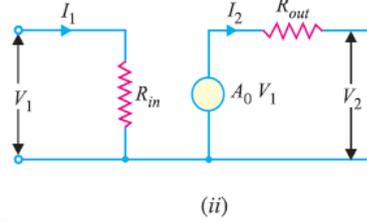
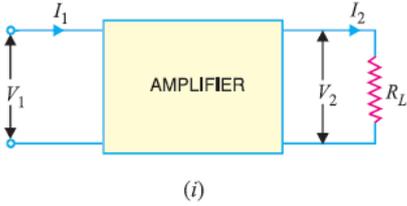


المحاضـ 10 - مرة

دوائر المكبر المكافئة

يمكن الاستعاضة عن دائرة المكبر بدائرة مكافئة كما في الشكل ادناه:



- V_1 = input signal voltage to the amplifier
- I_1 = input signal current
- R_{in} = input resistance of the amplifier
- A_0 = voltage gain of the amplifier when no load is connected
- I_2 = output current
- V_2 = output voltage across load R_L
- R_{out} = output resistance of the amplifier
- R_L = load resistance
- A_v = voltage gain when load R_L is connected

يعطى تيار الادخال والايخراج وجهد الادخال والايخراج للدائرة المكافئة بالعلاقات ادناه بفرض تسليط جهد مقداره E_S ومقاومة ادخال R_S

$$I_1 = \frac{E_S}{R_S + R_{in}}$$

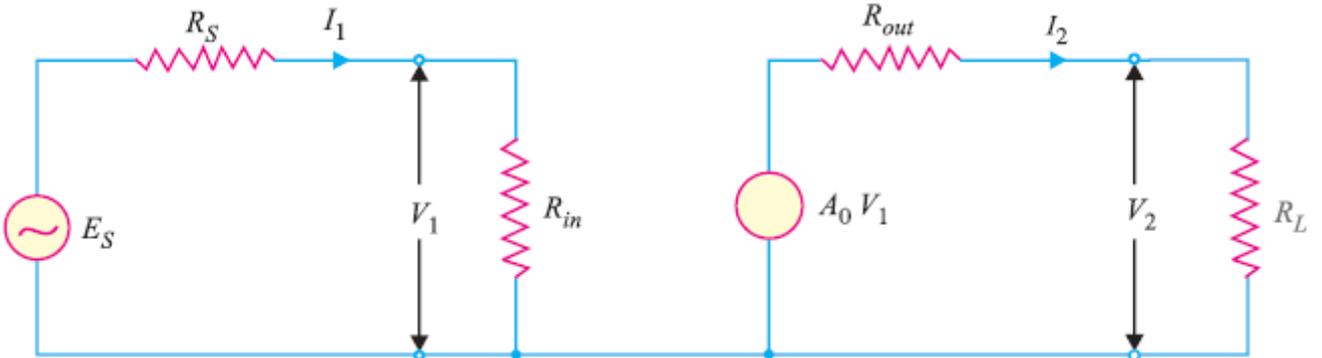
$$\therefore V_1 = I_1 R_{in} = \frac{E_S R_{in}}{R_S + R_{in}}$$

$$I_2 = \frac{A_0 V_1}{R_{out} + R_L} \quad \dots(i)$$

$$= \frac{A_0 I_1 R_{in}}{R_{out} + R_L} \quad \dots(ii)$$

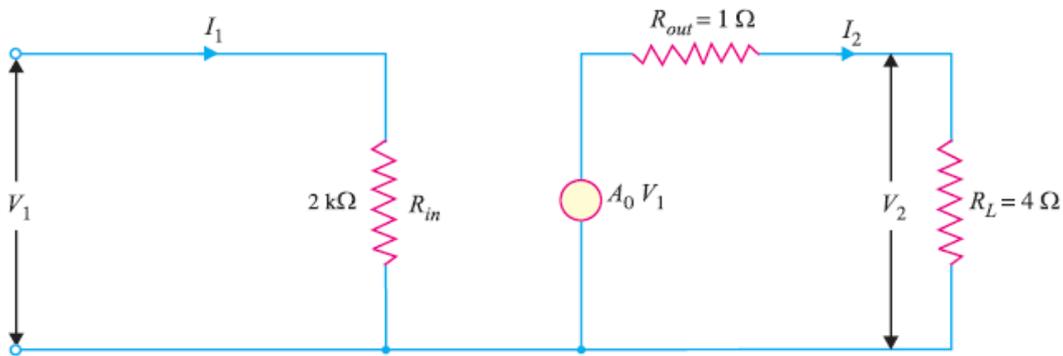
$$\therefore V_2 = I_2 R_L = \frac{A_0 V_1 R_L}{R_{out} + R_L} \quad \dots(iii)$$

$$\text{Voltage gain, } A_v = \frac{V_2}{V_1} = \frac{A_0 R_L}{R_{out} + R_L}$$



$$\begin{aligned} \text{Current gain, } A_i &= \frac{I_2}{I_1} = \frac{A_0 R_{in}}{R_{out} + R_L} \\ \text{Power gain, } A_p &= \frac{I_2^2 R_L}{I_1^2 R_{in}} = \frac{(I_2 R_L) I_2}{(I_1 R_{in}) I_1} \\ &= \frac{V_2 I_2}{V_1 I_1} = \left(\frac{V_2}{V_1} \right) \times \left(\frac{I_2}{I_1} \right) \\ &= A_v \times A_i \end{aligned}$$

مثال: مكبر يمتلك تحصيل الدائرة المفتوحة مقداره 1000 ومقاومة ادخال 2 كيلو اووم ومقاومة اخراج 1 اوماحسب جهد الاشارة الداخلة للحصول على تيار اخراج مقداره 0.5 امبير يسري بمقاومة حمل مقدارها 4 اووم.



Solution. Fig. 10.43 shows the equivalent circuit of the amplifier. Here $A_0 = 1000$.

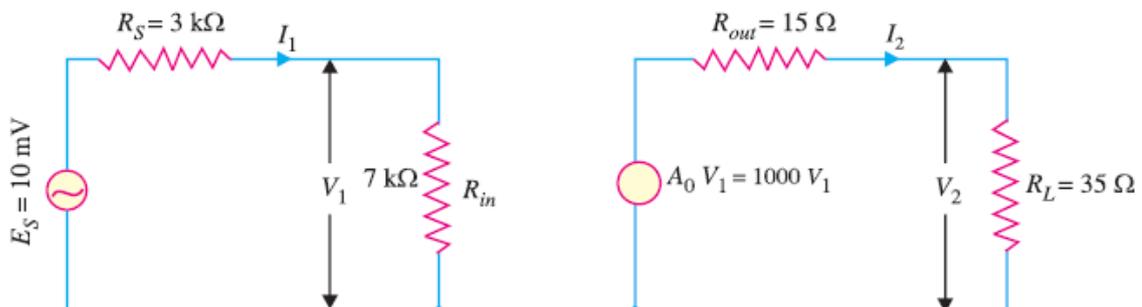
$$\begin{aligned} \frac{I_2}{I_1} &= \frac{A_0 R_{in}}{R_{out} + R_L} \quad [\text{See Art. 10.20}] \\ &= \frac{1000 \times 2000}{1 + 4} = 4 \times 10^5 \end{aligned}$$

$$\therefore I_1 = \frac{I_2}{4 \times 10^5} = \frac{0.5}{4 \times 10^5} = 1.25 \times 10^{-6} \text{ A}$$

$$V_1 = I_1 R_{in} = (1.25 \times 10^{-6}) \times 2000 = 2.5 \times 10^{-3} \text{ V} = \mathbf{2.5 \text{ mV}}$$

H.W

An amplifier has an open circuit voltage gain of 1000, an output resistance of 15Ω and an input resistance of $7 \text{ k}\Omega$. It is supplied from a signal source of e.m.f. 10 mV and internal resistance $3 \text{ k}\Omega$. The amplifier feeds a load of 35Ω . Determine (i) the magnitude of output voltage and (ii) power gain.



مثال: مكبر عندما يتم تحميله بمقاومة 2 كيلو اوم يكون التحصيل للجهد مساوي الى 80 وتحصيل التيار 120 احسب جهد وتيار الادخال للحصول على جهد اخراج مقداره 1 فولت ثم احسب تحصيل القدرة.

الحل:

Solution.

$$A_v = \frac{V_2}{V_1} = 80$$

$$\therefore V_1 = V_2/80 = 1/80 = 0.0125 \text{ V} = 12.5 \text{ mV}$$

$$A_v = \frac{A_0 R_L}{R_{out} + R_L}$$

$$A_i = \frac{A_0 R_{in}}{R_{out} + R_L}$$

$$\therefore \frac{A_v}{A_i} = \frac{R_L}{R_{in}}$$

or

$$\frac{80}{120} = \frac{2}{R_{in}}$$

$$\therefore R_{in} = 120 \times 2/80 = 3 \text{ k}\Omega$$

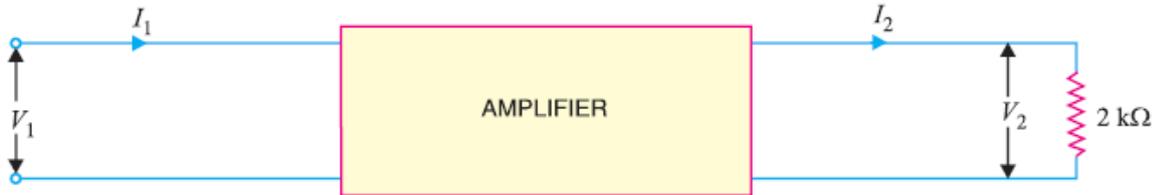


Fig. 10.45

$$I_1 = V_1/R_{in} = 12.5 \text{ mV}/3 \text{ k}\Omega = 4.17 \mu\text{A}$$

$$\text{Power gain} = A_v \times A_i = 80 \times 120 = 9600$$