

Syllabus for Written Exam for the post of JUNIOR TECHNICIAN – ELECTRICAL ENGINEERING

Common for all the streams: **Arithmetic-** Ratio and proportion, Arithmetic progression and geometric progression, Permutation and combination, Logarithm and exponential series, Complex numbers. **General English-** Parts of speech, Types of sentences, Numbers, genders, persons, tenses, articles and degrees, Direct speech and indirect speech, Active voice and passive voice.

Power Electronics and Power Systems

Electrical circuit analysis: Network theorems. Transient analysis and the initial value calculation for RLC circuits. Phasor, impedance, power factor, r.m.s value, active power and reactive power. Three-phase AC circuit analysis. **Electrical machines:** Transformer principle and equivalent circuit. Core loss, copper loss and inrush current phenomenon in a transformer. Open circuit, short circuit and polarity tests of a transformer. Three-phase transformer connections. Analysis of separately excited, series excited, shunt excited and compound excited DC machines. Steady-state modeling and analysis of synchronous and induction machines. **Power electronics:** Power electronic devices such as diode, thyristor, GTO, IGBT and MOSFET. Filter and snubber circuits. Thyristor commutation. Diode-bridge single-phase and three-phase rectifier circuits. Thyristor-bridge single-phase and three-phase converter circuits. Buck, boost, buck-boost converters. Harmonic analysis and THD calculation. **Control system:** Concept of the linear time-invariant (LTI) system. Laplace transformation, convolution, initial value theorem and final value theorem. Block diagram, impulse response, transfer function and characteristic equation. Routh-Hurwitz criterion for the stability analysis of an LTI system. Maximum overshoot, rise time and settling time. Nyquist criterion, Bode plot, gain margin and phase margin. PID, lead-lag and washout controllers.

Microelectronics and VLSI Stream

Electronic Devices and Circuits: Network theorems, Diode IV characteristics, MOSFET IV and operating regimes, Integrated Circuits, Scaling of semiconductor technology. **Laboratory Instrumentation and Measurements:** Impedance, sampling rate, settling time and other common instrument parameters, Oscilloscopes - Digital and analog, Function generators, Familiarity with low-current and high-speed measurements and necessary precautions, Understanding of Signal grounding, routing and noise reduction, EMI. **PCB Design and Testing:** High-speed high-performance PCB board design, Types of connectors and interfaces, ESD Protection. **Computer skills:** Basic programming skills (C and Python), pseudo-code, Types of interfaces for automating measurements (GPIB/USB/LXI). **Miscellaneous Topics:** Basic principles of common electronic/electrical devices in every-day life (e.g. communication devices, inverters, chargers, monitors, etc), Application of signal processing techniques for measurements

Communications and Signal Processing

1. Computing Skills: Basic programming constructs: data types, arrays, pointers, linked lists and trees, statements, I/O, conditionals, loops, functions, class/object. **2. Communication Technologies:** Communication Standards, 2G/3G/4G/5G, ZigBee, BLE, Wi-Fi, LTE, IEEE 802.11x, data rates, coverage/range, power, computations, bandwidth, sensing, processing, communication powering, communication networking, topologies, layer/stack architecture, QoS. **3. Communications System:** Physical layer description of communication systems, quantization, data formatting and framing, capacity of a point-to-point link, link budget analysis, multiple access techniques, network routing. **4. Data Analytics:** Combinatorics, Probability on finite sample spaces, Joint and conditional probabilities, independence, total probability; Bayes' rule and applications. **5. Digital Communications:** Passband representation, Baseband equivalent AWGN Channel, Data Modulation and Demodulation, Synthesis of the Modulated Waveform, Discrete Data Detection, The Additive White Gaussian Noise (AWGN) Channel, Signal-to Noise Ratio (SNR) Maximization with a Matched Filter, Error Probability for the AWGN Channel, MAP and ML detection, Digital Modulation Techniques, Wireless signal propagation and channel models. **6. Digital Signal Processing:** Sampling, continuous and discrete-time transforms, Frequency Domain Analysis of LTI Systems, implementation of FFT, algorithms, Filter Design: IIR and FIR filters, sampling rate conversion.