

# **EE105**

## **Microelectronic Devices and Circuits: MOS Capacitor**

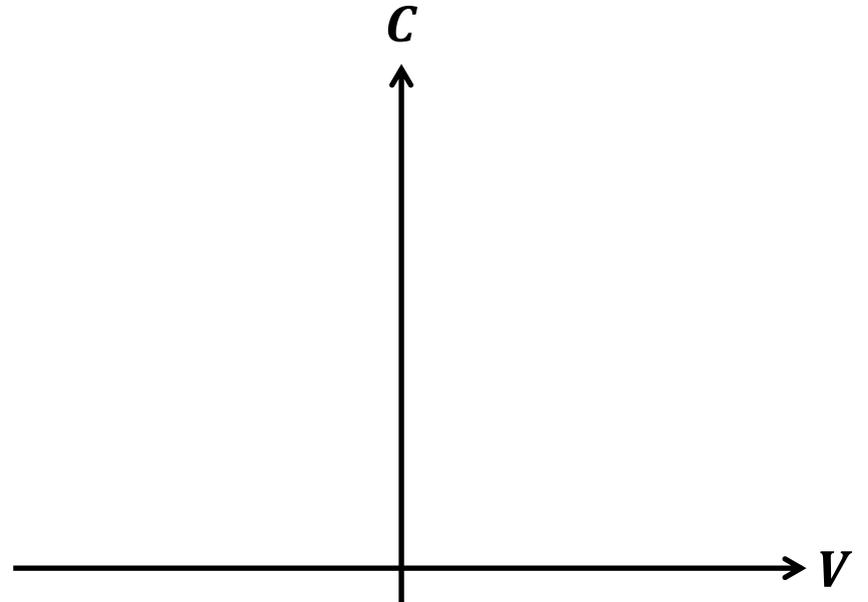
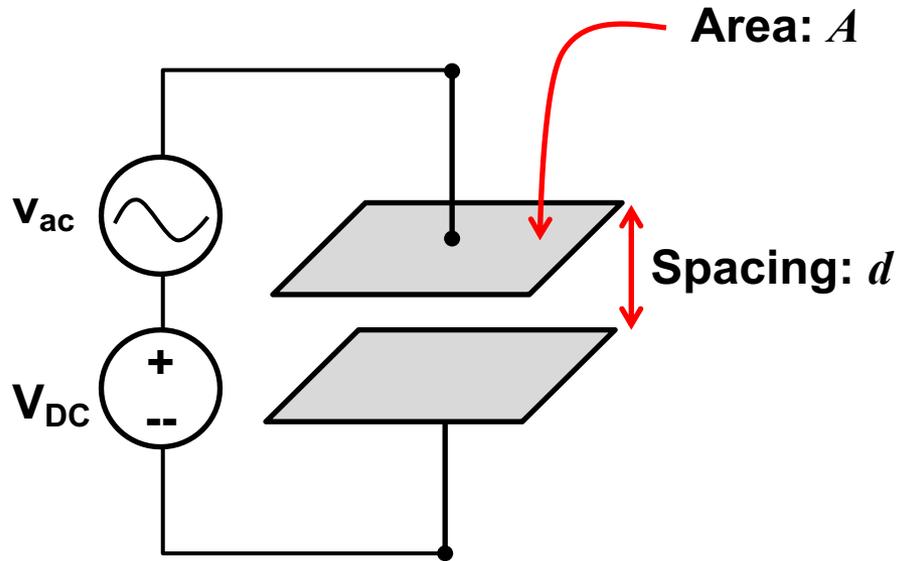
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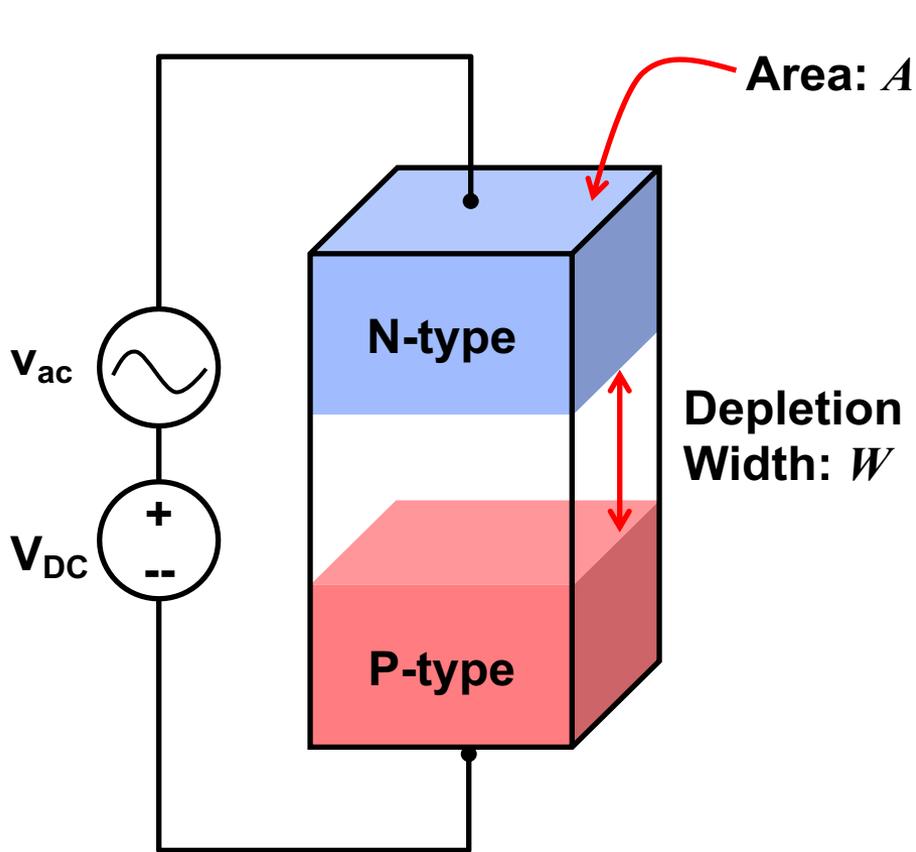
**511 Sutardja Dai Hall (SDH)**

# Linear Capacitor

$$C = \frac{\epsilon A}{d}$$

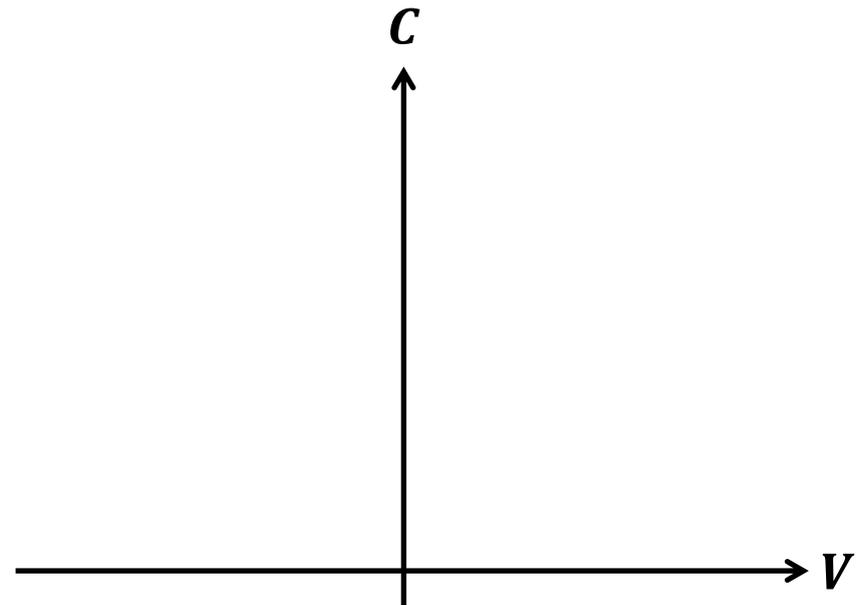


# Nonlinear Capacitor – Reverse-Biased PN Junction

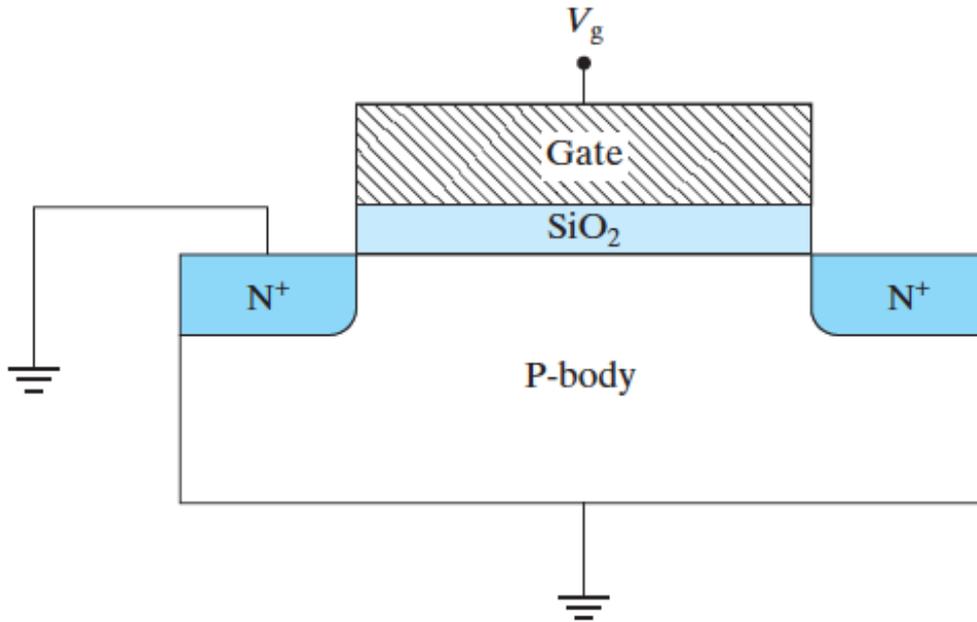


$$C = \frac{\epsilon A}{W}$$

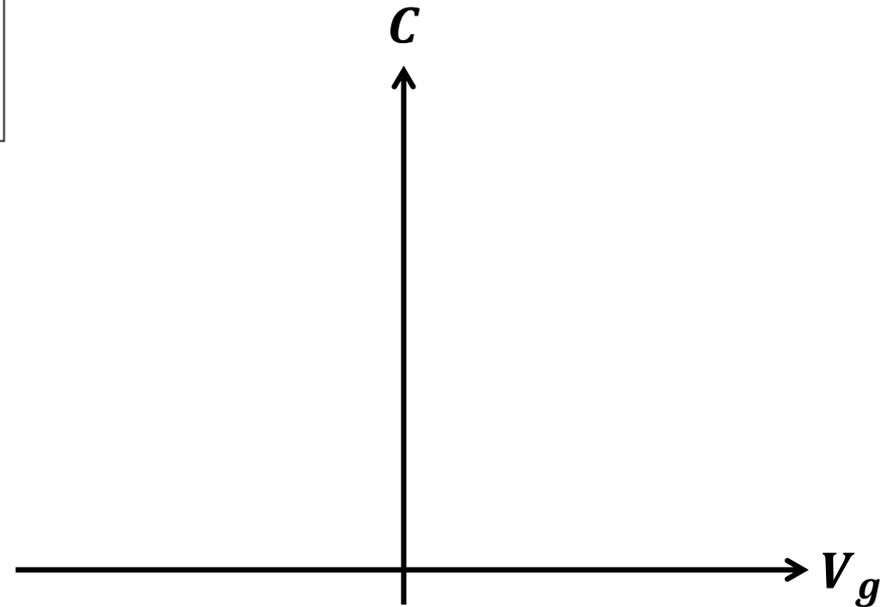
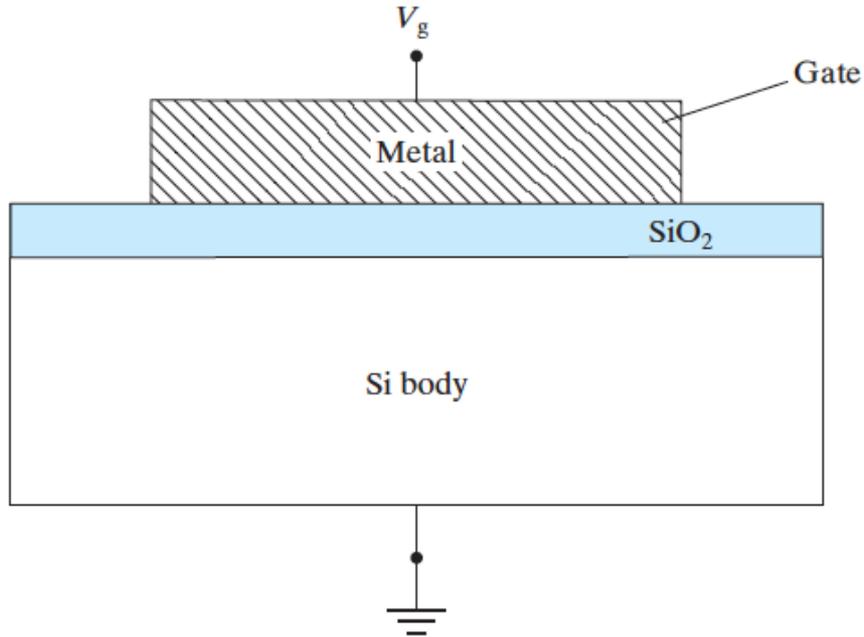
$$W = \sqrt{\frac{2\epsilon_s}{q} \left( \frac{1}{N_D} + \frac{1}{N_A} \right) (V_{bi} + V_{DC})}$$



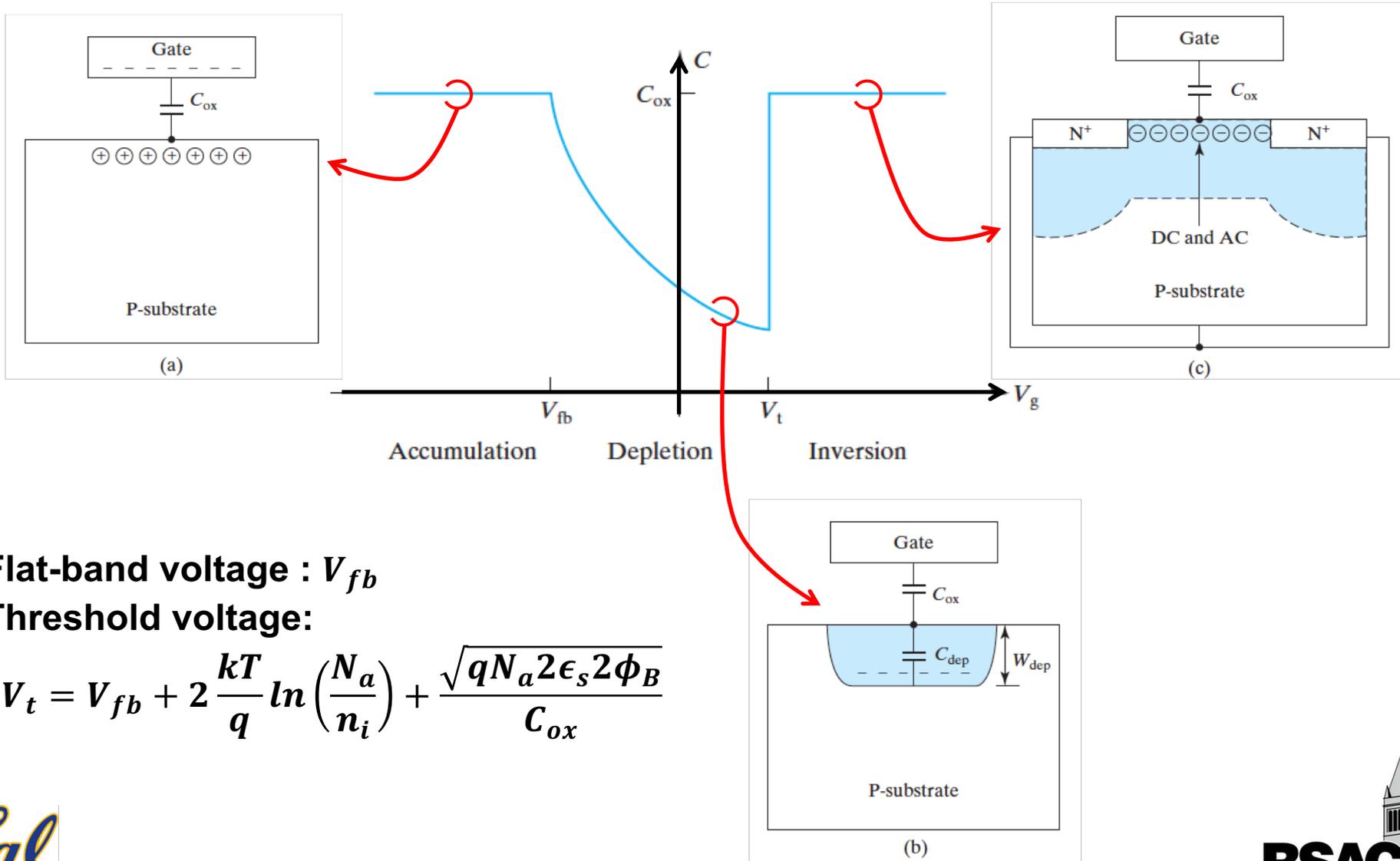
# Metal-Oxide-Semiconductor (MOS): Integral Part of MOS Transistor



# Metal-Oxide-Semiconductor (MOS) Capacitor



# C-V Curve of MOS Capacitor



Flat-band voltage :  $V_{fb}$

Threshold voltage:

$$V_t = V_{fb} + 2 \frac{kT}{q} \ln \left( \frac{N_a}{n_i} \right) + \frac{\sqrt{qN_a 2\epsilon_s 2\phi_B}}{C_{ox}}$$