Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent unit of MAHE, Manipal)

SECOND SEMESTER M.TECH. (ME) DEGREE END SEMESTER EXAMINATION
APRIL/MAY 2019
SUBJECT: CMOS MIXED SIGNAL DESIGN (ECE - 5222)

TIME: 3 HOURS **MAX. MARKS: 50**

Instructions to candidates

- Answer **ALL** questions.
- Missing data may be suitably assumed.

1A. Give the block diagram and Opamp-RC circuit implementation of KHN biquad filter to realise HP, LP and BP transfer functions based on two-integrator loop approach. Explain the digitally programmable version of this filter using MDAC.

1B. Discuss OTA-C realisation of RLC low-pass biquad. Give the expression for pole-frequency and pole-Q.

1C. Illustrate how virtual ground can be established in an op-amp based inverting amplifier.

(5+3+2)

2A. Derive the transfer function for the circuit structure given in **Fig. 2A.** Give your comments about filter type and tunability of pole-Q.

2B. Derive and analyze the transfer functions for fully differential active-RC realization of Tow-Thomas biquad filter.

2C. Discuss the OTA-C realisation of FDNR.

(5+3+2)

3A. Derive the transfer function for the circuit structure given in **Fig. 3A.** Identify the filter structure. Give your comments about filter type.

3B. Derive the transfer function for fully differential OTA-C circuit in **Fig. 3B**. Give your comments.

3C. Derive the transfer function for fully differential OTA-C circuit in **Fig. 3B** considering nonidealities of OTA.

(5+3+2)

4A. i. Discuss the method(s) used for compensation of the effects of frequency dependence of OTA transconductance.

ii. Discuss the layout considerations for the capacitor array used in charge scaling DAC.

4B. Realize a third-order all-pole OTA-C filter using leap-frog approach. Obtain the parameter determination formulas.

4C. For the 4 bit DAC shown in **Fig. 4C** find the output voltage.

(5+3+2)

5A. i. Discuss the design methods and layout guidelines used in analog and mixed-signal circuit design with respect to following: [a] Guard rings [b] Shielding

ii. Discuss the linearity related errors as applicable to DACs.

5B. Analyse the CCII based active-RC structure in **Fig. 5B** and give your comments.

5C. Give the op-amp based circuit for simulating grounded negative impedance and derive the expression.

(5+3+2)

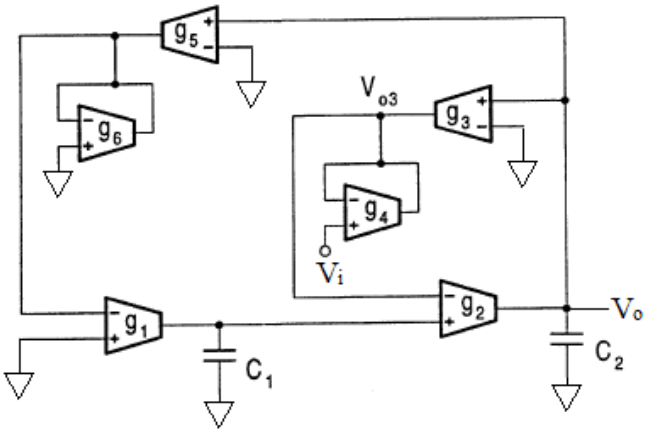

Fig. 2A

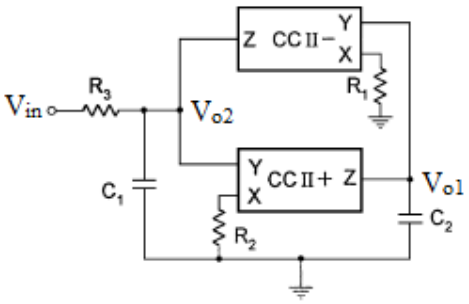

Fig. 5B

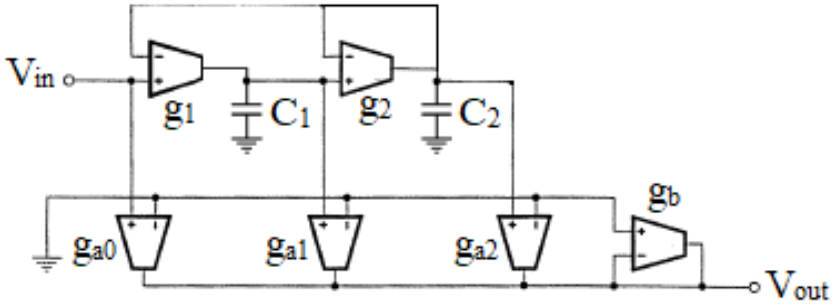

Fig. 3A

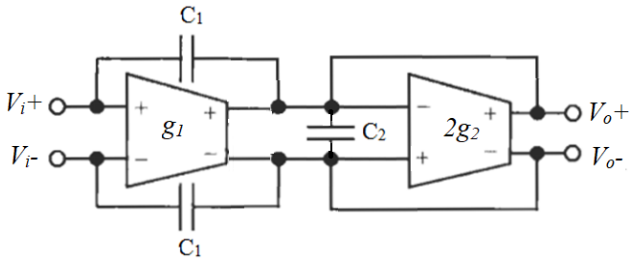

Fig. 3B

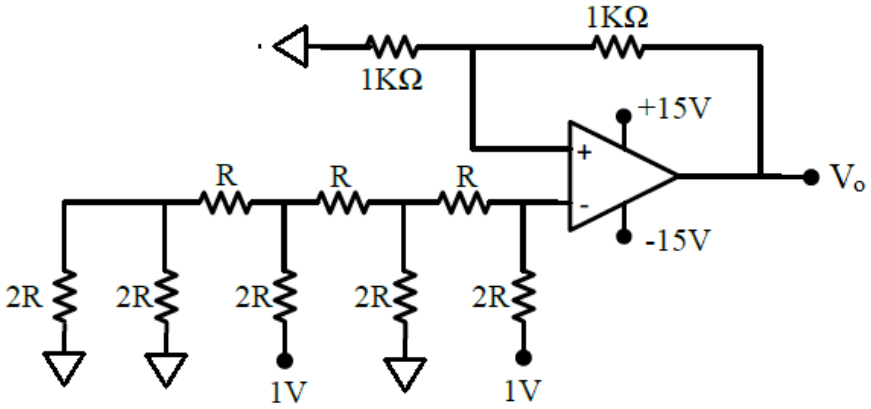

Fig. 4C