**UENG 102T: Introduction to Electrical and Electronics Engineering**

Circuit analysis: KVL, KCL, dependent voltage/current sources, series and parallel equivalent, mesh and nodal analysis, Norton and Thevenin's equivalent, network theorems (superposition, maximum power transfer, Tellegen, Millman etc.), Laplace transform, first and second order RLC circuit transient analysis, RLC circuit analysis in sinusoidal steady state using phasors, idea of complex impedance, active and reactive power, Fourier series, Bode plots and passive filters. P-N junction theory. Ideal diode, Zener diodes, rectifier, clipper and clamper circuits, Zener-based power supply. MOSFET device theory and derivation of circuit model. MOSFET DC biasing and large signal analysis, small signal analysis CE, CG, CC amplifiers, differential amplifier and source coupled pair, a three-stage differential amplifier. Biasing with MOSFETs, current mirror, cascode, source degeneration. Amplifiers at high frequency. Two-stage CMOS Operational Amplifier. Ideal Op-Amp. Op-Amp nonidealities, gain bandwidth product. Op-Amp with negative feedback and applications such as instrumentation amplifier, active filters, and analog computers. Operational Amplifier with positive feedback and applications such as Schmidt trigger, multivibrator, Wein-Bridge oscillator. Sample and Hold, ADC, DAC circuits. Combinational logic functions and its implementation using Boolean algebra (AND/OR/NOT), sum of products-product of sums, reduction with Karnaugh maps. Binary arithmetic, ripple carry adder and multiplier circuits. Multiplexer, de-multiplexer, decoder, encoders, and tri-state buffer. Logical sufficiency of NAND/NOR gates and their implementation with CMOS. Digital circuit design considerations-noise margin, propagation delay, fan-out, power loss. Sequential circuits with RS latch, D-T-JK flipflops and meta-stability. Asynchronous and synchronous counters. Finite state machines and its implementation. Introduction to computer organization: microprocessors and microcontrollers.

Software: SPICE and Verilog/VHDL.

**References:**


1. Electrical Engineering: Principles and Applications, Allan R Hambley.
2. Microelectronic Circuits: Theory And Applications, Sedra, Smith and Chandorkar.
3. Fundamentals of digital logic with Verilog design, Stephen Brown and Jovonko Vranesic.