Assignment No = 1

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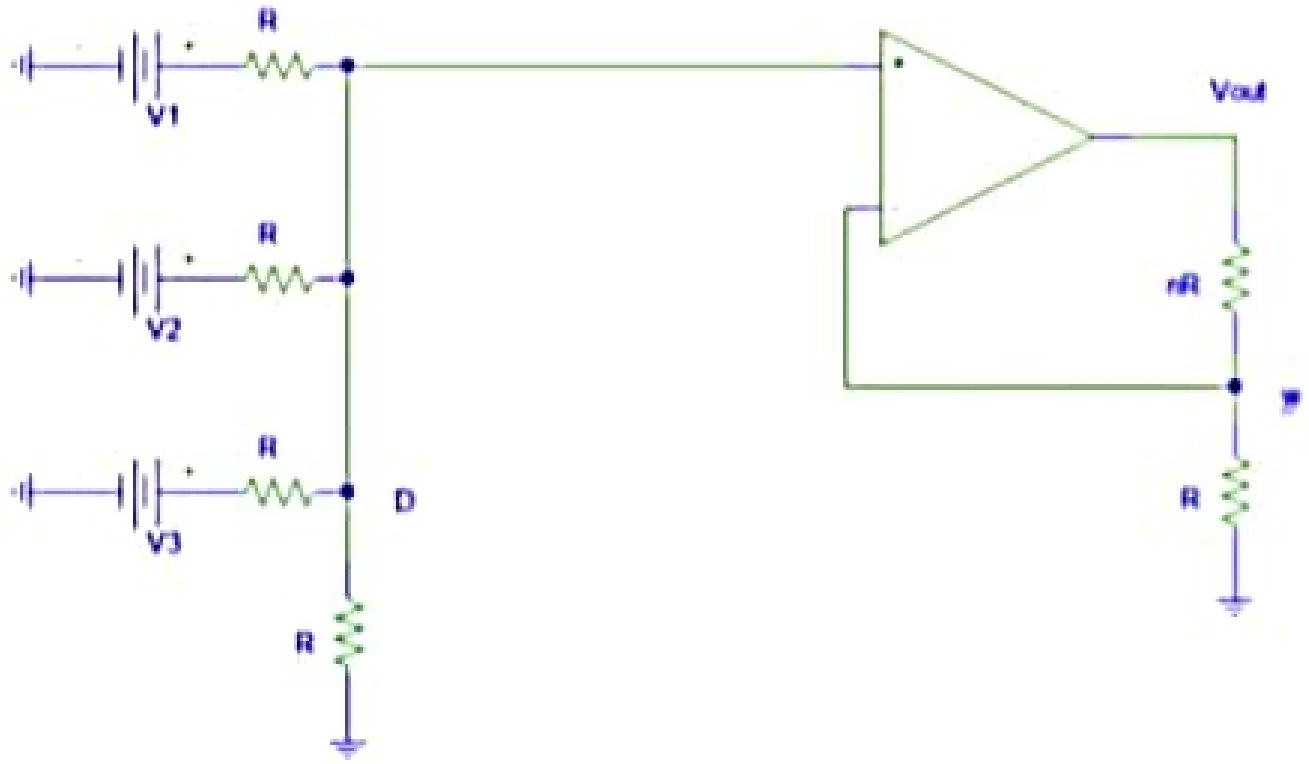
Reg No: 19PWCSE1795

Section: B

Subject CS-II

Q1:



APPLY KCL at NODE D

$$\left(\frac{V_1 - V_D}{R}\right) + \left(\frac{V_2 - V_D}{R}\right) + \left(\frac{V_3 - V_D}{R}\right) - \left(\frac{V_D}{R}\right) = 0$$

$$V_1 + V_2 + V_3 - 4V_D = 0$$

$$V_D = \frac{V_1 + V_2 + V_3}{4}$$

Now apply KCL at Node w

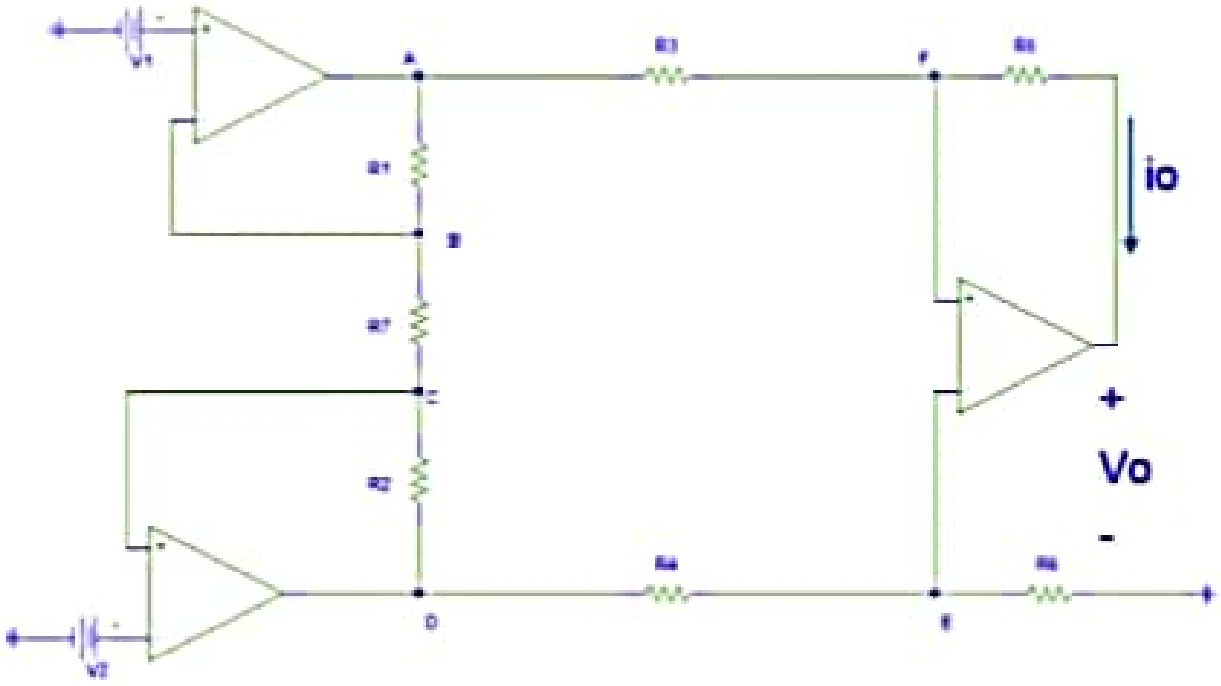
$$\left(\frac{V_{out} - V_D}{nR}\right) - \left(\frac{V_D}{R}\right) = 0$$

$$V_{out} = V_D(n + 1)$$

$$Vout = \frac{V_1 + V_2 + V_3}{4}(n + 1)$$

The equation given in the question will be true if n = 3

Q2:



APPLY KCL at NODE B,

$$\left(\frac{V_A - V_1}{R_1}\right) - \left(\frac{V_1 - V_2}{R_7}\right) = 0$$

$$V_A = V_1 + R_1\left(\frac{V_1 - V_2}{R_7}\right)$$

Now apply KCL at NODE C

$$\left(\frac{V_1 - V_2}{R_7}\right) - \left(\frac{V_2 - V_D}{R_2}\right) = 0$$

$$V_D = \left(V_2 - R_2\left(\frac{V_1 - V_2}{R_7}\right)\right)$$

The voltage at NODE E is the drop across R_6 Apply voltage drop formula.

$$V_E = \left(\frac{R_6}{R_6 + R_4}\right)V_D$$

Now apply KCL at NODE F

$$\left(\frac{V_A - V_E}{R_3}\right) - \left(\frac{V_E - V_o}{R_5}\right) = 0$$

Solving for V_o gives,

$$V_o = V_E - \frac{R_5}{R_3}(V_A - V_E) \quad \text{----------equation (1)}$$

Put values of V_A and V_E

$$V_o = \left(\frac{R_6}{R_6 + R_4}\right)V_D - \frac{R_5}{R_3}\left(V_1 + R_1\left(\frac{V_1 - V_2}{R_7}\right) - \left(\frac{R_6}{R_6 + R_4}\right)V_D\right)$$

Now put value of V_D

$$V_o = \left(\frac{R_6}{R_6 + R_4}\right)\left(V_2 - R_2\left(\frac{V_1 - V_2}{R_7}\right)\right) - \frac{R_5}{R_3}\left(V_1 + R_1\left(\frac{V_1 - V_2}{R_7}\right) - \left(\frac{R_6}{R_6 + R_4}\right)\left(V_2 - R_2\left(\frac{V_1 - V_2}{R_7}\right)\right)\right)$$

This is the required equation for voltage.

Current i_o flows through R_5 so we apply ohm's law

$$i_o = \left(\frac{V_E - V_o}{R_5}\right)$$

Put value of V_o from equation 1

$$i_o = \left(\frac{V_E - (V_E - \frac{R_5}{R_3}(V_A - V_E))}{R_5}\right)$$

$$i_o = \left(\frac{V_E - V_E + \frac{R_5}{R_3}(V_A - V_E)}{R_5}\right)$$

$$i_o = \left(\frac{(V_A - V_E)}{R_3}\right)$$

Putting values

$$I_o = \left(\frac{\left(V_1 + R_1 \left(\frac{V_1 - V_2}{R_7} \right) - \left(\frac{R_5}{R_6 + R_4} \right) \left(V_2 - R_2 \left(\frac{V_1 - V_2}{R_7} \right) \right) \right)}{R_3} \right)$$