Syllabus for the post of JUNIOR TECHNICAL ASSISTANT
(School of Artificial Intelligence & Data Science)

(A) WRITTEN TEST

1.1 For Engineering Background Candidates:

Properties of Real number system, Sequences and series of real numbers, review of limit, Continuity and differentiability of functions, Rolle's theorem, Mean value theorems and Taylor's theorem, Maxima, minima and curve tracing, Complex Numbers, Complex Vector Spaces.

Matrices, Vector spaces (over the field of real and complex numbers), subspaces, linear dependence/ independence, basis, dimensions, coordinate with respect to a basis, complementary subspaces, Linear transformations, Range space and rank, Null space and nullity, matrix representation of linear transformation, change of basis and similarity, rank-nullity theorem.

First Order Ordinary Differential Equations: Geometrical interpretation of solution, Solution methods for separable equations, Exact equations, Linear equations.

Memory, Processor, Instruction set Architecture, I/O, Data structure, algorithm, searching and sorting, hashing, data visualization and plotting functions, capacitors, transistors, resistors and their circuits, Circuit diagrams, linear rectifiers, Digital Principle and Digital Logic.

Energy Transfer; Thermodynamics Properties, Open, and Closed System; Second law of Thermodynamics; Entropy, Basics of fluid dynamics, Newtonian Mechanics.

Devices and Circuits: Circuit Theorems; Semiconductor Devices and their biasing Circuits: Rectifiers, filters, amplifiers, Operational amplifier and its circuits.

DC/AC Circuit Analysis: Single and Three Phase circuits, Power electronic devices and circuits: SCR controlled rectifier; DC/AC Electrical Machines: DC Motor and Generator, Single and Three phase transformers, Induction and Synchronous motors. Digital Electronics: Number systems, Combinatorial and Sequential circuits: Arithmetic circuits, Counters, shift-registers, and finite state machines.

Data converters: sample and hold circuits, ADCs and DACs; Semiconductor memories: ROM, SRAM, DRAM. Embedded Systems: architecture, programming, memory and I/O interfacing.

Signal Processing: Continuous and Discrete time signals, and their Fourier representations, sampling theorem; LTI systems and their properties, digital filter design techniques.

Communications: Analog and Digital communications concepts, Modulation/Demodulation concepts, Transmitter and Receiver. Control Systems: Feedback systems and their analysis.

Basic statistics: Sampling and its Techniques; Sample Mean, Median, Mode Variance; Random Samples and Random Numbers, Sample SD, SEM; Idea of Significance, Correlation of Measurements, and Significance Tests.

1.2 For Biology and Physics background candidates

Black body radiation, basic quantum physics, atomic and molecular physics. Rutherford model, alpha particle scattering, Bohr atom model, Bohr's interpretation of H atom, Hydrogen spectral series, Radioactivity, Basic concepts on particle accelerators.

Reflection, Refraction, focal plane, Image formation and magnification, F- number, Depth of the focus and depth of the field, aberrations, Snell's law, Polarization, collimation, Basics of Interference.

Motion along straight-line velocity, acceleration, velocity-time graph. Newton's laws of motion, Equations of motion, Force, work and energy, energy conservation, work-energy theorem. Rigid body dynamics, angular velocity and angular acceleration, angular momentum, torque. Newton's laws for rotational motion, conservation of angular momentum. Requirements of equilibrium, Centre of gravity, Newton's laws of gravitation, gravitation near the surface of earth and below the surface of earth, gravitational potential energy, Kepler's law.

Electric potential: equipotential surfaces, potential due to point charge, group of point charges and due to electric dipole. Dielectrics and Capacitance: Electric Current: current density, Resistance and Resistivity, Ohm's Law, Energy and power in electric circuits, Emf, potential differences, RC circuits. Magnetic field: the definition of B, magnetic force on a current carrying wire, magnetic dipole, Ampere's law.

Cell types, organization, cellular organelles, chloroplast, mitochondria,
vacuoles, endoplasmic reticulum, Golgi apparatus; nucleus, chromosomes - basic structure, number, central dogma in Molecular Biology, DNA, RNA, proteins, DNA

replication, transcription, translation, cell cycle, mitosis, meiosis. Concept of tissues, organs and systems, basic knowledge of different types of tissues and systems in the body.

Chemicals of life, water as vital essence of life, macromolecules carbohydrates, fats, proteins, lipids, enzymes, enzyme kinetics, enzyme regulation, metabolism, catabolism, anabolism.

Immunology: Innate and adaptive immune systems and their components, Antibody- antigen interactions, recent knowledge and applications concerning immunity to various infections.

Basic statistics: Sampling and its Techniques; Sample Mean, Median, Mode Variance; Random Samples and Random Numbers, Sample SD, SEM; Idea of Significance, Correlation of Measurements, and Significance Tests.

(B) SKILL TEST

2.1 For Engineering Candidates

1. Practical knowledge (including safe handling) of analytical devices
2. Analysis of Equipment technical specifications
3. General equipment maintenance & usage logging
4. Annual maintenance and calibration of equipment
5. Maintenance of consumable stocks
6. Basic computer knowledge and effective usage of Microsoft office
7. Laboratory management
9. Installation & maintenance of software

10. Multimeter and Oscilloscope for Circuit Testing, determination of resistance, voltage, parallel and series circuits
11. Basic Soldering skills
12. Screw gauge
13. Vernier Calipers
14. Electrical/Electronic circuits: Operating electrical/electronic instruments and equipment, testing and debugging of electrical/electronic circuits and systems
15. Communications and Signal Processing: Implementing communication and signal processing related functions

2.2 For Biology and Physics Candidates

1. Practical knowledge (including safe handling) of analytical devices
2. Analysis of Equipment technical specifications
3. General equipment maintenance & usage logging
4. Annual maintenance and calibration of equipment
5. Maintenance of consumable stocks
6. Basic computer knowledge and effective usage of Microsoft office
7. Laboratory management
8. Installation & maintenance of software
9. Multimeter and Oscilloscope for Circuit Testing, determination of resistance, voltage, parallel and series circuits
10. Basic Soldering skills
11. Screw gauge
12. Vernier Calipers
13. Reagent and Buffer preparation
14. Basic microscopy skills

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