



Government of Jammu and Kashmir  
Services Selection Board  
Sehkari Bhawan Rail Head Complex, Jammu  
([www.jkssb.nic.in](http://www.jkssb.nic.in))

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**NOTICE**

It is notified for the information of the concerned candidates who have applied for the posts advertised vide Advertisement Notification No 06/2019/001 to 06/2019/006, (Home Department) that the item wise syllabi for the posts detailed below is given as annexure "A" to "E" to this notice.

Detail of Items/Posts		
Advt. No/Item No	Name of the post	Syllabus Annexed
06/2019/001	Assistant Scientific Officer (C&T)	Annexure "A"
06/2019/002	Assistant Scientific Officer (Documents)	Annexure "B"
06/2019/003	Assistant Scientific Officer (Ballistics)	Annexure "C"
06/2019/004	Assistant Scientific Officer (Trainings)	Annexure "D"
06/2019/005	Junior Photographer	Annexure "E"
06/2019/006	Laboratory Assistant	Annexure "E"

The candidates are also intimated that there shall be negative marking for wrong answers (-0.25 for each wrong answer) attempted in the said examination.

(Ranjeet Singh) KAS  
Secretary  
Services Selection Board  
Jammu

No. SSB/Secy/Sel/2019/2365-69

Dated: 03.04.2019

Copy to the:-

1. Commissioner/ Secretary, Home Department, Civil Sectt. for information.
2. Director Information, J&K Government, Jammu with the request to get the said notification published in at least three leading local newspaper of Jammu/Srinagar on three consecutive dates.
3. Private Secretary to the Ld. Chairman for information to Chairman.
4. I/c Web site.
5. Syllabus file.

# Annexure "A"

## Syllabus for Written Test (Objective Type) for the post of Assistant Scientific Officer (Chemistry and Toxicology):

### 1. FORENSIC APTITUDE TEST:

- a. General knowledge, general English, aptitude and reasoning.
- b. Fundamentals of basic sciences as applied to forensic investigation.
  - i. Principles of the forensic science, disciplines of forensic science and their functions. Developments in forensic science in India and abroad. Scope of analysis in Forensic science laboratories/institutions. Legendries and their contributions in the field of forensic science.
  - ii. *Types of evidence materials in different type of crimes, source and significance of evidence material, tools and techniques in crime scene search, sketching, measurement, photography and videography. Identification, collection, preservation, packaging and forwarding of evidence materials. reconstruction of scenes of crime, lifting, developing and preserving fingerprints, footprints and tyre impressions and pattern evidence, Sampling, Chain of custody. Safety measures at the scene of crime and in laboratory.*
- c. Quality Control and Quality Assurance in the analysis of evidence materials, Proficiency Test.
- d. Class and individual characteristics of material evidence. Techniques and instruments for evidence analysis: Electromagnetic radiations, Interaction of radiation with matter, Microscopy, Spectroscopy, Spectrophotometry, Chromatography, Electrophoresis, Components of Computer and their functions, Imaging of digital evidence and authentication, Forensic photography. Precision, accuracy, error rate and standardisation.
- e. Basic Principles of Statistics – Probability, Mean, Median, Mode, F-Test, Chi-square Test, Measurement of uncertainty. Systematic and Random Sampling.
- f. Expert testimony in the Court of law. Admissibility of evidence, Laws, Acts, CrPC and IPC relevant to forensic science. Ethics in Forensic Science.

## FORENSIC CHEMICAL SCIENCES

### 1. FORENSIC CHEMISTRY-I

- a) Alcohols and alcoholic beverages, Analysis of alcohols, country made liquor, illicit liquor and medicinal preparations, Analysis of various denaturants of alcohol, detection and determination of ethanol, methanol, aldehyde, ester by colour test and instrumental technique, Relevant sections of Excise Act.
- b) Metals and alloys their composition; Importance of analysis, purity of metals, trace elements, asht dhatu and their analysis.

- c) Petroleum products and their adulterations: Analysis of petrol, kerosene, diesel, lubricants by BIS methods and ASTM methods. Detection of adulterants of gasoline, diesel and engine oils. Analysis of residues in forensic exhibits, chromatography analysis of petrol, kerosene, diesel and other solvents for detection of adulteration.
- d) Fire and Arson ; Examination of crime scene ,collection of exhibits, cause of fire and origin of fire, method of identification of inflammable material
- e) Analysis of trap case:- Mechanism of colour reaction, factor affecting the colour, detection of phenolphthalein and alkali used, method of detection of degraded product on conversion of pink colour to colourless solution by TLC and UV visible spectrophotometer. Photo and videography and voice recording as supporting evidence.
- f) Dyes: Role of dyes in crime investigation, comparison of dyes in fibres and different inks by TLC and UV-VIS Spectrophotometer.
- g) Pesticides: Different types of pesticide, formulation, identification of pesticide, standard or sub-standard or substituted pesticides. Determination of purity by analysis by chemical test, thin layer chromatography, ultra violet - visible spectrophotometry and gas liquid chromatography. Determination of level of pesticide in water, cold drinks, milk, food materials.

## **2. FORENSIC CHEMISTRY-II**

- a) Explosive and Explosion: Introduction, classification of explosives-primary ,secondary or High explosive, detonators pyro technique propellant IEDs and firing mechanism of IEDS
- b) Role of Forensic scientist in Post blast investigation, Explosions effects, Collection of samples, Technical report frame work, Homemade crude bombs, Evaluation and assessment of explosion site and reconstruction of sequence of events.
- c) Analysis of explosive: Methods for extraction of explosive from post blast material/ debris, Qualitative analysis of explosives and explosion residue by colour test, TLC/HPTLC and High Performance Liquid Chromatography and FTIR, GC-Mass, LC-Mass. X ray diffraction, equipment used for Detection of explosives and explosive devices.
- d) Narcotic Drugs and Psychotropic Substances: Sampling procedure and relevant notification, Laboratories authorised to conduct examination, an expert authorised to report NDPS cases.
- e) Laws related to forensic interest, Common terminology and NDPS act Small quantity and commercial quantity and extent of punishment
- f) Classification of Drugs commonly encountered: Narcotics, depressants, stimulants ,hallucinogens designer drugs , club drugs and date rape drugs.

- g) Analysis of Drugs: Narcotic drugs, Depressants, Barbiturates, methaqualone, Benzodiazepines, Stimulants, Hallucinogens, Designer Drugs, Club drugs, date rape drugs and precursors by Field test kits for drugs and precursors using colour test, thin layer chromatography and further confirmation by HPTLC, UV-Vis spectrophotometry, Gas Chromatography, HPLC, GC-Mass Spectrometry and LC-Mass Spectrometry, Raman Spectroscopy and FTIR after extraction of drug from the seized sample.
- h) Detection of common adulterants and determination of percentage purity in seized sample
- i) Court testimony and case studies.

## **FORENSIC TOXICOLOGY – I**

- a) Forensic Toxicological examination and its significance. Branches of Toxicology: Introduction & Scope, Classification of poisons, based on their origin, mode of action, chemical nature, poisons and poisoning in India, Classification of poisoning: accidental, homicidal, suicidal and miscellaneous, sign and symptoms of poisons and antidotes. Factors affecting the intensity of poisoning. Importance of post-mortem examination in poisoning cases. Information to be collected by Investigating Officers and precautions to be adopted while searching crime scene and collecting evidence material in poisoning cases. Laws related to Poisons. Poison Act 1919, Drugs Act 1940 and 1955, Drug and Cosmetic Act 1940 and amendments
- b) Classification of matrices- Biological, non-biological and Viscera. Different methods of extraction for volatile poisons of organic and inorganic nature: Solvent extraction, distillation/ steam distillation, micro diffusion, dialysis, dry ashing, wet digestion, modified Stas-Otto method, ammonium sulphate method. Isolation and clean up procedure, separation of poisons and drugs using chromatographic techniques. Identification of and estimation of poisons and drugs using chromatographic and spectrophotometric and other instrumental methods, significance of analytical studies with forensic examination. Analysis of different Gases and volatile poisons., Analysis of toxic metals and anions
- c) Analysis of pesticides : Organ chlorinated, organo phosphoro, carbamates, pyrethroids, aluminum phosphide and zinc phosphide
- d) Methods of analysis of acidic/ neutral and alkaline drugs and poison commonly encountered for forensic analysis
- e) Systematic method of extraction of poisons both organic and inorganic from biological matrix and their detection , identification and quantitation by colour test, TLC, HPLC, HPTLC, GLC, UV – visible spectrophotometry FTIR, Mass spectrometry. Qualitative and quantity analysis of Inorganic poisons using

instrument AAs, ICP, ion chromatography ion selective electrode.

### **3. FORENSIC TOXICOLOGY – II**

- a) Modern method of extraction and Isolation: Solid phase extraction, solid phase micro-extraction, accelerated solvent extraction, preparative TLC and HPLC
- b) Extraction of poisons from blood, urine, stomach wash and vomit, cold drink, food material, toxicological analysis of Nail, Bones and bile in decomposed materials. Interpretation of toxicological finding and preparation of reports, limitation of method and trouble shooting in toxicological analysis, disposal of analysis samples
- c) Hair analysis: Importance of hair for forensic examination of drugs and poisons, procedure for collection, storage and preservation. Methods of extraction of drugs and poisons from hair and their identification using instrumental techniques
- d) Metabolism: various path of metabolism of common poisons, their distribution and excretion and method of extraction, isolation and identification of metabolites.
- e) Food poisons: what is food poisoning, food poisoning due to common chemical and bacterial, sign and symptom of food poisoning, collection and preservation of evidence material, detection and identification by colour test and instrumental techniques
- f) Plant poison: introduction ,classification and their main active constituents, method of extraction of plant material from biological sample identification by colour test and TLC and UV- Visible spectrophotometer and other instrumental techniques
- g) Animal Poisons :Commonly encountered poisonous animals, snake and other insects , sign and symptoms, isolation of poison from biological material. Identity of poison by various chemical constituents ,precipitant test and gel diffusion and immunological test
- h) Common poison used in animal poisoning including wild life animals
- i) Environmental pollutants - Inorganic and Inorganic and their identification and quantitation
- j) Quaternary ammonium drugs and poisons Introduction and problems associated with their extraction from pharmaceuticals and biological materials. Method of extraction using ion pair and identification by TLC and UV visible spectrophotometry and other instrumental techniques.

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# Annexure "B"

## Syllabus for Written Test (Objective Type) for the post of Assistant Scientific Officer (Documents):

### 1. FORENSIC APTITUDE TEST:

- a. General knowledge, general English, aptitude and reasoning.
- b. Fundamentals of basic sciences as applied to forensic investigation.
  - i. Principles of the forensic science, disciplines of forensic science and their functions. Developments in forensic science in India and abroad. Scope of analysis in Forensic science laboratories/institutions. Legendries and their contributions in the field of forensic science.
  - ii. *Types of evidence materials in different type of crimes, source and significance of evidence material, tools and techniques in crime scene search, sketching, measurement, photography and videography. Identification, collection, preservation, packaging and forwarding of evidence materials. Reconstruction of scenes of crime, lifting, developing and preserving fingerprints, footprints and tyre impressions and pattern evidence, Sampling, Chain of custody. Safety measures at the scene of crime and in laboratory.*
- c. Quality Control and Quality Assurance in the analysis of evidence materials, Proficiency Test.
- d. Class and individual characteristics of material evidence. Techniques and instruments for evidence analysis: Electromagnetic radiations, Interaction of radiation with matter, Microscopy, Spectroscopy, Spectrophotometry, Chromatography, Electrophoresis, Components of Computer and their functions, Imaging of digital evidence and authentication, Forensic photography. Precision, accuracy, error rate and standardisation.
- e. Basic Principles of Statistics – Probability, Mean, Median, Mode, F-Test, Chi-square Test, Measurement of uncertainty. Systematic and Random Sampling.
- f. Expert testimony in the Court of law. Admissibility of evidence, Laws, Acts, CrPC and IPC relevant to forensic science. Ethics in Forensic Science.

### 2. FORENSIC DOCUMENT EXAMINATION:

- a) State-of-the-art-equipment: Working & features of various models of Video Spectral Comparators and Electrostatic Detection Apparatus. Working & application of Stereo Zoom Microscope, Crossline Examination System, HPTLC and Raman Spectroscopy in document examination.
- b) Care, handling, preservation, packing, marking and forwarding of forensic documents. Types of writing paper & inks and their analysis. Determination of all types of sequence

of intersecting strokes. Determination of sequence of writings/type writings over creases & folds. Examination of documents under UV, visible and IR light sources. Preliminary examination of documents. Comparison of alphabets and numerals.

- c) Document photography - Basic principles and techniques of black & white and colour photography. Specialized photography - UV, IR, transmitted light and side light photography close up photography, trick photography, contact photography, Photomicrography & Microphotography. Demonstrative and juxtapose charts and their relevance. Digital photography, file formats for digital photographs, digital watermarking and digital imaging. Photogrammetry & Radiography.
- d) Nature & scope of Forensic Document Examination and its limitations. Classification of forensic documents. Various writing features. Natural variations and disguise in hand writing Principle of handwriting identification. Procurement of standards for comparison. Comparison of like with like, suitability of standards for comparison. Features of writing instruments. Effect of age, illness, posture, emotions and writing instruments on handwriting.
- e) General and individual writing characteristics, definition and their estimation. Simon New Comb Theory of probability and its application in document examination. Determination of absolute and relative age of documents. Examination of anonymous letter and identification of its writer. Linguistics, stylistics, forensic stylistics, application of forensic stylistics in personal identification, application of forensic stylistics in different vernacular scripts for identification of writers.
- f) Types of forgeries and their detection, characteristics of genuine & forged signatures. Difference between tremors of fraud and genuine tremors in writings and signatures & identification of forger, Trends in forgery. Identification of manipulations in written, typed and computer printouts, identification of digitally manipulated documents. Detection and decipherment of alterations including additions, over writings, obliterations, erasures and secret writings.
- g) Principle , working and identifying features of Dot Matrix, Inkjet and Laser-jet printers, Various printing processes-Letter Press, Lithography and Intaglio printing processes and their identifying features. Examination of photo copies and scanned documents. Various security features of Indian Bank Notes of higher denominations and Indian Passports. Detection of Counterfeit Indian Bank Notes and fake Indian Passports, E-Passports. Security features of Credit/Debit/smart cards and detection of fake plastic cards.
- h) Use of computers in document examination. Computer forensics, hash value, imaging and digital signature. Automated Signature Verification System, NABL guidelines for accreditation of Forensic Science laboratories. safety management in document laboratories
- i) Various Indian laws with reference to IPC –29, 29A, 34, 120B, 409, 415, 416, 418, 420, 467,468, 470, 471, 489(A to E), Indian Evidence Act – Sec 3, 45, 45A, 47, 73 and 114 .

Final examination and report writing –different types of opinion writing and writing of reasons for opinion, importance of no opinion / qualified opinion. Debonair of expert and reparation for presentation of evidence in trial courts, examination-in-chief, cross examination by defense and cross examination by expert. Various court rulings on photocopies, unfamiliar scripts etc. and controversies.

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# Annexure “C”

## Syllabus for Written Test (Objective Type) for the post of Assistant Scientific Officer (Ballistics):

### 1. FORENSIC APTITUDE TEST:

- a. General knowledge, general English, aptitude and reasoning.
- b. Fundamentals of basic sciences as applied to forensic investigation.
  - i. Principles of the forensic science, disciplines of forensic science and their functions. Developments in forensic science in India and abroad. Scope of analysis in Forensic science laboratories/institutions. Legendries and their contributions in the field of forensic science.
  - ii. *Types of evidence materials in different type of crimes, source and significance of evidence material, tools and techniques in crime scene search, sketching, measurement, photography and videography. Identification, collection, preservation, packaging and forwarding of evidence materials. reconstruction of scenes of crime, lifting, developing and preserving fingerprints, footprints and tyre impressions and pattern evidence, Sampling, Chain of custody. Safety measures at the scene of crime and in laboratory.*
- c. Quality Control and Quality Assurance in the analysis of evidence materials, Proficiency Test.
- d. Class and individual characteristics of material evidence. Techniques and instruments for evidence analysis: Electromagnetic radiations, Interaction of radiation with matter, Microscopy, Spectroscopy, Spectrophotometry, Chromatography, Electrophoresis, Components of Computer and their functions, Imaging of digital evidence and authentication, Forensic photography. Precision, accuracy, error rate and standardisation.
- e. Basic Principles of Statistics – Probability, Mean, Median, Mode, F-Test, Chi-square Test, Measurement of uncertainty. Systematic and Random Sampling.
- f. Expert testimony in the Court of law. Admissibility of evidence, Laws, Acts, CrPC and IPC relevant to forensic science. Ethics in Forensic Science.

### 2. FORENSIC BALLISTICS:

- a) History of Firearms and Ammunitions, their classification, details of various small arms used in crime – shotguns, rifles, revolvers, pistols, carbines, improvised firearms. Bore and caliber, choke, automatic mechanisms employed in small arms, rifling – class characteristics of rifled bore, purpose of rifling, types of rifling, methods to produce rifling, various locks used in small arms. Head-space. Various types of primers/ priming mixtures, propellants, shotgun ball ammunition, various kinds of bullets, head-stamp markings. Manufacture of small arms and their ammunition. Proof firing, various physical, ballistic & functional tests of ammunitions.

- b) Physical evidence and other clues available in crimes involving firearms. Handling of evidence, various precautions.
- c) Internal Ballistics: Ignition and burning of propellants, regressive and progressive powders, rate of burning propellants, factors affecting internal ballistics of projectiles, internal ballistics of 12-bore guns, recoil.
- d) External Ballistics: Equations of motion of projectiles, principal problem of exterior ballistics, vacuum trajectory – calculation of various elements, effect of air resistance on trajectory, points of difference between trajectories in air and vacuum, nature of air resistance phenomena, base-drag, yaw, cross-wind force, overturning moments, stability – fin stabilization and gyroscopic stability, stability factor, nutation and precessional motions of bullets, drift, Magnus effect, Greenhill formula, shape of projectile – form factor, ballistic coefficient, calculation of trajectories of various small arm bullets, calculation of trajectories of shotgun projectile, use of ballistic tables, projectile velocity determination, determination of velocity of shot-charge, Doppler-radar method. Automated system of trajectory computation. Falling bullets – limiting velocity, drop, use of lead as bullet material.
- e) Terminal Ballistics: Interaction and penetration of various smallarm projectiles in various tissues. Threshold velocity for penetration of skin, flesh and bones, threshold energy/ casualty criteria, energy density, ricochet, various aspects of wound ballistics including wounds of entrance/ exit/ track of projectile, gunshot injuries caused by different types of firearm ammunitions. Temporary and permanent cavities, materials simulating human body, gunshot wound as a function of shape of nose of bullet, striking velocity, nature of target, tumbling of bullet, effect of instability of bullet, effect of intermediate target. Influence of range, identification of gunshot injuries, motion of projectile in dense medium.
- f) Class and Individual characteristics of fired bullets and cartridge cases and their linkage with the suspected firearms, comparison microscope, photomicrography, source correspondence, linkage of fired shots with shotguns.
- g) Determination of range of firing in cases of firing by smooth-bore and rifled firearms, factors affecting range of firing, stringing of shots, effect of string on pattern, Cart-wheel pattern, balling, Walkers' Test, IR photography.
- h) Chemical tests for examination and identification of shotgun holes in various targets. Gunshot residue. Identification of shooter.
- i) Reconstruction of sequence of events in crimes involving firearms, high velocity impact splatter blood. Firing through glass,

determination of direction of firing & sequence of shots. Scientific methods of shooting reconstruction, suicide, murder, accident, self-defense and encounter cases. All considerations during direct investigation of shooting incidents without the benefit of original crime scene investigation – the scene of occurrence, medico-legal report, basic ballistic facts, laboratory examination report, firearm and ammunition, clothes of victims, etc. Documentation and evaluation of bullet holes, ricochet marks, pellet pattern in various targets, etc. Bullet holes in tyres.

j) Instrumentation techniques - AAS, NAA, SEM/EDXA, ICP-MS, ASV and their application in ballistic examination.

k) Arms Act and Arms Rule, 2016.

### **3. INSTRUMENTAL TECHNIQUES – I**

a) Basic concept of atomic and molecular spectra.

b) Basics of Instrumentation, sample preparation ,purification of sample before analysis standardization and calibration of instrument

c) Ultra violet and visible spectrophotometry: Basic principle and instrumentation, Lambert and Beers Law. Role in identification and uantitation in forensic chemistry and toxicology and its limitations. Fluorescence and phosphorescence and its application

d) Infrared spectrophotometry: Basic principle, components, Sample handling, Dispersive and Fourier transform spectrophotometry, (FTIR). Qualitative analysis and interpretation of IR spectra, applications.

e) Atomic Absorption Spectrometry (AAS): Instrumentation and techniques, interference in AAS, background correction methods, graphite furnace quantitative analysis. Applications in forensic chemistry and toxicology

f) Atomic emission spectroscopy (AES)-Inductively Coupled Plasma and ICP-MS instrument for detection and quantitation of inorganic metals, alloys and poisons in biological materials. Advantage of ICP over AAS and vice –versa

g) Chromatography Techniques; General principles of paper chromatography, column chromatography, TLC, gas chromatography, HPTLC and HPLC for identification and quantitation.

h) X- ray spectroscopy- X ray absorption and fluorescence their application in forensic chemistry and toxicology

### **4. INSTRUMENTAL TECHNIQUES – II**

a) Mass spectrometry: Basic principle and component of Instrument sample chamber, ionization method, mass analyser, vaccum system, data handling. Tandem mass spectrometry. Interpretation of spectra. Application in Forensic chemistry and forensic toxicology

- b) Raman spectroscopy Basic principle, sample handling Application in Forensic chemistry and toxicology. Advantage of Raman over IR/FTIR
- c) NMR basic principle and instrumentation, interpretation of spectra and application
- d) Measurement of radioactivity, carbon dating, Neutron Activation analysis and its application in forensic science
- e) Scanning Electron Microscope Coupled with EDXR, advantage of SEM over optical microscope. Application in Forensic Science
- f) Hyphenated techniques- Gas Chromatography coupled with Mass Spectrometry, Liquid chromatography coupled with Mass spectrometry, GLC- FTIR.

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# Annexure ‘D

## Syllabus for Written Test (Objective Type) for the post of Assistant Scientific Officer (Trainings):

### 1. FORENSIC APTITUDE TEST:

- a. General knowledge, general English, aptitude and reasoning.
- b. Fundamentals of basic sciences as applied to forensic investigation.
  - i. Principles of the forensic science, disciplines of forensic science and their functions. Developments in forensic science in India and abroad. Scope of analysis in Forensic science laboratories/institutions. Legendries and their contributions in the field of forensic science.
  - ii. *Types of evidence materials in different type of crimes, source and significance of evidence material, tools and techniques in crime scene search, sketching, measurement, photography and videography. Identification, collection, preservation, packaging and forwarding of evidence materials. reconstruction of scenes of crime, lifting, developing and preserving fingerprints, footprints and tyre impressions and pattern evidence, Sampling, Chain of custody. Safety measures at the scene of crime and in laboratory.*
- c. Quality Control and Quality Assurance in the analysis of evidence materials, Proficiency Test.
- d. Class and individual characteristics of material evidence. Techniques and instruments for evidence analysis: Electromagnetic radiations, Interaction of radiation with matter, Microscopy, Spectroscopy, Spectrophotometry, Chromatography, Electrophoresis, Components of Computer and their functions, Imaging of digital evidence and authentication, Forensic photography. Precision, accuracy, error rate and standardisation.
- e. Basic Principles of Statistics – Probability, Mean, Median, Mode, F-Test, Chi-square Test, Measurement of uncertainty. Systematic and Random Sampling.
- f. Expert testimony in the Court of law. Admissibility of evidence, Laws, Acts, CrPC and IPC relevant to forensic science. Ethics in Forensic Science.

### 2. FORENSIC TRAININGS:

- a) History of Firearms and Ammunitions, their classification, details of various small arms used in crime – shotguns, rifles, revolvers, pistols, carbines, improvised firearms. Bore and caliber, choke, automatic mechanisms employed in small arms, rifling – class characteristics of rifled bore, purpose of rifling, types of rifling, methods to produce rifling, various locks used in small arms. Head-space. Various types of primers/ priming mixtures, propellants, shotgun ball ammunition, various kinds of bullets, head-stamp

markings. Manufacture of small arms and their ammunition. Proof firing, various physical, ballistic & functional tests of ammunitions.

- b) Physical evidence and other clues available in crimes involving firearms. Handling of evidence, various precautions.
- c) Internal Ballistics: Ignition and burning of propellants, digressive and progressive powders, rate of burning propellants, factors affecting internal ballistics of projectiles, internal ballistics of 12-bore guns, recoil.
- d) External Ballistics: Equations of motion of projectiles, principal problem of exterior ballistics, vacuum trajectory – calculation of various elements, effect of air resistance on trajectory, points of difference between trajectories in air and vacuum, nature of air resistance phenomena, base-drag, yaw, cross-wind force, overturning moments, stability – fin stabilization and gyroscopic stability, stability factor, nutation and precessional motions of bullets, drift, Magnus effect, Greenhill formula, shape of projectile – form factor, ballistic coefficient, calculation of trajectories of various small arm bullets, calculation of trajectories of shotgun projectile, use of ballistic tables, projectile velocity determination, determination of velocity of shot-charge, Doppler-radar method. Automated system of trajectory computation. Falling bullets – limiting velocity, drop, use of lead as bullet material.
- e) Terminal Ballistics: Interaction and penetration of various small arm projectiles in various tissues. Threshold velocity for penetration of skin, flesh and bones, threshold energy/ casualty criteria, energy density, ricochet, various aspects of wound ballistics including wounds of entrance/ exit/ track of projectile, gunshot injuries caused by different types of firearm ammunitions. Temporary and permanent cavities, materials simulating human body, gunshot wound as a function of shape of nose of bullet, striking velocity, nature of target, tumbling of bullet, effect of instability of bullet, effect of intermediate target. Influence of range, identification of gunshot injuries, motion of projectile in dense medium.
- f) Class and Individual characteristics of fired bullets and cartridge cases and their linkage with the suspected firearms, comparison microscope, photomicrography, source correspondence, linkage of fired shots with shotguns.
- g) Determination of range of firing in cases of firing by smooth-bore and rifled firearms, factors affecting range of firing, stringing of shots, effect of string on pattern, Cart-wheel pattern, balling, Walkers' Test, IR photography.
- h) Chemical tests for examination and identification of shotgun holes in various targets. Gunshot residue. Identification of shooter.

- i) Reconstruction of sequence of events in crimes involving firearms, high velocity impact splatter blood. Firing through glass, determination of direction of firing & sequence of shots. Scientific methods of shooting reconstruction, suicide, murder, accident, self-defense and encounter cases. All considerations during direct investigation of shooting incidents without the benefit of original crime scene investigation – the scene of occurrence, medico-legal report, basic ballistic facts, laboratory examination report, firearm and ammunition, clothes of victims, etc. Documentation and evaluation of bullet holes, ricochet marks, pellet pattern in various targets, etc. Bullet holes in tyres.
- j) Instrumentation techniques - AAS, NAA, SEM/EDXA, ICP-MS, ASV and their application in ballistic examination.
- k) Arms Act and Arms Rule, 2016.

### **3. INSTRUMENTAL TECHNIQUES – I**

- i) Basic concept of atomic and molecular spectra.
- j) Basics of Instrumentation, sample preparation ,purification of sample before analysis standardization and calibration of instrument
- k) Ultra violet and visible spectrophotometry: Basic principle and instrumentation, Lambert and Beers Law. Role in identification and uantitation in forensic chemistry and toxicology and its limitations. Fluorescence and phosphorescence and its application
- l) Infrared spectrophotometry: Basic principle, components, Sample handling, Dispersive and Fourier transform spectrophotometry, (FTIR). Qualitative analysis and interpretation of IR spectra, applications.
- m) Atomic Absorption Spectrometry (AAS): Instrumentation and techniques, interference in AAS, background correction methods, graphite furnace quantitative analysis. Applications in forensic chemistry and toxicology
- n) Atomic emission spectroscopy (AES)-Inductively Coupled Plasma and ICP-MS instrument for detection and quantitation of inorganic metals, alloys and poisons in biological materials. Advantage of ICP over AAS and vice –versa
- o) Chromatography Techniques; General principles of paper chromatography, column chromatography, TLC, gas chromatography, HPTLC and HPLC for identification and quantitation.
- p) X- ray spectroscopy- X ray absorption and fluorescence their application in forensic chemistry and toxicology

### **4. INSTRUMENTAL TECHNIQUES – II**

- g) Mass spectrometry: Basic principle and component of Instrument sample chamber, ionization method, mass analyser, vacuum system, data handling. Tandem mass spectrometry. Interpretation of spectra. Application in Forensic chemistry and forensic toxicology
- h) Raman spectroscopy Basic principle, sample handling Application in Forensic chemistry and toxicology. Advantage of Raman over IR/FTIR
- i) NMR basic principle and instrumentation, interpretation of spectra and application
- j) Measurement of radioactivity, carbon dating, Neutron Activation analysis and its application in forensic science
- k) Scanning Electron Microscope Coupled with EDXR, advantage of SEM over optical microscope. Application in Forensic Science
- l) Hyphenated techniques- Gas Chromatography coupled with Mass Spectrometry, Liquid chromatography coupled with Mass spectrometry, GLC- FTIR.

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Secretary  
Services Selection Board  
Jammu



## Annexure ‘E’

### Syllabus for Written Test (Objective Type) for the post of Laboratory Assistant and Junior Photographer:

#### FORENSIC APTITUDE TEST:

- a. General knowledge, general English, aptitude and reasoning.
- b. Fundamentals of basic sciences as applied to forensic investigation.
- iii. Principles of the forensic science, disciplines of forensic science and their functions. Developments in forensic science in India and abroad. Scope of analysis in Forensic science laboratories/institutions. Legendries and their contributions in the field of forensic science.
- iv. *Types of evidence materials in different type of crimes, source and significance of evidence material, tools and techniques in crime scene search, sketching, measurement, photography and videography. Identification, collection, preservation, packaging and forwarding of evidence materials. reconstruction of scenes of crime, lifting, developing and preserving fingerprints, footprints and tyre impressions and pattern evidence, Sampling, Chain of custody. Safety measures at the scene of crime and in laboratory.*
- c. Quality Control and Quality Assurance in the analysis of evidence materials, Proficiency Test.
- d. Class and individual characteristics of material evidence. Techniques and instruments for evidence analysis: Electromagnetic radiations, Interaction of radiation with matter, Microscopy, Spectroscopy, Spectrophotometry, Chromatography, Electrophoresis, Components of Computer and their functions, Imaging of digital evidence and authentication, Forensic photography. Precision, accuracy, error rate and standardisation.
- e. Basic Principles of Statistics – Probability, Mean, Median, Mode, F-Test, Chi-square Test, Measurement of uncertainty. Systematic and Random Sampling.
- f. Expert testimony in the Court of law. Admissibility of evidence, Laws, Acts, CrPC and IPC relevant to forensic science. Ethics in Forensic Science.

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