

Syllabus for M.S.(R) & Ph.D. Written test/ Interview – January 2026 semester

Department of Electrical Engineering

Sensors and Embedded Hardware Design

Electrical Circuits and Networks: Properties of resistance, Ohm's law, KVL, KCL, mesh and nodal analysis, Network theorems: Superposition, Thevenin, Norton and maximum power transfer, Properties of inductance and capacitance, DC transients: Series RL, RC, RLC and parallel RLC. 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.

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.

Sensors: Principles of electric and magnetic measurements, Log amplifiers, AD/DA converters.

Embedded Hardware Design; interfacing between analog and digital blocks, signal conditioning, digital signal processing, sub-system interfacing, interfacing with external systems, user interfacing; Programming Exercises with Microprocessors and Microcontroller Controller kits; Interfacing experiments with i/o ports, timers, ADC-DAC.

Reference books:

- [1] Hayt W H, Kemmerly J and Durbin S M, Engineering Circuit Analysis, McGraw Hill Education (2013).
- [2] Adel S. Sedra, Kenneth C. Smith and Arun N. Chandorkar, Microelectronic Circuits: Theory And Applications, Seventh Edition, Oxford University Press, 2017.
- [3] Sawhney, A. K., Electrical and Electronic Measurements and Instrumentation (4th Edition).
- [4] Ganssle J, The Art of Designing Embedded Systems, 2nd Edition, Newnes (2008).

Analog VLSI Design

Electrical Circuits and Networks: Properties of resistance, Ohm's law, KVL, KCL, mesh and nodal analysis, Network theorems: Superposition, Thevenin, Norton and maximum power transfer, Properties of inductance and capacitance, DC transients: Series RL, RC, RLC and parallel RLC. Time and frequency domain analysis of linear circuits: RL, RC and RLC circuits, solution of network equations using Laplace transform.



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ADMISSIONS

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Analog Circuits: Linear and non linear networks; Small signal analysis of nonlinear networks, Two port network analysis using Y parameters; Incremental gain model; Introduction to MOS and BJT device, MOS device characteristics and models, Single stage amplifiers: common source (CS), common drain (CD), and common gate (CG) amplifier, biasing, gain, input & output impedances, Large signal analysis behaviour, Current mirrors and differential amplifiers, Frequency response of single stage amplifiers, miller effect, bode plots, pole zero analysis, Gain and Phase margin.

Reference books:

- [1]. William H. Hayt, Jack Kemmerly, Jamie Phillips, Steven M. Durbin, Engineering Circuit Analysis, 10th Edition, Mcgraw Hill (2024).
- [2]. Sedra A S, Smith K C and Chandorkar A N, Microelectronic circuits: theory and applications, 5th Edition, Oxford University Press (2017).
- [3]. Behzad Razavi, Microelectronics, 2nd edition, Wiley (2017).