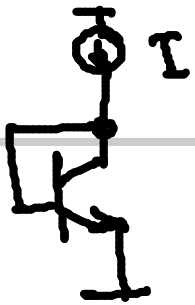
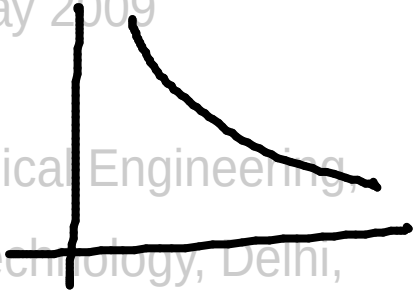


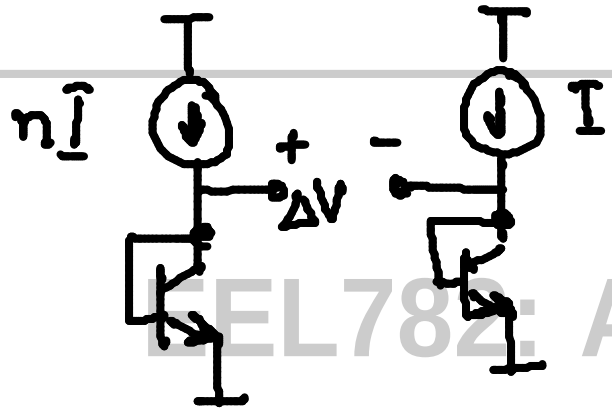
$$\frac{\partial V_{BE}}{\partial T} = \eta \frac{k}{q}\left[\ln I/I_S - \left(\frac{\varepsilon_g}{kT} + 4+m\right)\right]$$

$$V_{BE} = \eta V_T \ln I/I_S$$

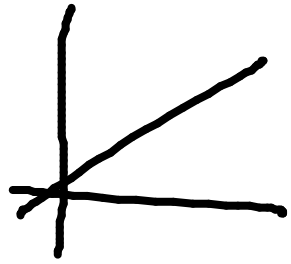
$$I_S = bT^{4+m}\exp(-\varepsilon_g/kT)$$

$$V_{BE} = \eta V_T\left(\ln I + \varepsilon_g/kT - \ln(bT^{4+m})\right)$$

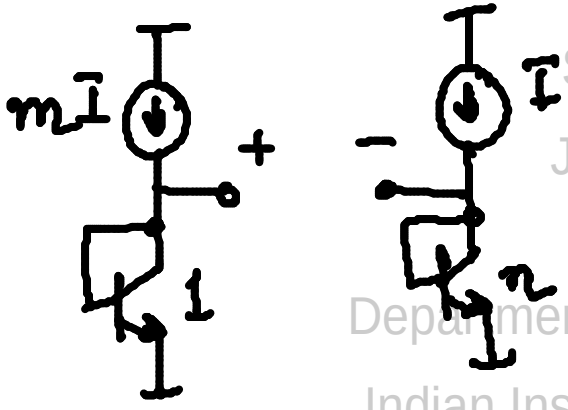




$$\frac{\partial \Delta V}{\partial T} = \eta \frac{k}{q} \ln(n)$$



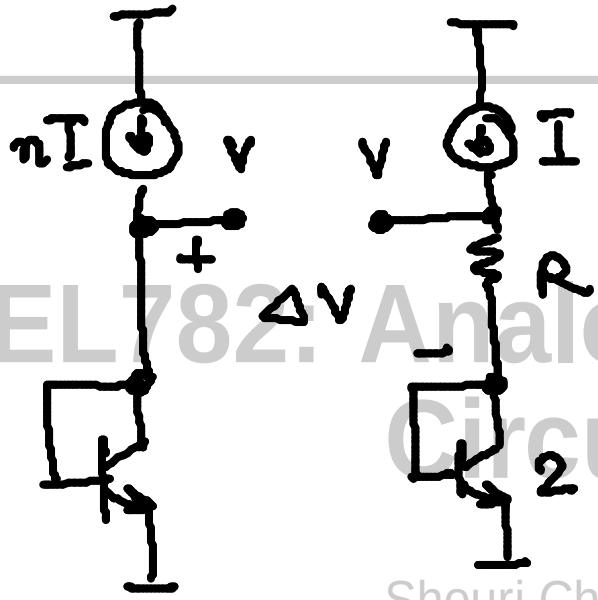
$$\Delta V = \eta V_T \ln(n)$$



$$V_{BE_1} = \eta V_T \ln\left(\frac{I}{mI_S}\right)$$

$$V_{BE_2} = \eta V_T \ln\left(\frac{I}{nI_S}\right)$$

$$\Delta V = \eta V_T \ln(mn)$$



$$\frac{\partial \Delta V}{\partial T} = \eta \frac{k}{q} \ln(n)$$

Shouri Chatterjee

$$V = \Delta V + V_{BE_2}$$

$$= V_{BE_2} + IR$$

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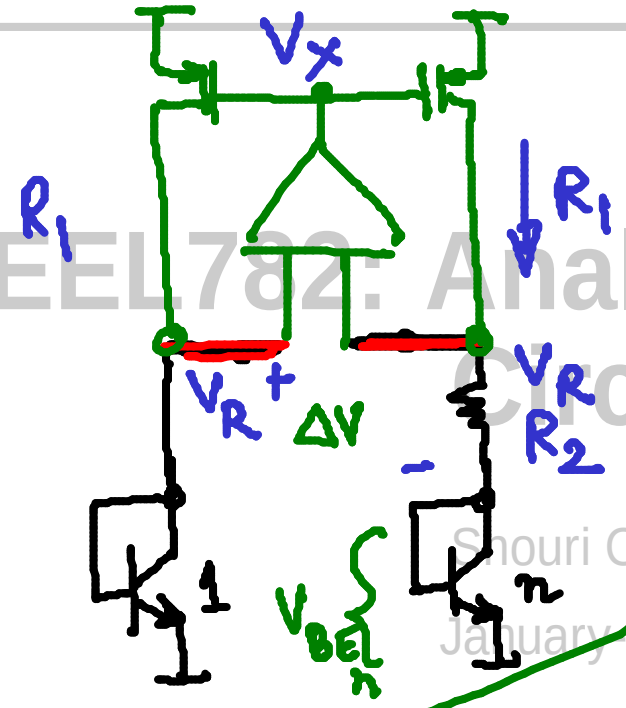

$$I = \frac{V_x - V_R}{R_1}$$

$$V_R = \Delta V + V_{BE_n}$$

$$= \eta V_T \ln(n) + \eta V_T \ln\left(I/nI_S\right)$$

$$\frac{\partial V_R}{\partial T} = \eta \frac{k}{q} \ln(n) + \eta \frac{k}{q}\left[\ln \frac{I}{nI_S} + T \cdot \frac{nI_S}{I} \frac{\partial}{\partial T}\left(I/nI_S\right)\right]$$

$$T\left(\frac{\partial I}{\partial T}/I - \frac{\partial I_S}{\partial T}/I_S\right)$$

$$I_S = bT^{4+m} \exp\left(-E_g/kT\right)$$

$$\frac{\partial I_S}{\partial T} = b(4+m)T^{3+m} \exp\left(-E_g/kT\right) + bT^{4+m} \cdot \exp\left(-E_g/kT\right) \cdot \frac{E_g}{kT^2}$$

$$= I_S\left[(4+m)/T + E_g/kT^2\right]$$

$$\frac{\partial V_R}{\partial T} = \eta \frac{k}{q}\left[\ln(n) + \ln\left(\frac{I}{nI_s}\right) - (4+m) - \frac{E_g}{kT} + \frac{\partial I/I}{\partial T/T}\right]$$

$$V_R = \eta V_T \ln\left(I/I_s\right)$$

$$= \eta V_T\left[\ln(I) - \ln\left(I_s\right)\right]$$

$$= \eta\left[\frac{V}{T}\ln(I) - V_T \ln\left(bT^{4+m}\right) + \frac{E_g}{q}\right]$$

$$I \stackrel{?}{\cong} bT^{4+m}$$

$$\frac{\partial I}{\partial T} = b(4+m)T^{3+m}$$

$$= \frac{I}{T}\cdot(4+m)$$

$$\frac{\partial I/I}{\partial T/T} \stackrel{??}{=} (4+m)$$