

**SYLLABUS FOR COMPETITIVE EXAMINATION FOR THE  
POST OF JUNIOR SCIENTIFIC OFFICER (FINGER PRINT)  
UNDER HOME (FORENSIC) DEPARTMENT,  
GOVT. OF MIZORAM, 2016**

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**SUBJECTS**

- (a) General English (Conventional / Objective Type) ..... 100 Marks
- (b) Technical Paper - I (MCQ/Objective Type)..... 150 Marks
- (c) Technical Paper - II (MCQ/Objective Type)..... 150 Marks

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**GENERAL ENGLISH**

**(Full Marks : 100)**

- (a) Essay Writing (Conventional)..... 20 Marks
- (b) Idioms & Phrases (Objective Type)..... 16 Marks
- (c) Comprehension of given passages (Objective Type)..... 16 Marks
- (d) Grammar (Objective Type) ..... 16 Marks  
Parts of Speech : Nouns, Adjective, Verb, Adverb, Preposition, etc.
- (e) Composition (Objective Type)..... 16 Marks
  - i) Analysis of complex and compound sentences
  - ii) Transformation of sentences
  - iii) Synthesis of sentences
- (f) Correct usage and vocabularies (Objective Type) ..... 16 Marks

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**TECHNICAL PAPER – I (MCQ/Objective Type) (150 MARKS)**

<b>Unit – I</b>	Biological Science.....	60 Marks
<b>Unit – II</b>	Chemical Science .....	60 Marks
<b>Unit– III</b>	Computer Knowledge (Certificate Level).....	30 Marks

**TECHNICAL PAPER – II (MCQ/Objective Type) (150 MARKS)**

<b>Unit – I</b>	Forensic Finger Print .....	70 Marks
<b>Unit– II</b>	Physical Science.....	60 Marks
<b>Unit- III</b>	Aptitude Test .....	20 Marks

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**TECHNICAL PAPER – I**

**Unit - I : Biological Science  
( 60 marks )**

Section A	Cell theory   Fluid mosaic model   Structure of mitochondrion   Ribosome   Endoplasmic reticulum   Golgi complex   Phagocytosis   Structure of nuclear envelope   Human chromosome structure   Stages of cell cycle	<b>20 Marks</b>
Section B	Glycolysis   Tricarboxylic cycle   Electron transport chain   ATP synthesis   Action potential   Synaptic transmission   Structure of haemoglobin   Blood clotting   Structure of immunoglobulin   Types of immunoglobulins	<b>20 Marks</b>
Section C	Structure of DNA   Types of RNA   DNA replication   Transcription   Genetic code   Translation   Principle of genetic engineering   Restriction enzymes and DNA ligase   DNA fingerprinting   cDNA and genomic libraries	<b>20 Marks</b>

N.B. : Number of topics = 30(10 in each section); hence, two questions from each topic = 60 questions

**Unit –II : Chemical Science**  
**( 60 Marks) (All unit carry 15 marks each)**

**(i) Atomic Structure, Periodic Properties and Chemical Bonding:** de-Broglie's concept of dual character of matter; Heisenberg's Uncertainty Principle; Schrodinger equation; quantum numbers; shapes of s, p and d-orbitals; Aufbau principle; Pauli's exclusion principle; Hund's maximum multiplicity rule; Effective nuclear charge. The general features of long form of periodic table; Detailed discussions (definition, factors affecting it and periodic trends) of the following properties of the elements, with reference to s and p- block: (a) Atomic radii and Ionic radii; (b) Ionization Energy, Successive ionization energies, (c) Electron Affinity, (d) Electronegativity. Covalent character in ionic compounds, Fajan's rules and consequences of polarization; Ionic character in covalent compounds, Percentage ionic character from dipole moment and electronegativity difference; Concept of hybridization; valence shell electron pair repulsion theory (VSEPR), valence bond theory and molecular orbital theory. Hydrogen bonding and its effect on melting point and boiling point.

**(ii) Organic functional groups & basic concept of reaction mechanism:**

General preparation, properties and inter-conversions of the following functional groups: alkyl halides, alcohols, aldehydes, ketones, amines, nitriles, carboxylic acids & its derivatives; Inductive-effect, Electromeric-effect, Mesomeric-effect or Resonance, hyperconjugation, homolytic and heterolytic bond-breaking; Reaction intermediates (formation & stability); electrophiles, nucleophiles. Energy considerations; Aromaticity- Huckel rule & its application; SN1, SN2, E1 & E2 mechanisms.

**(iii) Colloids, Surface Chemistry and Electrochemistry:** Classification of colloids; preparation of colloids - peptisation, Bredig's method and condensation methods; purification of colloids; properties of colloids - Tyndall effect, Brownian movement, electrophoresis and electro-osmosis; protective colloids and gold number. Sols (reversible and irreversible), emulsions and emulsifiers, association colloids (micelles), gels. Applications of colloids. Physisorption; chemisorption; molar enthalpy of adsorption. Langmuir and Freundlich adsorption isotherm. Specific Surface area determination (BET method). Electrical conductance; specific, equivalent and molar conductivity; variation of conductance with dilution for weak and strong electrolytes; Kohlrausch's law of independent migration of ions. Arrhenius theory of electrolytic dissociation; Ostwald's dilution law, ionic strength, Debye-Huckel-Onsager equation for strong electrolytes (derivation not required), asymmetry effect; electrophoretic effect; Debye-Falkenhagen effect and Wien effect (qualitative treatment only).

**(iv) Experimental Analysis:** Significant figures; rounding off of numerical expressions; types of errors: minimizing of errors, the normal distribution of indeterminate errors, propagation of determinate errors; accuracy and precision, methods of their expression, difference between accuracy and precision; reporting of analytical data, rejection of data, confidence limits and intervals, test of significance (the F-test and t-test). Volumetric titrimetry; primary and secondary standard; expressing concentrations of solutions; theory of acid-base and redox indicators; application of solubility product and common ion effect in analytical chemistry; Concept of group separation in qualitative analysis. Theories of distillation, fractional distillation, steam distillation, sublimation and zone refining. Solvent extraction: Principle and efficiency of the technique; Chromatography: Classification, principles and efficiency of different techniques.

## **Unit – II : Computer Knowledge (Certificate Level)** **( 30 Marks )**

### **1. Fundamental of Computers (5 Marks )**

**Introduction :** Characteristics of Computers, The Evolution of Computers, The Computer Generations (First Generation(1942-1955), Second Generation (1955 – 1964), Third Generation (1964 – 1975), Fourth Generation (1975 – 1989), Fifth Generation (1989 – Present).

**Basic Computer Organization :** Input Unit. Output Unit. Storage Unit. Arithmetic Logic Unit. Control Unit. Central Processing Unit.

**Processor and Memory :** The Central Processing Unit, The Main Memory.

**Secondary Storage Devices :** Magnetic Tape. Optical Disk. Mass Storage Devices. Storage Hierarchy.

**Input/Output Devices :** Input Devices (Keyboard Devices, Data Scanning Devices, Electronic Card Reader), Output Devices (Monitors, Printers, Screen Image Projector).

**Classification of Computers :** Notebook Computers. Personal Computers (PCs). Workstation. Mainframe Systems. Supercomputers. Clients and Servers

### **2. Operating System (5 Marks)**

**Basic DOS Commands :** Comparison of DOS and Windows. Switching between DOS and Windows. Basic DOS Commands. Copying of Files and Disks. Delete/Undelete

**The User Interface :** Using Mouse and Moving Icons on the Screen. The My Computer Icon. The Recycle Bin. Status Bar, Start and Menu & Menu selection. Running an Application. Windows Explorer Viewing of Files, Folders and Directories. Creating and Renaming of Files and Folders. Opening and Closing of different Windows.

**Windows Setting :**Control Panels. Wall Paper and Screen Savers. Setting the Data and Sound. Concept of menu Using Help.

**Advanced Windows :** Using right Button of the Mouse. Creating Short Cuts. Basics of Window Setup. Notepad. Installing/ Uninstalling application.

### **3. Office Automation software (15 Marks)**

#### **3.1. MS WORD**

**Word Processing Basic:** An Introduction to Word Processing. Opening Word Processing Package. The Menu Bar. Using the Help. Using the Icons below menu bar

**Opening Documents and Closing documents:** Opening Documents. Save and Save As. Page Setup. Printing of Documents. Display/Hiding of Paragraph Marks and Inter Word Space

**Moving Around in a Document:** Scrolling the Document. Scrolling by line/paragraph. Fast Scrolling and Moving Pages

**Text Creation and Manipulation:** Paragraph and Tab Setting. Text Selection. Cut, copy and paste. Font and Size selection. Bold, Italic and Underline. Alignment of Text: Center, Left, right and Justify

**Formatting the Text:** Changing font, Size and Color. Paragraph indenting. Bullets and Numbering. Use of Tab and Tab setting. Changing case

**Handling Multiple Documents:** Opening and closing of Multiple documents. Cut, Copy and Paste across the documents. Saving of Clip boards

**Table Manipulation:** Concept of table: Rows Columns and Cells. Draw Table. Changing cell Width and Height. Alignment of Text in Cell. Copying of cell Delete/insertion of row and columns. Borders for Table

**Printing:** Printing. Print Preview. Print a selected page

### 3.2. MS EXCEL

**Elements of Electronics Spread Sheet:** Application/usage of Electronic Spread Sheet. Opening of Spread Sheet. The menu bar. Creation of cells and addressing of cells. Cell inputting

**Manipulation of cells:** Enter texts numbers and dates. Creation of tables Cell Height and Widths. Copying of cells

**Providing Formulas:** Using basic functions/formalism a cell. Sum() function Average. Percentage. Other basic functions

### 3.3. MS POWERPOINT

**Basic:** Difference between presentation and document. Using Power Point. Opening a Power Point Presentation. Using Wizard for creating a presentation

**Creation of Presentation:** Title. Text Creation. Fonts and Sizes. Bullets and indenting. Moving to Next Slide

**Preparation of Slides:** Selection of type of Slides. Importing text from word documents. Moving to next Slide. The Slide manager

**Providing aesthetics:** Slide Designs. Background and Text colors. Making your own slide format. Footnotes and slide numbering

**Presentation of the Slides:** Using the Slide Show. Printing the Slides and Handouts. Slide sorter. Title sorter.

## 4. Internet Technologies (5 Marks)

**Introduction:** Growth and Owners of the Internet. History of World Wide Web. Basic Internet terminologies. Commerce on the Internet. Governance on the Internet. Impact of Internet on Society

**Internet Technology and Protocols:** Internet Protocols. TCP/IP. Network architecture. Local area networks. Wide Area Network. Domains

**World Wide Web:** What is World Wide web. Evolution of World Wide web. HTTP and URL's. Search Engines. Hypertext

**Browsers** : Basic features. Bookmarks, History and Progress Indication. Different Web Browser. Customization of Web Browser. Saving and printing web pages. The Internet Explorer. Searching and downloading on the internet

**Electronic Mail** : What is an Electronic Mail. Email Addressing. Using E-mails. Mailbox: Inbox and Outbox. Creating and Sending a new E-mail. Replying to an E-mail message. Forwarding an E-mail message. Sorting and Searching emails. Sending document by E-mail. Sending Softcopy as attachment

## TECHNICAL PAPER – II

### UNIT – I : FORENSIC FINGER PRINT ( 70 Marks )

Unit-A	1.History and Development of Finger print Science 2.Formation of ridges and its characteristics 3.Pattern types and pattern areas 4.Theory of Finger print identification 5.Finger print Bureau	--	20 Marks
Unit- B	1.Chance Finger prints, Plastic prints 2.Latent prints, plastic prints & visible Finger prints 3.Composition of sweat 4.Physical methods of Development 5.Chemical methods of Developments	--	15 Marks
Unit -C	1.Basics of taking of Finger prints 2.Taking Finger prints of living and dead person 3.Preserving and lifting of Finger prints 4.Comparison of Finger prints 5.Automated Finger Prints Identification	--	15 Marks
Unit-D	1.Foot prints/Shoe prints 2.Palm prints 3.Bite marks	--	10 Marks
Unit-E	1. Laws relating to Finger print evidence	--	10 Marks

*Suggested readings:*

- 1.Subramaniam KV & Lakshminarayanan : A guide to Finger prints, Madras book agency,1984
- 2.Nabar,BS: Forensic Science in crime investigation, Asia Law House,2007
- 3.Wentworth & Wilder: Personal Identification, 1948 R.G.Badger, Boston
- 4.Allision : Personal Identification
- 5.Cherril,FR : The Finger Prints, System at Scotland Yard,1954
- 6.James F.cowger: Friction Ridge skin CRC Press London, 1993

## **Unit II : Physical Science** **( 60 Marks )**

### **Section I: Mechanics, Waves and Optics.**

20 marks (20 MCQ Questions)

Laws of motion; conservation of energy and momentum, applications to rotating frames, centripetal and Coriolis accelerations; Motion under a central force; Conservation of angular momentum, Kepler's laws; Gravitational field and potential due to spherical bodies; Two-body problem; Reduced mass; Centre of mass and laboratory reference frames; Conservation theorems for energy, momentum and angular momentum; Elastic and inelastic collisions; Rigid body; Degrees of freedom, angular velocity, angular momentum, moments of inertia; Elasticity, Hooke's law; Streamline (Laminar) flow, viscosity; Michelson-Morley experiment and its implications; Lorentz transformations-length contraction, time dilation; Doppler effect, mass-energy relation.

Simple harmonic motion, damped oscillation, forced oscillation and resonance; Phase and group velocities; Laws of reflection and refraction; nodal planes, system of two thin lenses, chromatic and spherical aberrations; Interference of light-Young's experiment, Newton's rings, interference by thin films; Fraunhofer diffraction-single slit, diffraction grating, resolving power; Fresnel diffraction: half-period zones and zone plates; Production and detection of linearly and circularly polarized light; Optical activity; Lasers-Einstein A and B coefficients.

### **Section II: Thermodynamics, Electromagnetism.**

20 marks (20 MCQ Questions)

Laws of thermodynamics, reversible and irreversible processes, entropy; Isothermal, adiabatic, isobaric, isochoric processes and entropy changes; Gibbs' phase rule and chemical potential; van der Waals equation of state of a real gas, critical constants; Maxwell-Boltzmann distribution of molecular velocities, transport phenomena; Dulong-Petit, Einstein, and Debye's theories of specific heat of solids; Maxwell relations and applications; Clausius- Clapeyron equation.

Coulomb's law; electric field; Gauss' law; Electric potential; Capacitors, dielectrics and polarization; Ohm's law; Kirchhoff's first and second rules; resistors in series and parallel; Laplace and Poisson equations in electrostatics; Potential and field due to a dipole; force and torque on a dipole in an external field; Biot-Savart law, Ampere's law, Faraday's law, Lenz' law; Self-and mutual-inductances; DC and AC circuits with R, L and C components; Series and parallel resonances; Principle of transformer.

### **Section III: Atomic and Nuclear Physics, Electronics**

20 marks (20 MCQ Questions)

Photoelectric effect; Einstein's photon theory; Bohr's theory of hydrogen atom; Stern-Gerlach experiment; quantization of angular momentum, electron spin; Pauli exclusion principle and applications; Zeeman effect; Bragg's law; Compton effect, Compton wavelength; Wave nature of matter, de Broglie wavelength, wave-particle duality; Heisenberg's uncertainty relationships; Schrödinger's equation-eigenvalues and eigenfunctions of particle in a box; Natural and artificial radioactivity; Binding energy of nuclei, nuclear fission and fusion.

Intrinsic semiconductors; electrons and holes; Doping, impurity states; n and p type semiconductors; conductivity, mobility, and Hall Effect; p-n junction diode; majority and minority carriers; diode rectification (half and full wave); Zener diode; characteristics of a transistor in CB, CE and CC mode; Digital electronics-Boolean identities, De Morgan's laws, logic gates and truth tables.



**Unit – III : Aptitude Test**  
**(20 Marks)**

(a) Numerical And Figurework Tests: (4 Marks)

These tests are reflections of fluency with numbers and calculations. It shows how easily a person can think with numbers. The subject will be given a series of numbers. His/Her task is to see how the numbers go together to form a relationship with each other. He/She has to choose a number which would go next in the series.

(b) Verbal Analysis And Vocabulary Tests: (6 Marks)

These tests measure the degree of comfort and fluency with the English language. These tests will measure how a person will reason with words. The subject will be given questions with alternative answers, that will reflect his/her command of the rule and use of English language.

(c) Visual And Spatial/3-D Ability Tests: (4 Marks)

These tests are used to measure perceptual speed and acuity. The subject will be shown pictures where he/she is asked to identify the odd one out; or which comes next in the sequence or explores how easily he/she can see and turn around objects in space.

(d) Abstract Reasoning Tests: (6 Marks)

This test measures the ability to analyse information and solve problems on a complex, thought based level. It measures a person's ability to quickly identify patterns, logical rules and trends in new data, integrate this information, and apply it to solve problems.