

SYLLABUS - FORENSIC SEROLOGY

SECTION-C

Unit-1

Forensic serology: definition, importance and scope, significance, location, collection, evaluation, composition and tests for identification of semen and other body fluids (like saliva, urine, sweat, milk and vaginal secretions stains) including tissues from the crime scene.

Unit-2

Blood: composition, histology, examination of blood and blood stains, blood spatter pattern identification, identification of menstrual and other stains by various methods. semen: composition, structure. of spermatozoa, forensic methods of detection and identification of semen and seminal stain examination. origin of species : determination of human and animal origin from bones, hair, flesh, nails, skin, teeth, body tissue, fluids/stains viz. blood, menstrual blood, semen, saliva, sweat, tear, pus, vomit etc., through immuno-diffusion and immuno-electrophoresis, cross reactivity among closely related species. immunology: immuno system, immuno response, epitops, paratops, haptens and adjuvant, antigens and antibodies, antigen-antibody reaction.

Unit-3

Blood groups: ABO blood group system: biosynthesis of antigens, molecular basis of ABO system, Rh, MNSS and other systems such as Duffy, Kell, Kidd, Lewis from blood and blood stains (absorption elution and mixed agglutination techniques). General principles of their inheritance. Antigen definition, structure, function and characteristics of antigen. Antibody: definition, structure and function, polyclonal antibodies, monoclonal antibodies, ant-globulins. Immunoglobulin: types, physico-chemical properties, lectins, Raising of antisera, various antigen-antibody reactions (agglutination and precipitation), titer, rouleaux formation and Bombay blood group. Determination of blood group from stains of semen, saliva and other body fluids by Absorption Inhibition technique. Secretor and non-secretors status.

Unit-4

Serological techniques-primary binding assay: enzyme linked immunosorbent assay (ELISA), Immunochromatographic assays. Secondary binding assays, precipitation based assays: immunodiffusion, electrophoretic methods. Agglutination based assays: direct agglutination assay, passive agglutination assay, agglutination inhibition assays.

Unit-5

Biochemical Markers: forensic significance, characteristics of polymorphic enzyme like PGM, EsD, GLO-I, EAP, AK, ADA, - its typing and identification from bloodstains and hair. HP(Heptoglobin characterization) HLA System. Paternity disputes: causes, various serological and biochemical markers (PGM, AK, GLO-I,

Esd and Acid Phosphatase) methods, calculation of paternity index and probability for paternity and maternity. Forensic application biochemical markers.

Unit-6

Structure and function of cell, Mendelian genetics, genotypes, phenotypes, mutation, multiple alleles. Biochemical markers of individuality: general understanding, classification of markers, biochemical basis of genetic variation. Expression of gene, transcription and translation of DNA and gene mapping. Analysis of protein by electrophoresis and related methods. Protein polymorphism and characterization by electrophoretic methods.

Unit-7

Introduction to human genome-structure and properties of DNA: nucleotides and polynucleotides, double helix, Denaturation and renaturation of DNA, organization of DNA into Chromosomes, human Chromosomes. Human Nuclear Genome: Genes and Related Sequences, Intergenic Noncoding Sequences.

Unit-8

History of forensic DNA typing. Human genetics- heredity, alleles, mutations and population genetics, variations and polymorphism in DNA. DNA typing techniques- RFLP analysis, PCR amplifications, sequence polymorphism. Analysis of SNP, Y-STR, mitochondrial DNA. DNA bar-coding for species identification, evaluation of results, frequency estimate calculations, interpretations, allele frequency determination, matches probability- database, quality control, certification and accreditation.

Unit-9

DNA extraction and quantitation- cell and tissue disruption, lysis of membranes and organelles, removal of proteins and cytoplasmic contaminants, contamination, storage of DNA solutions. Methods of DNA extraction: extraction with phenol chloroform, extraction by boiling lysis and chelation, silica –based extraction, differential extraction. Slot-blot assay, fluorescent interchelating dye assay, quantitative PCR assay, Real- time quantitative PCR, Taq- man method.

Unit-10

Applications of DNA profiling in Forensic Investigations: Disputed paternity cases, child swapping, missing person's identity- civil immigration and wildlife cases. Mass Disaster Management: Victim identification cases. Legal Perspectives- legal standards for admissibility of DNA profiling, procedural and ethical concerns, status of development of DNA profiling in India and abroad, new and future technologies: DNA chips, SNPs, and limitations of DNA profiling.