Department of Electronics and Communication Engineering

Syllabus for Ph.D. Admission Eligibility Test

Paper-I: Research Methodology

Research and Types of research: Meaning of Research- Objectives of Research- Motivation in Research. Research methods vs Methodology. Types of research – Descriptive vs. Analytical, Applied vs. Fundamental, Quantitative vs. Qualitative, Conceptual vs. Empirical. Research Process. Criteria of good Research. Research Formulation – Defining and formulating the research problem - Selecting the problem - Necessity of defining the problem - Importance of literature review in defining a problem – Literature review – Primary and secondary sources – reviews, treatise, monographs-patents – web as a source – searching the web - Critical literature review – Identifying gap areas from literature review - Development of working hypothesis. Data Collection and analysis: Execution of the research - Observation and Collection of data - Methods of data collection – Modeling, Mathematical Models for research, Sampling Methods- Data processing and Analysis strategies. Data Analysis with Statistical Packages – Hypothesis-testing, Generalization-and Interpretation.

Paper-II: Core Subjects

Section 1: Signals and Systems

Continuous-time signals: Fourier series and Fourier transform, sampling theorem and applications.

Discrete-time signals: DTFT, DFT, z-transform, LTI systems: properties, causality, stability, impulse response, convolution, poles and zeroes, frequency response.

Section 2: Electronic Devices

Energy bands in intrinsic and extrinsic semiconductors, diffusion current, drift current, mobility and resistivity, generation, and recombination of carriers. P-N junction, Zener diode, BJT, MOSFET, LED, photo diode and solar cell.

Section 3: Analog and Digital Circuits

Diode circuits: clipping, clamping and rectifiers. BJT and MOSFET amplifiers, Op-amp circuits: Amplifiers, summers, differentiators, integrators, active filters, Schmitt trigger and oscillators.

Combinatorial circuits: Boolean algebra, minimization of functions using Boolean identities and Karnaugh map, logic gates and their static CMOS implementations, code converters, multiplexers, decoders.

Sequential circuits: latches and flip-flops, counters, shift-registers, finite state machines.

Data converters: sample and hold circuits, ADCs, and DACs Semiconductor memories: ROM, SRAM, DRAM.

Section 4: Communication

Random processes: autocorrelation and power spectral density, properties of white noise, filtering of random signals through LTI systems.

Analog communications: amplitude modulation and demodulation, angle modulation and demodulation, spectra of AM and FM, super heterodyne receivers.

Digital communications: PCM, DPCM, digital modulation schemes (ASK, PSK, FSK, QAM), bandwidth, SNR and BER.

Section 5: Electromagnetics

Maxwell's equations: differential and integral forms and their interpretation, boundary conditions, wave equation, Poynting vector.

Plane waves and properties: reflection and refraction, polarization, phase and group velocity, propagation through various media, skin depth.

Transmission lines: equations, characteristic impedance, impedance matching, impedance transformation.