SYLLABUS FOR THE POST OF SCIENTIFIC OFFICER-
FIRE ARMS SECTION, PHYSICS SECTION
FORENSIC SCIENCE LABORATORY-POLICE DEPARTMENT

Syllabus:

The metric system: Unit of measurement - SI units. Measuring devices, Accuracy, senstivity and precision of measuring instruments. Errors in measurement, Significant figures.

Mechanics: Laws of motion, Linear and rotational motion, Friction, Elasticity.

Magnetism and Electricity :Basic properties

Glass: Types of glass and their composition, glass fractures, cone – fracture, rib marks, hackle marks, backward fragmentation, colour and fluorescence, physical matching, density comparison, physical measurements, refractive index by refractometer, elemental analysis.

Holography: Importance of coherence, Principle of holography and characteristics, Recording and reconstruction, classification of hologram and application, non-destructive testing.Inline hologram, off axixhologram,Fourier hologram, image hologram.

Laser: Production, properties of laser beams such as intensity, monochromaticity, coherence, directionality and brightness. Basic laser systemsGas Lasers: (i) Molecular gas lasers- CO2 laser & N2 (ii) ionic gas laser – Ar+ laser (iii) gas dynamic laser (iv) high pressure pulsed gas laser Solid State Laser: (i) Nd:YAG laser, (ii) Nd:Glass laser, comparison of performances (iii) Tunable. solid state laser: Ti:sapphire laser; Alexandrite laser Chemical Laser: HF laser, HCl laser, COIL. Excimer laser; Color centre laser; Free electron laser; semiconductor diode laser. Laser Beam Propagation: Laser beam propagation, properties of Gaussian beam, resonator, stability, various types of resonators, resonator for high gain and high energy lasers, Gaussian beam focusing.

Basic concept of Spectroscopy: Atomic, molecular spectroscopy, imaging spectroscopy. Interaction of radiation with matter and its consequences.Reflection, absorption, transmission, scattering, emission, fluorescence, phosphorescence.

Fluorescence and phosphorescence spectrophotometry: Types of sources, structural factors, instrumentation, comparison of luminescence and UV-visible absorption methods. Infrared spectrophotometry: Dispersive and Fourier transform spectrophotometry (FTIR). Sample handling and preparation, quantitative analysis and interpretation of IR spectra, forensic applications.

Raman spectroscopy: Theory, instrumentation, sample handling and preparation. Correlation of IR and Raman Spectroscopy, applications.

Atomic Emission Spectrometry (AES): Instrumentation and techniques, arc/spark emission, ICPMS, ICP-AES,quantitative analysis, applications.

Advanced microscopy: The compound microscope, comparison microscope, stereomicroscope, polarizing microscope, microspectrophotometer, scanning electron microscope.

Detectors: photographic detectors, thermal detectors, photoelectric detectors, PMT and semiconductor detectors.

Statistics: Statistical evaluation of data obtained by instrumental methods. Tests of hypothesis- tests of significance of attributes, Z-test of significance and coefficient of correlation, small sample test, T-test, paired test, chi-square test, F-test for equality of variance, large sample test, normal test.

FIREARMS

Introduction History and background of firearms, Classifications, Various types of small fire arms, Types of ammunition Classification and construction features of different types of cartridges, primers, priming compositions. Velocity and pressure characteristics – Various types of bullets and compositional aspects.Internal and external ballistics – Introduction, Direction of fire, Time of fire, Range of fire, Projectile velocity determination, Theory of recoil, Trajectory determination. Terminal ballistics, Effect of projectile on hitting the target, Function of bullet shape, Striking velocity, striking angle, Tumbling bullets, Cavitations, Ricochet and its effects

Principles and practice of identification of firearms - Ammunition and their components - Different types of marks produced during firing process on cartridge-firing pin marks, breech face marks, chamber marks, extractor and ejector marks and on bullet. Identification of various parts of firearms. Techniques for obtaining test material from various types of weapons and their linkage with fired ammunition - Class and individual characteristics. Determination of range of fire. Time of firing – Different methods employed and their limitations.Analysis of Gunshot Residues – Mechanism of formation of GSR - Source and collection - Spot tests, chemical tests - Identification of shooter .

FORENSIC PHYSICS:

1. Soil: Formation and types of soil, composition and colour of soil, particle size distribution and turbidity test, microscopic examination, density gradient analysis, ignition loss, differential thermal analysis, elemental analysis,
2. Paint: Types of paint and their composition, macroscopic & microscopic studies, pigment distribution and colorimetry, micro-chemical analysis- solubility test, TLC, pyrolysis chromatographic techniques, IR absorption spectroscopy of paint samples & X-ray diffraction, elemental analysis.
3. Fibre: Classification of textile fibres - production, structure, and properties, the structure of textiles - an introduction to the basics, ropes and cordage, visible & infrared microscopical examination of fibres, instrumental methods used in fibre and dye examination,
4. Impressions: Foot/Footwear/Tyre Impression, Collection, Tracing, Lifting, Casting of impressions, Gait Pattern and Identification characteristics, Superimposition of impression on footwear and foot imprints
5. Tool marks: Types of tool marks: compression marks, striated marks, combination of compression and striated marks, repeated marks, class characteristics and individual characteristics, tracing and lifting of marks, photographic examination of tool marks and cut marks on clothes ,comparison of tool marks by comparison microscope.