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MANIPAL INSTITUTE OF TECHNOLOGY Manipal University



SECOND SEMESTER M.TECH (Microelectronics) DEGREE END SEMESTER EXAMINATION MAY/ JUNE 2016 SUBJECT: CMOS MIXED SIGNAL DESIGN (ECE 524)

TIME: 3 HOURS

Instructions to candidates

MAX. MARKS: 50

- Answer ANY FIVE FULL questions.
- Missing data may be suitably assumed.
- 1A. [i] Show how Miller's theorem can be employed to realize negative capacitance circuit using OTA.[ii] Justify the distortion improvement in fully-differential circuits as compared to single ended circuits.
- 1B. Give circuit of G_m-C fully differential lossy integrator and derive the transfer function.
- 1C. Define the following terms: [i] Dynamic range [ii] Total Harmonic Distortion (THD)

(5+3+2)

- 2A. With the circuit diagram explain the working of 4-bit charge scaling DAC. Discuss the layout considerations for the capacitor array used in charge scaling DAC.
- 2B. Discuss the merits and demerits associated with switched capacitor circuits.
- 2C. Derive the value of R that compensates the lossless integrator circuit in FIG. 2C.

(5+3+2)

- 3A. Give the fully differential realization of RLC parallel resonator circuit shown in **FIG. 3A**. Find the transfer function. Check whether it is possible to realize a low-pass biquad?
- 3B. Find the transfer function of the circuit in **FIG. 3B** and give your comments.
- 3C. Give the op-amp based circuit for simulating grounded negative impedance and derive the expression.

(5+3+2)

- 4A. Discuss the FLF and IFLF topologies for realization of higher order filters. How is the circuit structure extended to provide finite transmission zeros? Give an account of higher-order continuous-time filter realization based on these structures using any of the active devices.
- 4B. Explain the practical OTA macro models.
- 4C. Study the integrator based circuit structure in **FIG. 4C**. Derive the expression for transfer function and give your comments.

(5+3+2)

- 5A. Discuss the design methods and Layout guidelines employed in Analog and Mixed-Signal Circuit Design with respect to following: [i] Power supply and grounding issues [ii] Guard Rings [iii] Shielding
- 5B. Discuss the linearity related errors as applicable to DACs.

5C. Show how current conveyor can be used to realize differential voltage-to-current transconductor.

(5+3+2)

- 6A. Explain the circuit realization of Deboo integrator. Explain the usefulness of Deboo integrator in Biquad realization
- 6B. Compare the different signal processing methods with respect to following: [i] Need for antialiasing filter [ii] Power consumption [iii] Frequency range
- 6C. Give the circuit realization for [i] current-mode damped integrator [ii] current-mode feedback amplifier

(5+3+2)













