**EE101:Electrical Sciences, Tutorial-8**

DEPARTMENT OF ELECTRONICS & ELECTRICAL ENGINEERING

INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI

[Q-1 is for pre-tutorial. Solve it in the space provided and submit at beginning of tutorial]

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Name: Roll No.: Tutorial Group:

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1. Design the following circuits using an ideal opamp and 10kΩ resistors: (a) an inverting amplifier with a gain of four, (b) a non-inverting amplifier with a gain of four, and (c) a differential amplifier with a gain of four.

**Basic Electronics (Theme: Macro-electronics)**

2. In advanced integrated circuits, an amplifier is often used to realize an unavailable component using other easily available components. In this tutorial, we are going to learn these other applications of an amplifier.

   (a) Find out the input impedances of the circuits shown in Fig. Q2 and model them using RLC components. Write your observations from these models. The amplifier in Fig. Q2(a) is an ideal voltage amplifier with a gain of $A_v$. The amplifiers in Fig. Q2(b) are ideal transconductance amplifiers with $g_m$ being their gain. In a non-inverting transconductor, current flows out of the output terminal for a positive input voltage.

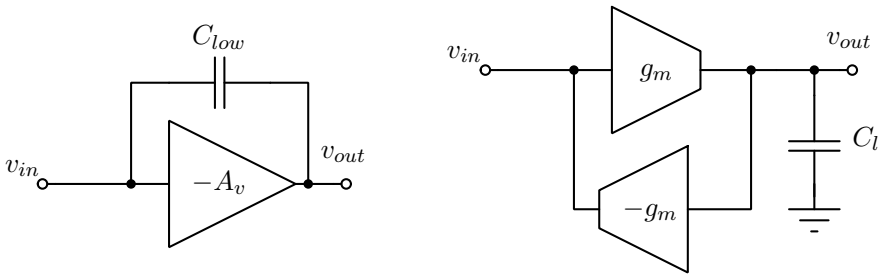


Fig. Q2 (a) Miller multiplier (b) Impedance inverter

**Polyphase Circuits**

3. A balanced three-phase three-wire system has a Y-connected load with $V_{ab} = 400\angle 0^0$ V rms. Each load contains three loads in parallel: $-j100\Omega, 100\Omega$ and $50 + j50\Omega$. Find out (a) voltage phasor $V_{cn}$, (b) current phasor $I_{aA}$ and (c) the total power (kW) drawn by the load.

4. In the balanced three phase system of Fig. Q4, let $Z_P = 12 + j5\Omega$ and $I_{bB} = 20\angle 0^0$ **A** rms with (+) phase sequence. If the source is operating with a power factor of 0.935, find out (a) $R_W$ , (b) $V_{bn}$, (c) $V_{AB}$ and (d) the complex power supplied by the source.

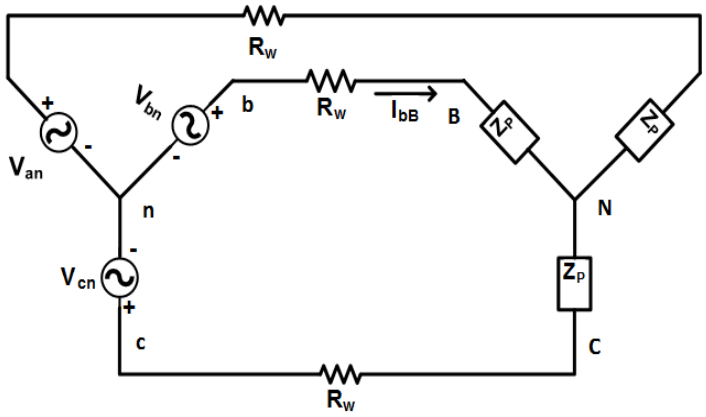


Fig. Q4