

Electronics and Communication/Automation ENGG. syllabus for (Ph.D. ENTRANCE TEST)

1. **Probability and Statistics:** Mean, median, mode, standard deviation, combinatorial probability, probability distributions, binomial distribution, Poisson distribution, exponential distribution, normal distribution, joint and conditional probability.
2. **Circuit Analysis:** Node and mesh analysis, superposition, Thevenin's theorem, Norton's theorem, reciprocity. Sinusoidal steady state analysis: phasors, complex power, maximum power transfer. Time and frequency domain analysis of linear circuits: RL, RC and RLC circuits, solution of network equations using Laplace transform.
Linear 2-port network parameters, wye-delta transformation.
3. **BJT and MOSFET Amplifiers:** Biasing, AC coupling, small signal analysis, frequency response. Current mirrors and differential amplifiers.
Op-amp Circuits: Amplifiers, summers, differentiators, integrators, active filters, Schmitt triggers and oscillators.
4. **Digital Electronics:**
Combinational logic Circuits
Minimization of Boolean Functions
IC Families: TTL and CMOS
Arithmetic Circuits, Comparators, Schmitt Trigger
Multi-vibrators, Sequential circuits
Flip flops, Shift Registers, Timers, and Counters
Sample-and-hold circuit
Multiplexer
Analog-to-digital (Successive approximation, integrating, flash, and sigma-delta)
Digital-to-analog converters (Weighted R, R-2R ladder, and current steering logic).
Characteristics of ADC and DAC (Resolution, Quantization, Significant bits, Conversion/Settling time)
Basics of number systems
Embedded Systems: Microprocessor and microcontroller applications
Memory and input-output interfacing
Basics of data acquisition systems
Basics of distributed control systems (DCS)
Programmable logic controllers (PLC).

Binary, integer and floating-point- numbers. Combinatorial circuits: Boolean algebra, minimization of functions using Boolean identities and Karnaugh map, logic gates and their static CMOS implementations, arithmetic circuits, code converters, multiplexers, decoders.

Sequential Circuits: Latches and flip-flops, counters, shift-registers, finite state machines, propagation delay, setup and hold time, critical path delay.

5. Data Converters: Sample and hold circuits, ADCs and DACs.

Semiconductor Memories: ROM, SRAM, DRAM.

Computer Organization: Machine instructions and addressing modes, ALU, data-path and control unit, instruction pipelining.

Basic control system components; Feedback principle; Transfer function; Block diagram representation; Signal flow graph; Transient and steady-state analysis of LTI systems; 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.

6. Analog Communications: Amplitude modulation and demodulation, angle modulation and demodulation, spectra of AM and FM, super heterodyne receivers. Signals and Systems

The topics covered in this section are Laplace, periodic, aperiodic, and impulse signals, Z-transformers and Fourier, the frequency response of first and second-order linear time-invariant systems, the impulse response of systems, correlation, and convolution. Other topics include the Discrete time system that provides for impulse response, frequency response, pulse transfer function, FFT and DFT, and basics of IIR and FIR filters.

7. Transmission Lines: Equations, characteristic impedance, impedance matching, impedance transformation, S-parameters, Smith chart. Rectangular and circular waveguides, light propagation in optical fibres, dipole and monopole antennas, linear antenna arrays

10. Sensors and Industrial Instrumentation

Resistive- Capacitive- Inductive- Piezoelectric

Hall Effect Sensors and Associated Signal Conditioning Circuits

Transducers for industrial instrumentation

Displacement (Linear and Angular)

Velocity, Acceleration, Torque, Force, Vibration, Shock, Pressure (including low pressure)

Flow (Variable head, Variable Area, Electromagnetic, Ultrasonic, turbine and open channel flow meters)

Temperature (Thermocouple, bolometer, RTD ($\frac{3}{4}$ wire))

Thermistors, Pyrometers, and Semiconductors

Liquid level

pH, conductivity, and viscosity measurement

4-20 two-wire transmitter