

**UNIT-4 >>CURRENT MIRROR AND OP-AMP  
DESIGN**

**SUBJECT-ANALOG CIRCUITS**

**PAPER CODE-402**

**LECTURE-NO>>3**

**TOPIC>> OUTPUT RESISTANCE**

**FACULTY NAME>>DR.NIDHI CHAUHAN**

## **OUTPUT RESISTANCE OF THE CURRENT MIRROR**

1-  $I_o = I_c$ , the current transfer ratio can be found  
as

$$I_o/I_{REF} = I_c/I_c(1 + 2/\beta) \dots\dots (1)$$

As  $\beta$  approaches  $\infty$ ,  $I_o/I_{REF}$  approaches the nominal value of unity.

2- For typical value of  $\beta$ , however, the error in the current transfer ratio can be significant.

3- For instance,  $\beta = 100$  results in a 2% error in the current transfer ratio.

4- The BJT mirror has a finite output resistance  $r_o$ ,

$$R_o = \Delta V_o / \Delta I_o = r_{o2} = -V_{A2} / I_o$$

Where  $V_{A2}$  and  $r_{o2}$  are the Early voltage and the output resistance, respectively, of  $Q_2$ .

5- Taking both the finite  $\beta$  and finite  $R_o$  into account, we can express the output current of a BJT mirror with a nominal current transfer ratio  $m$  as

$$I_o = I_{REF} (m / (1 + m + 1/\beta)) (1 + V_o - V_{BE})$$