Department of Electronics & Communication Engineering

PhD Admissions
Syllabus for Written Test

Sl. No.	Research Area	Syllabus
1	**VLSI Design and Circuits**	**Network Theory:** Analysis of networks with Theorems, transient and steady state analysis of RL,RC,RLC circuits **Solid state devices:** Basics of semiconductor physics, carrier transport in PN Junction, basics of BJT and MOS devices. **Analog circuits**: Circuits with MOSFETs and BJTs, OPAMP Circuits **Digital circuits:** Boolean algebra, design and analysis of combinational and sequential circuits, CMOS Inverter and CMOS logic circuits **VLSI Technology:** Basic semiconductor fabrication techniques for ICs. **Digital logic design:** Boolean algebra, design and analysis of combinational and sequential circuits, CMOS Inverter and CMOS logic circuits.

2	**Signal Processing**	**Signals and Systems**: Continuous time signals and systems, basic system properties. Continuous-time and discrete time Linear Time-invariant system. Fourier series representation of continuous-time periodic signals. The Fourier transform for periodic signals, Properties of the continuous-time Fourier transform. The Laplace transform for continuous-time signals and systems and properties of the Laplace transform. **Digital Signal Processing**: Discrete-time signals: sequences, discrete-time systems, Linear constant-coefficient difference equations, linear and circular convolution, correlation. Z-transform, The inverse z-transform, Properties of the z-transform. Frequency domain representation of sampling, Reconstruction of a bandlimited signals from its samples. Discrete Fourier Transform (DFT), Properties of DFT, convolution using the DFT. Fast Fourier Transform, Design of digital filters, IIR and FIR filters. All-pass systems, Minimum phase systems.

3	**Power and Energy**	**Electric Circuits and Networks:** Network graph, KCL, KVL, Node and Mesh analysis, Transient response of dc and ac networks, Sinusoidal steady-state analysis, Resonance, Passive filters, Ideal current and voltage sources, Thevenin's theorem, Norton's theorem, Superposition theorem, Maximum power transfer theorem, Wye-Delta transformation, Steady state sinusoidal analysis using phasors, Time domain analysis of simple linear circuits; Solution of network equations using Laplace transform, Frequency domain analysis of RLC circuits; Two-port networks, Three phase circuits, Power and power factor in ac circuits. **Electrical Machines:** Energy conversion principles, DC machines, types, generator and motor characteristics, Armature reaction and commutation, starting, braking and speed control, Single phase transformer, equivalent circuit, phasor diagram,

		regulation and efficiency, Three phase transformer, connections, parallel operation, autotransformer, Three phase Induction motor, equivalent circuit, performance characteristics, starting, braking, and speed control, Single phase induction motors, Synchronous machines, performance, regulation, parallel operation, starting, characteristics, and applications, Switched reluctance, BLDC, Servo and Stepper motors **Power Electronics:** Characteristics of semiconductor power devices: Diode, Thyristor, Triac, GTO, MOSFET, IGBT; DC to DC conversion: Buck, Boost, Buck-Boost, Cuk, Fly-back and Forward converters; Single and three phase configuration of uncontrolled rectifiers, Line commutated thyristor based converters, Bidirectional ac to dc voltage source converters, Issues of line current harmonics, Power factor, Distortion factor of ac to dc converters, unity power factor converters, Single phase and three phase inverters, Sinusoidal pulse width modulation techniques, Snubber circuits. **Control Systems:** Mathematical modeling and representation of systems, Feedback principle, transfer function, Block diagrams and Signal flow graphs, Transient and Steady-state analysis of linear time invariant systems, Routh-Hurwitz and Nyquist criteria, Bode plots, Root loci, Stability analysis, Lag, Lead and Lead-Lag compensators; P, PI and PID controllers; State space model, State transition matrix.

4	**Communications** *(Communications, RF, and Fiber-Optics/Photonics Group)*	The question paper for the written test consists of four Sections namely, Section A, Section B, Section C, and Section D. Of the four Sections, ***Section A is common to all candidates***, and from the remaining Sections, a candidate can ***choose only one Section that corresponds to his area of interest.*** **Section A**: Signals and Systems, Fourier Series, and Fourier Transforms **Section B**: Wireless Communications/ Networks **Section C**: Antennas/RF/Microwave **Section D**: Fiber-optics/Photonics **Syllabus for Section A:** Basics of signals and systems, Fourier Series, Fourier Transforms, Frequency Response, Sampling Theorem. **Syllabus for Section B:** Basic Analog and Digital Communication Systems (AM, FM, BPSK, QPSK, QAM, FSK, etc). **Syllabus for Section C**: Transmission lines, waveguides, S-Parameters, Antenna basics, Maxwell equations, Boundary conditions, Plane wave propagation, Reflection and transmission of interface. **Syllabus for Section D:** Single mode and multimode fibers, Numerical aperture, Dispersion, Basic principles of light generation (LED, LASER) and detection (PIN photodiode, APD).