Department of Electronics and Electrical Communication Engineering,
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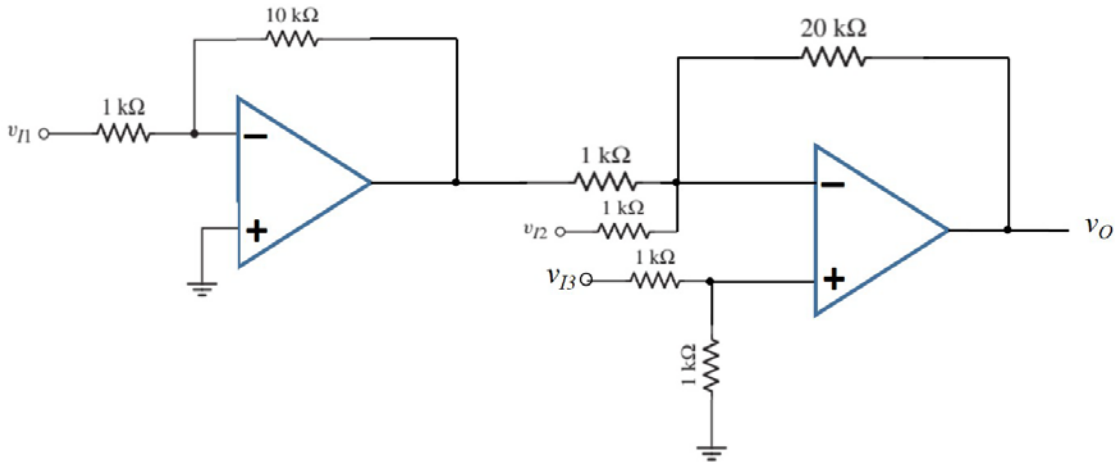
Class test-4, Basic Electronics (EC21101), Total marks: 40	**Duration: 10-10:45 am** **45 mins including the uploading of the answers**	**Date: 01.04.2021**

Kindly provide the solution of all sub-parts of a question at one place. A single file (.doc/pdf/zip) to be uploaded for all answers. There are four questions with sub-parts indicated.

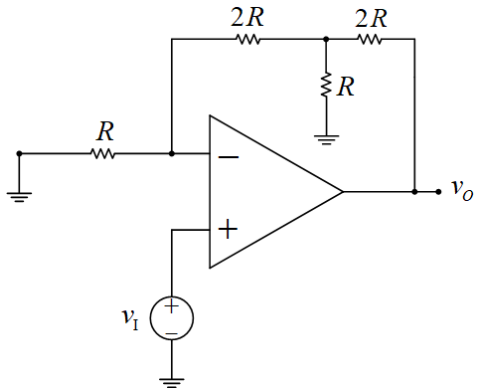
Q1. Consider a process technology for which $\frac{W}{L} = 10$, $t_{ox} = 8\ nm$, $\mu_n = 450 \frac{cm^2}{V.s}$, and $V_{TN} = 0.7\ V$ and $\epsilon_{ox} = 3.9 \times 8.85 \times 10^{-14}$ F/cm**. [1+1+2+2+2 marks]**

a. From the given information identify the type of the MOSFET.
b. Calculate the oxide capacitance per unit area of the device.
c. Calculate the process conduction parameter for the device.
d. If the device need to be operated in the 'saturation' region with a source current of 100 μA, what should be the applied voltage between gate and source?
e. What should be the minimum voltage applied across drain and source?

Q2. For the Fig. shown below, derive and determine the output voltage of the circuit given below, where the op-amp is an ideal. Express in terms of input voltages. **[8 marks]**



Q3. Derive and obtain the gain $A_v = v_O / v_I$ for the ideal circuit in the figure below : **[8 marks]**



Q4.

(a) Obtain the small-signal parameters (g_m, r_π) of a BJT based CE amplifier circuit shown in figure below. The transistor parameters are β =100, V_{BE} (on) = 0.7 V, V_T = 26mV, R_1 = 20kΩ, R_2 =10kΩ, R_C = 3kΩ, R_{E1} =1 kΩ, R_{E2} = 1.1kΩ, C_C = C_E = 10μF and Vcc =12 V. **[6 marks]**

(b) Draw the hybrid-π equivalent circuit if the Early voltage is very large. Also obtain input resistance, R_i and R_{ib}. **[2+2+1 marks]**

(c) Obtain the gain of amplifier circuit when C_E is not connected. What happens to the gain when C_E is connected. **[3+2 marks]**