

ANIMAL DIVERSITY - I

Scheme of examination:

MM: 35

- 1. In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.*

UNIT – I

TAXONOMY

Hierarchy, Binomial nomenclature, Trinomial nomenclature, Rules of nomenclature, Concept of Five kingdom

Basis of Classification- Grade of organization, Symmetry, Coelom, Embryogeny, segmentation.

Classification of Invertebrate phyla upto Class level.

UNIT - II

Phylum Protozoa:

Type study *Amoeba*, *Euglena*, *Paramecium* (Habit, Habitat & Salient features with particular reference to locomotion, nutrition and reproduction). Economic Importance

UNIT – III

Phylum Porifera

Type study- *Sycon* Canal system of Sponges, Skeletal system, Economic Importance

UNIT - IV

Phylum Coelenterata

Type study – *Obelia*, Polymorphism, Coral reefs

UNIT - V

Phylum Platyhelminthes

Type study- *Taenia*

Phylum Nematelminthes

Ascaris (External features and life cycle), Parasitic adaptations of Helminthes

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CELL BIOLOGY

Scheme of examination:

MM: 35

- 1. In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.*

UNIT – I

Applications of Tools & Techniques in Cytology:

Principles of microscope and application:

Light Microscopy, Phase contrast microscopy, Fluorescence Microscopy, Interference Microscopy, Electron Microscopy (SEM & TEM)

Cell fractionation (Homogenization & Centrifugation)

Calorimetry/Spectrophotometry

UNIT - II

The Cell: Diversity of Cell Size & shape, Characteristics of Prokaryotic & Eukaryotic cells, Cell theory, Cell membrane – composition & ultrastructure (membrane models – Danielli & Davson, unit membrane, Singer & Nicholson – Fluid Mosaic model), Transport across cell membrane – Permeability, Passive and Active transport, Exocytosis, Endocytosis, (Pinocytosis, Phagocytosis).

UNIT - III

Cell organelles: structure, composition & function

Endoplasmic reticulum, Golgi complex, Ribosome, Lysosomes

Mitochondria: biogenesis, electron transport chain, generation of ATP molecules, (Chemiosmotic hypothesis of Mitchelle)

Peroxisomes, Microtubules & Centrioles, cilia & flagella

UNIT – IV

Nuclear Organization: Ultrastructure of Nucleus - nuclear envelope, nuclear matrix and nucleolus, Chromosomes: Morphology, Chromatids, Chromonema, Chromomeres, telomeres, Primary & secondary constrictions, Chromosome type- Polytene & Lampbrush
Chromosomal Organization: euchromatin, Heterochromatin, folded fibre model & nucleosome Concept.

UNIT - V

Cell Division

Cell cycle(S, G1, G2, M phase)

Mitosis: Phases & process of mitosis, structure & function of spindle apparatus

Meiosis: Phases & Process of meiosis

Cytology

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ANIMAL DIVERSITY - II

Scheme of examination:

MM: 35

1. *In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.*

UNIT – I

Type study- Habit, Habitat & Salient features & structural organization:

Phylum Annelida

- Type study: Earthworm
- Metamerism
- Vermiculture

UNIT - II

Type study- Habit, Habitat & Salient features & structural organization:

Phylum Arthropoda

- Type study: Prawn
- Metamorphosis in insects
- Sericulture
- Lac culture
- Apiculture
- Prawn culture

UNIT III

Type study- Habit, Habitat & Salient features & structural organization:

Phylum Mollusca

- Type study: Pila
- Respiration
- Torsion
- Pearl culture

UNIT IV

Type study- Habit, Habitat & Salient features & structural organization:

Phylum Echinodermata

- Type study: Starfish

- Water vascular system

UNIT V

Larval forms of Invertebrates (Parasitic & Free living forms)

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MOLECULAR BIOLOGY AND GENETICS

Scheme of examination:

MM: 35

- 1. In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.*

UNIT – I

DNA structure (Watson & Crick's model). Polymorphism (A, B, Z type), Replication (Semiconservative mechanism), Replication forks (both Unidirectional & Bidirectional), Leading & lagging strand, Okazaki fragments). Experiments of Messelson & Stahl. Elementary idea about Polymerases, Topoisomerases, Single stranded binding protein, RNA Primer, DNA repair

UNIT II

Genetic code, Protein synthesis (Translation), Gene expression – Gene concept, molecular structure of gene, gene regulation (lac operon), gene splicing & gene sequencing.

UNIT III

Mendelism – I

Mendel's work and laws. Interactions of Genes: Co-dominance and incomplete dominance, Complementary, Epistasis(dominant & recessive), Polymorphic (multiple) genes. Multiple alleles- Inheritance of human blood group-(A, B, O) & Rh factor.

UNIT IV

Mendelism – II

Chromosomal theory of inheritance. Linkage & linkage maps. Crossing over- Mechanism, theories, Cytological detection & significance, Mutations- Chromosomal & Gene, mutagens. Cytoplasmic inheritance.

UNIT V

Determination of Sex – Chromosomal mechanism, Genic Balance Theory, sexual function of X & Y chromosome, Non disjunction, Gynandromorphs. Sex linked inheritance in man. Y linked genes, Sex limited genes, Sex influenced genes,

Human genetics – Human Chromosomes, Karyotype & Idiogram:

Chromosomal abnormalities (Autosomes & Sex chromosomes), Genetics counseling, Eugenics & Euthenics.

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MAMMALIAN PHYSIOLOGY

Scheme of examination:

MM: 35

- 1. In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.*

UNIT – I

Nutrition & Digestion

Nature of Food stuff, Digestive enzymes & their action in alimentary canal, Hormonal control of digestion, Absorption

UNIT - II

Circulation

Composition & Function of Blood and lymph, Blood clotting mechanism, Cardiac cycle, Heart beat, blood pressure, Angina pectoris, Myocardial infarction, E.C.G

UNIT - III

Respiration

Mechanism & control of Breathing, Gaseous exchange in tissues, Transportation of oxygen and carbon di oxide in blood, Mechanism & regulation of respiration

Excretion

Structure & Function of Kidney, Mechanism of urine formation, Hormonal regulation of water & electrolyte balance

UNIT - IV

Nervous system

Structure of neurons, Origin and propagation of nerve impulse, Synaptic transmission, Reflex action & reflex arc

Muscular system

Structure & types of muscle, Mechanism of skeletal muscle contraction

UNIT - V

Endocrine System

Endocrine glands and their Hormones, Mechanism of Hormone action, Role of hypothalamus, Role of hormones in Reproduction, Pregnancy & Lactation

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BIOTECHNOLOGY AND IMMUNOLOGY

Scheme of examination:

MM: 35

- 1. In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.*

UNIT – I

Definition, History, scope and application of biotechnology, Major areas of biotechnology.

Vectors for gene transfer (plasmids and phages).

Protoplast fusion in prokaryotes and eukaryotes.

Recombinant DNA technology

UNIT - II

Applications of genetic engineering, hazards and regulations.

Transgenic animals, their uses in biotechnology

Brief account of cloning, its advantages and disadvantages.

Biotechnology in Medicine (outline idea only) : P.C.R., Antibiotics. Vaccines.

UNIT - III

Hybridoma technology, Monoclonal antibodies and their applications

Food, drink and dairy Biotechnology (outline idea only) : Fermented food production : dairy products, alcoholic beverages, food preservation.

Scope of biotechnology based industries.

UNIT - IV

Immunity: Innate & acquired immunity, Antigen : Antigenicity of molecules, haptens. Immunoglobulins: Structure and functions, Antigen-antibody reactions: Precipitation reaction, agglutination reaction, neutralizing reaction, complement and lytic reactions and phagocytosis.

UNIT - V

Mechanism of humoral & cell mediated immune response.

Complement and its action

AIDS

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BIOCHEMISTRY

Scheme of examination:

MM: 35

- 1. In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.*

UNIT – I

Carbohydrates: Classification & Structure, Metabolism- Oxidation of glucose through glycolysis, Krebs' cycle & oxidative phosphorylation, Interconversion of glycogen and glucose in liver

UNIT II

Lipids: Classification & structure. Metabolism- Beta-oxidative pathway of fatty acids

Biosynthesis of Triglycerides.

UNIT III

Proteins- Classification & structural properties, Amino acids & peptides- Properties & structure, Metabolism- Transformation of amino acids, Deamination, Transamination, Decarboxylation, Synthesis of Urea (Ornithine cycle)

UNIT IV

pH and Buffers, Nature of chemical bonding,

Enzymes: Classification & Characteristics of enzymes. Michaelis-Menten Equation.

UNIT V

Biochemical techniques (Brief account): Chromatography, Colorimetry & pH Meter, Vitamins, Fat soluble and water soluble vitamins.

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MICROBIOLOGY

Scheme of examination:

MM: 35

- 1. In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.*

UNIT – I

Brief introduction to the history of Microbiology: Work of Anton Van Leeuwenhoek, Work of Louis Pasteur, John Tyndall, Robert Koch & Jenner
Prokaryota(Bacteria): Size, shape & pattern of Arrangement
Structural Organization—Slime layer (Capsule), Cell envelope, Cytoplasmic membrane (Inner membrane), Cell wall (Outer membrane) of gram-ve & gram +ve bacteria, Mesosomes; Cytoplasmic organization, Cell projections- Flagella & pili

UNIT II

Virus (Lytic & Lysogenic cycles)
Genetic material of bacteria: Chromosomes, Plasmids,
Replication of bacterial DNA

UNIT III

Reproduction in Bacteria: Asexual reproduction: Binary fission, budding, Endospore formation & cyst formation, Sexual reproduction: Conjugation, Transduction & Bacterial recombination.

Microbial nutrition culture of Bacteria

- Carbon & energy source
- Nitrogen & minerals
- Organic growth factors
- Microbial growth
- Environmental factors: Temperature, pH

UNIT IV

Bacterial of medical importance:

Gram +ve:

- Cocci : Staphylococci, Streptococci

- Bacilli: Diphtheria, Tetanus

Gram –ve:

- Cocci: Gonorrhoea, Meningitis
- Bacilli: Diarrhoea

UNIT V

Mycobacteria: Tuberculosis

Hepatitis (with emphasis on B type)

The causative agents, Transmission, Pathogenicity, Laboratory, Diagnosis,
Treatment & Prevention

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CHORDATES

Scheme of examination:

MM: 35

- 1. In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.*

UNIT – I

Classification and characters of phylum Chordata (excluding extinct forms) up to orders (up to subclass in mammals).

Habit, habitat and Salient features of Herdmania, Branchiostoma and Petromyzon :

Ascidian tadpole larva and its metamorphosis

Ammocoete larva.

UNIT - II

Comparative Anatomy (with special reference to Scoliodon, Frog, Varanus, Columba and Rabbit)-

Integument - skin structure and development of placoid scales, feathers and hair.

Basic plan of vartebtrate endoskeleton

Alimentary canal

UNIT - III

Comparative Anatomy (with special reference to Scoliodon, Frog, Varanus, Columba and Rabbit)-

Origin and evolution of Heart and aortic arches.

Respiratory system.

UNIT - IV

Comparative Anatomy (with special reference to Scoliodon, Frog, Varanus, Columba and Rabbit)-

Brain

Urinogenital system.

UNIT - V

Pisces – Types of scales and fins, Migration Parental care.

Amphibia - Parental care.

Reptilia - Poisonous and non-poisonous snakes,

Aves - Flight adaptation, Bird migration.

Mammals - Dentition.

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DEVELOPMENTAL BIOLOGY

Scheme of examination:

MM: 35

- 1. In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.*

UNIT – I

Historical review: types & scope of embryology

Gametogenesis: Spermatogenesis and oogenesis

Fertilization mechanism & its significance, Parthenogenesis

UNIT - II

Types of eggs

Planes and patterns of cleavage

morulation and blastulation

gastrulation - Fate maps, morphogenetic cell movements, significance.

UNIT - III

Development of chick up to 4 – somite stage.

Extra-embryonic membranes in chick.

Mammalian placentation - types, classification & functions.

UNIT - IV

Embryonic induction; primary organizer, differentiation, competence;

Regeneration in vertebrates

Apoptosis

UNIT - V

Metemorphosis in Frog & Insects.

Teratological effects of Xenobiotics.

Embryonic stem cells, Brief idea on cloning.

Brief account of biology of aging.

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EVOLUTION AND ETHOLOGY

Scheme of examination:

MM: 35

- 1. In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.*

UNIT – I

Chemical origin of Life.

Lamarckism & Darwinism.

Natural selection (Differential reproduction).

Genetic basis of evolution.

UNIT II

Variation and Speciation.

Isolation

Adaptations.

Palaeontology: fossils: Geological division of the Earth crust: imperfection of fossil record.

UNIT III

Zoogeographical distribution: Principal zoogeographical regions of the world with reference to their mammalian fauna.

Continental drift.

Study of Extinct forms: Dinosaurs, Archaeopteryx

UNIT IV

Introduction of Ethology.

Concept of Ethology: Fixed action pattern, Sign stimulus, Innate releasing mechanism, Action specific energy, motivation, imprinting & learning.

Methods of studying brain behaviour: Neuroanatomical, neurophysiological,

neurochemical techniques

UNIT V

Pheromones and behaviour.

Hormones and behaviour.

Societies: Characteristics & advantages with special reference to Honey Bee,
Deer & Monkey.

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ECOLOGY AND BIOSTATISTICS

Scheme of examination:

MM: 35

- 1. In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.*

UNIT – I

Basic concepts of ecology & limiting factors.

Biotic and Abiotic Factors.

Ecosystem- Components of ecosystem, energy flow, ecological pyramids, Food chain, Food web

UNIT II

Biogeochemical cycles (O₂, CO₂, H₂O, N and P).

Populations- Characteristics, Growth and its analysis.

Intraspecific & interspecific: Commensalism & Mutualism.

Community ecology: Characteristics & structure, Ecotone, Edge effect

UNIT III

Ecological Succession (Xerosere and Hydrosere).

Major Biome.

Habitat Ecology-Aquatic, Marine, Terrestrial - Desert, Forest.

UNIT IV

Conservation and management of natural resources.

Pollution.

Green house effect, El-Nino and La-Nino effects.

Wild life conservation and management.

Biodiversity of Rajasthan, Concept of threatened species.

UNIT V

Introduction, scope and application of Biostatistics.

Frequency distribution, Graphical presentation of data.

Mean, mode, median and their significance.

Standard deviation and standard error.

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BIOSYSTEMATICS AND TAXONOMY

Scheme of examination:

MM: 70

1. Each theory paper is divided into FOUR units. There will be FIVE questions in all; each will be of 14 marks.
2. Q. No. 1 will be compulsory and will contain 7 very short answer type questions, each of **two** marks. Questions will be evenly distributed covering the entire syllabus.
3. Q. No. 2, 3, 4 and 5 will be from unit No. I, II, III and IV respectively. Two questions will be set from each unit. First question of the unit will be having two short notes of 7 marks each and second question will be of long answer type of 14 marks. The students may attempt either of the two questions from a unit.

UNIT -I

1. Definition and basic concepts of biosystematics and taxonomy. History of taxonomy.
2. Importance and applications of biosystematics in biology.
3. Definition and understanding of various taxonomic categories.
4. Species concepts and species categories –subspecies and infra species.

UNIT – II

Modern trends in taxonomy- 5. Chemotaxonomy 6. Cytotaxonomy 7 Molecular taxonomy 8 Neotaxonomy 9 Determination of phylogenetic relationships using computer programs.

UNIT - III

10 Taxonomic procedures; collection, preservation, curation and process of identification. 11 Taxonomic characters of different kinds. Quantitative and

Qualitative analysis of variation. 12 Process of typification, different zoological types and their significance. 13 Theories of biological classification.

UNIT - IV

14 Different kinds of systematic Publications. 15 Taxonomic Keys: their kinds, merits and demerits. Use of taxonomic keys. 16 International Code of Zoological Nomenclature (ICZN) 17 Interpretation and application of important rules and formation of scientific names of different taxa.

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STRUCTURE & FUNCTION OF INVERTEBRATES

Scheme of examination:

MM: 70

1. Each theory paper is divided into FOUR units. There will be FIVE questions in all; each will be of 14 marks.
2. Q. No. 1 will be compulsory and will contain 7 very short answer type questions, each of **two** marks. Questions will be evenly distributed covering the entire syllabus.
3. Q. No. 2, 3, 4 and 5 will be from unit No. I, II, III and IV respectively. Two questions will be set from each unit. First question of the unit will be having two short notes of 7 marks each and second question will be of long answer type of 14 marks. The students may attempt either of the two questions from a unit.

UNIT I

1. Body organization: 1.1 Origin of life, Uni and multi cellular organisms 1.2 Body cavity : Acoelome, Pseudocoelome , Coelome (schizo and enterocoelous) 1.2 Fate of Blastopore : Protostome, Deuterostome 1.3 Fate of Blastomeres : Determinate and Indeterminate blastomeres 1.4 Type of cleavage : Spiral and Radial 1.5 Type of symmetry : Body planes, Asymmetry, Radial, biradial, bilateral symmetry 1.6 Segmentation : Pseudo, superficial and metameric 2. Locomotion: 2.1 Flagella and ciliary movement in Protozoa. 2.2 Hydrostatic movement in Coelenterata, Annelida and Echinodermata.

UNIT II

3. Nutrition and Digestion: 3.1 Strategies of feeding in invertebrates and digestion in lower Metazoa. 3.2 Feeding in Polycheta, Mollusca and Echinodermata. 4. Respiration: 4.1 Organs of respiration in invertebrates - Gills, book lungs and trachea. 4.2 Mechanism of respiration 5. Excretion: 5.1 Organs

of excretion in invertebrates specially Coelomoducts, Nephridia and Malphigian tubules, organ of bojanus, green gland 5.2 Mechanisms of excretion.

UNIT III

6. Nervous System : 6.1 Primitive nervous system Coelenterata and Echinodermata. 6.2 Advanced Nervous system Annelida, Arthropoda (Crustacea and insecta) and Mollusca (Cephalopoda) 7. Reproduction: 7.1 Regeneration, Asexual (paramecium, obelia) and sexual reproduction (annelida, arthropoda and mollusca)

UNIT IV

8. Important systems: 8.1 Canal system in sponges 8.2 Parasitic helminthes 8.3 Proto,meso and meta nephridia 8.4 Respiration in unio and pila 8.4 Water vascular system in star fish 9. Minor Phyla : Organization and general characters 9.1 Tardigrada , Entoprocta , Ctenophora , Rhynchocoela, Sipunculida, Rotifera,Gastrotricha

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BIOCHEMISTRY

Scheme of examination:

MM: 70

1. Each theory paper is divided into FOUR units. There will be FIVE questions in all; each will be of 14 marks.
2. Q. No. 1 will be compulsory and will contain 7 very short answer type questions, each of **two** marks. Questions will be evenly distributed covering the entire syllabus.
3. Q. No. 2, 3, 4 and 5 will be from unit No. I, II, III and IV respectively. Two questions will be set from each unit. First question of the unit will be having two short notes of 7 marks each and second question will be of long answer type of 14 marks. The students may attempt either of the two questions from a unit.

UNIT I

1 The scope of biochemistry, 1.1 Bio molecules, 1.2 Chemical bonds, 1.3 pH 1.4 Acid, Base, Buffer 1. 1.5 Concept of free energy. **2.** Proteins: Covalent properties of Proteins 2.1 Structure and chemistry of amino acids 2.2 Isolation and purification of protein 2.3 Protein sequencing 2.4 Peptide synthesis 2.5 Covalent modifications 2.6 Protein splicing Protein secondary and tertiary structure 2.7 Peptides and peptide bonds 2.8 Ramchandaran plots and amino acid propensities 2.9 Common secondary structures 2.10 Protein tertiary structure and, folding patterns 2.11 Common tertiary structural motifs. 2.12 Role of packing constraints in tertiary structure patterns. 2.13 Divergent vs. convergent evolution of similar structure. Globular and fibrous proteins. 2.14 Water and the hydrophobic effect 2.15 Tertiary and quaternary effect. 2.16 Motifs in globular proteins 2.17 Properties of protein interiors and surfaces. 2.18 Fibrous proteins (keratin, fibroin, collagen and elastin) Protein folding and

thermodynamics 2.19 Protein folding and dynamics 2.20 Folding Overview: the Levinthal paradox 2.21 Condensation and molten globules 2.22 Chaperion-assisted protein folding
2.23 Amino acid sequence variation and protein misfolding diseases Allostery (Hemoglobin), Myoglobin structure and oxygen binding 2.24 Hemoglobin subunits cooperatively, the Hill coefficient. 2.25 Quaternary structure changes and Sickle cell and other molecular diseases

UNIT II

3. Carbohydrates: Structure and biological importance of - 3.1 Monosaccharide, 3.2 Oligosaccharides 3.3 Polysaccharides(Storage and structural polysaccharides, glycosaminoglycans 3.4 Glycoconjugates(glycoprotein and preteoglycans) 4. Lipids 4.1 Fatty acids: structure, nomenclature, acyl glycerols, wax, phospholipids, sphingolipids, glycolipids, lipoproteins 4.2 Terpenoids and sterols: structure, properties and function 4.3 Function of lipids 4.4 Signal transducing molecules 5 . Nucleic acid structure 5.1 Nucleotides 5.2 Primary structure of nucleic acid. 5.2 Secondary and tertiary structures of nucleic acids; Triple helices and H- DNA; unusual secondary structure of DNA 5.3 Duplex stability 5.4 Hybridization 5.5 DNA and RNA sequencing.

UNIT III

6. Vitamins 6.1 Classification, structure, occurrence and functions of fat soluble vitamins 6.2 Classification, structure, occurrence and biological functions water soluble vitamins 6.3 Phenolics and alkaloids: structure, biological properties and functions 7. Enzymes: 7.1 Enzyme as biocatalyst 7.2 The kinetics of enzyme catalysis 7.3 Principles of enzyme catalysis 7.4 Proteases, polymerases, other examples 7.5 Coenzymes and Cofactor 7.6 Isozymes 7.7 Enzyme inhibition 7.8 Allosteric enzyme 7.9 RNA catalysis 7.10 Chemistry and structure of ribozymes 7.11 Evolutionary implications 7.12 Immobilized enzymes and their plications 7.13 Enzymes as biosensor

UNIT IV

8. Metabolism 8.1 Catabolism, anabolism, Metabolic pathway, regulation, concept of free energy 8.2 Carbohydrate metabolism: Enzymatic reaction, regulation and importance of Glycolysis, Citric acid cycle. Pentose phosphate pathway, glycogenolysis, glycogenesis, gluconeogenesis. 8.3 Lipid metabolism: fatty acid oxidation, fatty acid biosynthesis, biosynthesis of triglycerides, Cholesterol. 8.4 Amino acid metabolism: Catabolism of amino acid, transamination, deamination, biosynthesis of nonessential amino acid, fate of carbon skeleton. 8.5 Nucleotide metabolism: Degradation of purine and pyrimidines nucleotides, biosynthesis (De novo, salvage pathways) of purine and pyrimidine nucleotides 8.6 Oxidative phosphorylation and mechanism of ATP biosynthesis. **9. Inborn error of metabolism: (Important diseases of** 9.1 carbohydrate 9.2 protein 9.3 lipid 9.4 nucleotide metabolism

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BIOSTATISTICS AND BIOINFORMATICS

Scheme of examination:

MM: 70

1. Each theory paper is divided into FOUR units. There will be FIVE questions in all; each will be of 14 marks.
2. Q. No. 1 will be compulsory and will contain 7 very short answer type questions, each of **two** marks. Questions will be evenly distributed covering the entire syllabus.
3. Q. No. 2, 3, 4 and 5 will be from unit No. I, II, III and IV respectively. Two questions will be set from each unit. First question of the unit will be having two short notes of 7 marks each and second question will be of long answer type of 14 marks. The students may attempt either of the two questions from a unit.

UNIT I

1. Introduction to Biostatistics 1.1 Definitions of biostatistics 1.2 Statistical symbols 1.3 Scope & Applications of biostatistics 1.4 Collection, organization and representation of data 2. Measures of Variability 2.1 Mean deviation 2.2 Standard deviation 2.3 Variance and coefficient of variation 3. Correlation and Regression 3.1 Types of correlation 3.2 Methods of studying correlation 3.3 Regression analysis 3.4 Uses of regression analysis

UNIT II

4. Tests of Significance 4.1 Significance of difference in means Standard error of mean 4.3 Student's t-test 4.4 F-test 5. Chi-square test 5.1 Testing goodness of Fit 5.2 Chi-square distribution and characteristics 5.3 Applications of Chi-square test 5.4 Yate's correction 6. Analysis of Variance 6.1 One-way classification 6.2 Two-way classification

UNIT III

7. Introduction to Bioinformatics 7.1 Definitions of bioinformatics 7.2 Applications of bioinformatics 7.3 Scope of bioinformatics 7.4 Bioinformatics in India

UNIT IV

8. Biological Databases 8.1 Primary, secondary and composite databases 8.2 Nucleotide sequence databases 8.3 Protein sequence databases 8.4 Structural databases 9. Sequence Analysis 9.1 Types of sequence alignment 9.2 Methods of sequence alignment 9.3 Scoring schemes 9.4 Gaps and gap penalties 10. Genomics and proteomics 10.1 Structural genomics 10.2 Functional genomics 10.3 Comparative genomics 10.4 Classification of proteomics 10.5 Data mining in proteomics 10.6 Significance of proteomics

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EVOLUTION AND POPULATION GENETICS

Scheme of examination:

MM: 70

1. Each theory paper is divided into FOUR units. There will be FIVE questions in all; each will be of 14 marks.
2. Q. No. 1 will be compulsory and will contain 7 very short answer type questions, each of **two** marks. Questions will be evenly distributed covering the entire syllabus.
3. Q. No. 2, 3, 4 and 5 will be from unit No. I, II, III and IV respectively. Two questions will be set from each unit. First question of the unit will be having two short notes of 7 marks each and second question will be of long answer type of 14 marks. The students may attempt either of the two questions from a unit.

UNIT I

1. Concepts of evolution and theories of organic evolution (Lamarckism, Darwinism, Mendelism) Evolution in our hands, major transitions in Evolution.
2. Neo- Darwinism, Darwinian medicine 2.1 Hardy-Weinberg law of genetic equilibrium 2.2 Detailed account of destabilizing forces- Natural selection, Mutation, Genetic drift, Migration, Meiotic drive 2.3 Genetic structure of natural populations 2.4 Phenotypic variations 2.5 Models explaining changes in genetic structure of population

UNIT II

- 3 Genetics of speciation 3.1 Phylogenetic and biological and other concepts of species 3.2 Patterns and mechanisms of reproductive isolation 3.3 Models of speciation (Allopatric, sympatric, parapatric, peripatric) 3.4 Co-evolution and sexual selection, altruism, punctuated equilibrium, phyletic gradualism 4. Molecular population genetics 4.1 Gene duplication and divergence 4.2 Patterns

of change in nucleotide and amino acid sequences 4.3 Ecological significance of molecular variations

UNIT III

5. Genetics of Quantitative traits in populations 5.1 Analysis of quantitative traits 5.2 Quantitative traits and natural selection 5.3 Estimation of heritability 5.4 Genotype-environment interactions 5.5 Molecular analysis of quantitative traits 5.6 Phenotypic plasticity 6. Molecular Evolution 6.1 Gene Evolution 6.2 Evolution of gene families 6.3 Molecular drive

UNIT IV

7. Molecular Phylogenetics 7.1 How to construct phylogenetic trees 7.2 Phylogenetic inference-Distance methods, parsimony methods, maximum likelihood Method 7.3 Immunological techniques 7.4 Amino acid sequence and phylogeny 7.5 Nucleic acid phylogeny- DNA- DNA hybridizations, Restriction Enzyme sites, Nucleotide sequence comparisons and homologies. 7.6 Molecular Clocks.

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PHYSIOLOGY

Scheme of examination:

MM: 70

1. Each theory paper is divided into FOUR units. There will be FIVE questions in all; each will be of 14 marks.
2. Q. No. 1 will be compulsory and will contain 7 very short answer type questions, each of **two** marks. Questions will be evenly distributed covering the entire syllabus.
3. Q. No. 2, 3, 4 and 5 will be from unit No. I, II, III and IV respectively. Two questions will be set from each unit. First question of the unit will be having two short notes of 7 marks each and second question will be of long answer type of 14 marks. The students may attempt either of the two questions from a unit.

UNIT-I

1. Digestive system: 1.1 Nature of food-stuff 1.2 Various types of digestive enzymes and their action in alimentary canal, 1.3 Absorption and assimilation of food 1.4 Nervous and hormonal control of digestion 1.5 Energy balance 2. Circulatory system: 2.1 Composition and function of blood, 2.2 Haemopoiesis, blood clotting, 2.3 Blood volume, blood volume regulation, 2.4 Immunity, homeostasis, 2.5 Comparative anatomy of heart structure, 2.6 Myogenic heart, ECG – its principle and significance, cardiac cycle, 2.7 Heartbeat, blood pressure and blood groups. 3. Respiratory system: 3.1 Respiratory organs (gills, trachea and lungs), respiratory pigments 3.2 Mechanism of breathing, 3.3 Physiology of respiration, control of breathing, 3.4 Aerodynamics and BMR.

UNIT-II

4. Excretory system: 4.1 Comparative physiology of excretion, 4.2 Functional architecture of kidney and nephron, 4.3 Nitrogenous end products, formation of urine and its hormonal control, 4.4 Role of kidney in osmoregulation, urine concentration, 4.5 Waste elimination, micturition 4.6 Electrolyte balance, acid-base balance. 5. Muscular system: 5.1 Types and properties of muscles, 5.2 Functional architecture of skeletal muscles, 5.3 Biophysical and biochemical events during muscular activity. 6. Nervous system: 6.1 Functional architecture of neurons, 6.2 Origin and propagation of nerve impulse through axon, 6.3 Action potential, synaptic transmission, 6.4 Reflex arc and reflex action, 6.5 Gross neuroanatomy of the brain and spinal cord, 6.6 Central and peripheral nervous system, 6.7 Neural control of muscle tone and posture.

UNIT-III

7. Sense organs: 7.1 Structural architecture and functioning of eyes and ears, 7.2 Tactile response. 8. Thermoregulation and cold tolerance: 8.1 Heat balance and exchange, endotherms Vs ectotherms, 8.2 Counter-current heat exchanger, 8.3 Torpor, hibernation and aestivation, 8.4 Adaptations to extreme climate, 8.5 Comfort zone, body temperature- physical, chemical and neural regulation. 9. Stress: 9.1 Basic concepts of environmental stress and strain, 9.2 Homeostasis, physiological response to body exercise, 9.3 Meditation, yoga and their effects.

UNIT-IV

10. Endocrinology: 10.1 Endocrine glands in vertebrates, hormones and related diseases. 11. Reproduction: 11.1 Reproductive cycle, 11.2 Reproductive processes (implantation, parturition and lactation), neuroendocrine regulators in insects and mammals, pheromones.

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MOLECULAR BIOLOGY & BIOTECHNOLOGY

Scheme of examination:

MM: 70

1. Each theory paper is divided into FOUR units. There will be FIVE questions in all; each will be of 14 marks.
2. Q. No. 1 will be compulsory and will contain 7 very short answer type questions, each of **two** marks. Questions will be evenly distributed covering the entire syllabus.
3. Q. No. 2, 3, 4 and 5 will be from unit No. I, II, III and IV respectively. Two questions will be set from each unit. First question of the unit will be having two short notes of 7 marks each and second question will be of long answer type of 14 marks. The students may attempt either of the two questions from a unit.

UNIT I

1. DNA replication 1.1 Prokaryotic and eukaryotic DNA replication. 1.2 Mechanics of DNA replication. 1.3 Enzymes and accessory proteins involved in DNA replication. 2. Recombination and repair 2.1 Holiday junction. 2.2 FLP/FRT and Cre-Lox recombination. 2.3 Rec A and other recombinases. 2.4 DNA repair mechanisms.

UNIT II

3 Transcription 3.1 Prokaryotic transcription. 3.2 Eukaryotic transcription. 3.3 Regulatory elements and mechanisms of transcription regulation. 3.4 Transcription termination – attenuation and antitermination. 3.5 Gene silencing. 4 Post-transcriptional modifications in RNA 4.1 5'- Cap formation. 4.2 End processing and polyadenylation. 4.3 Splicing and editing. 4.4 Nuclear export of mRNA. 4.5 RNA stability.

UNIT III

5 Translation 5.1 Genetic code 5.2 Prokaryotic and eukaryotic translation 5.3 Regulation of translation 5.4 Co-and post-translation modifications of proteins. 6 Protein sorting Organelle biogenesis and protein synthesis. 6.1 Synthesis and targeting of mitochondrial and chloroplast proteins 6.2 Synthesis and targeting of peroxisomal proteins 6.3 Secretory pathways 6.4 Translocation of secretory proteins across the ER membrane 6.5 Insertion of membrane proteins in the ER membrane 6.6 Post-translation modifications in rER. 6.7 Protein glycosylation in ER and Golgi complex 6.8 Golgi and post-Golgi protein sorting and proteolytic processing 6.9 Receptors-mediated endocytosis and sorting of internalized proteins 6.10 Molecular mechanisms of vesicular traffic.

UNIT IV

7 Molecular mapping of genome 7.1 Genetic and physical maps 7.2 Southern hybridization, fluorescence in *situ* hybridization(FISH) for genome analysis. 7.3 Molecular markers in genome analysis(RFLP, RAPD and AFLP) 7.4 Application of RFLP in forensic, disease prognosis, genetic counseling and pedigree analysis. 8 Transgenic animals and knock-outs 8.1 Production 8.2 Applications 8.3 Embryonic stem cells 8.4 Bioethics 9 Assisted reproduction technologies 9.1 Embryo sexing and cloning. 9.2 Screening for genetic disorders. 9.3 ICSI, GIFT etc. 9.4 Cloning of animals by nuclear transfer.

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ECONOMIC ZOOLOGY

Scheme of examination:

MM: 70

1. Each theory paper is divided into FOUR units. There will be FIVE questions in all; each will be of 14 marks.
2. Q. No. 1 will be compulsory and will contain 7 very short answer type questions, each of **two** marks. Questions will be evenly distributed covering the entire syllabus.
3. Q. No. 2, 3, 4 and 5 will be from unit No. I, II, III and IV respectively. Two questions will be set from each unit. First question of the unit will be having two short notes of 7 marks each and second question will be of long answer type of 14 marks. The students may attempt either of the two questions from a unit.

UNIT-I

1. Economic importance of Protozoa: Beneficial and Harmful Protozoa.
2. Economic importance of Helminthes: Beneficial and Harmful Helminthes.
3. Economic importance of Arthropods: Beneficial and Harmful mites and ticks, crustaceans, spiders, insects.
4. Insects as pollinators, ornamental insects, as food.
5. Lac insect, Honey bees, Silk worm and industries related to them.
6. Harmful insects: - Insect pests: crop pests, storage pests, pests of fruits and vegetables, Pests of medical and veterinary importance and their management.

UNIT-II

7. Pisciculture and products of fishing industry
- 7.1 Common Freshwater and Marine Food Fishes of India.
- 7.2 Freshwater Aquarium, Common Freshwater aquarium Fishes.
- 7.3 Exotic Food and Game Fishes.
8. Prawn fisheries.
9. Economic importance of mollusca: Pearl culture.

UNIT-III

10. Poultry keeping and Duck poultry. 11. Dairy farming and Piggery. 12. Leather industry, wool industry, (Fur and Fur Industry).

UNIT-VI

13. Pharmaceuticals from animals (Snake venom). 14. Wild life in India and its conservation and Significance. 15. Economic Importance of Mammals (Rodents and their management).

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BIOLOGY OF CHORDATES

Scheme of examination:

MM: 70

1. Each theory paper is divided into FOUR units. There will be FIVE questions in all; each will be of 14 marks.
2. Q. No. 1 will be compulsory and will contain 7 very short answer type questions, each of **two** marks. Questions will be evenly distributed covering the entire syllabus.
3. Q. No. 2, 3, 4 and 5 will be from unit No. I, II, III and IV respectively. Two questions will be set from each unit. First question of the unit will be having two short notes of 7 marks each and second question will be of long answer type of 14 marks. The students may attempt either of the two questions from a unit.

UNIT I

1. Origin and outline classification of the chordates. 2. Salient features and Interrelationships of Hemichordate, Urochordata and Cephalochordata. 3. Origin, evolution and adaptive radiation of chordates. 4. Origin, evolution and general characters of Agnatha: Ostracoderms and Cyclostomes. 5. The early Gnathostomes (Placoderms).

UNIT II

6. A general account of the Elasmobranchii, Holocephali, Dipnoi and Crosspterygii. 7. Adaptive radiation in bony fishes. 8. Origin, evolution and adaptive radiation of Amphibia. 9. Parental care in Amphibia 10. Neotany in Amphibia

UNIT III

11. Origin and evolution of Reptiles: Seymouria and Cotylosauria. 12. Skull of Reptiles. 13. Venom in Ophidians. 14. Dinosaurs. 15. Living reptiles: a brief account of Rhynchocephalia. Chelonia, Crocodilia and Squamata.

UNIT IV

16. Origin and evolution of birds. 17. Origin of flight: Flight adaptations. 18. Flightless Birds. 19. Modifications of Beak, Feet and Palate in Birds. 20. Origins of mammals: Primitive mammals (Prototheria and Metatheria). 21. General account on adaptive radiations in Eutherian mammals. 22. Evolution of man.

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GENES AND DIFFERENTIATION

Scheme of examination:

MM: 70

1. Each theory paper is divided into FOUR units. There will be FIVE questions in all; each will be of 14 marks.
2. Q. No. 1 will be compulsory and will contain 7 very short answer type questions, each of **two** marks. Questions will be evenly distributed covering the entire syllabus.
3. Q. No. 2, 3, 4 and 5 will be from unit No. I, II, III and IV respectively. Two questions will be set from each unit. First question of the unit will be having two short notes of 7 marks each and second question will be of long answer type of 14 marks. The students may attempt either of the two questions from a unit.

UNIT I

1. Introduction to animal development 1.1 Problems of development biology 1.2 Develop patterns in metazoans 1.3 Development in unicellular eukaryotes 2. Creating multicellularity 2.1 Cleavage types 2.2 Comparative account of gastrulation 3. Early vertebrate development 3.1 Neurulation and ectoderm 3.2 Mesoderm and endoderm 4. Cytoplasmic determinants and autonomous cell specification 4.1 Cell commitment and differentiation 4.2 Cell specification in nematodes 4.3 Germ cell determinants 4.4 Germ Cell Migration. 4.5 Progressive cell- Cell interaction and cell specification fate

UNIT II

5. Body Axes 5.1 Establishment of body axes in mammals and birds 5.2 Proximate tissue interactions 5.3 Genetics of axis specifications in Drosophila 6. Homeobox concept in different phylogenetic groups 7. Tetrapod limb development 8. Hormones as mediators of development 8.1 Amphibian

metamorphosis 8.2 Insect metamorphosis 8.3 Ovarian luteinization and mammary gland differentiation.

UNIT III

9. Environmental evolution and animal development. 9.1 Environmental cues and effects 9.2 Malformations and disruptions. 9.3 Changing evolution through development modularity 9.4 Developmental constraints 9.5 Creating new cell types-basic evolutionary mystery. 10. Biology of sex determination 10.1 Chromosomal sex determination - Mammals and *Drosophila* 10.2 Testis determination genes 10.3 Ovarian development 10.4 Secondary sex determination in mammals. 10.5 Environmental sex determination

UNIT IV

11. Cell diversification in early embryo 11.1 *Xenopus* blastomeres 11.2 Morphogen gradients 11.3 Totipotency & Pluripotency 11.4 Embryonic stem cells. 11.5 Renewal by stem cells-epidermis 11.6 Skeletal muscle regeneration 11.7 Connective tissue cell family 12. Hemopoietic stem cells 12.1 Stem cell disorders. 12.2 Blood cell formation 12.3 Bone marrow transplants 12.4 Gene therapy.

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**ENTOMOLOGY: INSECT SYSTEMATIC, TAXONOMY AND INSECT
ECOLOGY**

Scheme of examination:

MM: 70

1. Each theory paper is divided into FOUR units. There will be FIVE questions in all; each will be of 14 marks.
2. Q. No. 1 will be compulsory and will contain 7 very short answer type questions, each of **two** marks. Questions will be evenly distributed covering the entire syllabus.
3. Q. No. 2, 3, 4 and 5 will be from unit No. I, II, III and IV respectively. Two questions will be set from each unit. First question of the unit will be having two short notes of 7 marks each and second question will be of long answer type of 14 marks. The students may attempt either of the two questions from a unit.

UNIT-I

1. Historical review of insect classification .basis of insect classification. Phylogeny of Arthropoda and Hexopoda .Introduction to primitive insects. 2. Detailed classification of important and selected super families and families of the following orders- Orthoptera, Isoptera, Hemiptera, Coleoptera, Lepidoptera, Diptera and Hymenoptera.

UNIT-II

3. Social life in Isoptera and Hymenoptera. Life cycle of locusts and aphids. 4. Origin and evolution of insects with special reference to fossil insects. Causes of success of insects.

UNIT-III

5. Ecology of insects- (a) Effect of physical factors. (b) Intra and inter specific relations. (Biotic factors) (c) Insect plant interaction.

UNIT-IV

6. Population ecology: Population dynamics, size, fluctuation, biogeography, community ecology, species interaction, community structure, diversity. 7. Biochemical adaptations to environmental stress (metamorphosis, diapause, polymorphisms, swarms, out breaks and migration).

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ENTOMOLOGY: INSECT MORPHOLOGY, PHYSIOLOGY,
EMBRYOLOGY AND DEVELOPMENT

Scheme of examination:

MM: 70

1. Each theory paper is divided into FOUR units. There will be FIVE questions in all; each will be of 14 marks.
2. Q. No. 1 will be compulsory and will contain 7 very short answer type questions, each of **two** marks. Questions will be evenly distributed covering the entire syllabus.
3. Q. No. 2, 3, 4 and 5 will be from unit No. I, II, III and IV respectively. Two questions will be set from each unit. First question of the unit will be having two short notes of 7 marks each and second question will be of long answer type of 14 marks. The students may attempt either of the two questions from a unit.

UNIT-I

1. General organization of insect body, 1.1 Integument 1.2 Head: sutures and area of cranium, tentorium, Gnathal appendages. 1.3 Thorax: Legs and their modifications, wings and wing coupling.

UNIT-II

2. (a) Digestive system 2.1 Alimentary canal and its modifications 2.2 Physiology of digestion. 3. Physiology of circulatory system 4. Excretory system and its modifications 5. Respiratory system and its modifications, adaptations for aquatic respiration.

UNIT-III

6. Nervous system and its modifications. 7. Morphology and physiology of neuroendocrine system. 8. Sense organs: Mechanoreceptors, Chemoreceptor. 9.

Auditory organs, light producing organ, sound producing organ, visual organ (Compound eye and ocelli). 10. Muscular system and distribution of muscles.

UNIT-IV

11. Reproductive system. Morphology and physiology of male and female, reproductive system, its associated ducts and glands and external genitalia. 12. Embryology: - Structure of egg, embryonic and post embryonic development, 13. Types of larvae, pupae and metamorphosis.

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FISH & FISHERIES: ICHTHYOLOGY: STRUCTURE AND FUNCTION

Scheme of examination:

MM: 70

1. Each theory paper is divided into FOUR units. There will be FIVE questions in all; each will be of 14 marks.
2. Q. No. 1 will be compulsory and will contain 7 very short answer type questions, each of **two** marks. Questions will be evenly distributed covering the entire syllabus.
3. Q. No. 2, 3, 4 and 5 will be from unit No. I, II, III and IV respectively. Two questions will be set from each unit. First question of the unit will be having two short notes of 7 marks each and second question will be of long answer type of 14 marks. The students may attempt either of the two questions from a unit.

UNIT I

1. Classification of fishes with special reference to evolutionary trends and adaptations. 2. Integument and exoskeleton. 3. Fins: Types of fins, structure, modifications and functions of fins 4. Locomotion: Locomotor muscle, the red (slow) and white (fast) muscle fiber types; modes of swimming and hydromechanics of propulsion; role of fins in swimming; significance of swim bladder in swimming; non swimming locomotion.

UNIT II

5. Food, feeding habits and feeding adaptations/behavior; structure of the alimentary canal and physiology of digestion and absorption 6. Blood vascular system: Structure of the heart; principal blood vessels and circulation of blood (elasmobranchs, teleost and Dipnoi). 7. Gills and aquatic respiration: Organization of gills in fishes; structure of a typical teleostean gill: physiology of gill respiration gill ventilation. Gill surface area. Blood flow through gills.

Water-blood barrier. gas exchange at the gill surface and gas exchange between blood and tissues 8. Air-breathing fishes: causative factors and structural adaptations.

UNIT III

9. Structure and functions of the kidney: nitrogenous end products and pattern of their excretion 10. Water and electrolyte regulation in marine, freshwater and euryhaline fishes 11. Structure and functions of the swim-ladder.

UNIT IV

12. Nervous system: Structure and functions of the central. Peripheral and autonomic nervous systems; anatomy and function of the Mauthner neurons.

13. Structure and functions of the sense organs: Eye; visual pigments and vision, Chemoreceptors: Olfactory and gustatory biological significance of chemoreception. Labyrinth. Mechanoreceptors (lateral line organs).

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FISH & FISHERIES: PHYSIOLOGY

Scheme of examination:

MM: 70

1. Each theory paper is divided into FOUR units. There will be FIVE questions in all; each will be of 14 marks.
2. Q. No. 1 will be compulsory and will contain 7 very short answer type questions, each of **two** marks. Questions will be evenly distributed covering the entire syllabus.
3. Q. No. 2, 3, 4 and 5 will be from unit No. I, II, III and IV respectively. Two questions will be set from each unit. First question of the unit will be having two short notes of 7 marks each and second question will be of long answer type of 14 marks. The students may attempt either of the two questions from a unit.

UNIT I

1 Structure and physiology of the endocrine organs and tissues: Pituitary, Thyroid, Gonads, Adrenal, Endocrine pancreas, Ultimobranchial, Caudal neurosecretory cells and urophysis, Pineal. 2 Defense mechanism– integument and Immune system, development of immune system, cells and tissues of the fish immune system, modulators of fish immune responses, humoral and cell mediated immune defense, fish antibody molecules and their effector functions.

UNIT II

3 Reproduction: Organs of reproduction; modes of reproduction viviparity, hormonal and environmental regulation of reproduction. 4 Reproductive strategies, environmental and endocrine factors regulating reproductive cycles, hormonal and molecular mechanisms of oogenesis, spermatogenesis, oocyte maturation and spermiation, fertilization, mechanism of sex determination, maternal factors in early development.

UNIT III

5 Reproductive behaviour: Secondary sexual character. Nest building and parental care. 6 Behaviour and cognition -patterns of migration, orientation and homing, schooling, feeding, background adaptations.

UNIT IV

7 Adaptations: Coloration, sound production, electric organs, luminescent organs (location, structure, physiology and biological significance). 8 Adaptations in deep sea. Hill-stream and cave-dwelling fishes, freezing avoidance in arctic and Antarctic fishes.

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ENVIRONMENTAL BIOLOGY AND ETHOLOGY

Scheme of examination:

MM: 70

1. Each theory paper is divided into FOUR units. There will be FIVE questions in all; each will be of 14 marks.
2. Q. No. 1 will be compulsory and will contain 7 very short answer type questions, each of **two** marks. Questions will be evenly distributed covering the entire syllabus.
3. Q. No. 2, 3, 4 and 5 will be from unit No. I, II, III and IV respectively. Two questions will be set from each unit. First question of the unit will be having two short notes of 7 marks each and second question will be of long answer type of 14 marks. The students may attempt either of the two questions from a unit.

UNIT I

1. Ecological law of minimum and law of tolerance 2. Ecological niches , overlapping of niches , ecotone 3. Energy flow, food chain, food web and trophic levels, ecological pyramids 4. Nutrient cycles in nature -carbon, nitrogen, phosphorus and water. 5. Ecozones of India -habitat and fauna 6 Population ecology: 6.1 Characteristics of a population 6.2 Population growth curves, population regulation 6.3 Life history strategies (r and K selection) 7 Environmental Pollution - air, water, noise and radiation(electromagnetic and ionizing) ; carbon foot print

UNIT II

8. Biodiversity : 8.1 Species diversity, ecosystem diversity , genetic diversity and molecular Diversity. 8.2 Alpha, Beta and Gamma Diversity 8.3 Biodiversity indices. Measuring -species richness, species evenness Simpson's diversity Index and Shannon's diversity index 8.4 Biodiversity act of India and Biodiversity hot spots in India (with special reference to Western Ghats and

North east), UNESCO heritage sites (Kaziranga National Park) 9 Ecological communities: (succession, zonation, environment, biota and adaptations) 9.1 Terrestrial 9.2 Fresh water 9.3 Marine and estuarine 10. Climatic Changes - El Nino and La Nina, Earth quacks and Tsunami 11 . Elementary knowledge of : Wildlife acts and schedules, CITIES, TRAFFIC, WWF, Ramser convention, IUCN,ZSI,ZAI,ENVIS,IGCMC, Project Tiger, Biosphere reserves, world heritage sites and hot spots.

UNIT - III

12. Scientists and their works : Konrad Lorenz, Niko Tinbergen, Karl Von Frisch, Skinner B F and Harlow Harry, Richard Dawkins, EO Wilson, Desmond Morris 13. Concepts of Ethology (SS,FAP,ASE,IRM) , Flush Toilet model ; Genes and behaviour; Evolution of behaviour, Development of behavior 14. Neuroethology : 14.1 Methods of studying brain and behaviour: neuroanatomical, neurophysiological and neurochemical 14.2 Basic knowledge of EEG, LASER, PET,CAT , MRI and nuclear medicine imaging 14.3 Mammalian Brain and Behaviour, Limbic system and hypothalamus 14.4 Sleep - arousal and reticular formation 15. Definition of Social behaviour 15.1 Properties and advantages of social grouping, social group of monkeys 15.2 Sociobiology-Darwinian fitness, individual fitness, kin selection, group selection, cooperation, reciprocation, altruism , reciprocal altruism, Proximate and Ultimate causations 15.3 Home range, territory, core area and aggression 15.4 Human behaviour

UNIT IV

16. Feeding and sexual strategies in animals 17. Parental care in animals 18. Communication in animals - vocal, tactile, visual and chemical 19. Learning: 19.1 Introduction and definition 19.2 Types - Habituation, trial and error ,conditioning , cognition and imprinting 19.3 Short and long term memory, neural mechanism of learning

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TOOLS & TECHNIQUES

Scheme of examination:

MM: 70

1. Each theory paper is divided into FOUR units. There will be FIVE questions in all; each will be of 14 marks.
2. Q. No. 1 will be compulsory and will contain 7 very short answer type questions, each of **two** marks. Questions will be evenly distributed covering the entire syllabus.
3. Q. No. 2, 3, 4 and 5 will be from unit No. I, II, III and IV respectively. Two questions will be set from each unit. First question of the unit will be having two short notes of 7 marks each and second question will be of long answer type of 14 marks. The students may attempt either of the two questions from a unit.

UNIT I

1. Principle, construction and application of 1.1 Light Microscopy 1.2 Phase contrast Microscopy 1.3 Interference Microscopy 1.4 Polarized Microscopy 1.5 Fluorescence Microscopy 1.6 Electron Microscopy (TEM+SEM) 1.7 Confocal and Atomic Force Microscopy

UNIT II

2. Electrophoresis; Principle, construction, application and equipment used 2.1 Various types such as ; paper, agarose, PAGE, submerged DNA , Pulse chase 2.2 Isoelectric focusing points and capillary electrophoresis 2.3 Various media for Electrophoresis 3. Chromatography; Principle, construction, application and equipment used 3.1 Various types such as; paper, TLC, GLC, HPLC, Ion-Exchange and affinity chromatography.

UNIT III

4. Colorimetry and Spectrophotometry; Principle, construction, application and equipment used 4.1 Various types such as; fluorescence, UV, IR, Atomic Absorption 4.2 Lambert-Beer's Law 5. Principle and application of radiations in biology 5.1 Radiation Dosimetry and equipment used for it 5.2 Radioisotopes, types, characteristics and uses of 5.3 Tracer techniques in biology 5.4 Scintillation techniques

UNIT IV

6 Principle of cytological and cytochemical techniques 6.1 Fixation, chemical basis of fixation by formaldehyde, gluteraldehyde, chromium salts, mercury salts, osmium salts, alcohol and acetone. 6.2 Chemical basis of Staining of carbohydrates, proteins, lipids and nucleic acids. 7 Cell and Tissue Culture techniques 7.1 Design and functioning of tissue culture laboratory 7.2 Cell proliferation measurements 7.3 Cell viability testing 7.4 Culture media preparation and harvesting techniques.

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ENTOMOLOGY: ECONOMIC ENTOMOLOGY

Scheme of examination:

MM: 70

1. Each theory paper is divided into FOUR units. There will be FIVE questions in all; each will be of 14 marks.
2. Q. No. 1 will be compulsory and will contain 7 very short answer type questions, each of **two** marks. Questions will be evenly distributed covering the entire syllabus.
3. Q. No. 2, 3, 4 and 5 will be from unit No. I, II, III and IV respectively. Two questions will be set from each unit. First question of the unit will be having two short notes of 7 marks each and second question will be of long answer type of 14 marks. The students may attempt either of the two questions from a unit.

UNIT-I

1. Concept of pest .How and why insects have become pests? 2. Bionomics, distribution; mode of damage caused and management of major pests

UNIT-II

3. Cash crops: sugar cane, tobacco and mustard, cotton. 4. Cereal crops: wheat, paddy, millet, maize, sorghum, pulses.

UNIT-III

5. Pests of vegetables, fruits and oil seed crops. 6. Pests of medical and veterinary importance and role of WHO and UNICEF. 7. Storage pests (stored grains and milled products).

UNIT-IV

8. Forensic entomology with special reference to man and wild life. 9. Beneficial insects (silk worm, honey bee, lac insect and industries related to them).

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ENTOMOLOGY: INSECT TOXICOLOGY AND PEST CONTROL

Scheme of examination:

MM: 70

1. Each theory paper is divided into FOUR units. There will be FIVE questions in all; each will be of 14 marks.
2. Q. No. 1 will be compulsory and will contain 7 very short answer type questions, each of **two** marks. Questions will be evenly distributed covering the entire syllabus.
3. Q. No. 2, 3, 4 and 5 will be from unit No. I, II, III and IV respectively. Two questions will be set from each unit. First question of the unit will be having two short notes of 7 marks each and second question will be of long answer type of 14 marks. The students may attempt either of the two questions from a unit.

UNIT-I

1. Definition and history of various methods of insect pest control 1.1 Physical 1.2 Mechanical 1.3 Chemical 1.4 Cultural 1.5 Quarantine regulations.

UNIT-II

2. Nomenclature and classification of insecticides. 2.1 Concept of Ist, IInd and IIIrd generation pesticides 2.2 Pesticides act of India. 2.3 Selection of insecticides, their formulation and mode of action. 3. Preventive measures and antidotes. 4. Fumigants and appliances used for application of insecticides. 5. Mechanism of insecticides resistance in insects. Insecticide synergists and antagonist.

UNIT-III

6. Biological control : 6.1 Definition, biological control agents 7. Parasites : 7.1 Parasitoids 7.2 Predators 7.3 Microbial pesticides 7.4 Mass production and distribution 7.5 Advantages and disadvantages of biological control.

UNIT-IV

8. Integrated pest management (IPM) 8.1 Definition, importance, 8.2 Tools, basic principles 8.3 Evolutionary trends. (b) Dynamics of environmental pollution. 9 . Pesticides: 9.1 Their impact on wild life 9.2 Their impact on human health (bioaccumulation, biomagnification, biodegradation)

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FISH & FISHERIES: ICHTHYOLOGY - AQUATIC RESOURCES AND THEIR CONSERVATION

Scheme of examination:

MM: 70

1. Each theory paper is divided into FOUR units. There will be FIVE questions in all; each will be of 14 marks.
2. Q. No. 1 will be compulsory and will contain 7 very short answer type questions, each of **two** marks. Questions will be evenly distributed covering the entire syllabus.
3. Q. No. 2, 3, 4 and 5 will be from unit No. I, II, III and IV respectively. Two questions will be set from each unit. First question of the unit will be having two short notes of 7 marks each and second question will be of long answer type of 14 marks. The students may attempt either of the two questions from a unit.

UNIT I

1 Riverine fisheries- important river systems and their hydrological conditions, flora and fauna with special reference to fisheries, dams and their impact on riverine fisheries, fish ladders, interlinking of rivers and likely impact on fisheries. 2 Cold water fisheries - ecology of hill streams, biology of important cold water fishes of India, recreational fishing. 3 Lacustrine fisheries - origin of lakes and lake morphology, light, temperature and density relationship in the lacustrine ecosystems, heat energy and water movements, oxygen and other dissolved gases in lakes, pH and redox potential, fisheries profile and potential of major Indian lakes.

UNIT II

4 Estuarine fisheries- major estuarine systems of India, hydrography, flora and fauna with special reference to fisheries. 5 Marine fisheries – coastal and deep

sea fisheries, permanent and seasonal stratification, upwelling, the photic zone, control of primary production by light and nutrients availability, chemical properties of sea water, biology of important fishes (sardine, mackerel, tuna), marine protected areas.

UNIT III

6 Integrated resources- coastal wet lands, mangroves, coral reefs, sea grasses and their conservation. Fishing techniques-- technologies for localizing catches- remote sensing, sonar, radar; crafts and gears. 7 Stock assessment and management-- Natural markers- morphological analyses, environmental signals, genetic analyses; Applied markers- marking and tagging, Stock identification data analysis - stock composition analysis, age and growth, fecundity estimation, application of statistical methods in fisheries. 8 Fish conservation- fishing laws and regulation, permitting. Post harvest technology-- Fish spoilage, rigor mortis, rancidity, enzymatic spoilage, microbial spoilage.

UNIT IV

9 Fish preservation and processing- handling of fish at harvest/onboard, principles of fish preservations, methods of preservation, problems associated with fish preservations, quality control. 10 Fish products and byproducts: Liver oil, body oil, meal, fish manure, guano. Glue. Isinglass, roe (caviar), tins and leather. 11 Aquatic pollution- types and sources, impact of pollution on aquatic organisms, ecosystem analysis- bio-indicators, biomonitoring, environmental factors and fish health, xenobiotics. 12 Waste management- national and international standards. Extension services - basic principles and emerging issues of extension, role of information and communication technology in fisheries extension.

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FISH & FISHERIES: ICHTHYOLOGY – AQUACULTURE

Scheme of examination:

MM: 70

1. Each theory paper is divided into FOUR units. There will be FIVE questions in all; each will be of 14 marks.
2. Q. No. 1 will be compulsory and will contain 7 very short answer type questions, each of **two** marks. Questions will be evenly distributed covering the entire syllabus.
3. Q. No. 2, 3, 4 and 5 will be from unit No. I, II, III and IV respectively. Two questions will be set from each unit. First question of the unit will be having two short notes of 7 marks each and second question will be of long answer type of 14 marks. The students may attempt either of the two questions from a unit.

UNIT I

1.Culture technology– freshwater (carps, catfishes, murrels, prawns). 2.Brackish water (asian sea-bass, milk fish, mullets, crabs, shrimps). 3.Mariculture (mussels, oysters, sea weeds), fish food organisms (algae; *Artemia*; zooplankton).

UNIT II

4.Water Quality Requirements for Aquaculture- Role of temperature, pH, salinity, dissolved oxygen, ammonia, nitrite, nitrate, phosphate, Biological oxygen demand, Chemical oxygen demand. Integrated farming - fish-cum-live stock farming, paddy-cum-fish farming, aquaculture engineering- aquahouse, hatchery, ponds, race ways, recirculating system, cage, and pen. 5.Fish seed technology - natural collection, bundh breeding, induced breeding, cryopreservation of gametes. 6.Transport of finfish and shellfish- transport of eggs, fry, fingerlings and adults.

UNIT III

7.Nutrition of aquatic animals - nutritional requirements of commercially important finfish and shellfish, dietary requirements of larvae and brooders, feed types, manufacture and ingredients, anti-nutritional factors in fish feed ingredients and their treatments, use of attractants and growth stimulants in fish feeds, alternative protein sources in aquaculture diets, feeding techniques, role of probiotics in nutrition. 8.Setting up of display aquarium- freshwater and marine aquaria, selection of compatible species, breeding of aquarium fishes. 9.Role of genetics in aquaculture– gynogenesis, androgenesis, triploidy, tetraploidy, hybridization, sex reversal and breeding, production of transgenic fish, impact of GMOs on aquatic biodiversity.

UNIT IV

10.Fish health- infection and diseases in fish, common fish pathogens, routes of pathogen entry in fish, methods of colonization and spread of pathogens, immune - evasion mechanisms of fish pathogens. 11.Environmental impact of aquaculture- aquacultural wastes and future developments in waste minimization, environmental consequences of hypernutrition. Fish vaccines- strategy and use in aquaculture.

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