PhD Admission Test-2022
Electronics and Communication Engineering
Syllabus

NETWORK ANALYSIS:

Network solution methods: nodal and mesh analysis. Network theorems: superposition, Thevenin and Norton's, maximum power transfer, Wye-Delta transformation. Steady state sinusoidal analysis using phasors. Linear constant coefficient differential equations; time domain analysis of simple RLC circuits, Solution of network equations using Laplace transform: frequency domain analysis of RLC circuits. 2-port network parameters: driving point and transfer functions. State equations for networks.

ELECTRONIC DEVICES:

Energy bands in silicon, intrinsic and extrinsic silicon. Carrier transport in silicon: diffusion current, drift current, mobility, and resistivity. Generation and recombination of carriers. p-n junction diode, Zener diode, tunnel diode, BJT, JFET, MOS capacitor, MOSFET. Device technology: integrated circuits fabrication process, oxidation, diffusion, ion implantation, photolithography, n-tub, p-tub and twin-tub CMOS process.

ANALOG CIRCUITS:

Small Signal Equivalent circuits of diodes, BJTs, MOSFETs and analog CMOS. Simple diode circuits, clipping, clamping, rectifier. Biasing and bias stability of transistor and FET amplifiers. Amplifiers: single-and multi-stage, differential and operational, feedback, and power. Frequency response of amplifiers. Simple op-amp circuits, filters. Sinusoidal oscillators; criterion for oscillation; single-transistor and op-amp configurations. Function generators and wave-shaping circuits, 555 Timers and power supplies.

DIGITAL CIRCUITS:

Boolean algebra, minimization of Boolean functions; logic gates; digital IC families (DTL, TTL,

ECL, MOS, CMOS). Combinatorial circuits: arithmetic circuits, code converters, multiplexers, decoders, PROMs and PLAs. Sequential circuits: latches and flip-flops, counters and shift registers. Sample and hold circuits, ADCs, DACs. Semiconductor memories. Microprocessor (8085): architecture, programming, memory and I/O interfacing.

SIGNALS, SYSTEMS AND PROCESSING

Continuous time signals:- classification and definition, Fourier series, Fourier transform representation (CTFT), Laplace transform, sampling Theorem and applications; Discrete time signals: classification and definition, discrete time Fourier series and Fourier transform (DTFT), DFT, FFT, Z-transform, interpolation of discrete-time signals; Linear Time-Invariant (LTI) Systems (continuous-time and discrete time): definitions and properties; causality, stability, impulse response, linear convolution (integral and sum), circular convolution, system characterization in time and frequency domain, poles and zeros, parallel and cascade structure, frequency response, group delay, phase delay; signal transmission through LTI systems.

Digital filter design: Basic structures of digital filters, significance of linear phase response; FIR filters design: Frequency sampling and Windowing techniques, IIR filter design: Approximation of filter functions; Butterworth, Chebyshev, Elliptic; IIR filter design based on analog filter functions- impulse invariant techniques, bilinear transformation method.

COMMUNICATIONS:

Random variable, Probability mass function, probability density function, autocorrelation, power spectral density ; Continuous wave modulation: amplitude and angle modulation and demodulation systems, spectral analysis of AM, PM & FM, super heterodyne receivers with concept of Image frequency; realizations of analog communication systems; signal-to-noise ratio (SNR) calculations for amplitude modulation (AM) and frequency modulation (FM) along with concept of pre-emphasis and de-emphasis. Fundamentals of information theory and channel capacity theorem. Digital Communication systems: pulse code modulation (PCM), differential pulse code modulation, (DPCM), Delta Modulation, Adaptive delta modulation; digital modulation schemes: amplitude, phase and frequency shift keying schemes (ASK, PSK, FSK), matched filter receivers, bandwidth consideration and probability of error calculations for these schemes. Basics of multiplexing: TDMA, FDMA and CDMA and GSM

ELECTROMAGNETICS:

Elements of vector calculus: divergence and curl; Gauss' and Stokes' theorems, Maxwell's equations: differential and integral forms. Wave equation, Poynting vector. Plane waves: propagation through various media; reflection and refraction; phase and group velocity; skin depth. Transmission lines: characteristic impedance; impedance transformation; Smith chart; impedance matching; S parameters, pulse excitation. Waveguides: modes in rectangular waveguides; boundary conditions; cut-off frequencies; dispersion relations. Basics of propagation in dielectric waveguide and optical fibers. Basics of Antennas: Dipole antennas; radiation pattern; antenna gain