

Syllabus for the Preliminary Test for the recruitment of

Assistant Director (Physics), (FSL), Class-I,

ADVT. NO – 116/2016-17

ભાગ-૧

પ્રાથમિક કસોટીનો અભ્યાસક્રમ		
કુલ પ્રશ્નો-૧૦૦	માધ્યમ: ગુજરાતી	કુલ ગુણ :૧૦૦
૧	ભારતની ભૂગોળ- ભૌગોલિક, આર્થિક, સામાજિક, કુદરતી સંસાધન અને વસ્તી અંગેની બાબતો- ગુજરાતના ખાસ સંદર્ભ સાથે	
૨	ભારતનો સાંસ્કૃતિક વારસો- સાહિત્ય, કલા, ધર્મ અને સ્થાપત્યો- ગુજરાતના ખાસ સંદર્ભ સાથે	
૩	ભારતનો ઇતિહાસ- ગુજરાતના ખાસ સંદર્ભ સાથે	
૪	ભારતની અર્થવ્યવસ્થા અને આયોજન	
૫	<u>ભારતીય રાજનીતિ અને ભારતનું બંધારણ:</u> (૧) આમુખ (૨) મૂળભૂત અધિકારો અને ફરજો (૩) રાજ્યનીતિના માર્ગદર્શક સિદ્ધાંતો (૪) સંસદની રચના (૫) રાષ્ટ્રપતિની સત્તા (૬) રાજ્યપાલની સત્તા (૭) ન્યાયતંત્ર (૮) અનુસૂચિત જાતિ, અનુસૂચિત જનજાતિ અને સમાજના પછાત વર્ગો માટેની જોગવાઈઓ (૯) એટર્ની જનરલ (૧૦) નીતિ આયોગ (૧૧) પંચાયતી રાજ (૧૨) નાણા પંચ (૧૩) બંધારણીય તથા વૈધનિક સંસ્થાઓ- ભારતનું ચૂંટણી પંચ, સંઘ લોક સેવા આયોગ, રાજ્ય લોક સેવા આયોગ, કોમ્પ્ટ્રોલર એન્ડ ઓડિટર જનરલ; કેન્દ્રીયસતર્કતા આયોગ, લોકપાલ તથા લોકાયુક્ત અને કેન્દ્રીય માહિતી આયોગ	
૬	સામાન્ય બૌદ્ધિક ક્ષમતા કસોટી	
૭	સામાન્ય વિજ્ઞાન, પર્યાવરણ અને ઈન્ફર્મેશન એન્ડ કોમ્યુનિકેશન ટેકનોલોજી	
૮	ખેલ જગત સહિત રોજબરોજના પ્રાદેશિક, રાષ્ટ્રીય અને આંતરરાષ્ટ્રીય મહત્વના બનાવો	

Part-1

Syllabus of Preliminary Test		
Total Questions-100	Medium: Gujarati	Total Marks- 100
1	Geography of India-Physical, Economic, Social, Natural Resources and population related topics- with special reference to Gujarat	
2	Cultural heritage of India-Literature, Art, Religion and Architecture-with special reference to Gujarat	
3	History of India with special reference to Gujarat	
4	Indian Economy and Planning	
5	<u>Indian Polity and the Constitution of India:</u> (1) Preamble (2) Fundamental Rights and Fundamental Duties (3) Directive Principles of State Policy (4) Composition of Parliament (5) Powers of the President of India (6) Powers of Governor (7) Judiciary (8) Provisions for Scheduled Castes, Scheduled Tribes and backward classes of the society (9) Attorney General (10) NITI Aayog (11) Panchayati Raj Institutions (12) Finance Commission (13) Constitutional and Statutory Bodies: Election Commission of India, Union Public Service Commission, State Public Service Commission, Comptroller and Auditor General; Central Vigilance Commission, Lokpal and Lokayukta, Central Information Commission	
6	General Mental Ability	
7	General Science, Environment and Information & Communication Technology	
8	Daily events of Regional, National and International Importance including Sports	



Syllabus for the Preliminary Test for the recruitment of Assistant

Director (Physics), (FSL), Class-I, ADVT. NO – 116/2016-17

PART- 2

Total Questions-200

Medium: English

Total Marks- 200

1. ADVANCES IN PHYSICAL TECHNIQUES

Thermal Analysis: Principle theory and applications of Thermo gravimetric analysis, differential thermal analysis and differential scanning calorimetry. Density gradient analysis, Specific Gravity analysis, Abbe's and Digital Refractometer, Micro-chemical analysis, TLC. Introduction to principles and application for analysis of physical evidences: IR spectroscopy, Raman spectroscopy, FT-IR spectroscopy, Atomic Absorption Spectroscopy.

Lasers: Characteristics of laser light, Spontaneous emission, Stimulated emission, Stimulated absorption, Einstein coefficients, Population inversion and light amplification, Essential components of the laser, Ruby and He-Ne laser (principles only). Holography and its Application In forensic investigation. X-rays: Production; continuous and characteristic X-rays and their spectra; Mosley's law; diffraction of X-rays by crystals; Bragg's law; Compton Effect.

Natural Radioactivity & Radioactive Decays: Type of radioactive decays, theory of radioactive disintegration, radioactive constants, Mean life of a radio element, Activity of radioactive sources, Radioisotopes – their production & uses and forensic applications, Nuclear Reactions: Types of nuclear reactions, conserved quantities of nuclear reaction, energies of nuclear reaction–Q-value & its experimental determination. Exoergic & endoergic reactions, Weapons of mass destruction, forensic significance, Nuclear Magnetic Resonance Spectroscopy (NMR): Theory of NMR, Environmental effect on NMR, NMR spectrophotometers, Proton NMR, C-13 NMR, and other nuclei, their Applications.

Forensic Nanotechnology: introduction to Nano particles, Nano tubes, Utilization of nanotechnology in analysis of physical evidences, selectivity particles with compatibility and feasibility.

2. **Conventional & Modern Ballistics & Forensic Ballistics:**

Firearms characteristics & classification of firearms, History and background of firearms, Functional assembly & Operating principle of firearms, Characteristics & Working mechanism of Standard: Rifled firearms, Small arms, Shot guns & Non-standard: Improvised, Country made, Imitative firearms, identification of origin.

Illegal firearms: AK-47, SKS and M16/AR15 Assault Rifles, Techniques of dismantling / assembling of firearm, improvised / country-made / imitative firearm and their constructional features.

Concepts of Ammunition: Types of ammunition - classification and constructional features of different types of cartridges, types of primers and priming composition, propellants and their compositions, velocity and pressure characteristics under different conditions, various types of bullet and compositional aspects, latest trends in their manufacturing and design projectile, identification of origin, improvised ammunition and safety aspects for handling firearm and ammunition.

Internal ballistics: Barrel, body, Firing pin, Breech face, trigger, cork, and firing mechanism, measurement of strength of barrel & trigger pull. General elementary & other principle problems: Heat problems, Pressure, Recoil, Vibration & Jump, Barrel Fouling. Ignition of propellants, shape and size of propellants, manner of burning, various factors affecting the internal ballistics: lock time, ignition time, barrel time, erosion, corrosion and gas cutting, equation of motion of projectile, Density of loading, Measurement of strength of firearm, projectile velocity determination, theory of recoil, methods for measurement of recoil.

External ballistics: vacuum trajectory, Trajectory Formation & its computation, effect of air resistance on trajectory, Angle of Fall, Influence of Earth on Trajectory, base drag, yaw, shape of projectile and stability, ballistics coefficient and limiting velocity, Ballistics tables, measurements of trajectory parameters, Escape velocity & Ricochet.

Terminal / Wound Ballistics: Effect of projectile on hitting the target: function of Bullet shape, striking velocity, striking angle and nature of target, tumbling of bullets, effect of instability of bullet, effect of

intermediate targets, Influence of range Cavitations - Temporary and permanent cavities, Ricochet and its effects, stopping power, threshold velocity for penetration of skin / flash / bones, Nature of wound of entry & exit wound, Characterization & evaluation of injuries depending upon Range, Velocity, Projectile Types, Firearm types, etc. preparation of gel block, penetrative in gel block and other targets, explosive wounds, methods of measurements of wound ballistics parameters, post-mortem and anti-mortem firearm injuries. Determination of range of fire- burning, scorching, blackening, tattooing and metal fouling shots dispersion and GSR distribution, time offering different method employed, and their limitations, Bullet recovery, time of firing.

Gunshot Residues/ Powder Residues: Composition of GSR depending upon propellants & primer mixtures, GSR Distribution, Mechanism of formation of GSR, Location, source and collection of GSR, Analysis of GSR: spot test, chemical test, identification of shooter and instrumental techniques involved of GSR Analysis, Practical problems related with GSR detections.

Test firing: Procedure for test fire, Purpose for test firing, Recovery methodology, Specifications of Firing gallery, working of automatic firing rest, Safety & Preventive measures. Characterization of bullet proof jacket, Introduction to various standard for ballistic and material testing.

Principles and practice of identification of origin: different types of marks produced during firing process on cartridge- firing pin marks, breech face marks, chamber marks, extractor and ejector marks band on bullet- number/ direction of lands and grooves, striation marks on lands and grooves, 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.

Instrumental techniques used for ballistic evidence analysis: Borescope, Comparison Microscope, Stereo microscope, traveling microscope, Scanning Electron microscope, EDXRF. Introduction to automated system of trajectory computation, (Ballistic Data Acquisition system): Operating system & its concepts, Universal Receiver, ICM,

Target Frame. Automated management of ballistics data, (Integrated Ballistics Identification system): History of establishment, Brass Trax, Bullet Trax & Match Point, Limitation & Advantages, Application-comparison of bullets and cartridges- data base creation and significance in forensic ballistic investigations Management and reconstruction of cases involving firearm; Report writing and court findings.

Determination of range of fire & its related phenomena, Techniques involved in ballistic studies, Stereo and comparison microscopy, BDAS, IBIS.

3. Computer Forensics:

Introduction to Computer and its components, Computer Storage Media, Windows and Unix File Storage, Introduction to Cybercrime and Cyber Law, Terms: Internet, hacking, virus, obscenity, pornography, program manipulation, Software piracy, attacks, phishing etc.

4. Audio Recognition & Video Analysis

Introduction to voice identification/speaker recognition and its forensic importance, History of voice analysis, Voice production theory, uniqueness in person's voice, interspeaker and intraspeaker variations, text-dependent and text-independent speaker recognition, Discriminating tests, closed test, Open test, Scope of voice analysis, collection of standards for comparison, Handling of audio recording evidences & its physical examination, marking of speakers, Procedure for preparation of working copies, Speech signal processing, Components of speaker recognition- feature extraction, pattern matching and comparison, normalization techniques, speaker profiling, enhancement of speech signal/audio recordings, establishing the authenticity and integrity of audio recordings, Approaches to speaker recognition- Segregation of Speech samples, auditory analysis/listener's approach, spectrographic approach or voiceprint analysis, automatic speaker recognition technique, phonetic Transcription, linguistic & phonetic analysis, acoustic parameters for examining speech samples, Temporal measurement,

Fourier analysis, frequency & time domain representation of speech signal, analogue to digital conversion, CSL & Linear predictive coding technique, Gold wave analysis, Multi speech analysis, SIS software, Voice Net, CEDAR, Video Focus, Discrete Fourier transformation, Fast Fourier transformation, Examination using SPID, Vocal behaviours-alcohol speech relationships- importance in forensic investigations, Report writing, Limitations, Precautions, Related Case Studies and its admissibility in court proceedings, Forensic Video analysis, establishing the authenticity of video recordings, Processing of video media, Capturing, Enhancement techniques, Specific frame analysis, Resolution, Image analysis, Biometric Analysis for Identification of Individual, Scope & its forensic application in the field of security.

5. Digital Forensics

Introduction to Digital Forensics, Branches of Digital Forensics, Phases of digital/computer forensics investigation, Identification of digital evidences, necessary documentations such as Chain of Custody, pre-acquisition forms etc., Digital evidence handling at crime scene as per standards, Collection/Acquisition and preservation of digital evidences, Processing & analysis, Compilation of findings & Reporting, Pre-requisite for setting up Digital Forensic lab and global standards.

Computer Basics and File Systems

Understanding of Windows, Linux & Macintosh operating systems, Understanding of mobile operating systems such as android, iOS, Windows, Blackberry etc., Introduction to hardware and software, Key terms, Number systems, Boot process, File types and signature, Architecture and Functioning of memory device, Retrieval of information, etc., Windows file systems, UNIX /Linux file systems, MAC file systems, Mobile file systems, Network file system, other types of file systems.

Imaging / acquisition & data recovery

Acquisition of stand-alone machine, peripheral device, other storage media, CCTV, systems (both physical & logical), Acquisition or triage

collection of live system, Acquisition of mobiles, PDA's, Tablets, Navigation systems etc., Acquisition over the network i.e. remote acquisition, Understanding of various acquisition software/hardware device, details of various file formats of forensic image, Deleted data recovery techniques.

Registry and Logging

Understanding and in-depth analysis of registry in various operating systems, Log analysis with respect to standalone machine and server, which includes event logs, ftp/sftp, application, Web Servers/ Proxy logs.

Computer and Mobile Forensic Analysis

Introduction to DFF, Working with Autopsy, Using FTK to solve a Cyber Crime, Introduction to EnCase, various features of EnCase, Solving a case using EnCase, Understanding of other intermediate tools for data processing, keyword search & analysis etc., Encryption handling techniques, Acquisition and Analysis of Volatile Memory.

6. Forensic Voice, Multimedia Comparison and Evidence Evaluation

Forensic Phonetics: Introduction, History, Forensic Linguistics, Literature and Plagiarism, Larynx Anatomy and Physiology, Anatomy and Physiology of ear.

Evidence: Handling, Legal Aspects of digital multimedia evidence, recovery of audio and video files, copyright infringement.

Signal Processing: Audio and Video Examination and Recovery, DFT, Fourier Transform for Periodic Signals, Properties of DFT-Signal Sampling, Analog to Digital Conversions, Frequency and Time Domain functions, LPC and FFT, Speech and Video Enhancement.

Video: Video Analysis, Video Technology, Forensic Video Analysis, Types of Video Signals, Analog and Digital Video Formats, Models of Image Formation and Sequencing, Tools for Analysis.

Audio and Voice: Audio Analysis Methodology, Speech and Noise Characteristics, Audio Clarification Principles, Voice Identification, Speaker Identification, Voice Spectrograph, Tools for Analysis.

7. Instrumental Techniques

Spectroscopic Methods, Molecular and Atomic Spectroscopy, Emerging and Hyphenate Spectroscopy, Separation and Detection Techniques.

8. Laboratory Management System.

9. Crime Scene Management and Forensic Physics.

Introduction to the crime scene, Types of crime scene, Evaluation and processing of crime scene, Securing the scene of crime, Documenting the crime scene (Note making, Sketching, Photography, videography of crime scene), role of the first arriving officer at the crime scene

Digital Imaging of Crime Scene, 3-D scanning technique. Searching techniques of Crime scene, Processing of physical evidence-discovering, recognizing and examination of physical evidences, Collection, Safety measures for evidence collection. Preservation, Packaging, sealing, labeling and forwarding of physical evidences, Maintaining the chain of custody, Probative value of physical evidences, Reconstruction of scene of crime. Introduction to physical evidences, Types of physical evidences, Classification and Role of physical evidences in Criminal Investigations & Trails.

Advances in crime scene management:

Tele forensic Technology for crime scene investigation, Information, Manpower, and logistics management of crime scene, Mobile kits and equipment, their utility on crime scene, Technology innovation in crime scene management, Case studies & report writing of crime scene visits, National and International scenario of crime scene management.

10. Forensic Science and Criminology.

11. Traffic accidents and Tool marks.

12. Current Trends and Recent Advancements in Forensic Physics.