



## অসম লোকসেৱা আয়োগ

**ASSAM PUBLIC SERVICE COMMISSION**

Jawaharnagar, Khanapara, Guwahati-781022.

**(3) Name of Post:** Junior Scientific Officer for Mobile Forensic Laboratories under the Directorate of Forensic Science, Assam

### **SYLLABUS**

(Master Degree Standard)

### **SUBJECT: BIOLOGY AND GENERAL STUDIES**

(Multiple Choice Objective Type)

**Full Marks: 200 Marks**

**Time: 2 Hrs**

### **PART - A**

#### **1. General Biology**

Cell and cellular organelles, The cell theory, Prokaryotic and Eukaryotic cells (Plant cell and animal cell), Structure and function of cell and cellular organelles, Eukaryotic sub-cellular components: Nucleus, chromosomes, plasma membrane, endoplasmic reticulum, lysosomes, peroxisomes, Golgi apparatus, mitochondria, chloroplast, cytoskeleton. Cell cycle and its control; Cell division-amitosis, mitosis and meiosis.

Amino acids – structure and functional group properties. Proteins and peptides – Composition of proteins – Primary, Secondary and Tertiary structure of protein. Definition, biological importance, classification and chemistry of Carbohydrates and Lipids. Enzymes: Classification and importance of various enzymes. Basics of Human anatomy and physiology. Basic concept of Taxonomy.

Basic concepts of Microscopy and use of Optics. Light microscopy, Bright and Dark Field microscopy, Fluorescence microscopy, Phase Contrast microscopy, scanning probe microscopy, atomic force microscopy, fluorescence microscopy, Electron microscopy (TEM and SEM), and Cryo Electron Microscopy.

Antigen – Epitope, essential factors for antigenicity, haptenes and adjuvant. Immunoglobulin – structure, classes of immunoglobulin, antigen – antibody reactions and their techniques in serological analysis. Overview of cells and organs of immune system and basic immunology. Applications of various polymorphic enzymes and proteins in criminal investigation.

Antigen Processing and presentation. Production of Monoclonal and polyclonal antibodies, hybridoma technology. Autoimmunity and hypersensitivity. HLA typing and its forensic importance. Vaccines, Lectins and their forensic significance.

Blood and its composition. Hemoglobin and its variants. Theories and biochemical tests for the identification of blood. Blood Typing/Grouping – ‘ABO’ system and its significance in forensic investigation. Other blood group antigens – ‘Rh sub types’, MN, I, P, Kell, Duffy, Kidd, Lewis, Lutheran and Bombay blood group.

## **2. Fundamentals of various branches of Forensic Biology**

History and development of Forensic Science, Brief History of Forensic Biology: Developments and Scope in the field of Forensic Biology, Branches of Forensic Biology Different types of biological Evidences and their significance in Forensic Science Collection, Preservation, Packing, Forwarding and Documentation of Biological Evidences.

Forensic Examination of semen and other body fluids – vomit, feces, urine, saliva and vaginal secretions. structure and morphology of human and animal hair.

Introduction to various types of woods and its anatomy, Identification of endangered wood & its significances. Varieties of timber, seeds and leaves – their identification and matching. Study and identification of pollen grains, starch grains. Morphological and anatomical characteristics of plants yielding drugs of abuse like opium, Cannabis, Coca plant, Psilocybe mushrooms, Tobacco, etc. Botanical analysis of plants with concern to Narcotics and psychotropic drugs analysis.

Introduction to microbiology, cell wall composition of Gram positive and Gram-negative bacteria. Sterilization techniques – Physical agents: Dry heat, wet heat and cold sterilization, filtration, radiation; Chemical agents (Disinfectants, antibiotics, alcohols) and their mechanisms. Different methods for isolation of microorganisms from forensic samples like vomit, stool, stomach wash and residual food.

Introduction to Forensic Limnology, Role of algae & fungi in Forensic Science, Introduction to Diatoms, Identification of diatoms from biological matrices from soil & water, Diatoms testing, Legal aspects of Diatoms.

Introduction and History of Forensic Entomology, Anatomy and Taxonomy of Forensically relevant Insects (Diptera), Insect Succession (in buried bodies, burnt bodies, decomposed bodies above the soil and in water) & Factors that affect Insect Succession, Estimating Postmortem Interval/ Time since infestation from invertebrate development rates, Forensically important Aquatic Insects, Insects as weapons and Threats to National Security, Collection of entomological evidence during death investigations, Forensic Entomology and the Law,



### 3. General Biotechnology

Cell lines: Definition, development, maintenance and management, established cell lines and their characteristic features. Transgenic animals- Creating transgenic animals, Example of transgenic animals Dolly, Insects, Primates, mice.

Somaclonal and gameto clonal variation: applications and limitations. Transgenic Plants: Herbicide resistant, insect Resistant, drought/stress resistant, delayed ripening, Ti Plasmid and T- DNA transfer.

Gene therapy: potential approach to gene therapy. Southern blotting, Northern blotting, Western blotting, ISO-electric focusing. Overview of Stem cells and its applications. Bonding in Organic Compounds, Gravimetric Analysis, Volumetric Analysis, and Analysis of real Samples.

### 4. Forensic DNA and Wildlife

Chemical structure of DNA and RNA. Overview of DNA replication, transcription and translation. Procedure for collection and preservation of biological sample for DNA analysis. Techniques of DNA isolation and its quantitation. DNA separation techniques. History of DNA fingerprinting and DNA polymorphism. Genes and DNA markers in forensic DNA analysis. Introduction to Polymerase Chain Reaction and its applications. Introduction to mitochondrial DNA and its forensic importance. Fundamentals of RFLP and PCR based DNA typing. STR, VNTR, and Single Nucleotide Polymorphism (SNP) and its applications in forensic investigation. STR genotyping, Result of STR marker analysis and its interpretation. LCN typing. Mitochondrial DNA analysis in Forensic investigation. X-STR and Y-STR analysis and its significance in establishing paternal-maternal relationships. Nonhuman DNA analysis. Amplifying DNA: PCR and Cell based DNA Cloning.

Definition and advances in wildlife forensics, Threats to the natural resources and wild species inhabiting globally, Importance of Wildlife Conservation, Classification of species as per IUCN Red Data Book, Introduction to CITES and CBD, Wildlife (Protection) Act, 1972 of India and other related acts, Different Methods of Poaching, Conventional methods of species identification, Morphological identification and examination of wildlife parts and products, Application of DNA technologies used in Wildlife Forensics.



##### **5. Recent Developments, Regulatory affairs, and IPR**

Methods of DNA sequencing. Prediction of physical characteristics, such as eye, hair, and skin color based solely on DNA. Molecular autopsy. Genetic genealogy in the genomic era. Evolving technologies in forensic DNA analysis. Forensic tissue identification with nucleic acids: Classical, RNA based and DNA methylation-based approaches. CRISPR-Cas9 technology and its potential forensic applications, Non-Microbiome analysis for identifying individuals and linking them to environments, Non-human DNA analysis for wildlife crime investigations.

Basic principles of quality control (QC) and quality assurance (QA). Guidelines for QA and QC: raw materials, products and validation. Introduction to pharmacopoeia. Intellectual Property Rights. Importance of protecting scientific discoveries. IPR policy of Government of India. Patent: Qualification (novel, commercial and non-obvious), jurisdiction of patent laws, Indian and international patent laws, filing procedures, Various accreditation agencies of India: NABL, NABH etc.

#### **PART – B**

- 1. General Knowledge.**
- 2. General English.**
- 3. General Science.**

Controller of Examinations,  
Assam Public Service Commission  
Khanapara, Guwahati-22  
MS

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