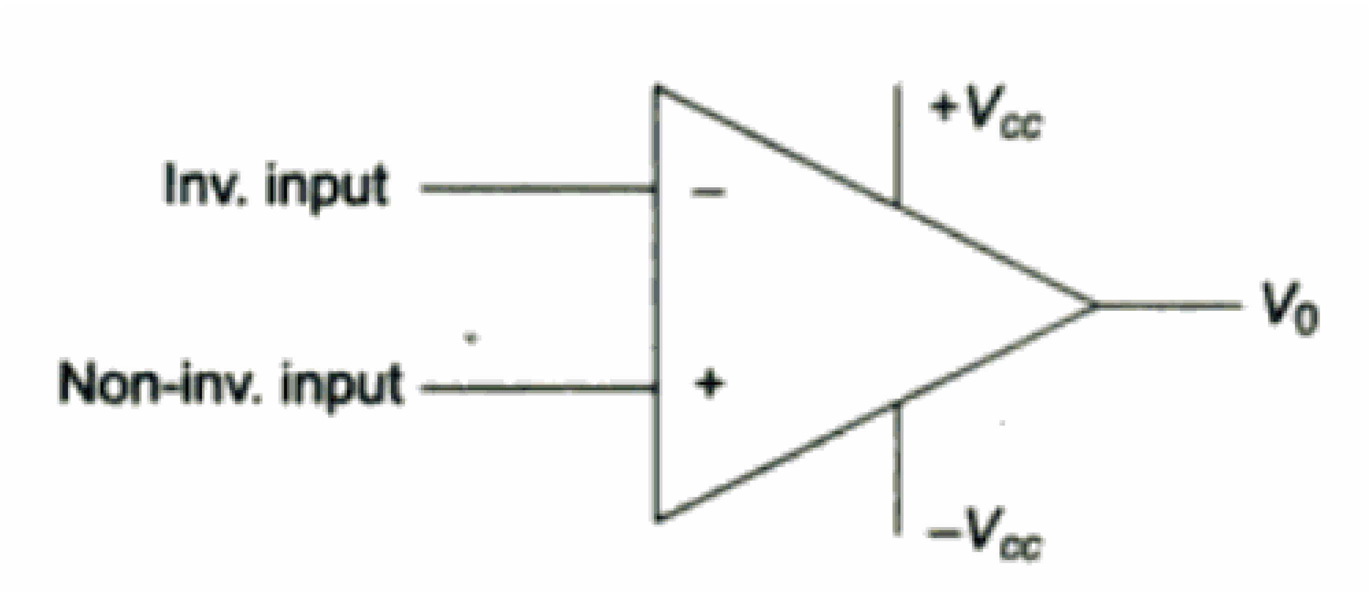
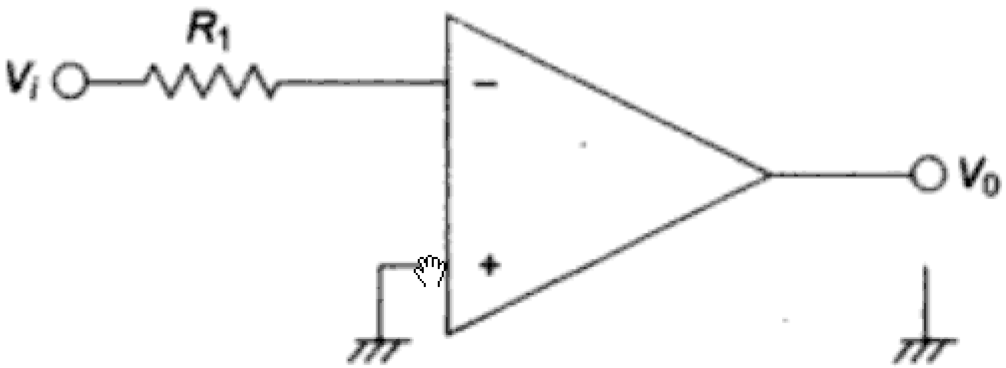
Operational Amplifier

Symbol for Operational Amplifier



Operational Amplifier in Open-loop configuration



$$A_v = \infty$$

Operation Amplifier in Closed-loop

R_f = Feedback resistance because it is connected in the feedback path of the circuit (connecting input and output points).

R_1 = Resistance connected in the input side of the circuit.

$$A_{VCL} = A_v = \frac{V_0}{V_i} = \left(\frac{R_f}{R_1}\right)$$

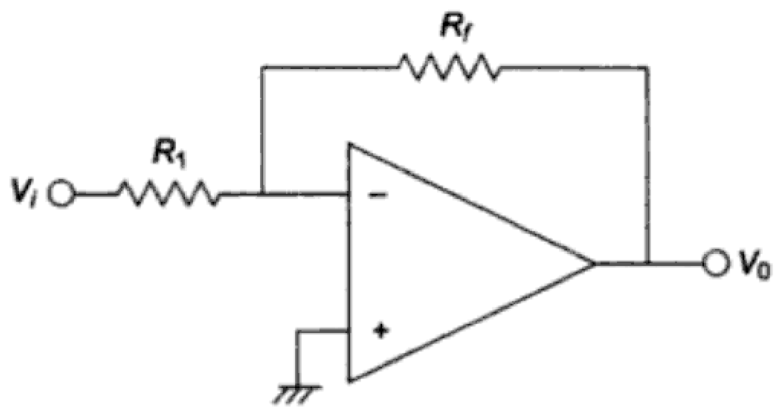
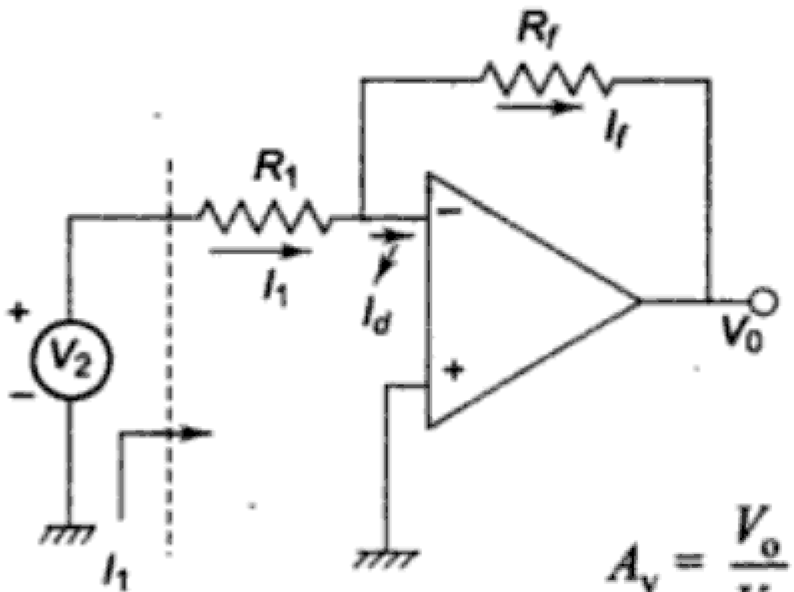


Fig. 1.13 Operational Amplifier in Closed-loop

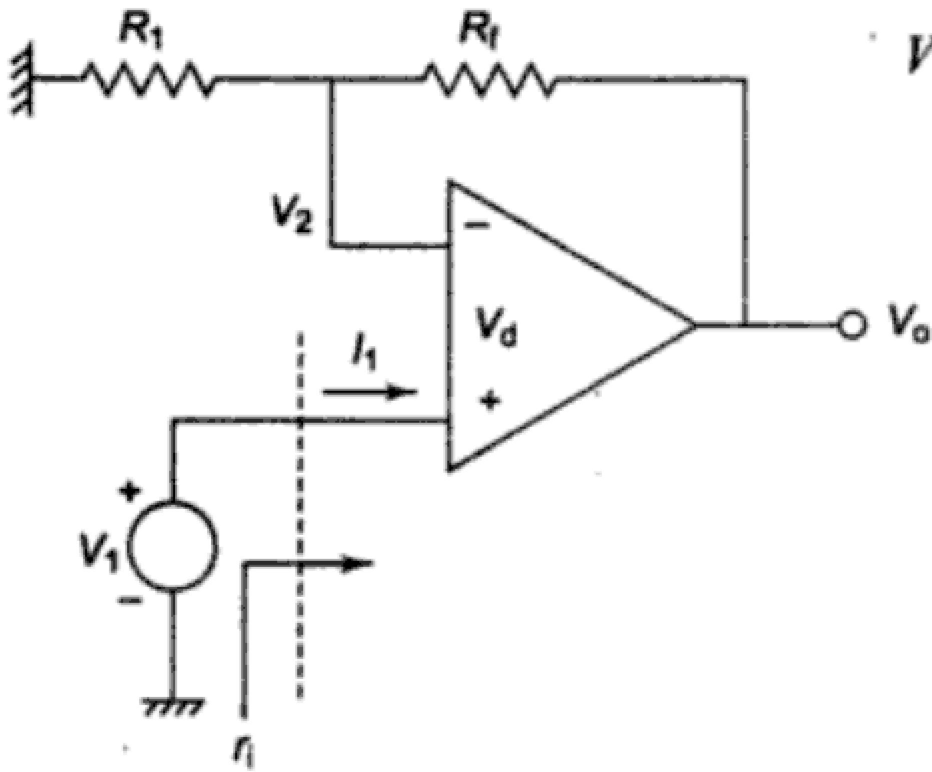
Inverting Amplifier circuit

$$V_o = -\left(\frac{R_f}{R_1}\right) \cdot V_2$$



$$A_v = \frac{V_o}{V_2}; \quad \therefore \frac{V_o}{V_2} = -\frac{R_f}{R_1} \quad \boxed{A_v = -\frac{R_f}{R_1}}$$

Non-inverting Amplifier circuit



$$V_o = \left(1 + \frac{R_f}{R_1}\right) V_1$$

Adder circuit

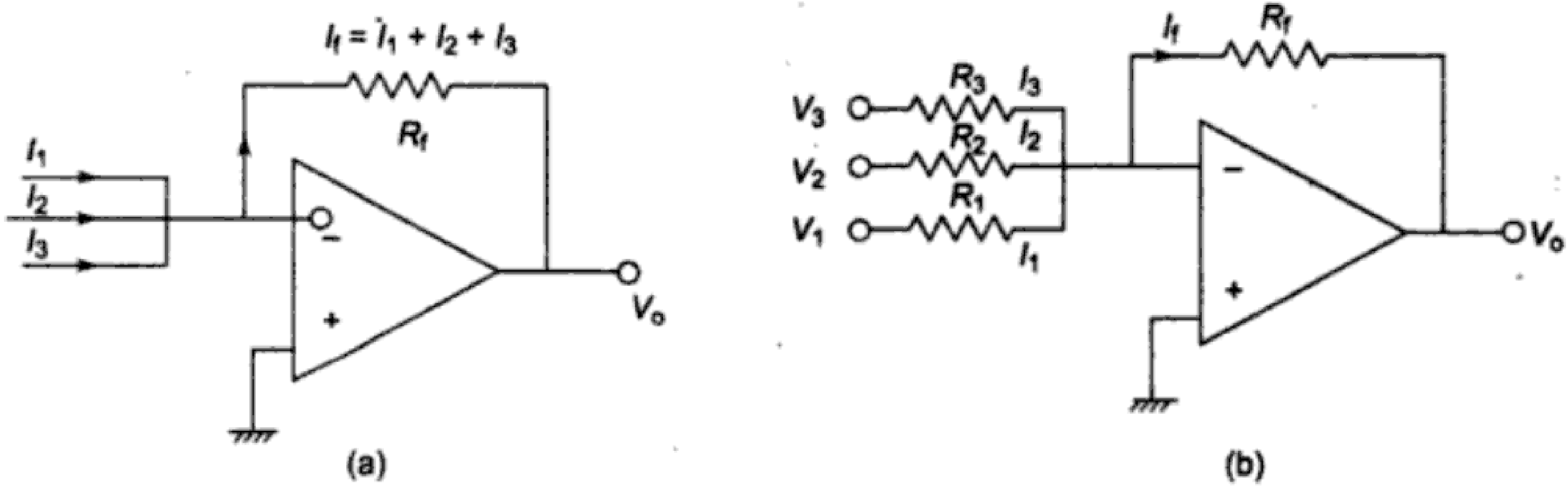
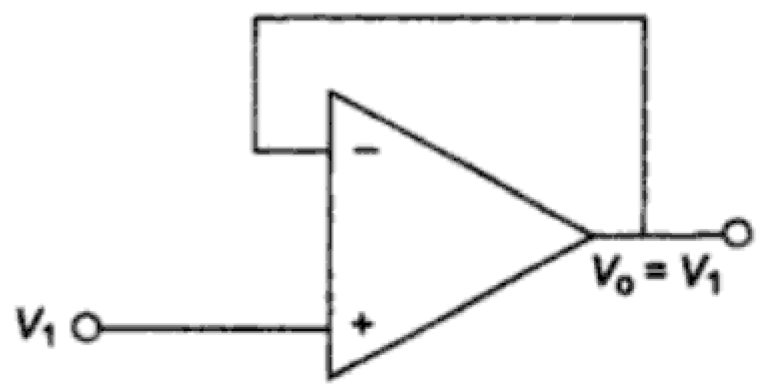


Fig. 1.24 *Op-amp Adder Circuits*

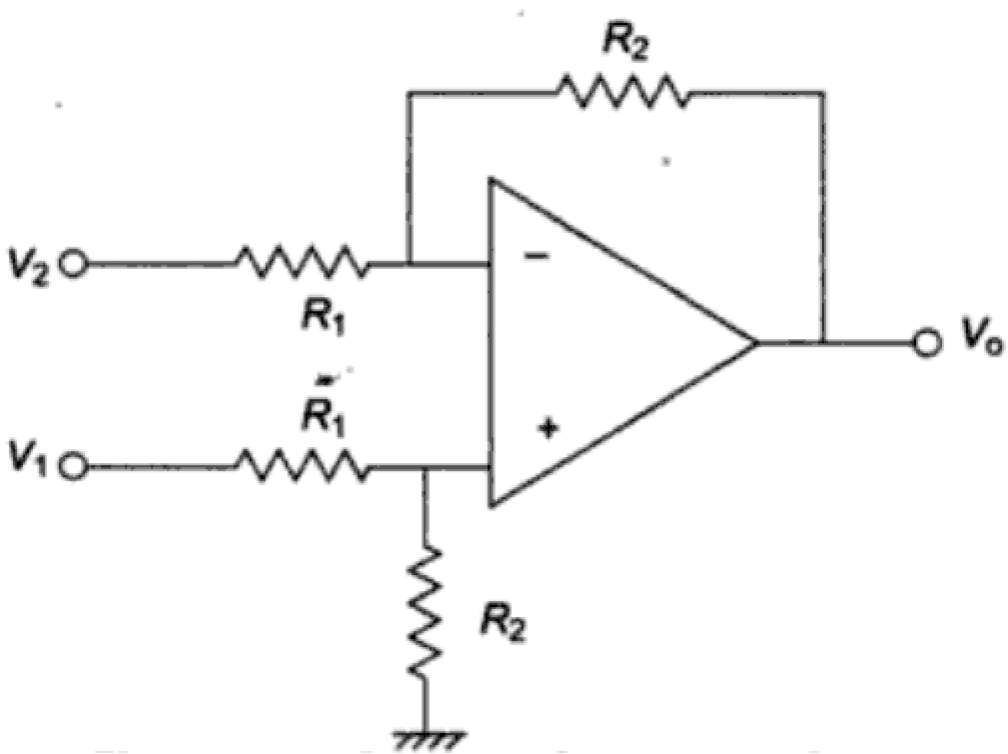
$$V_o = -(I_1 + I_2 + I_3)R_f, \quad V_o = -\left(\frac{V_1}{R_1} + \frac{V_2}{R_2} + \frac{V_3}{R_3}\right)R_f$$

Buffer circuit

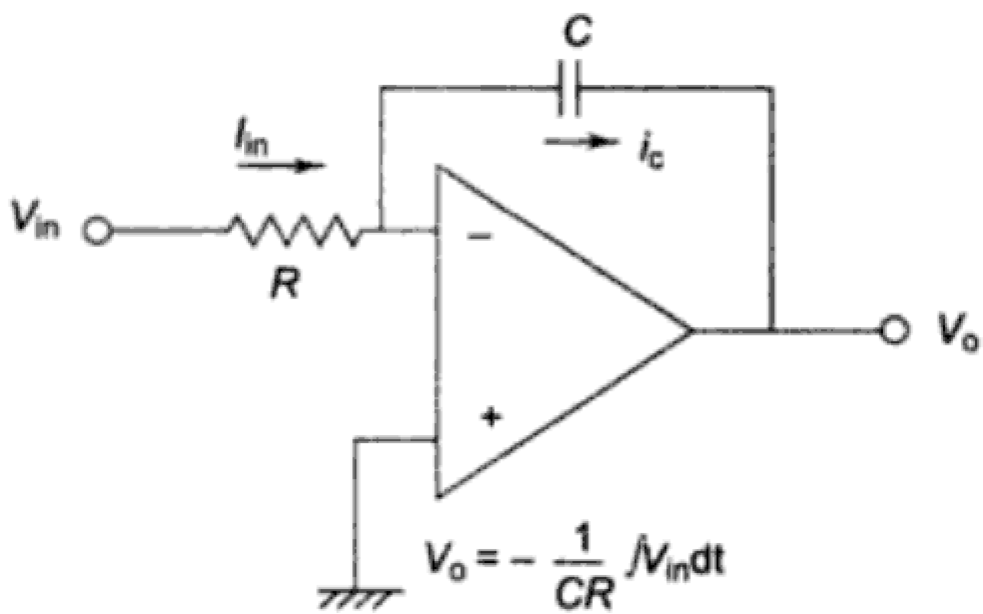


Sub-tractor circuit

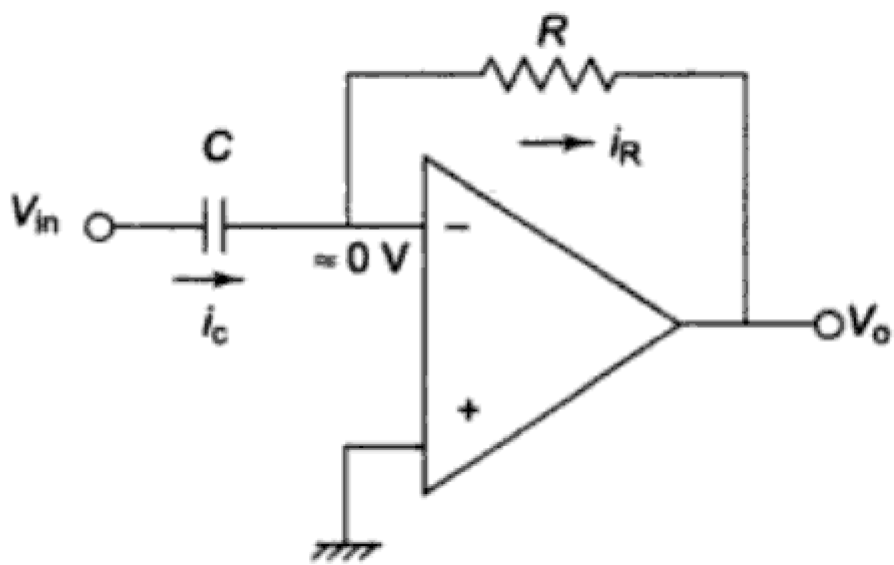
$$V_o = \frac{R_2}{R_1}(V_1 - V_2)$$



Integrator circuit

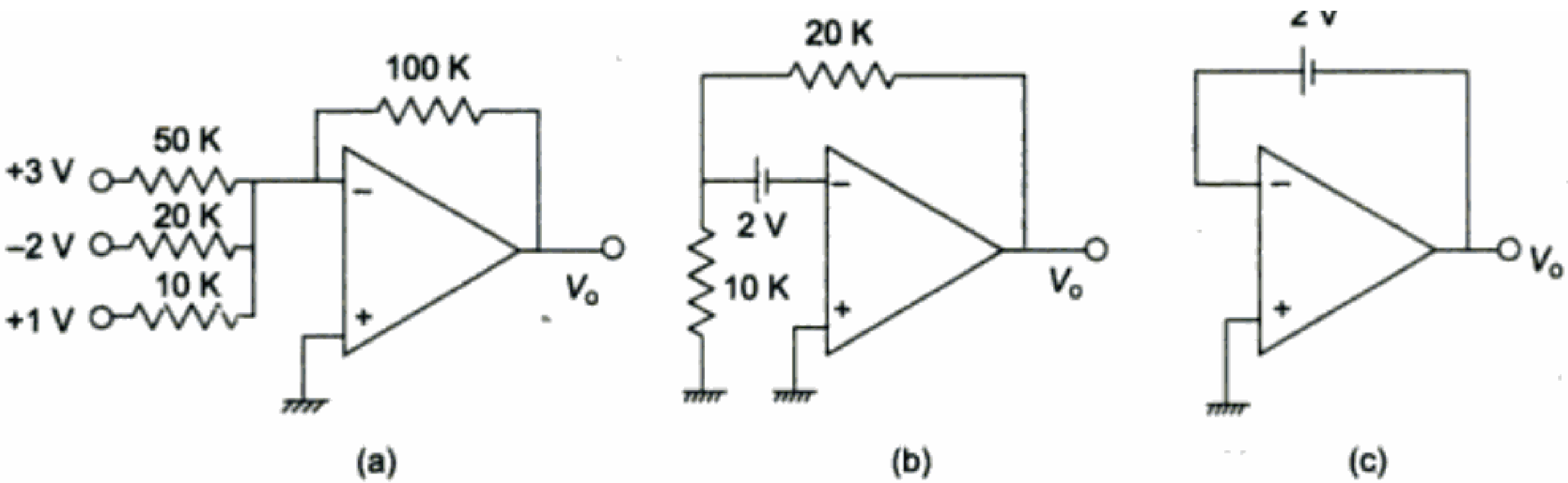


Differentiator circuit

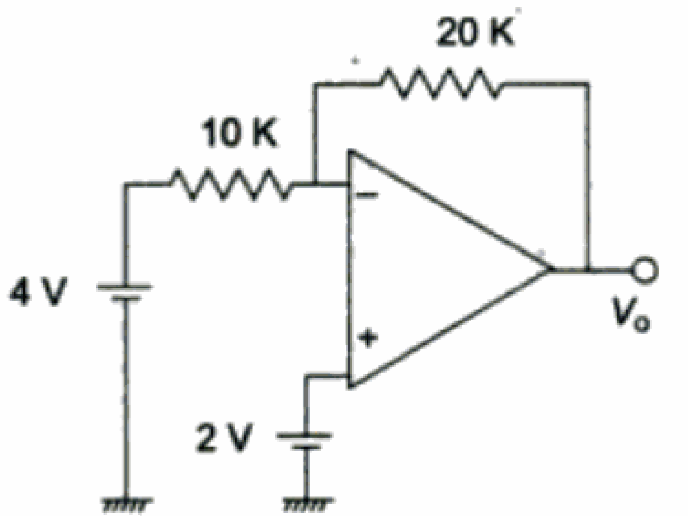


$$V_o = -CR\frac{dV_{in}}{dt}$$

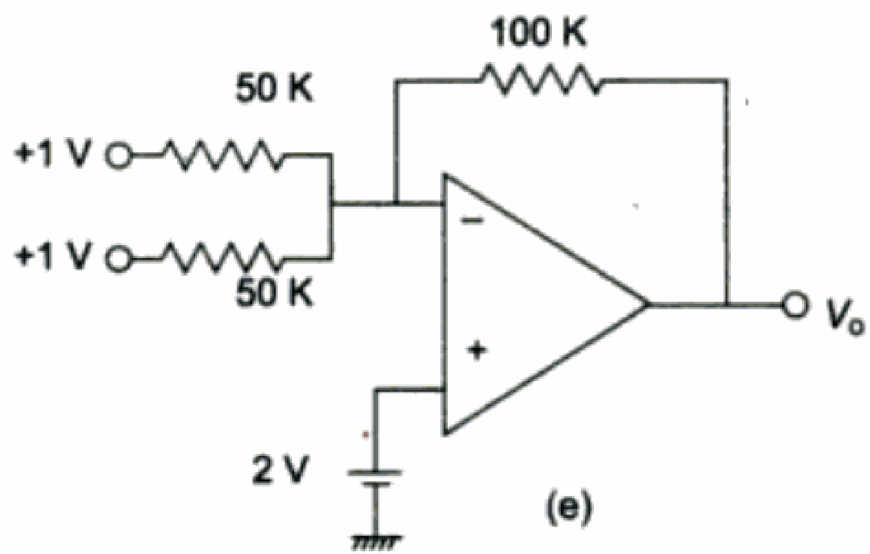
11. Assuming the operational amplifier to be ideal, calculate V_o for circuits a to g.



11. Assuming the operational amplifier to be ideal, calculate V_o for circuits a to g.

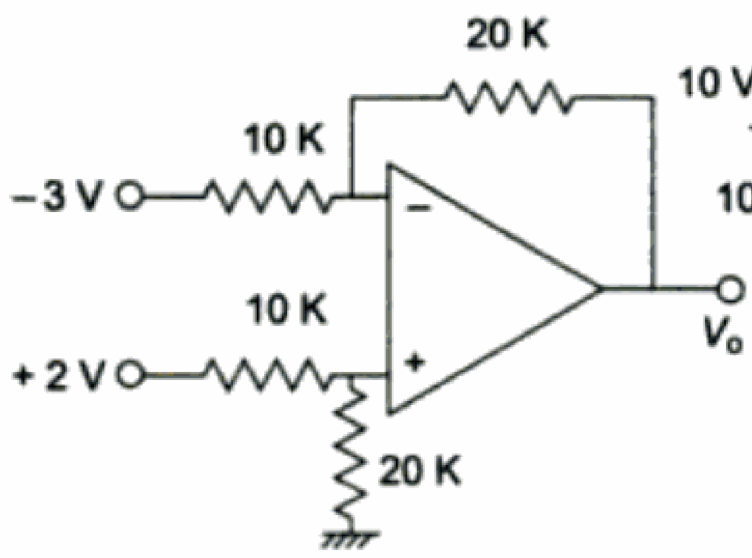


(d)

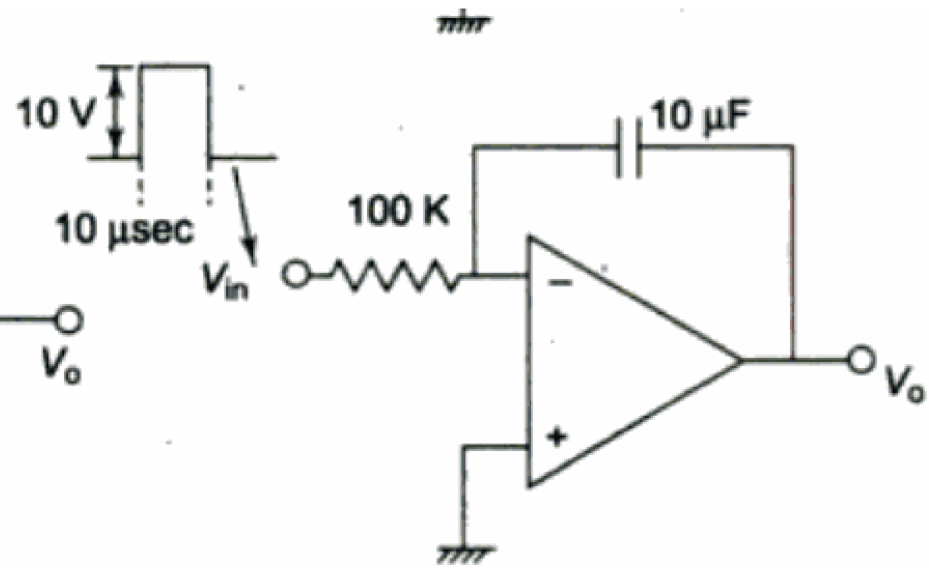


(e)

11. Assuming the operational amplifier to be ideal, calculate V_o for circuits a to g.



(f)



(g)

12. Assuming the operational amplifier to be ideal, find the values of circuit for (i), (ii) and (iii).

(i) Amp voltage gain = – 5 and input resistance 100 K

(ii) Amp voltage gain = – 20 and input resistance 2 K

(iii) Voltage gain = + 100 and high gain input resistance