SYLLABUS OF WRITTEN TEST FOR RECRUITMENT TO THE POST OF SCIENTIST/ENGINEER 'SC'
ADVERTISEMENT NO.: सैक SAC: 01:2026, Dated 23.01.2026

DOMAIN: ELECTRONICS AND COMMUNICATION
Post Code – 04

Electromagnetic Theory –
Review of Basic Electromagnetic Theory, Maxwell's equations, Wave Equation, Time-Harmonic Fields, Plane waves in lossless and lossy media, Poynting's Theorem, boundary conditions, Reflection and Transmission of waves.
Theorems and Concepts: The Generalized Current Concept, Circuit-Field Relations, Auxiliary Vector potentials, The source concept, Duality, Uniqueness, Image Theory, The Equivalence Principle, Induction and Reciprocity theorems, Green's Functions. Guidance of Waves in Rectangular and circular waveguides

Microwave Circuits and Systems-
Scattering Parameters: Formulation and properties of S-matrices for n-port networks; conversion between S, Z, Y, and ABCD parameters. Smith Chart Applications: Use of the Smith Chart for impedance and admittance calculations and solving matching problems. Signal Flow Graphs: Modeling microwave networks

Guiding Systems: Analysis of rectangular and circular waveguides, coaxial lines, and planar lines like microstrip, stripline, and coplanar waveguides. Mode Theory: Detailed study of TE, TM, and TEM modes, including cut-off frequencies, phase/group velocities, and power losses.

Passive Microwave Components - Impedance Matching: Design of lumped-element networks, single/double stub tuning, and multi-section transformers (Binomial, Chebyshev). Power Dividers & Couplers: Wilkinson power dividers, branch-line couplers, rat-race hybrids, and coupled-line directional couplers. Resonators & Filters: Design of waveguide cavities, dielectric resonators, and microwave filters.

Active Microwave Circuits & Devices- Noise in microwave circuits, Microwave amplifier Design: Design of small-signal amplifiers (gain, stability circles, noise figure), power amplifiers, microwave oscillators and mixers.
Microwave Measurements

Microwave Devices-
Diodes; high-frequency equivalent circuit; Schottky barrier diode; varactor diode; PIN diode; Applications.
Tunnel diodes; Impact ionization; IMPATT and other related diodes; small-signal analysis and model of IMPATT diode; TRAPATT; BARRITT.

Transferred electron devices; differential negative resistance and two-valley model of Gunn Effect devices; modes of operation; waveguide cavity Gunn oscillator.
Three terminal devices; BJT, MESFET, MOSFET, HFET, HEMT – device physics, characteristics, model. Microwave Tubes: Operation of high-power devices such as Klystrons, Magnetrons, and Traveling Wave Tubes (TWTs). Monolithic Microwave Integrated Circuits (MMICs): Fabrication technology and design of on-chip microwave systems

Antennas Theory –
Fundamental: Concepts of antenna parameters, Radiation from Wires and Loops: dipole antenna and variants, Aperture Antennas: Huygens' principle, radiation from rectangular and circular apertures, design considerations, Babinet's principle, Fourier transform method in aperture antenna theory, Horn and Reflector Antennas: design concepts, parabolic reflector antennas, Microstrip Antennas: Basic characteristics, feeding methods, methods of analysis, design of rectangular and circular patch antennas, Antenna Arrays: Analysis of uniformly spaced arrays with uniform and non-uniform excitation amplitudes, synthesis of antenna arrays

Radar Systems Engineering
Basic Principles: Radar equation, Radar Cross section **,** CW Radar, FMCW Radar, Pulsed Radar Principles **,** Clutter Analysis, MTI Improvement Factor, Pulsed Doppler Radar **,** Tracking Radar, Angular resolution, Monopulse Technique **,** Detection Theory: Match Filtering, Radar Ambiguity Function **,**Imaging Radar: Resolution Concept, Pulse Compression **,** Synthetic Aperture Processing, ISAR Imaging **,** Probability of false alarm and Detection, Modified Radar Range Equation with Swerling Models**,** Ground Penetrating Radar for close sensing **,** Radar Tomography and Radar based Microwave Imaging **,** Emerging and Modern Applications of Radar Principles

Microwave Communications-
Link Budget Analysis: Calculating path loss, antenna gain (EIRP), noise figure, and carrier-to-noise ratio for line-of-sight and satellite links. Modulation & Multiplexing: Application of digital modulation schemes (QAM, PSK) and multiple access techniques (FDMA, TDMA, CDMA) specifically for microwave bands. Propagation Effects: Ground wave and tropospheric propagation, atmospheric attenuation (rain fade), and multipath fading.

Basic Electronics and Communication

Basic Electronics, Electronic Devices & Circuits, Semiconductor Physics, Network Theory, Analog and digital electronics, electrical measurement and instruments, Control Theory and systems, microprocessor and microcontroller, Analog and digital communication, Electromagnetics, Antenna & Waves propagation fundamentals, transmission lines, Maxwell' Equation, Analogue & digital modulation and demodulation techniques, FPGA & ASIC fundamentals, wired and wireless communication systems, satellite communication, Modern cellular communication systems.

Hindi version shall follow.