JGI JAIN DEEMED-TO-BE UNIVERSITY | FACULTY OF ENGINEERING AND TECHNOLOGY

Department of Electronics and Communication Engineering

Ph.D. Entrance Exam Syllabus - 2022
For Electronics Engineering Discipline

Networks:

Network theorems; Superposition, Thevenin's and Norton's, maximum power transfer; Wye-Delta transformation; Steady state sinusoidal analysis; Time domain analysis of simple linear circuits; Transients, Resonance – Series and Parallel Resonance Solution of network equations using Laplace transform; Frequency domain analysis of RLC circuits; Linear 2-port network parameters: driving point and transfer functions; State equations for networks.

Signals and Systems:

Continuous-time signals; Fourier series and Fourier transform representations, sampling theorem and applications; Discrete-time signals: Various types, discrete-time Fourier transform (DTFT), DFT, FFT, Z-transform, interpolation of discrete-time signals; LTI systems: definition and properties, causality, stability, impulse response, convolution, poles and zeros, parallel and cascade structure, frequency response, group delay, phase delay, digital filter design techniques.

Electronic Devices:

Energy bands in intrinsic and extrinsic silicon; Carrier transport: diffusion current, drift current, mobility and resistivity; Generation and recombination of carriers; Poisson and continuity equations; P-N junction, Zener diode, BJT, MOS Capacitor, MOSFET, SCR, IGBT, LED, photo diode and solar cell; Integrated circuit fabrication process: oxidation, diffusion, ion implantation, photolithography and twin-tub CMOS process. Thick and thin film techniques.

Analog Electronic Circuits:

Small signal equivalent circuits of diodes, BJTs and MOSFETs; Simple diode circuits: clipping, clamping and rectifiers; Single-stage BJT and MOSFET amplifiers: biasing, bias stability, mid-frequency small signal analysis and frequency response; BJT and MOSFET amplifiers: multi-stage, differential, feedback, power and operational; Simple op-amp circuits; Active filters; Sinusoidal oscillators: criterion for oscillation, single-transistor and op- amp configurations; Function generators, wave-shaping circuits and 555 timers; Voltage reference circuits; Power supplies: ripple removal andregulation. Voltage Regulators.

Digital Circuits:

Number systems; Combinatorial circuits: Boolean algebra, minimization of functions using Boolean identities and Karnaugh map, Logic Families. logic gates, CMOS implementations, Logic gates, code converters, multiplexers, decoders and PLAs; Sequential circuits: latches and flip-flops, counters, shift-registers and finite state machines; Data converters: sample and hold

circuits, ADCs and DACs; Semiconductor memories: ROM, SRAM and DRAM. Cache Memories. Sensors, Transducers – Display Devices – LED and LCDs.

Control Systems:

Basic control system components; Feedback principle; Transfer function; Block diagram representation; Signal flow graph; Transient and steady-state analysis of LTI systems; error coefficient, steady state error, Frequency response; Routh-Hurwitz and Nyquist stability criteria; Bode and root-locus plots; Lag, lead and lag-lead compensation; State variable model and solution of state equation of LTI systems, Closed loop response - M & N Circles, Nichols Chart. Basics of Non Linear controls, Industrial Automation and Robotics.

Communications:

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, circuits for analog communications; Information theory: entropy, mutual information and channel capacity theorem; Digital communications: PCM, DPCM, digital modulation schemes, amplitude, phase and frequency shift keying (ASK, PSK, FSK), QAM, MAP and ML decoding, calculation of bandwidth, SNR and BER for digital modulation; Fundamentals of error detection correction and Hamming code; Basics of Spread spectrum communications, TDMA, FDMA, CDMA and OFDM. CCN: Basics, Ethernet, Internet Relevant Protocols Services.

Electromagnetics:

Electrostatics; Maxwell's equations: differential and integral forms and their interpretation, boundary conditions, wave equation, Pointing 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, S-parameters, Smith chart; Waveguides: modes, boundary conditions, cut-off frequencies, dispersion relations; Antennas: antenna types, radiation pattern, gain and directivity, return loss, antenna arrays; Basics of radar; Light propagation in optical fibers, Dipole and Yagi antennas

Microprocessor and Microcontrollers:

Microprocessor family. Evolution, advances in architecture.8086 processor—Architecture, pin details, functions, Instruction set, assembler directives, Simple programs. Interrupts and interrupt handling. I/O and memory interfacing. Buses—RS232 and USB. Microcontroller—8051, architectural details, Instruction sets, Interrupts, Programming Arm Processor-Basics. Embedded system