Duration : 60 Minutes

INDUS TEQSITE PVT. LTD.
HDD TEST NO : 2/2017

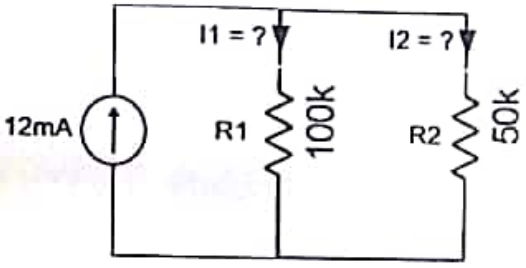
Total Marks : 20

INSTRUCTIONS TO CANDIDATES

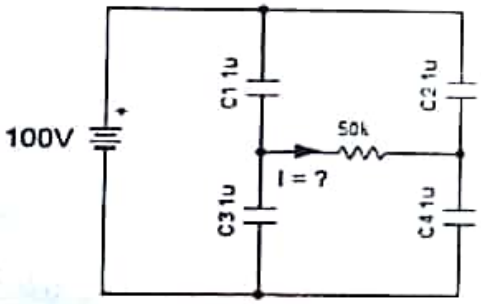
1. **Write the following details on the answer sheet: Your Name, Educational Qualification, Name of your Institution, E-mail ID, Mobile / Contact Tel. No. and the Test No given at the top.**
2. **DO NOT WRITE ANYTHING on the question paper; please return the question paper once the test is over.**
3. **Answer all questions.**

1. Given two wires with diameter "d" and "2d"; which cable specified will carry more current and what is the relationship between resistance and diameter ?

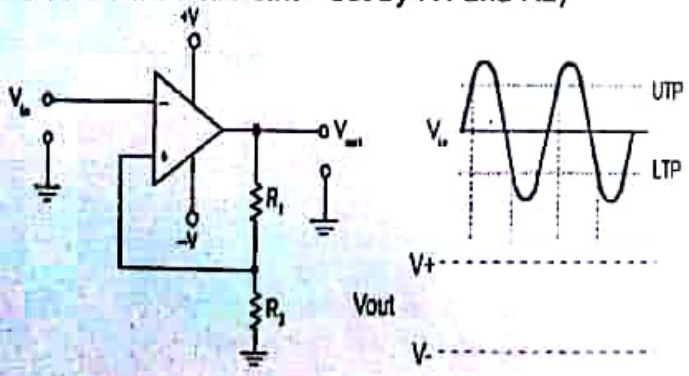
2. Find the current and power dissipation on R1 and R2 – I1, I2 in amps & PR1, PR2 in watts



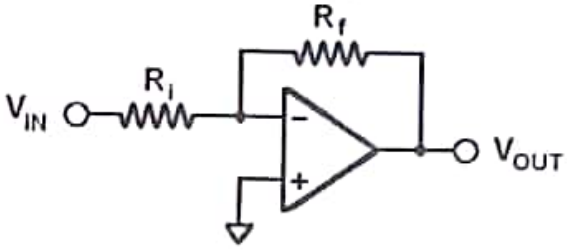
3. What is the voltage drop across each capacitor VC1, VC2, VC3, VC4 ? What is the steady state current I ?



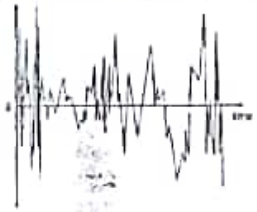
4. **Draw the output waveform with respect to input waveform. (UTP – Upper Threshold Point ; LTP – Low Threshold Point – set by R1 and R2)**



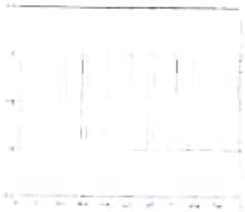
5. What is the input impedance of circuit when Ri = 10K ohm and Rf = 10Kohm ?



6. Mark which one is periodic waveform and which is aperiodic waveform. Explain why ?

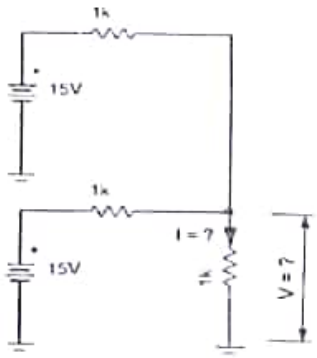


Wave form 1



Wave form 2

7. Find V and I.

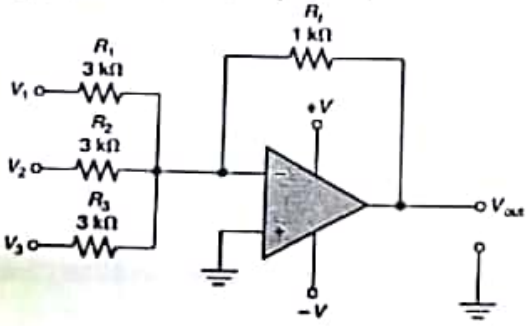


8. What is meant by time constant of RC network ? What is the settling time for an RC network with respect to time constant ?

9. Write down the formula to find power from
   a) Voltage (V) and Current (I)
   b) Voltage (V) and Resistance (R)
   c) Current (I) and Resistance (R)
   d) Energy (E) and Time (T)

10. Given a Transformer of 1:8 turns ratio. What is the output voltage when the input voltage is
    a. 100V, 50Hz b. 100V, 100Hz

11.
    a) What is the simplified output formula ?
    b) What is the output voltage Vout when
    $V_1 = 2V : V_2 = 4V : V_3 = 6V$?



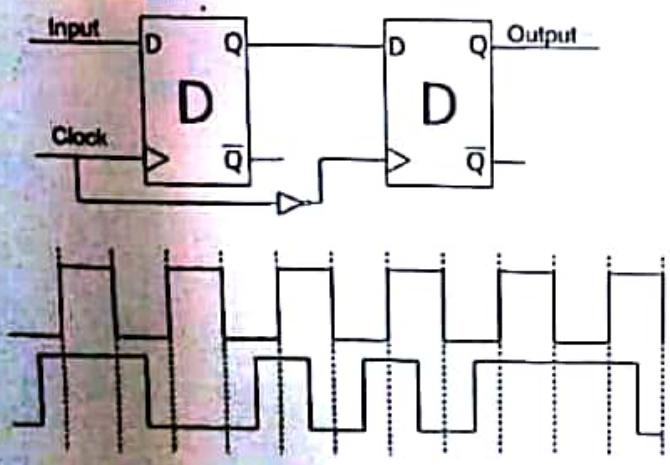
12. How many address lines will be required to address 4KByte memory connected with 8 data lines?

13. Simplify the following function
    F = AB'C' + ABC' + A'BC'

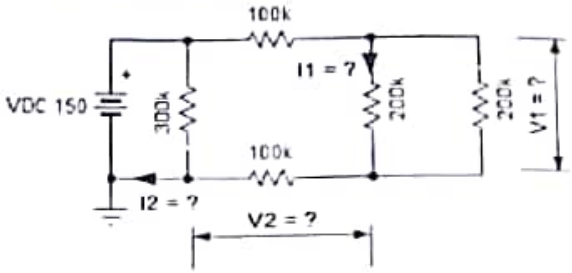
14. Given a 12-bit counter counting the clock pulse with the resolution of 1 micro sec; what is the counting frequency ? What is the maximum time the counter can count with out overflow ?

15. Draw frequency divide by 2 with D flip flop.

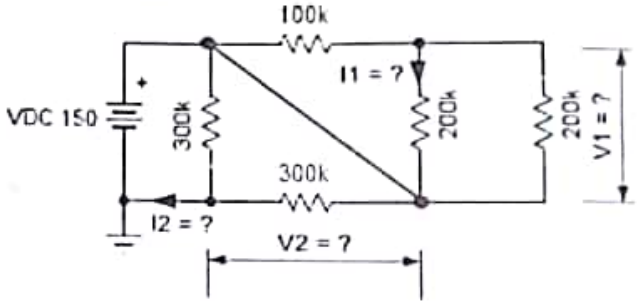
16. Draw the output timing waveform with respect to clock and Input.



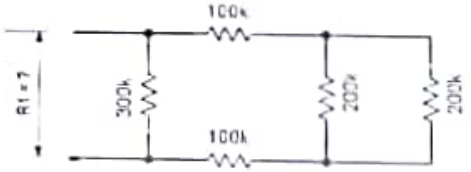
17. Find V1, V2, I1 and I2

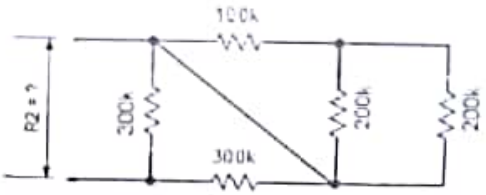


18. Find V1, V2, I1 and I2



19. Find the measured resistance across the points R1 and R2





20. The battery is fully charged and the capacity of the battery is 10V, 10 amp-hour. For how many hours will the battery supply to load
    a. 5 Ohms & b. 2.5 Ohms.

1) Resistance $R = \frac{\rho l}{A}$

For wire 1, $R_{(W1)} = \frac{\rho l}{A} = \frac{\rho l}{\pi r_1^2}$

$= \frac{\rho l}{\pi \left(\frac{d_1}{2}\right)^2} = \frac{4\rho l}{\pi d^2}$

$$\boxed{R_{(W1)} = \frac{4\rho l}{\pi d^2}}$$

For wire 2, $R_{(W2)} = \frac{\rho l}{\pi r_2^2} = \frac{\rho l}{\pi \left(\frac{2d}{2}\right)^2}$

$= \frac{\rho l}{\pi d^2}$

$$\boxed{R_{(W2)} = \frac{\rho l}{\pi d^2}}$$

$$\boxed{R_{(W1)} = 4\, R_{(W2)}}$$

∴ W_2 will carry more current since $R_{(W2)}$ is smaller

And Resistance is inversely proportional to square of diameter

2) $I_1 = I_t \times \frac{R_2}{R_1 + R_2} = 12mA \times \frac{50K}{150K}$

$I_1 = 4mA$ $\boxed{I_1 = 0.004A}$.

$P_{R1} = I_1^2 R_1 = 0.004^2 \times 100K$

$\boxed{P_{R1} = 1.6W}$

$I_2 = I_t \times \frac{R_1}{R_1 + R_2} = 12mA \times \frac{100K}{150K}$

$= 12mA \times \frac{2}{3}$

$\boxed{I_2 = 0.008A}$

$P_{R2} = I_2^2 R_2 = 0.008^2 \times 50K$

$\boxed{P_{R2} = 3.2W}$

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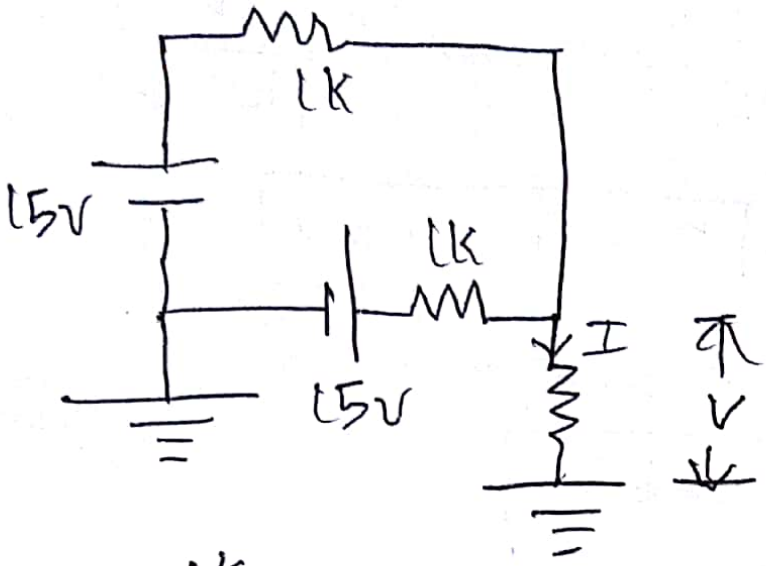
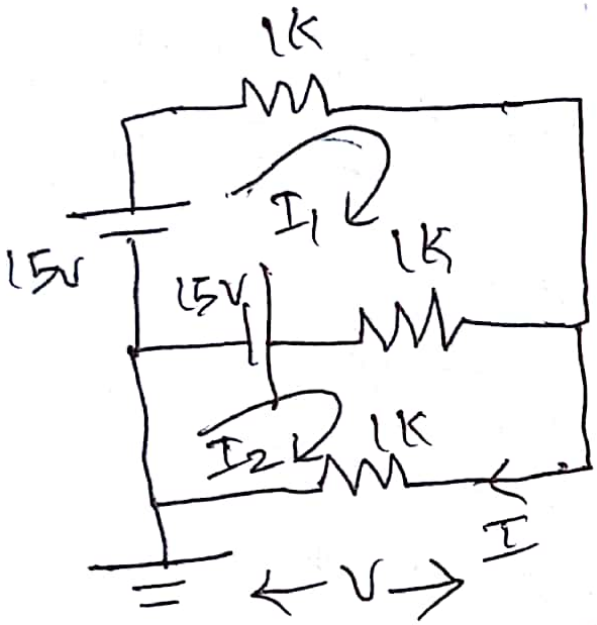
b) Waveform 2 is periodic
waveform 1 is aperiodic.
∴ Waveform 2 repeats after every T time period.

7)





$$\begin{bmatrix} R_{11} & R_{12} \\ R_{21} & R_{22} \end{bmatrix} \begin{bmatrix} I_1 \\ I_2 \end{bmatrix} = \begin{bmatrix} V_1 \\ V_2 \end{bmatrix}$$

$$\begin{bmatrix} 2000 & -1000 \\ -1000 & 2000 \end{bmatrix} \begin{bmatrix} I_1 \\ I_2 \end{bmatrix} = \begin{bmatrix} 15 \\ 15 \end{bmatrix}$$

$I_1 = 0.005A$; $\boxed{I_2 = I = 0.01A}$

$V = I \times 1000 = 10 \Rightarrow \boxed{V = 10V}$

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8) For RC n/w; time constant

$$\boxed{\tau = RC}$$

In an RC; at time $> 5\tau$, the steady state is reached.

9) a) $P = V \times I$

$P = V^2/R$

$P = I^2 R$

$P = E/T$

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10) $N_1 : N_2 \Rightarrow N_P : N_S = 1 : 8 \Rightarrow \frac{N_P}{N_S} = \frac{1}{8}$

$V_P =$ 100V, 50Hz; 100V, 100Hz

a) $V_P = 100$V, 50Hz

$\frac{N_P}{N_S} = \frac{V_P}{V_S} \Rightarrow V_S = V_P \frac{N_S}{N_P}$

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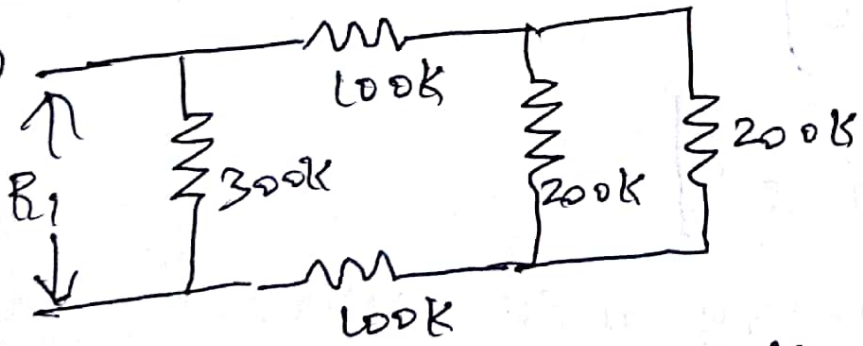
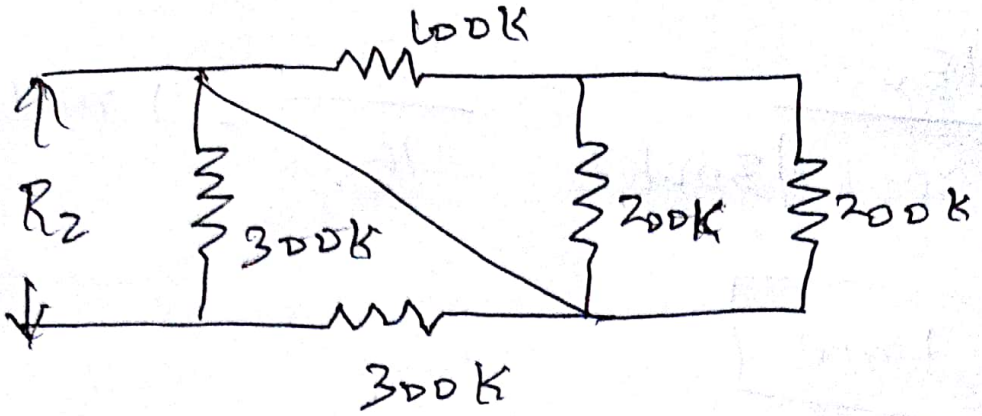
19)



$200K \,||\, 200K = 100K$

$100K + 100K + 100K = 300K$

$R_L = 300K \,||\, 300K = 150K\Omega$



$200K \| 200K = 100K$

$100K + 100K = 200K$.

$200K \| 0 = 0$.

$R_2 = 300K \| 300K = 150K$.

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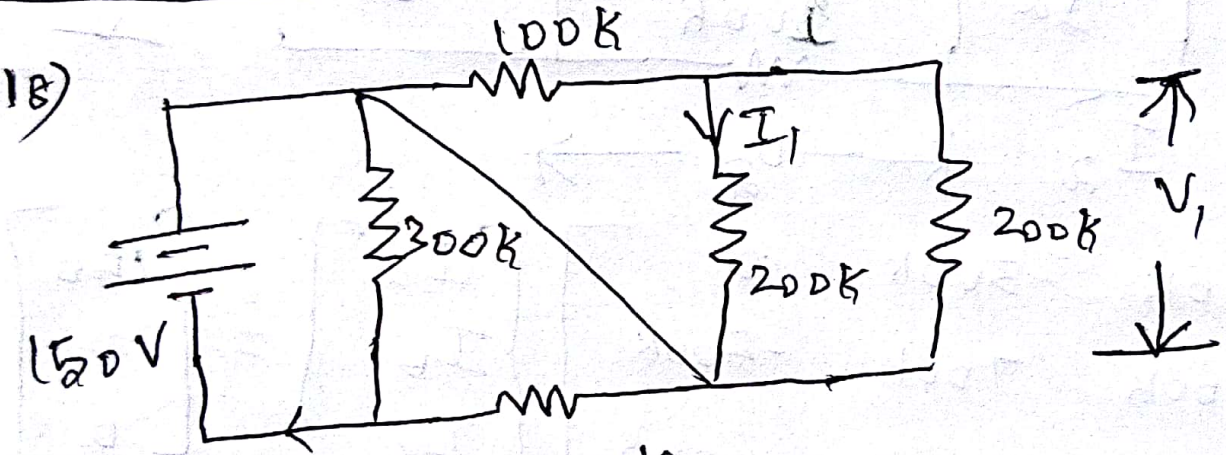
18)



$I_2 \leftarrow V_2 \rightarrow$

100K, 200K, 200K become inactive because of a parallel short circuit

$\therefore I_1 = 0 \; ; \; V_1 = 0$

And 300K & 300K are parallel to 150 V source. $\therefore V_2 = 150 V$

$$I_2 = \frac{150}{(300K \| 300K)} = \frac{150}{150K} = 1\ mA$$

$$\boxed{I_2 = 1\ mA}$$

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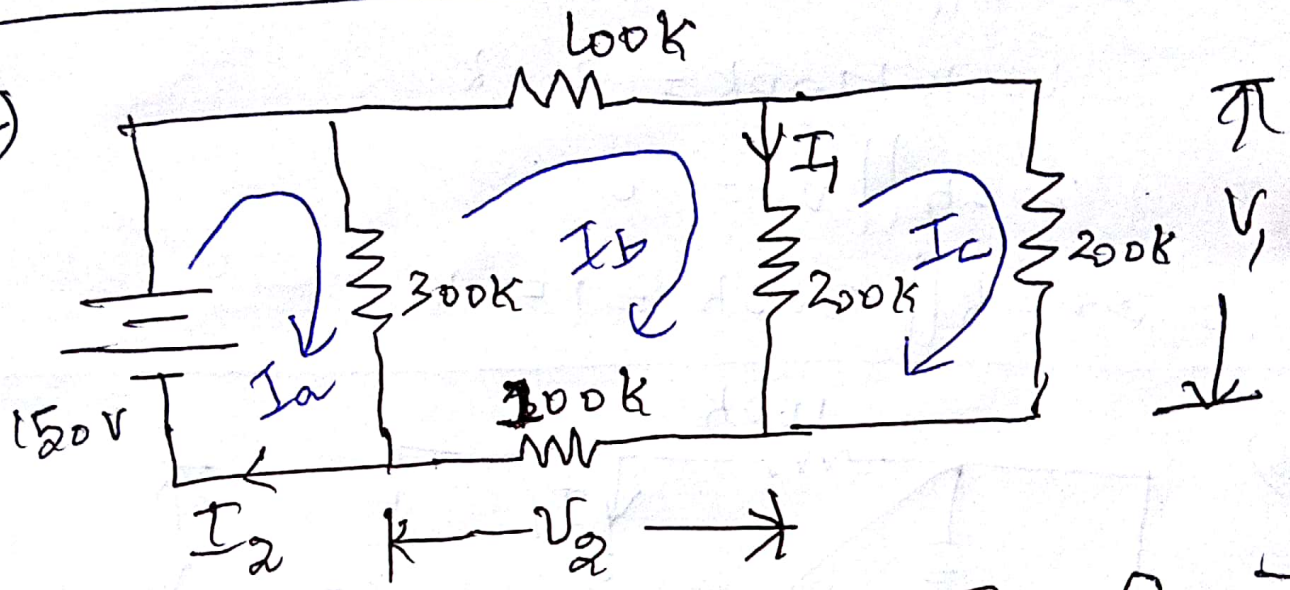
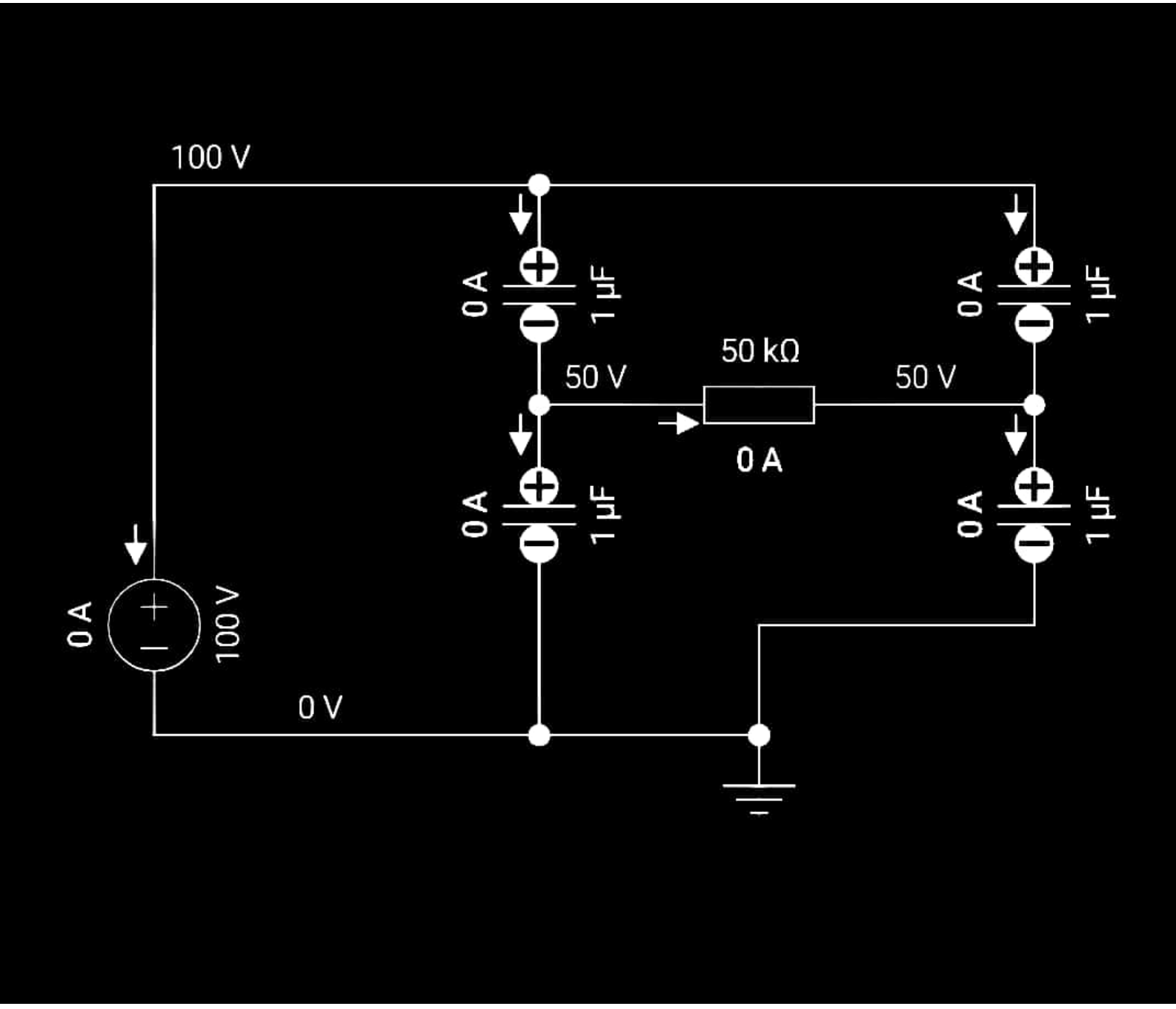
(17)



$$\begin{bmatrix} 300K & -300K & 0 \\ -300K & 700K & -200K \\ 0 & -200K & 400K \end{bmatrix} \begin{bmatrix} I_a \\ I_b \\ I_c \end{bmatrix} = \begin{bmatrix} 150 \\ 0 \\ 0 \end{bmatrix}$$

$I_a = 1\ mA$; $I_b = 0.5\ mA$; $I_c = 0.25\ mA$

$$\boxed{\begin{aligned} I_1 &= I_b - I_c = 0.25\ mA \\ V_1 &= I_c \times 200K = 50\ V \\ I_2 &= I_a = 1\ mA \\ V_2 &= I_b \times 100K = 50\ V \end{aligned}}$$



3) $\boxed{V_{C_1} = V_{C_2} = V_{C_3} = V_{C_4} = 50\ V}$

Since capacitor acts as open circuit to DC supply.

Final current $\boxed{I = 0}$

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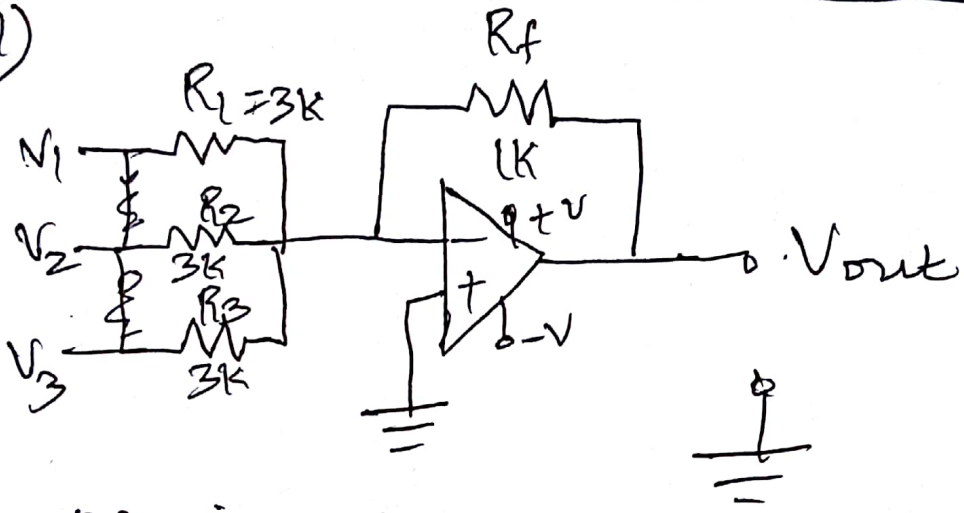
11)



For inverting amp.

$$A_V = \frac{-R_f}{R_{in}}$$

When $R_1 = R_2 = R_3 = 3K, = R_{in}$

(a) $V_{out} = \frac{-R_f}{R_{in}} (V_1 + V_2 + V_3)$

(b) $V_{out} = \frac{1K}{3K} (2 + 4 + 6) = \frac{12}{3} = 4V$

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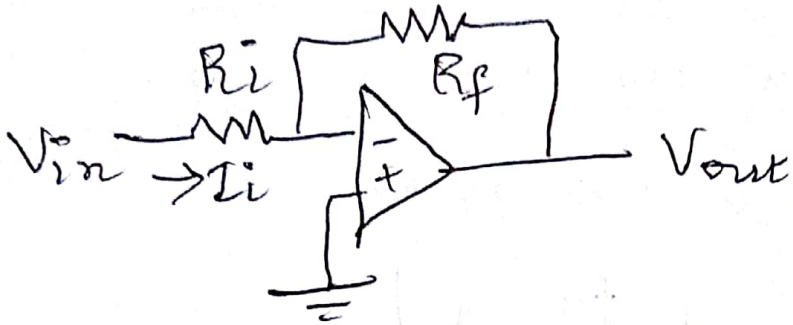
5) Given $R_i = 10K$; $R_f = 10K$; $R_{in} = ?$



$$R_{in} = \frac{V_{in}}{I_{in}}$$

$$I_{in} = I_i = \frac{V_{in} - V_i}{R_i}$$ & $V_i = 0$ due to virtual gnd

$$\therefore I_{in} = I_i = \frac{V_{in}}{R_i} \Rightarrow R_{in} = \frac{V_{in}}{I_{in}} = R_i$$

$\therefore$ Input impedance $R_{in} = 10K\Omega$