# SARVAJANIK UNIVERSITY

## SARVAJANIK COLLEGE OF ENGINEERING AND TECHNOLOGY

## Electronics and Communication Engineering

## SU Ph.D Entrance Test Syllabus

### Syllabus for Ph.D. Entrance Test in Electronics and Communication Engineering

### Section 1: Engineering Mathematics

**Linear Algebra:** Matrix algebra, rank, eigenvalues and eigenvectors, Systems of linear equations, vector spaces, orthogonality

**Calculus:** Functions of single and multiple variables, partial derivatives, Maxima/minima, gradient, divergence, curl, line/surface/volume integrals.

**Probability and Statistics:** Random variables, Uniform, normal, exponential, Poisson and binomial distributions. Mean, median, mode and standard deviation. Conditional probability and Bayes theorem.

### Section2: Networks, Signals and Systems

Circuit analysis, Two-port networks, Transient analysis, Continuous-time signals: classification, energy and power, even/odd decomposition; LTI systems, Fourier series and Fourier transform of continuous-time signals, Laplace transform, Discrete-time signals and systems: difference equations, Z-transform; Sampling theorem, aliasing, and reconstruction of bandlimited signals

### Section 3: Electronic Devices and Circuits

p-n junction diodes and its applications, BJT: biasing, FETs: JFET, MOSFET; Amplifiers: multistage, feedback, frequency response, bandwidth; Operational amplifiers: common applications; Oscillators: Barkhausen criterion, standard oscillators; Power amplifiers: classes A, B, AB, C; Voltage regulators

### Section 4: Digital Circuits and Microprocessors

Boolean algebra, Combinational logic, Sequential logic, State machines, Memory devices, Programmable logic: PAL, PLA, CPLD, FPGA architectures and programming, Arithmetic circuits; Number systems and codes: BCD, Gray, Excess-3; Microprocessors: architecture, instruction set, addressing modes, interrupts; Microcontrollers: GPIO, timers, UART, I2C, SPI interfacing

### Section 5: Electromagnetic Fields and Microwave Engineering:

Electrostatics, Magnetostatics, Maxwell's equations, boundary conditions, Plane electromagnetic waves, Transmission lines, Waveguides, Cavity resonators, Microwave components: directional couplers, circulators, isolators, attenuators, power dividers; **Antennas:** radiation pattern, gain, directivity, half-wave dipole, Yagi-Uda, horn, microstrip patch, arrays; Radar and satellite communication fundamentals

### Section 6: Analog and Digital Communications

Amplitude modulation, Angle modulation: FM and PM; Sampling, PCM, DPCM, DM, ADPCM, Nyquist criterion, Digital bandpass modulation: ASK, FSK, PSK, DPSK QAM — BER performance; Information theory: entropy, mutual information, Shannon-Hartley theorem; Source coding: Huffman, Shannon-Fano, arithmetic coding; channel coding: Hamming, cyclic, convolutional codes

### Section 7: VLSI Design and Embedded Systems

MOS transistor theory, CMOS logic families, VLSI design flow, VHDL / Verilog HDL, Digital design for testability: scan chain, BIST, JTAG boundary scan, Clocking and power, Memory design;

Embedded processor architecture: pipeline, hazards, cache hierarchy, MMU, SoC design, Low-power VLSI techniques: voltage scaling, clock gating, body bias; Fundamentals of Embedded systems

### Section 8: Optical and Wireless Communication:

**Optical Communication:** Optical fiber waveguide, Single-mode and multimode fibers, Fiber losses, Fiber dispersion, Optical sources, Optical detectors, Optical amplifiers, Wavelength division multiplexing, Photonic integrated circuits, Optical communication systems

**Wireless Communication:** Wireless channel models: path loss, shadowing, multipath fading, Diversity techniques, Cellular systems: frequency reuse, handoff, capacity, co-channel interference, Multiple access, Cognitive radio, ZigBee, LoRaWAN, BLE; Network layer: OSI model, IP routing, QoS, software-defined networking (SDN); Emerging topics: massive MIMO, mmWave communication, terahertz communications, New radio