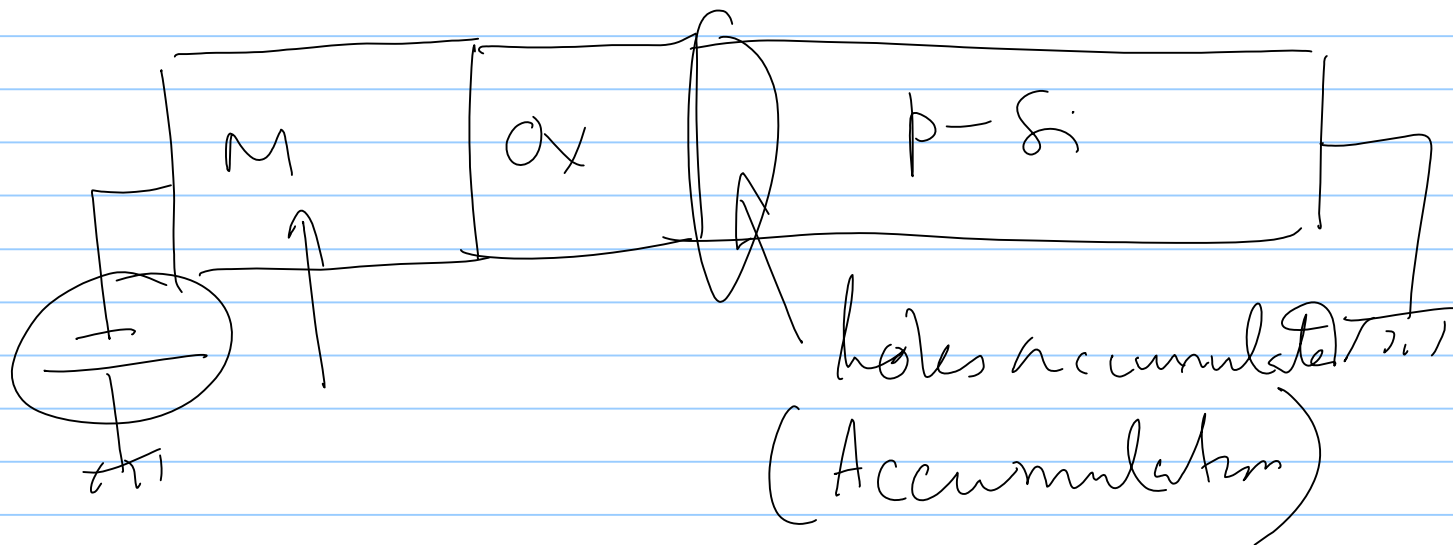


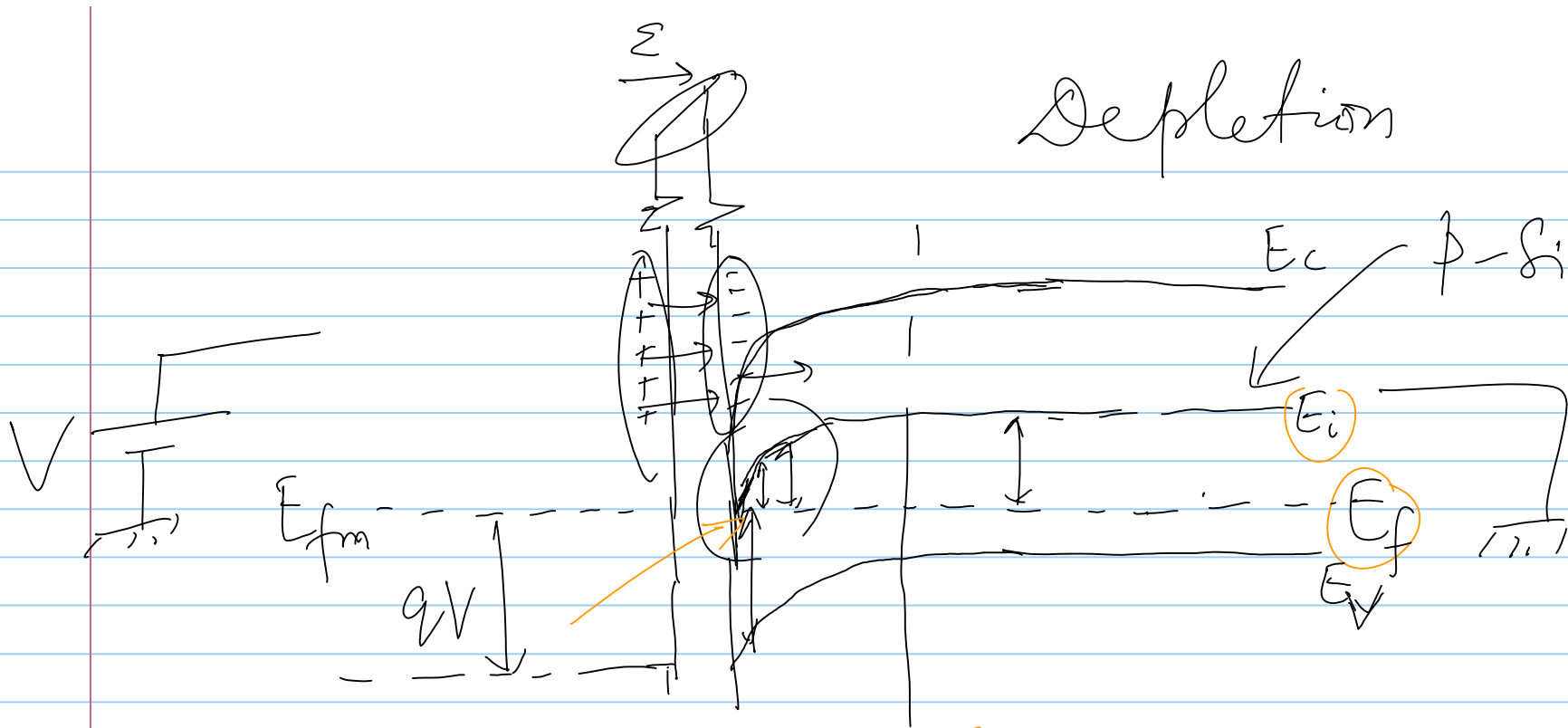
MOS Capacitor Structure

29/10/2014

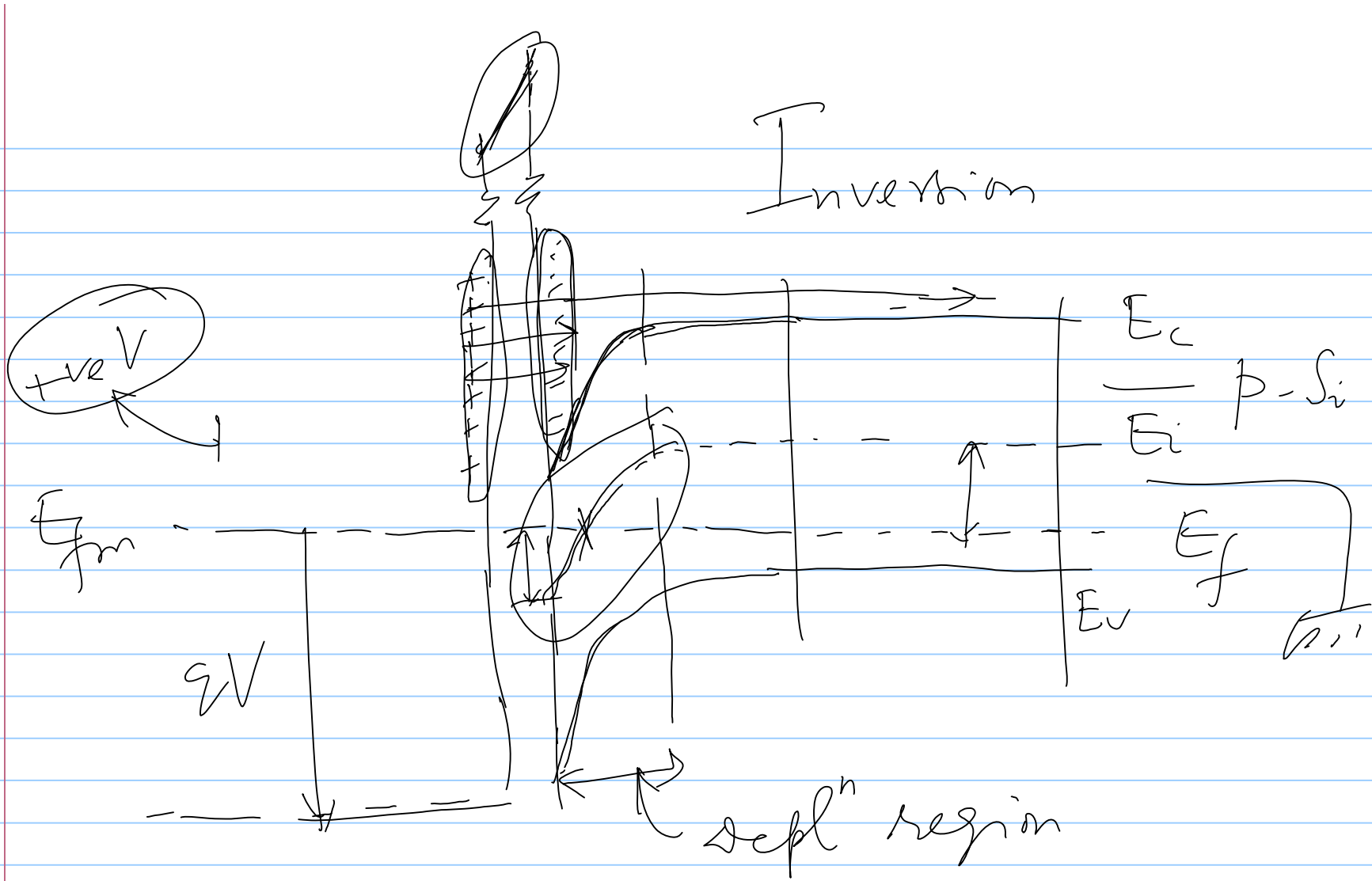
We have already discussed in band diagram for ϵ_b^m & Accumulation

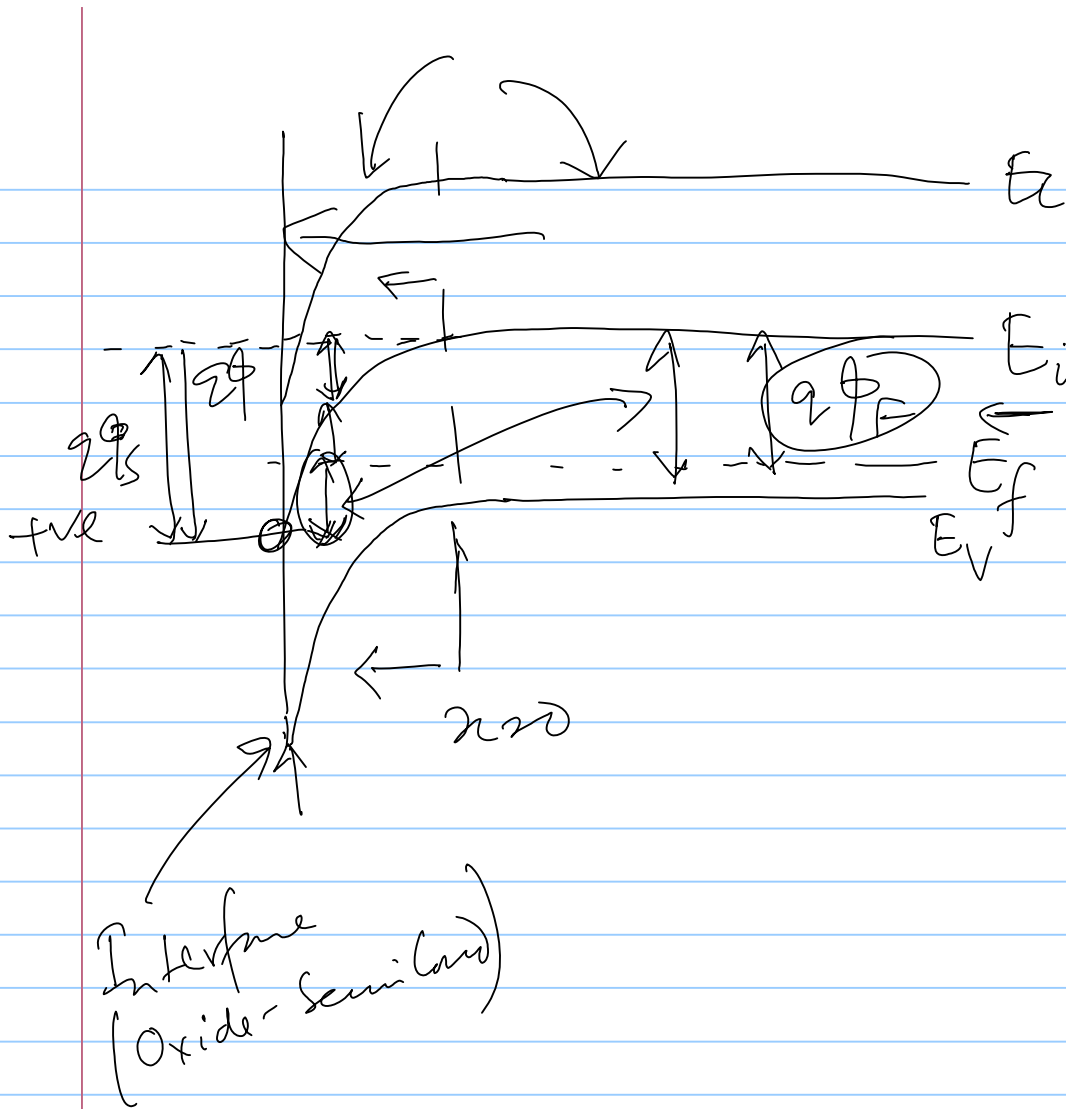


Depletion



$$\phi_s = \phi_F$$





$$E_i - E_f = q\phi_B = q\phi_s$$

$$p_0 = n_i e^{q\phi_B/kT}$$

$$n_0 = n_i e^{-q\phi_B/kT}$$

ϕ_s = Surface potential

$\phi_s = -ve$ for accumulation

$\phi_s = 0$ in eqb^m

$\phi_s = +ve$ for depletion & Inv.

$$\phi = n_i \exp\left(\frac{E_i - E_F}{kT}\right) = n_i \exp\left(\frac{2\phi_F}{kT}\right) \exp\left(-\frac{e\phi}{kT}\right)$$

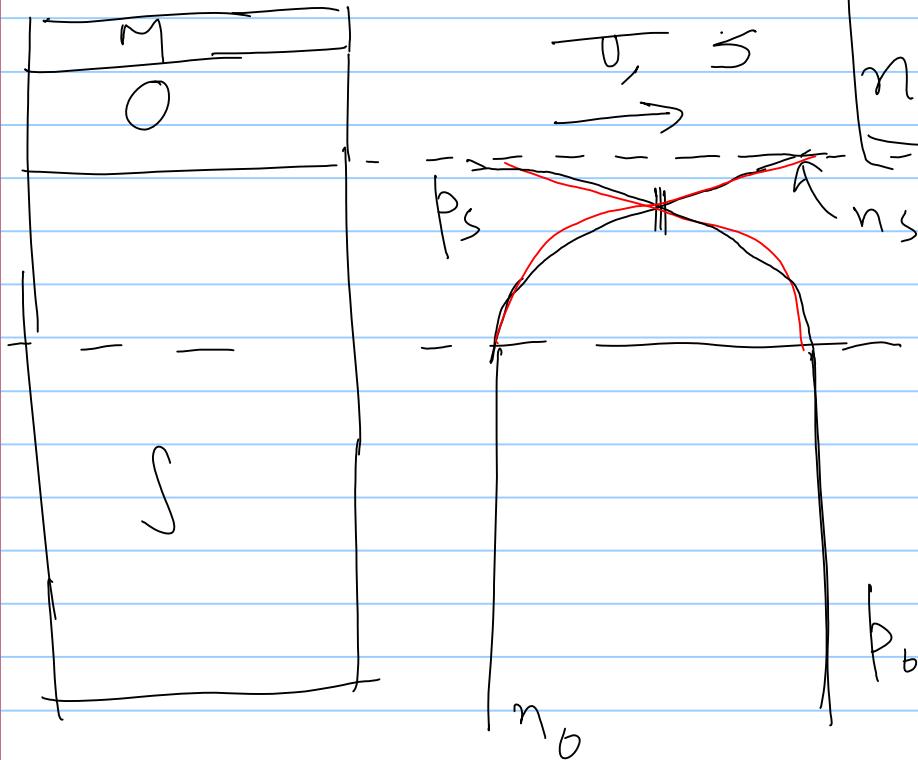
$$p = p_0 \exp\left(\frac{e\phi}{kT}\right)$$

$$n = n_0 \exp\left(-\frac{e\phi}{kT}\right)$$

Strong inversion

$$n_s = p_0$$

$$\phi_s = 2\phi_F$$



$$\rho = q [N_d^+ - N_a^- + p - n]$$

$$p = p_0 e^{-q\phi/kT}$$

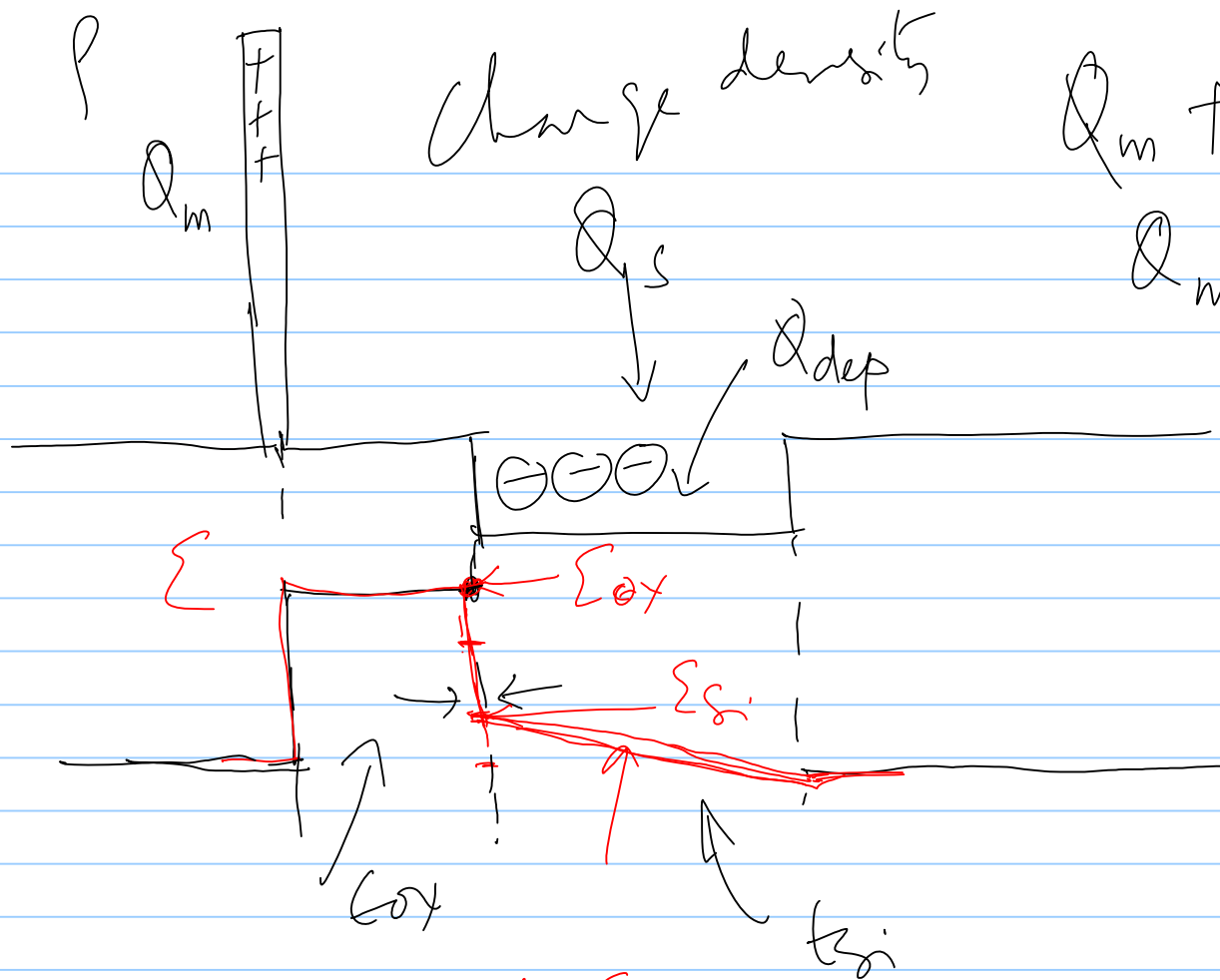
$$n = n_0 e^{q\phi/kT}$$

unknown

unknown

$$\frac{d^2\phi}{dx^2} = -\frac{\rho}{\epsilon} = -\frac{q}{\epsilon} \left[N_d^+ - N_a^- + p_0 e^{-q\phi/kT} - n_0 e^{q\phi/kT} \right]$$

Iterative method



Charge density

$$Q_m + Q_s = 0$$

$$Q_m = -Q_s$$

$$= -[Q_{dep} + \dots]$$

$$\epsilon_0 = 8.85 \times 10^{-14} \text{ F/cm}$$

$$\epsilon_{si} = 11.8$$

$$\epsilon_{SiO_2} = 3.9$$

3x

$$D_{ox} = D_{si}$$

$$t_{ox} \epsilon_{ox} = t_{si} \epsilon_{si}$$

$$\epsilon_{si} = \frac{1}{3} \epsilon_{ox}$$

