

SEMESTER-I (THEORY)		L	Cr
Paper- II Biomolecules-I, Basic Biotechnology And Laboratory Safety & Measurement		45	2
Paper Code: RJSUZOO102			
UNIT I		15	
Biomolecules-I			
1	<p>1.1: Basic biochemistry: Concept of monomers & polymers, Role and significance of carbon, types of chemical bonds. Water- role as universal solvent, properties of water.</p> <p>1.2: Carbohydrates</p> <p>1.2.1: Nomenclature and isomerism.</p> <p>1.2.2: Glycosidic bond.</p> <p>1.2.3: Classification of carbohydrate.</p> <p>a. Monosaccharides- galactose & fructose</p> <p>b. Disaccharides- sucrose & lactose</p> <p>c. Polysaccharides- Starch, cellulose, glycogen, chitin</p> <p>1.2.4: Biological role of carbohydrates.</p> <p>1.3:Nucleic Acids</p> <p>1.3.1: Structure (structure of purine & pyrimidine bases, hydrogen bonding between nitrogenous bases in DNA, structure of nucleosides, nucleotides and polynucleotides) & functions of nucleic acids.</p> <p>1.3.2: Properties and types of DNA (A, B, & Z) & RNA.</p> <p>1.3.3: Differences between DNA and RNA.</p>		
UNIT II		15	
Basic Biotechnology			
2	<p>2.1: Concept of Biotechnology</p> <p>2.1.1: Definition</p> <p>2.1.2: An overview of achievements and scope (fishery, animal husbandry, medical, industrial, agriculture).</p> <p>2.2: Transgenesis and cloning</p> <p>2.2.1 Methods of transgenesis: Retroviral method, nuclear transplantation method, DNA micro injection method and embryonic stem cell method.</p> <p>2.2.2. Animal Cloning (Dolly experiment).</p> <p>2.2.3 Ethical issues of transgenic and cloned animals.</p> <p>2.3: Applications of Biotechnology</p> <p>2.3.1 Forensic biotechnology: DNA fingerprinting; Technique in brief and its application in forensic science (Crime Investigation).</p> <p>2.3.2: Enzyme Technology:</p> <p>a. Bio-detergents</p>		

F.Y.B.Sc Zoology Syllabus Semester I & II

	b. Concept of enzyme immobilization. c. Enzymes as meat tenderizer. 2.3.3: Medical biotechnology: a. Recombinant DNA in medicines (recombinant insulin). b. Gene therapy: Ex-vivo and <i>In vivo</i> , Severe Combined Immunodeficiency (SCID), Cystic Fibrosis. 2.3.4: Environmental Biotechnology: a. Bioremediation: Concepts and applications. b. Biodegradation of polycyclic aromatic hydrocarbons (PAHs) and petrochemicals.		
	UNIT III	15	
	Laboratory safety, Units and Measurement		
3	3.1: Introduction to good laboratory practices. 3.2: Use of safety symbols: meaning, types of hazards and precautions. 3.3: Units of measurement: 3.3.1: Calculations and related conversions of each: Metric system- length (meter to micrometer); weight (gram to microgram), Volumetric (cubic measures) 3.3.2: Temperature: Celsius, Fahrenheit, Kelvin. 3.3.3: Concentrations: percent solutions, ppt, ppm, ppb dilutions, normality, molarity and molality. 3.4: Biostatistics: Introduction and scope, sampling and its types, central tendencies (mean, median, and mode) tabulation, graphical representations (histograms, bar diagrams, pie diagrams).		

F.Y.B.Sc	Semester I Theory
RJSUZOO102 Paper- II Biomolecules- I, Basic Biotechnology And Laboratory Safety & Measurement	Course Objectives: <ol style="list-style-type: none"> 1. To appreciate the structure and function of biomolecules. 2. To introduce the concept of biotechnology and the techniques involved in transgenesis and cloning. 3. To introduce the basic laboratory techniques and biostatistics. Learning Outcomes: <ol style="list-style-type: none"> 1. The learners will understand the structure- function relationship. 2. Learners will comprehend the methods of transgenesis and various ethical issues associated with it. They will get familiarized with the applications of biotechnology. 3. Learners will understand the importance of accuracy, precision and reproducibility in experiments. Use of different statistical methods of representation of biological data.

SEMESTER-II (THEORY)		L	Cr
Paper I- Animal Diversity II, Ecology II & Ethology		45	2
Paper Code: RJSUZOO201			
UNIT I		15	
Classification of Animal kingdom-II			
1	1.1: Phylum Hemichordata 1.2: Phylum Chordata 1.2.1: Subphylum: Urochordata 1.2.2: Subphylum: Cephalochordata 1.2.3: Subplylum: Vertebrata I. Division: Agnatha; Class Cyclostomata II. Division: Gnathostomata A. Super class: Pisces i . Class Chondrichthyes ii. Class Osteichthyes B. Super class: Tetrapoda i. Class Amphibia ii. Class Reptilia iii. Class Aves iv. Class Mammalia		
UNIT II		15	
Ecology-II			
2	2.1: Concepts of Ecosystem: Components of ecosystem, energy flow in ecosystem, food chain and food web, energy pyramids. 2.2: Population Ecology: Concept, Factors influencing population dynamics: natality, mortality, migration, density, age structure and sex ratio, fecundity, growth curves and survivorship curves. 2.3: Animal Interactions: Concept, Positive and negative interactions, ecological significance.		
UNIT III		15	
Basics of Ethology			
3	3.1: Development of Behaviour: Ontogeny of behaviour, sensitive periods during development e.g bird song development. 3.2: Innate behaviour: Fixed Action Plan, orientation, taxes, irritability. 3.3: Learned behaviour: Conditioned reflex, habituation, sensitization, instrumental learning and operant behaviour. 3.4: Protective behaviour: Camouflage, warning colouration, Mimicry- Batesian & Mullerian, adaptive & evolutionary significance of mimicry.		

F.Y.B.Sc Zoology Syllabus Semester I & II

F.Y.B.Sc	Semester II Theory
RJSUZOO201 Paper- I Animal Diversity II, Ecology II & Ethology	<p>Course Objectives:</p> <ol style="list-style-type: none"> 1. To understand taxonomy of higher and lower chordates. 2. To introduce concepts of population ecology. 3. To familiarize the learners with basics of ethology. <p>Learning Outcomes:</p> <ol style="list-style-type: none"> 1. The learners will be able identify and associate the phylum with specific structural organization. 2. Learners will understand the significance of population dynamics. 3. Learners will appreciate the evolution of behavior and its various types.

SEMESTER-II (THEORY)		L	Cr
Paper II- Biomolecules-II, Health, Hygiene And Health Hazards & Instrumentation		45	2
Paper Code: RJSUZOO202			
UNIT I		15	
Biomolecules-II			
1	1.1: Lipids 1.1.1: Classification of Lipids 1.1.2: Types of Fatty Acids (Saturated & Unsaturated) 1.1.3: Biological roles of lipids 1.1.4: Overview of Phospholipids, Glycerides (mono, di & tri) 1.2: Proteins 1.2.1: Amino acids- basic structure, types based on carboxylic, amino & aromatic groups, essential, semi-essential & non-essential amino acids, amino acid pool. 1.2.2: Peptide bond. 1.2.3- Structure of protein- primary, secondary, tertiary and quaternary 1.2.4- Biological role of proteins 1.3: Vitamins 1.3.1: Types & Classification (water soluble & lipid soluble). 1.3.2: Functions of vitamins		
UNIT II		15	
Health, Hygiene & Health Hazard			
2	2.1: Health 2.1.1: Definition of Health, need for health education. 2.1.2: Physical, psychological and social health issues. 2.1.3: Water and water supply, standards of potable water. 2.1.4: Purification of water: small scale, medium scale and large scale (rapid sand filters) 2.1.5: Water footprint: concept, brief account and significance. 2.2: Hygiene 2.2.1: Hygiene and health factors at home. 2.2.2: Personal hygiene, oral hygiene and sex hygiene. 2.3: Health Hazards 2.3.1: Radiation risk: Mobile cell tower and electronic gadgets (data of recommended level, effects and precaution). 2.3.2: Ill-effects of self-medication.		
UNIT III		15	
Instrumentation			
3	3.1: Microscope (dissecting and compound): Principle, SOP and applications. 3.2: Analytical balance: Principle, SOP and applications. 3.3: Colorimetry and spectroscopy: Principle, SOP and applications. 3.4: pH meter: Principle, SOP and applications.		

F.Y.B.Sc Zoology Syllabus Semester I & II

	3.5: Centrifuge (clinical and ultra-centrifuge): Principle, SOP and applications. 3.6: Electrophoresis (AGE, PAGE): Principle, SOP and applications. 3.7: Instruments for sterilization: Autoclave, Incubator, Laminar overflow: Principle, SOP and applications. 3.8: Chromatography (paper, TLC, adsorption): Principle and applications.		
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F.Y.B.Sc	Semester II Theory
RJSUZOO202 Paper- II Biomolecules-II, Health, Hygiene And Health Hazards & Instrumentation	Course Objectives: <ol style="list-style-type: none"> 1. To appreciate the structure and function of biomolecules. 2. To comprehend various health problem arising due to unhygienic conditions. 3. To introduce the principle of laboratory instruments their use and maintenance. Learning Outcomes: <ol style="list-style-type: none"> 1. The learners will understand the structure function relationship of lipids and proteins. 2. Learners will inculcate good personal and public sanitary habits. They will be aware of effects of excessive use of gadgets. 3. Learners will know the use of various instruments in a scientific inquiry.

SEMESTER-I (PRACTICALS)		L	Cr
Practical I- Animal Diversity-I, Ecology- I and Biodiversity & Conservation Paper Code: RJSUZOO101			1
1. Levels of organization in Animal kingdom A) Symmetry: i) Asymmetric organization: <i>Amoeba</i> , ii) Radial symmetry: Sea anemone, <i>Aurelia</i> iii) Bilateral symmetry: <i>Planaria</i> B) Acoelomate: T.S. of <i>Planaria</i> C) Pseudocoelomate: T.S. of <i>Ascaris</i> D) Coelomate : T.S. of Earthworm E) Segmentation i) Pseudosegmentation: Tapeworm ii) Metamerism: Earthworm iii) Specialization of body parts for division of labour: Head, thorax and abdomen- Insect F) Cephalization i) Cockroach – Head, ii) Prawn/ crab – Cephalothorax			
2. Animal Diversity -I <ul style="list-style-type: none"> • Porifera: <i>Leucosolenia</i>, Bath sponge • Coelenterate: <i>Hydra</i>, <i>Obelia</i> colony, <i>Aurelia</i>, Sea anemone and coral (anyone) • Platyhelminthes: <i>Planaria</i>, Liver fluke and Tapeworm • Nematelminthes: <i>Ascaris</i>- male and female • Annelida: <i>Nereis</i>, Earthworm and Leech • Arthropoda: Lobster, <i>Lepisma</i>, Beetle, Butterfly, Moth, Spider, Centipede, Millipede • Mollusca: <i>Chiton</i>, <i>Dentalium</i>, <i>Pila</i>, Bivalve, <i>Sepia</i> and <i>Nautilus</i> • Echinodermata: Starfish, Brittle star, Sea urchin, Sea cucumber, Feather star. 			
3. Determination of soil pH: by pH meter, universal indicator, pH paper.			
4. Estimation of salinity by refractometer.			
5. Study of Biodiversity hotspots using world map.			
6. Study of peculiar animals found in the world biodiversity hotspots.			
7. Field visit and report submission.			
Practical II - Biomolecules-I, Basic Biotechnology And Laboratory Safety & Measurement Paper Code: RJSUZOO102			1
1. Qualitative tests for carbohydrates.			
2. Extraction and qualitative detection of nucleic acids: <ul style="list-style-type: none"> • DNA (SDS-NaCl extraction), • RNA (Phenol extraction) 			
3. Aseptic techniques: Packaging of test tubes, pipettes, petriplates, conical flask.			
4. Aseptic transfer of liquids between burners. (Demonstration)			

F.Y.B.Sc Zoology Syllabus Semester I & II

5. Assay of immobilized invertase from immobilised yeast cells by DNSA method		
6. (visual observation for comparative colour intensity in test tube)		
7. To demonstrate fermentation of grape juice/sugar cane juice or any fruit juice – (Detection of alcohol generated during fermentation by benzoic acid).		
8. Effect of Papain (raw papaya extract) as a meat tenderizer.		
9. Study of central tendencies and plotting of bar diagram, histogram and pie diagram.		
10. Problem based on concentrations: percent solutions, normality, molarity.		

F.Y.B.Sc	Semester I Practical
RJSUZOO101 RJSUZOO102 Practical- I & II	<p>Course Objectives:</p> <ol style="list-style-type: none"> 1. To study the animal classification. 2. To perform soil and water analysis of selected parameters. 3. To understand the significance of qualitative estimation. To get trained in sterilization techniques. <p>Learning Outcomes:</p> <ol style="list-style-type: none"> 1. The learners should identify and classify the animals based on their external features into phylum and class. 2. The learners will develop the analytical thinking and calculation skills. 3. A short excursion will inculcate the discipline and experience of field work.

SEMESTER-II (PRACTICALS)		L	Cr
Practical I- Animal Diversity II, Ecology II & Ethology Paper Code: RJSUZOOP201			1
	1. Animal Diversity-II a) Hemichordata: <i>Balanoglossus</i> b) Urochordata: <i>Herdmania</i> c) Cephalochordata: <i>Amphioxus</i> d) Cyclostomata: <i>Petromyzon</i> e) Pisces: Chondrichthyes: Shark, Sting ray Osteichthyes: <i>Sciaena</i> , <i>Synagris</i> f) Amphibia: <i>Caecilian</i> , Salamander, Frog, Toad, g) Reptilia: Turtle, Chameleon, Cobra, Crocodile. h) Aves: Kite, Kingfisher, Duck i) Mammalia: Platypus, Kangaroo, Shrew, Dolphin, Bat.		
	2. Determination of population density; a. Subsampling method using <i>Daphnia</i> . b. Capture-recapture method using rice weevil		
	3. Interpretation of the given graphs/ tables and comment on pattern of population nature: a) Survivorship curve b) Age structure c) Sex ratio		
	4. Calculation of natality, mortality, fecundity w.r.t. population studies.		
	5. Interpretation of Growth curves (Sigmoid and J shaped).		
	6. Study of animal interaction: a) Commensalism: Hermit crab and sea anemone, <i>Echinus</i> and shark b) Mutualism: Termite and <i>Trichonympha</i> c) Antibiosis: Effect of antibiotic on bacterial growth on a petri plate d) Parasitism: Ectoparasite – head louse and bed bug Endoparasite: <i>Trichinella spiralis</i> e) Predation: Praying mantis and spider		
	7. Study of Mimicry: Leaf insect, stick insect, Dead leaf butterfly (<i>Kallima</i>), Monarch butterfly and common tiger butterfly (Danais).		
	8. Study of Warning Colouration in animals: Coral snake, strawberry poison dart frog, chameleon, honey badger, blue ring octopus.		

F.Y.B.Sc Zoology Syllabus Semester I & II

	Practical II - Biomolecules-II, Health, Hygiene And Health Hazards & Instrumentation Paper Code: RJSUZOOP202		1
	1. Qualitative tests for proteins.		
	2. Separation of amino acids by paper chromatography.		
	3. Thin layer chromatography of lipids		
	4. Qualitative tests for lipids.		
	5. Qualitative estimation of Vitamin C by Iodometric method.		
	6. Study of Microscope: Use, care and functions of its components.		
	7. Study of microbial flora of water by Gram's staining.		
	8. Estimation of total hardness of water.		
	9. Handling of common laboratory equipment: Burner, balance, homogenizer, colorimeter, pH meter, centrifuge.		
	10. Sterilization techniques: Autoclave, Oven, Laminar air flow.		
	11. Electrophoresis apparatus: AGE, PAGE.		
	12. Adsorption (Column) chromatography using chalk to separate mixture of dye.		

F.Y.B.Sc	Semester II Practical
RJSUZOOP201 RJSUZOOP202 Practical- I & II	Course Objectives: <ol style="list-style-type: none"> 1. To classify animals into different phyla and class based on external morphology. 2. To introduce methods used in population density. 3. To identify different associations of animals. 4. To gets hands on training on basic laboratory instruments. 5. To familiarize the learners with chromatography techniques. Expected Outcome: <ol style="list-style-type: none"> 1. The learners will identify the animals and classify them. 2. Learners will be able to calculate basic parameters used in population studies. 3. Learners will know the use of various instruments used in a scientific inquiry. 4. Learners will know the use and application of different chromatography techniques.

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SCHEME OF EXAMINATION (FOR BOTH SEMESTERS)

Internal examination

The first internal class test comprising of 20 marks shall consist of 20 multiple choice questions with equal weightage.

The second class test will comprise of three short notes- one from each unit of 4 marks each and eight questions of one mark each from all units.

External theory paper pattern Total: 60 marks

Q.1 Based on Unit I..... 15M

- a. 8 M
- b. 7 M

OR

- a. 5 M
- b. 5M
- c. 5M

Q.2 Based on Unit II.....15M

- a. 8 M
- b. 7 M

OR

- a. 5 M
- b. 5M
- c. 5M

Q.3 Based on Unit III.....15M

- a. 8 M
- b. 7 M

OR

- a. 5 M
- b. 5M
- c. 5M

Q.4 Short notes (mixed on all units).....15M (5marks each)

- a or a (Unit I)
- b or b (Unit II)
- c or c (Unit III)

EVALUATION AND ASSESSMENT:

QUESTION PAPER FOR PRACTICAL EXAMINATION

SEMESTER I- PRACTICAL I

Total marks: 50

Q.1 Major experiment- Soil pH/ Salinity of water	08M
Q.2 Identify and comment on the level of organization. (Symmetry /coelom/segmentation/cephalization)	03M
Q.3 Identify and Classify with reasons.	15M
a. One specimen from Porifera/Coelenterata	
b. One specimen from Platyhelminthes/Nemathelminthes	
c. One specimen from Annelida/Arthropoda	
d. One specimen from Mollusca	
e. One specimen from Echinodermata	
Q.4 Identification of Biodiversity hotspots using map/peculiar animals of hotspots.	04M
Q.5 Field report	10M
Q.6 Viva	05M
Q.7 Journal	05M

PRACTICAL II

Total marks: 50

Q.1 Major experiment- Extraction of DNA/RNA/ Assay of immobilized enzyme	12M
Q.2 Minor experiment- Fermentation/Papain as meat tenderizer/aseptic techniques	08M
Q.3 Problems based on biostatistics	10M
a. Central tendency	
b. Graphical presentation of data	
Q.4 Problems based on concentration calculations	10M
a. % solutions	
b. Normality/ Molarity	
Q.5 Viva	05M
Q.6 Journal	05M

QUESTION PAPER FOR PRACTICAL EXAMINATION

SEMESTER II- PRACTICAL I

Total marks: 50

Q.1 Major Experiment	09M
Estimation of population density of <i>Daphnia</i> / Rice weevil	
Q.2 Identify and classify with reasons.	12M
a. Any one specimen from Hemichordata/Urochordata/Cephalochordata	
b. Any one specimen from Cyclostomata/ Pisces	
c. Any one specimen from Amphibia/ Reptiles	
d. Any one specimen from Aves/Mammals	
Q.3 Identify and Comment on	09M
a. One specimen from Mimicry	
b. One specimen from warning colouration	
c. One specimen from animal interaction.	
Q.4 Problems based on population ecology (2 problems)	10M
(Natality/Mortality/Fecundity/Sex ratio)	
Q.5 Viva	05M
Q.6 Journal	05M

PRACTICAL II

Total marks: 50

Q.1 Major experiment– Paper chromatography/ Grams staining/Hardness	12M
Q.2 Minor experiment	
a. Chromatography (Column/TLC)	07M
b. Qualitative tests (Lipids/Vitamin C/Proteins)	05M
Q.3 Identify and describe the principle/working/uses.	16M
a, b, c & d (Any 4 instruments studied in practical)	
Q.4 Viva	05M
Q.5 Journal	05M