**Syllabus**

**Lecturer (Electronics Engineering (ECE/Digital Electronics/ Medical Electronics)**

**Engineering Mathematics:** Linear Algebra Calculus Differential Equations Vector Analysis Complex Analysis Numerical Methods Probability and Statistics

**Electrical networks** and network theorems, network reduction, star delta transformations, source transformation, AC and DC circuit analysis, Resonant circuits and coil parameters

**Signals and systems,** Digital signal processing, FFT, DFT and inverse. Discrete and continuous time systems, impulse response. Convolution, Sampling and sampling theorem

**Control systems:** 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. Eigen values and eigenvectors.

**Semiconductor physics and devices**. Energy bands in intrinsic and extrinsic semiconductors, equilibrium carrier concentration, direct and indirect band-gap semiconductors. 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, LED, photodiode, and solar cell.

**Analog circuits:** Diode circuits: clipping, clamping, and rectifiers. 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

**Power Electronics:** Buck, boost and buck-boost converters, inverters, transfer function.

**Digital circuits and microcontrollers:** Number representations: 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. Data converters: sample and hold circuits, ADCs, and DACs. Peripherals, interrupts and timers

**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, superheterodyne receivers. Information theory: entropy, mutual information, and channel capacity theorem. Digital communications: PCM, DPCM, digital modulation schemes (ASK, PSK, FSK, QAM), bandwidth, inter-symbol interference, MAP, ML detection, matched filter receiver, SNR, and BER. Fundamentals of error correction, Hamming codes, CRC.

**Electro-magnetics:** 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, S-parameters, Smith chart. Rectangular and circular waveguides, light propagation in optical fibers, dipole and monopole antennas, linear antenna arrays.