Roll No.: .....

National Institute of Technology, Delhi

Name of the Examination: B. Tech

Branch	: ECE	Semester	: V
Title of the Course	: Linear Integrated Circuits	Course Code	: EC 303
Time: 2 Hours		Maximum Marks: 30	

- **Note: Question 1 carries65 questions 2 mark each. Rest questions 2 to 7 carries 3 marks each.**
- **Questions are printed on BOTH sides. Answers should be CLEAR, TO THE POINT AND LEGIBLE.**
- **All parts of a single question must be answered together and in the same sequence as given in question paper. ELSE QUESTION SHALL NOT BE EVALUATED.**

Q1. **(a)** An OPAMP has a differential gain of 10^3 and a CMRR of 100. What will be the output voltage of the OPAMP with inputs 120 μV and 80 μV ? **[2]**

(b) Using the frequency scaling technique, convert the 1 KHz cutoff frequency of low pass filter to a cutoff frequency of 1.6 KHz. **[2]**

(c) A 100 pF capacitor has a maximum charging current of 150 μA. What will be its slew rate? **[2]**

(d) For the given circuit of fig. 1, $I_{in(off)} = 20\ nA$. If $V_{in(off)} = 0\ V$, what is the differential input voltage? What will be the output offset voltage? **[2]**

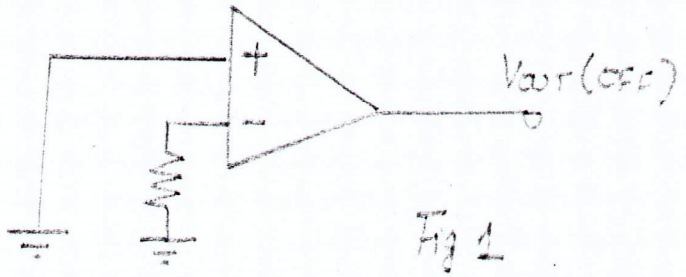


Fig 1

(e) For the current converter shown in fig. 2, prove that $\frac{I_L}{I_i} = -(1 + \frac{R_1}{R_2})$. **[2]**

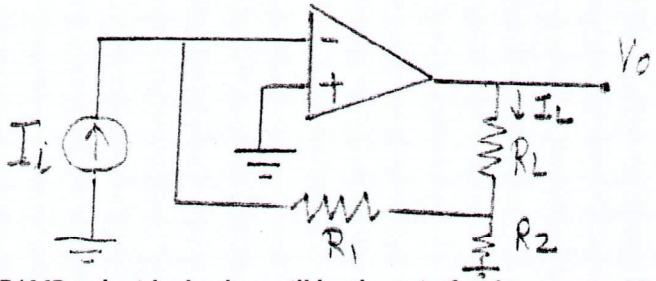
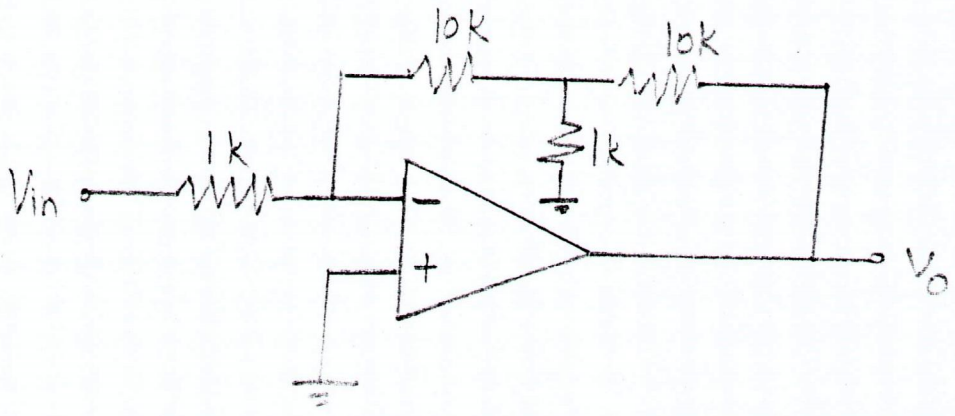


Fig. 2

(f) Assuming the OPAMP to be ideal, what will be the gain for the circuit of fig. 3 . **[2]**



Q 2. (a). Verify that the circuit shown in fig. 4 has input impedance $\frac{V_i}{I_i} = \frac{R_1 R_2}{Z}$.
(b). If Z is a capacitor, show that the system behaves as an inductor.
(c). Find the value of C in order to obtain a 1H inductance if $R_1 = R_2 = 1K$. [3]

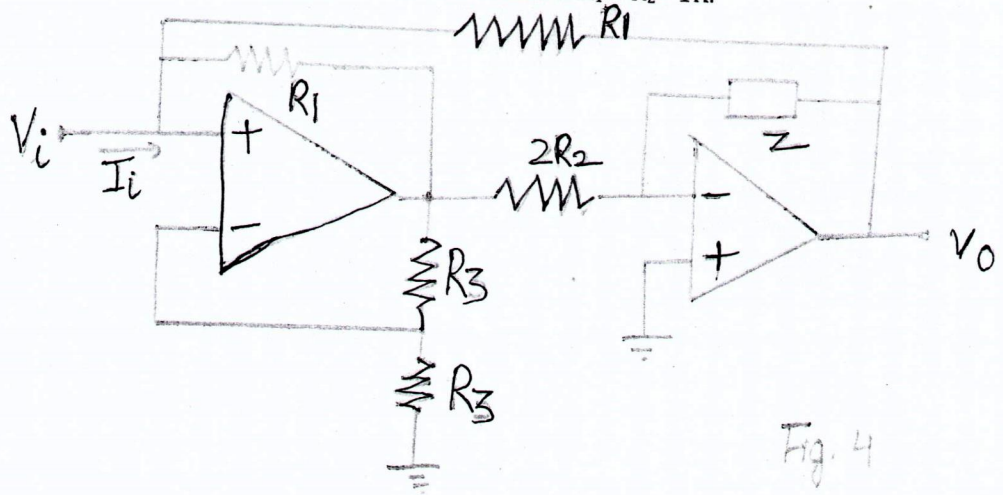


Fig. 4

Q 3. For the differential amplifier shown in fig. 5, verify that $v_0 = -\left(1 + \frac{2R_2}{R_3}\right)\frac{R_f}{R_1}(v_x - v_y)$. [3]

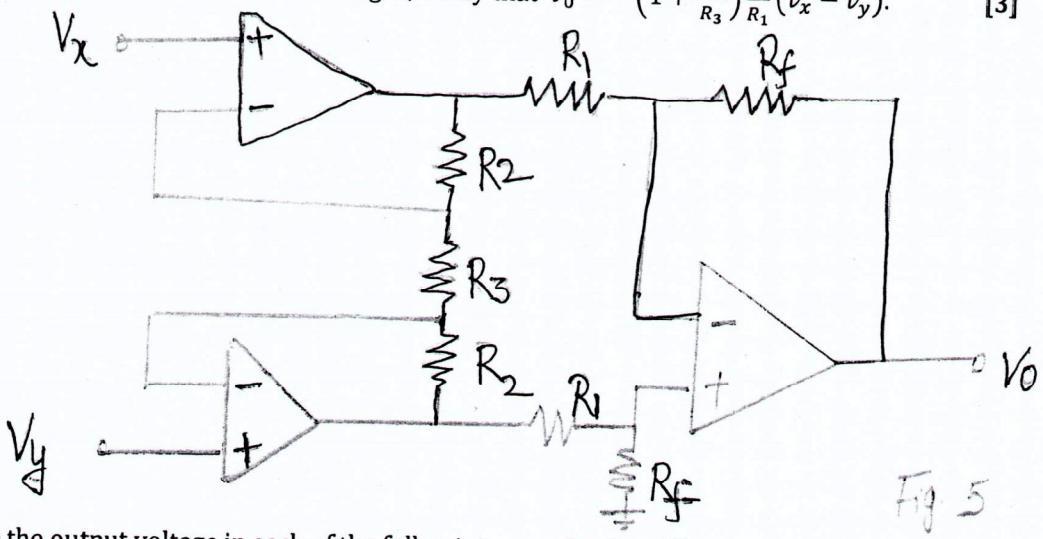


Fig. 5

Q 4. Determine the output voltage in each of the following cases for the differential amplifier of fig. 6,
(a) $vin\ 1 = 5\ m\ V\ dc, vin\ 2 = -7\ \mu V dc$ (b) $vin\ 1 = 10\ mV\ rms, vin\ 2 = 20\ mV\ rms$
Specifications of the OPAMP are given below:
$A = 200{,}000, Ri = 2\ M\ \Omega, R_0 = 75\Omega, +VCC = +15\ V, -VEE = -15\ V$, and voltage swing = ± 14V. [3]

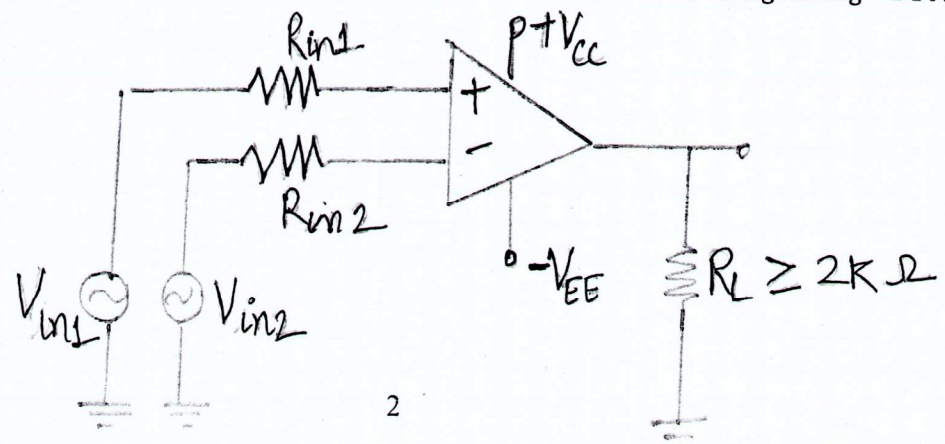


Fig. 6

Q 5. Design a switched capacitor integrator for $f_0 = 10\ Hz$. Compare the values with an RC integrator. **[3]**

Q 6. For the circuit shown in fig. 7, if the input is a constant V, show that the output is given by a differential equation. **[3]**

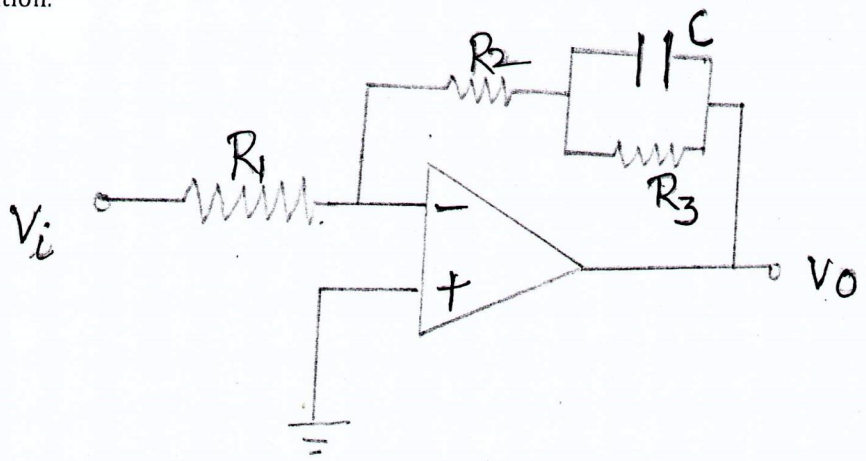
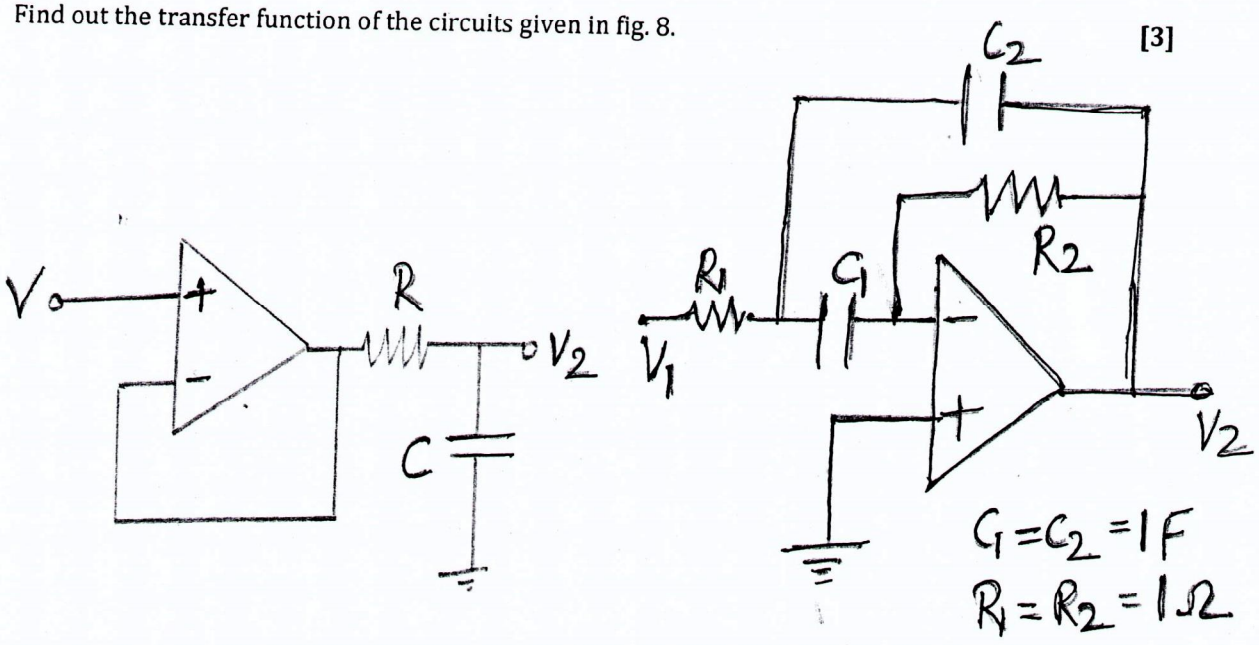


Fig. 7

Q 7. Find out the transfer function of the circuits given in fig. 8. **[3]**



(a) (b)

Fig. 8