Slide 17:

$A_V = 100$ V/V

$$A_V \text{ in dB} = 20\log_{10} A_V$$
$$= 20\log_{10} 100$$
$$= 20\log_{10} 10^2$$
$$= 2 \times 20$$
$$= 40 \text{ dB}$$

$A_V = 1000$ V/V

Or you can use calculator

$$A_V \text{ in dB} = 20\log_{10} A_V$$
$$= 20\log_{10} 10^3$$
$$= 3 \times 20$$
$$= 60 \text{ dB}$$

$A_V = 10K$ V/V

$$A_V \text{ in dB} = 20\log_{10} 10^4$$
$$= 20 \times 4$$
$$= 80 \text{ dB}$$

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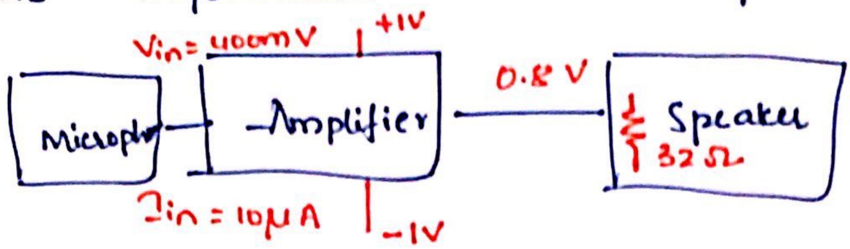
Slide 20:

From the information in the question,



$V_{in} = 400mV$

$V_{out} = 0.8V$

$A_V = \frac{V_{out}}{V_{in}} = \frac{0.8}{0.4} = 2 \, V/V$

A_V in dB $= 20 \log_{10} 2$

$= 6 dB$

$R_L = 32 \Omega$

$I_{out} = V_{out} / R_L = \frac{0.8}{32} = 25 \mu A$

$I_{in} = 10 \mu A$

$A_I = \frac{I_{out}}{I_{in}} = \frac{25\mu}{10\mu} = 2.5 \, A/A$

A_I in dB $= 7.9 dB$

Power gain $= \frac{P_{out}}{P_{in}} = \frac{V_{out} \cdot I_{out}}{V_{in} \cdot I_{in}}$

$= \left(\frac{V_{out}}{V_{in}}\right)\left[\frac{I_{out}}{I_{in}}\right]$

$= A_V \cdot A_I$

$= 2 \times 2.5 = 5 \, W/W$

$10 \log_{10} 5 = 6.98 dB$

Power gain in dB $=$ $\cancel{20 \log_{10} 5} = 13.97 dB$

or $\boxed{\cancel{A_{I_{dB}} + A_{V_{dB}}}} = 13.9 dB$

$\frac{1}{2}\left[A_{I_{dB}} + A_{V_{dB}}\right] = \frac{1}{2}\{6 + 7.9\}$

$= \frac{13.9}{2}$

$= 6.9 dB$

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Slide 23:

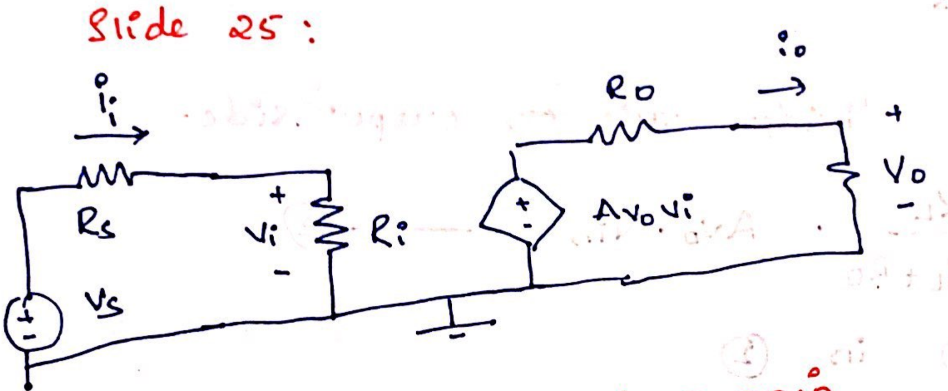
$i_C(t) = I_C + i_c(t)$

$i_C(t)$ — Total current

I_C — Dc current

$i_c(t)$ — Ac current

Slide 25:



A_{vo} — open loop gain

A_v — closed loop gain

open loop gain - A_{vo} - when you buy an amplifier, you will get the amplifier with some gain that you can find in the datasheet.

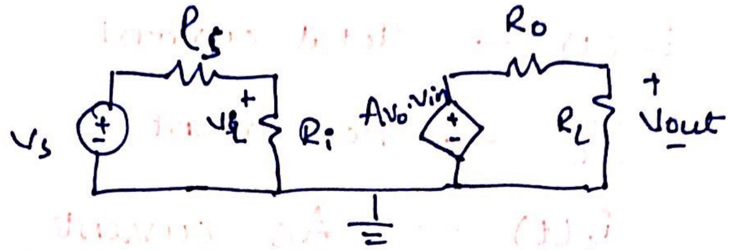
Closed loop gain - A_v - Gain of the amplifier after you add source and load.

$$A_v = \frac{V_o}{V_s}$$

Oo

Relation between openloop gain and closed loop gain:

$$A_V = \frac{V_{out}}{V_s}$$



Apply voltage divider rule on input side.

$$V_i = \frac{R_i}{R_i + R_s} \cdot V_s \quad \text{——— (1)}$$

Apply voltage divider rule on output side.

$$V_{out} = \frac{R_L}{R_L + R_o} \cdot A_{Vo} \cdot V_{in} \quad \text{——— (2)}$$

Substitute (1) in (2)

$$V_{out} = \frac{R_L}{R_L + R_o} \cdot A_{Vo} \cdot \frac{R_i}{R_i + R_s} \cdot V_s$$

$$A_V = \frac{V_{out}}{V_s}$$

$$\frac{V_{out}}{V_s} = \underbrace{A_V}_{\text{Closed loop gain}} = \frac{R_L}{R_L + R_o} \cdot \frac{R_i}{R_i + R_s} \cdot \underbrace{A_{Vo}}_{\text{open loop gain}}$$

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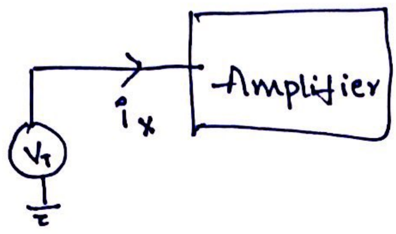
Slide 27:

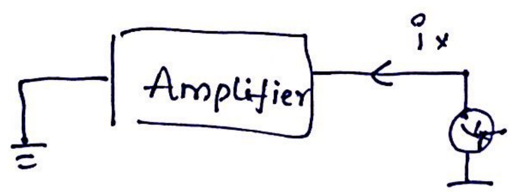
Input Resistance:



Apply a known voltage source and measure current

$$R_i = \frac{V_T}{i_x}$$

Output Resistance:



eliminate input source

Apply a known voltage source at the output and measure current

$$R_o = \frac{V_T}{i_x}$$

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