

# Current Mode VLSI Circuits & Applications (GEC-302)

(Elective-II)

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## Unit I

**Voltage Mode/Current Mode Overview:** Comparison of Digital & Analog principles & systems, Voltage Mode /Current Mode circuit principles, Comparison, Advantages of current mode circuits, BJT, MOSFET and their analog models, power and  $f_T$  considerations.

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## Unit II

**Current mode operations:** Current Mirror, Its Types (Simple cascade, high swing, regulated) and their performances, Translinear principle in BJT and MOS (Subthreshold and ohmic regions), Analog switches, Differential pair and its DC/AC characteristics, Logic function realization & latches, Multipliers.

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## Unit III

**Transconductance Amplifiers:** Differential pair  $g_m$  cell, fixed gain  $g_m$  cell, linearized gain  $g_m$  cell, multiple differential pair  $g_m$  cell, CMOS  $g_m$  cell, Ohmic transistor  $g_m$  cell, fixed and variable bias  $g_m$  cells, Active transistor  $g_m$  cell, OTA structures and its applications.

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## Unit IV

**Current conveyors(CC):** Classification and generations of CCs, characteristic features, CC as analog building block, design considerations with CC, circuit realization of CC's, Translinear CC, I order BJT CCI, class AB CCI, CMOS CCI, CMOS CCII, differential pair based CC cells,  $\pm$ CC circuits, MOCC, multi-X/multi-Y CCs, CCIII realization, UCC, GCC, Fully differential CMOS CCII, CC applications.

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## Unit V

**Switched current techniques and applications:** Switched capacitor and switched current techniques, switched current (SI) principle, SI building blocks: Switch, Current copier, Current comparator, I and II order integrators, Bilinear integrator, Memory cell, Multiplier applications.

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### Text Books:

1. Liu, Kramer, Indeveri, Delbruck, Douglas "Analog VLSI: Circuits and Principles", Pearson, Education India
2. Ananda Mohan "Current Mode VLSI Analog Filters" Springer, Anne Books, India
3. Giuseppe Ferri, Nicola Carlo Guerrini "Low-voltage low-power CMOS current conveyors" Springer

### Reference Books

1. M Ismail and Terri Fiez "Analog VLSI: Signal and Information Processing" McGraw Hill.
2. R.J. Baker "CMOS: Circuit Design, Layout, and Simulation" 3<sup>rd</sup> Ed, Wiley, IEEE Press
3. C. toumazou, F.J. Lidgley, D.G. Haigh "Analog IC design: the current mode approach" IEE circuits and systems series-2
4. Edgar Sánchez-Sinencio, Andreas G. Andreou "Low-voltage/low-power integrated circuits and systems: low-voltage mixed-signal circuits" IEEE Solid-State Circuits Society