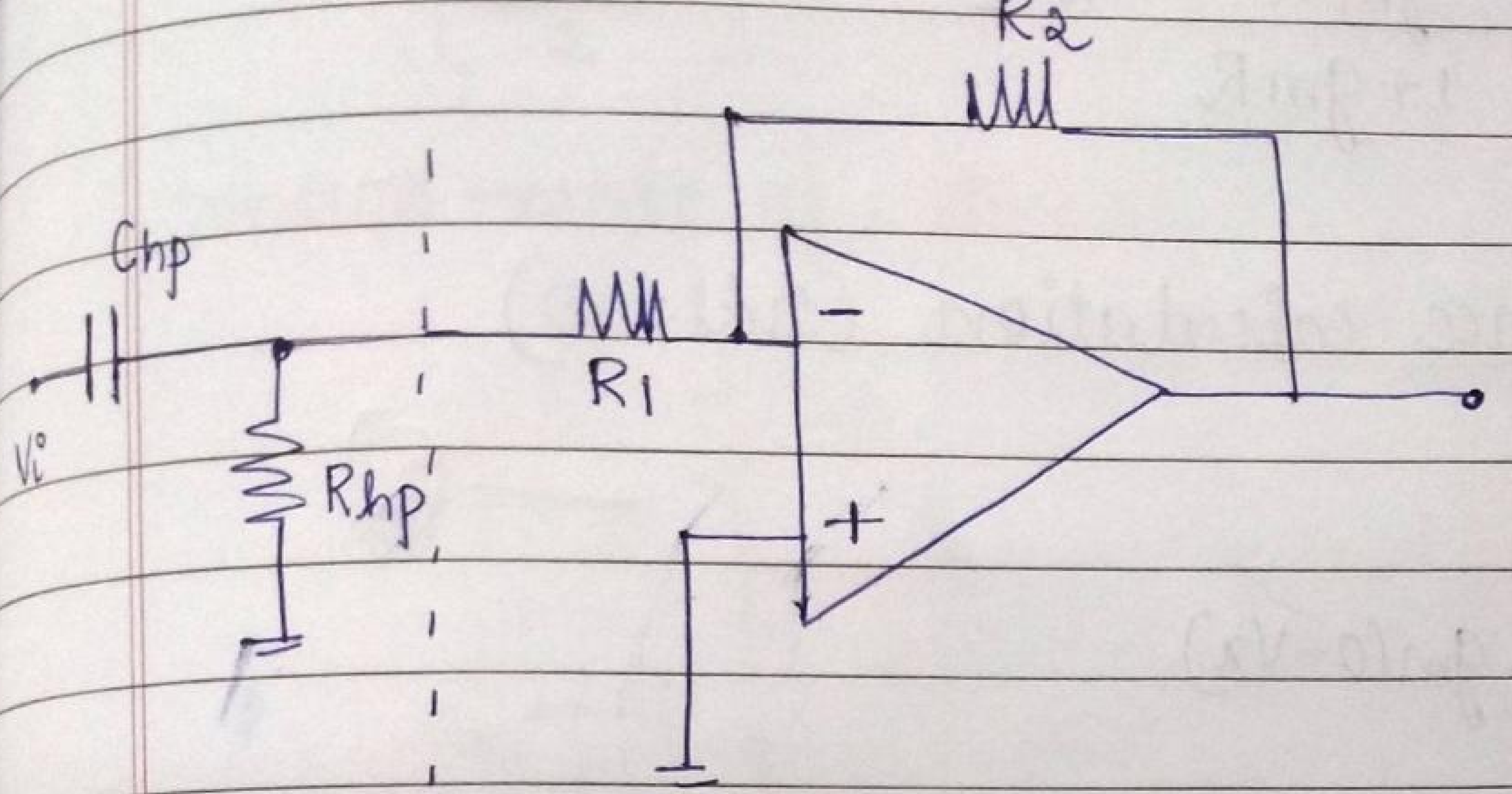
(1) Design a high pass filter with inverting amplifier. → 6



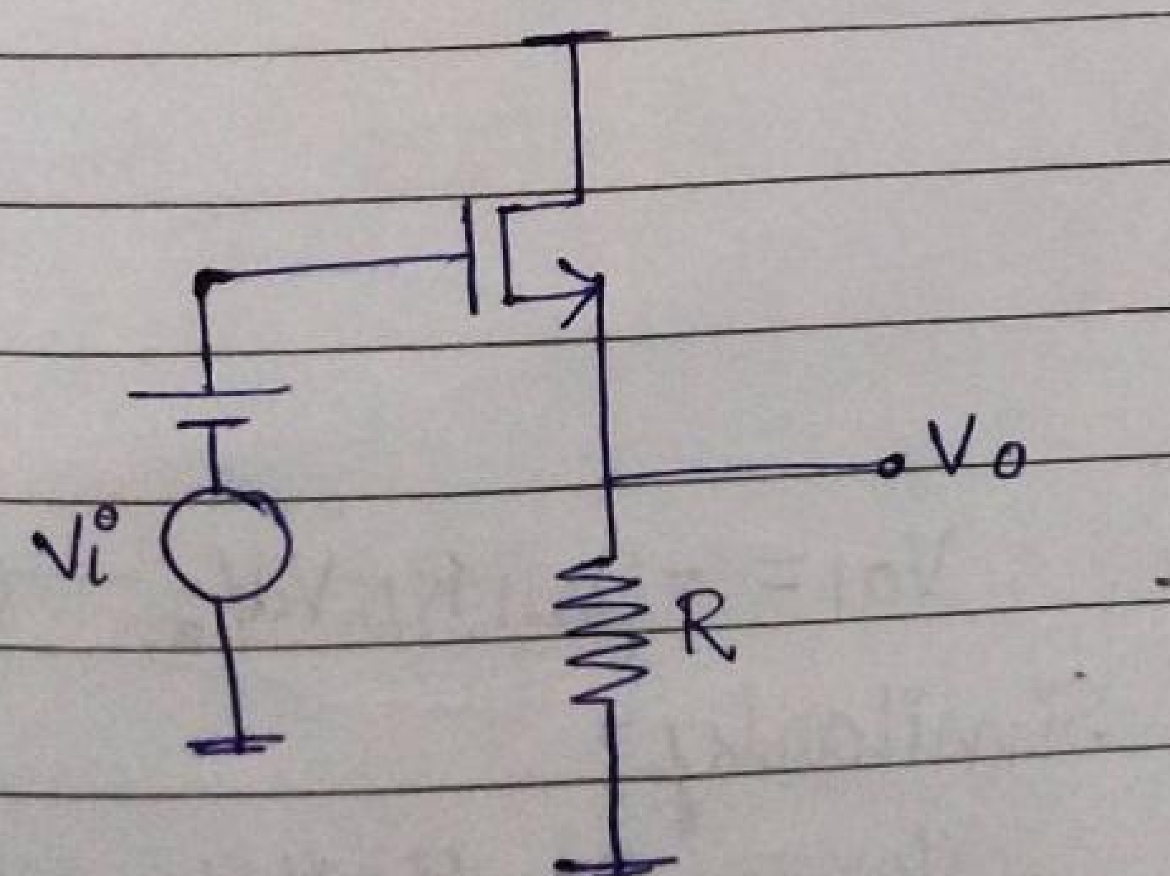
Design: $A_V = -\frac{R_2}{R_1}$ — 2

$f_H = \frac{1}{2\pi C_{hp} R_{hp}} = 150\,Hz$ — 2

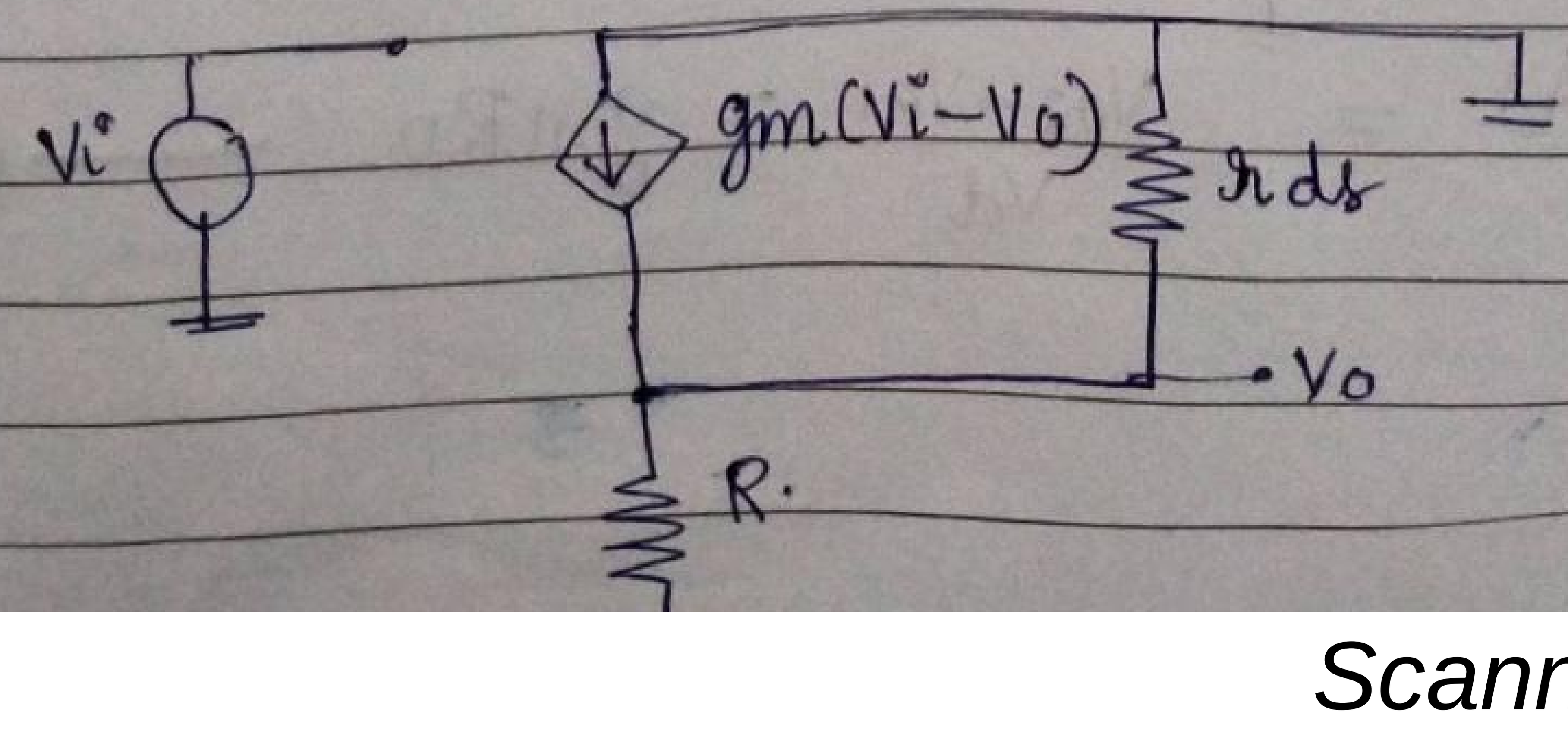
choose R_{hp}, C_{hp} appropriately — 2

6

(2) Source follower → 6



— (2)



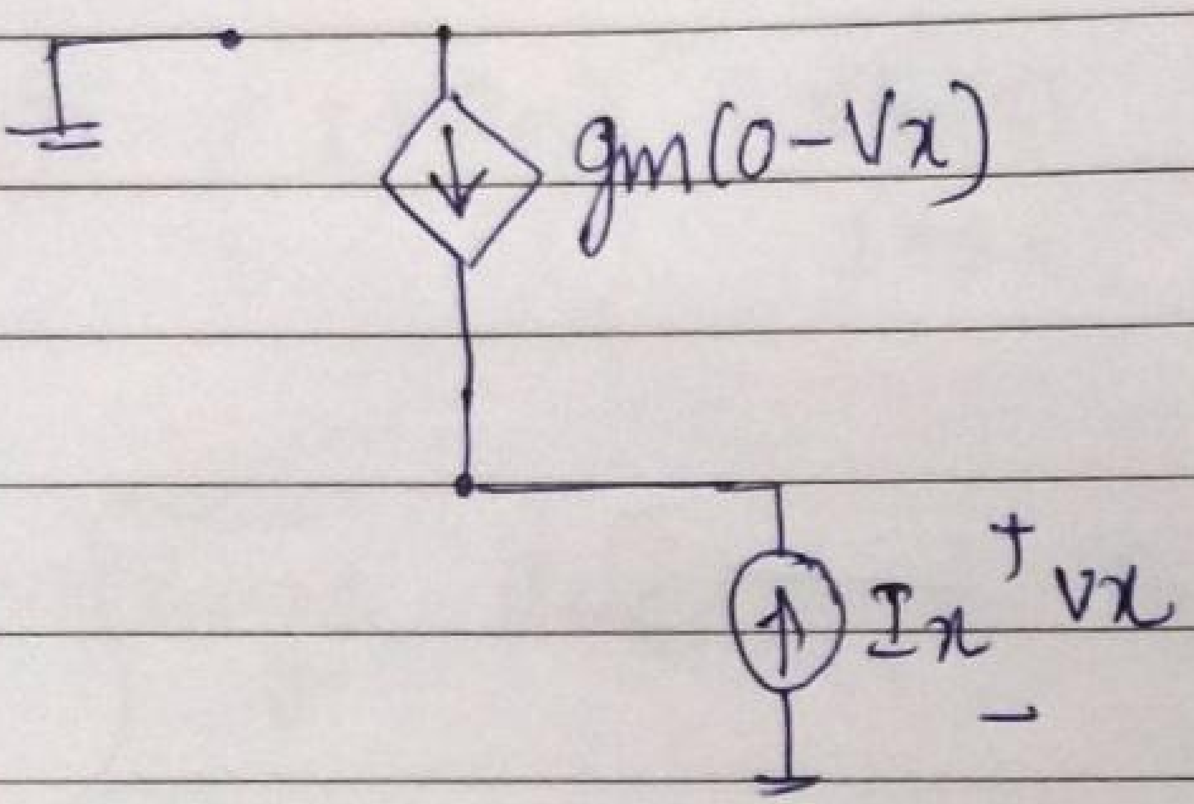
small signal gain (assuming $\lambda = 0$) i.e. $r_{ds} = \infty$

— (2)

$$A_v = \frac{V_o}{V_{in}} = \frac{g_m R}{1 + g_m R} \approx 1.$$

<u>o/p impedance</u> calculation ($r_{ds} = \infty$)

— (2)



$$\frac{V_x}{I_x} = \frac{1}{g_m}$$

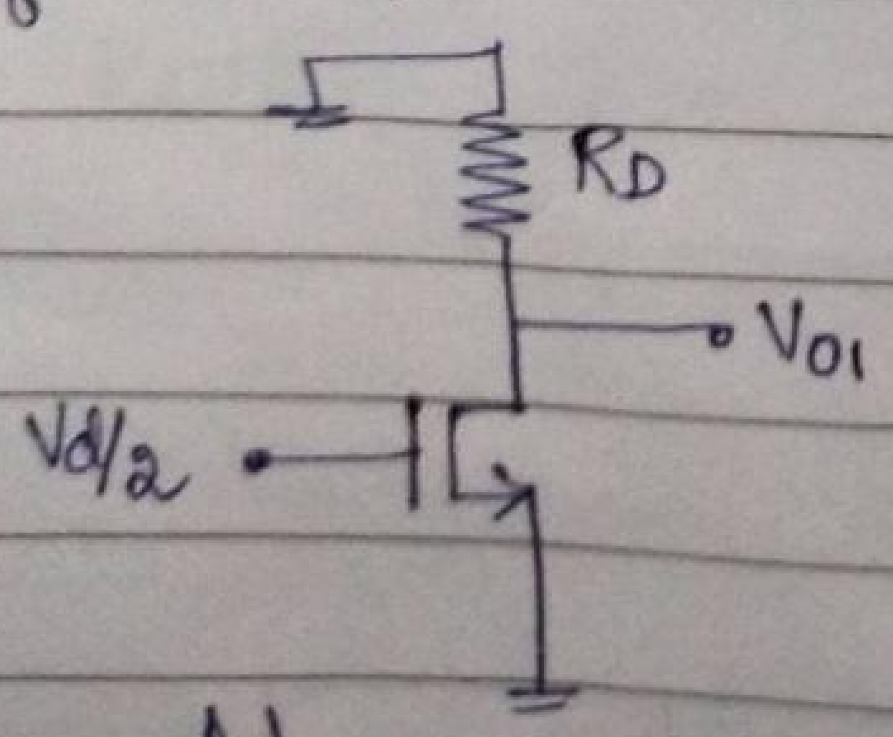
o/p impedance with load R = $R \parallel 1/g_m$.

(3). Differential gain calculation. (A_d) → 8 ✓

→ $V_d = (V_i^{+} - V_i^{-})$

The source voltages at small signal gnd for differential i/p.

Half circuit.



$$V_{o1} = -g_{m1} R_D V_d/2 \quad \text{— (i)}$$

Similarly

$$V_{o2} = g_{m1} R_D V_d/2 \quad \text{— (ii)}$$

$$A_d = \frac{V_{o2} - V_{o1}}{V_d} = g_{m1} R_D. \quad \text{— (3)}$$

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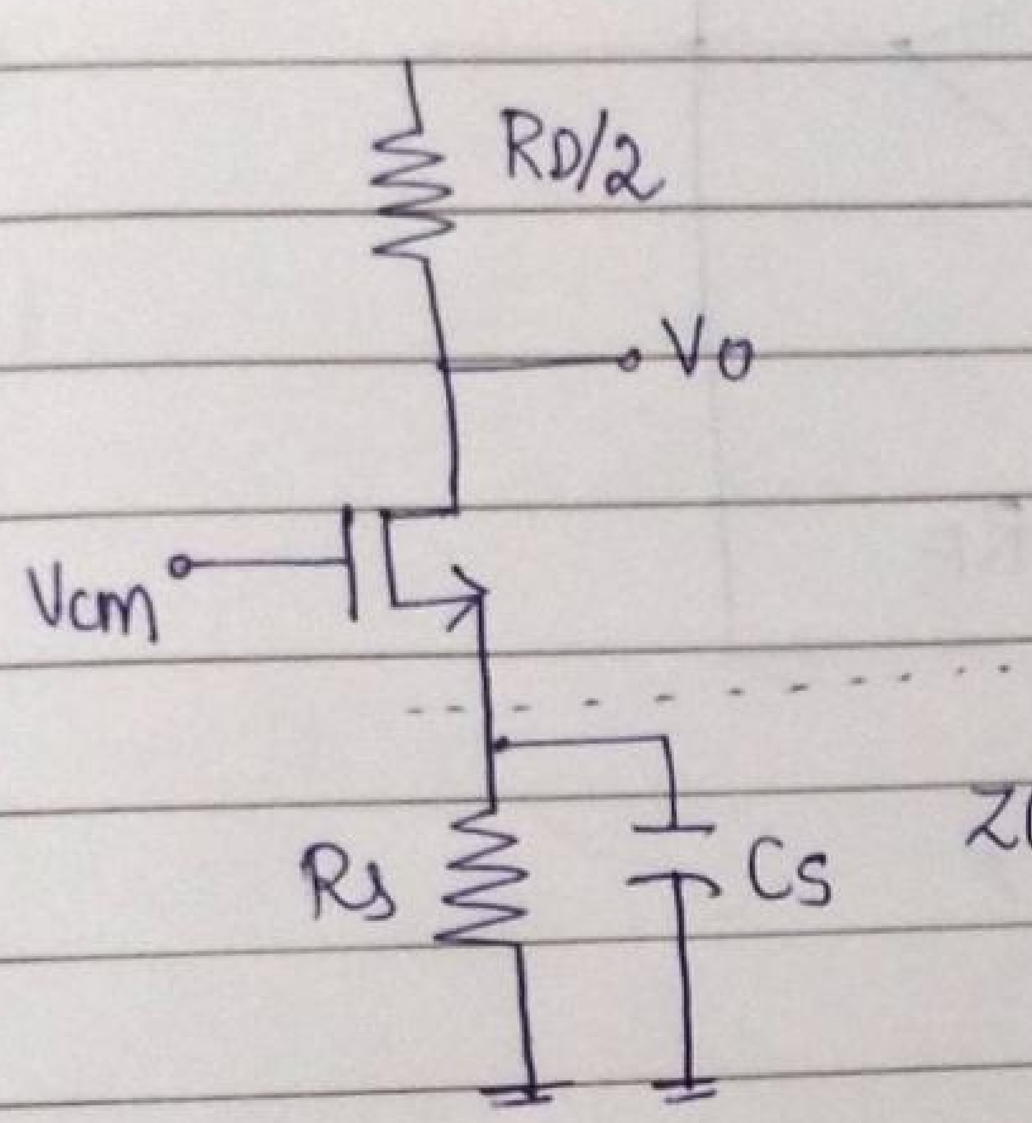
common-mode gain.

$$V_{cm} = \left(\frac{V_i^+ + V_i^-}{2}\right)$$

common-mode eq. circuit



3

$$Z(s) = \frac{R_s}{R_s s C_s + 1}$$

$$A_{CM} = \frac{-g_m R_D/2}{1 + g_m Z(s)}.$$

$$CMRR = \frac{|A_d|}{|A_{CM}|}.$$ 2

Obs :- 3

3 ⓐ if $C_s = 0$, $Z(s) = R_s$. $|A_{CM}| = \frac{g_m R_D/2}{1 + g_m R_s}$

if $C_s = \infty$, $Z(s) = 0$ $|A_{CM}| = g_m R_D/2$

as C_s value increases CMRR decreases.

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