Modalities of the ETA selection process

Only the short-listed applicants showcased on the IIT Dharwad's website are permitted to participate in the selection process for the ETA positions in the department of electrical engineering, IIT Dharwad. The selection process consists of

1. *Screening test (online or written):* The screening test will be common for all the candidates. An outline of the syllabus is provided below. During the screening test, the candidates need to specify their preference **(ONLY ONE)** for the lab test.
2. *Lab test:* The details are provided below in the "Details of the lab test" section of this document.

Based on the performance in the screening test, some of the candidates will be short-listed for the lab test. The details of the screening test and the lab test are given in the next section.

Details of screening test

The following broadly outlines the syllabus that will be used for the screening test:

1. Signals and Systems:
    a. Continuous-time signals: Fourier series and Fourier transform representations, sampling theorem and applications
    b. Discrete-time signals: discrete-time Fourier transform (DTFT), DFT, FFT, z transform and sampling theorem
    c. LTI systems: definition and properties, causality, stability, impulse response, convolution, poles and zeros and frequency response
    d. Random processes: basics of probability, random variables, CDF, PDF, random processes, mathematical expectation, conditional probability and conditional expectation.
2. Electric Circuits: Network graph, KCL, KVL, Node and Mesh analysis, Transient response of dc and ac networks, Sinusoidal steady-state analysis, Resonance, Ideal current and voltage sources, Thevenin's theorem, Norton's theorem, Superposition theorem, Maximum power transfer theorem, Three phase circuits, Power and power factor in ac circuits.
3. Electronic Devices and circuits: Basic working of transistors, diode, MOSFETS etc., energy bands in intrinsic and extrinsic silicon; Carrier transport: diffusion current, drift current, mobility and resistivity; Generation and recombination of carriers; P-N junction, Zener diode, BJT, MOS capacitor, MOSFET, LED, photo diode, basic electronic circuits.
4. Digital Systems: Number systems; Combinatorial circuits; Sequential circuits.

Details of the lab test

Experiments/programs based on the following syllabus will be asked during the lab test.

Communication and Signal Processing

1. Signals and Systems:
    a. Continuous-time signals: Fourier series and Fourier transform representations, sampling theorem and applications
    b. Discrete-time signals: discrete-time Fourier transform (DTFT), DFT, FFT, z transform and sampling theorem
    c. LTI systems: definition and properties, causality, stability, impulse response, convolution, poles and zeros and frequency response
    d. Random processes: basics of probability, random variables, CDF, PDF, random processes, mathematical expectation, conditional probability and conditional expectation.
2. Communication:
    a. Digital communications: Digital modulation schemes, MAP and ML decoding, notions of bandwidth, SNR and BER for digital modulation;
    b. Fundamentals of error correction codes (e.g.: Linear Block Codes like Hamming code), and basics of information theory.

Electronic Devices and Circuits

1. Electronic Devices: Basic working of transistors, diode, MOSFETS etc., energy bands in intrinsic and extrinsic silicon; Carrier transport: diffusion current, drift current, mobility and resistivity; Generation and recombination of carriers; P-N junction, Zener diode, BJT, MOS capacitor, MOSFET, LED, photo diode, basic electronic circuits.
2. Digital Systems: Number systems; Combinatorial circuits; Sequential circuits.

Electrical Machines and Power Electronics

1. Electric Circuits: Network graph, KCL, KVL, Node and Mesh analysis, Transient response of dc and ac networks, Sinusoidal steady-state analysis, Resonance, Ideal current and voltage sources, Thevenin's theorem, Norton's theorem, Superposition theorem, Maximum power transfer theorem, Three phase circuits, Power and power factor in ac circuits.
2. Power Electronics: characteristics of MOSFET, IGBT and diode, DC to DC conversion: Buck, Boost and Buck-Boost converters; Single and three phase configuration of uncontrolled rectifiers, Line commutated thyristor based converters.
3. Power Systems: Per-unit quantities, Newton-Raphson load flow methods, Voltage and Frequency control, Power factor correction, Symmetrical components, Symmetrical and unsymmetrical fault analysis, System stability concepts, Equal area criterion.
4. Electrical Machines and transformers:
    a. Single phase transformer: equivalent circuit, phasor diagram, open circuit and short circuit tests, regulation and efficiency;
    b. Three phase transformers: connections, parallel operation;
    c. Three phase induction motors: principle of operation, types, performance, torque-speed characteristics, no-load and blocked rotor tests, equivalent circuit, starting and speed control;
    d. Synchronous machines: cylindrical and salient pole machines, performance, regulation, starting of synchronous motor, characteristics.