EEE-1222: Basic Electronics

Computer Science & Engineering (CSE)

Lecture PPT # 02

http://study.riazulislam.com

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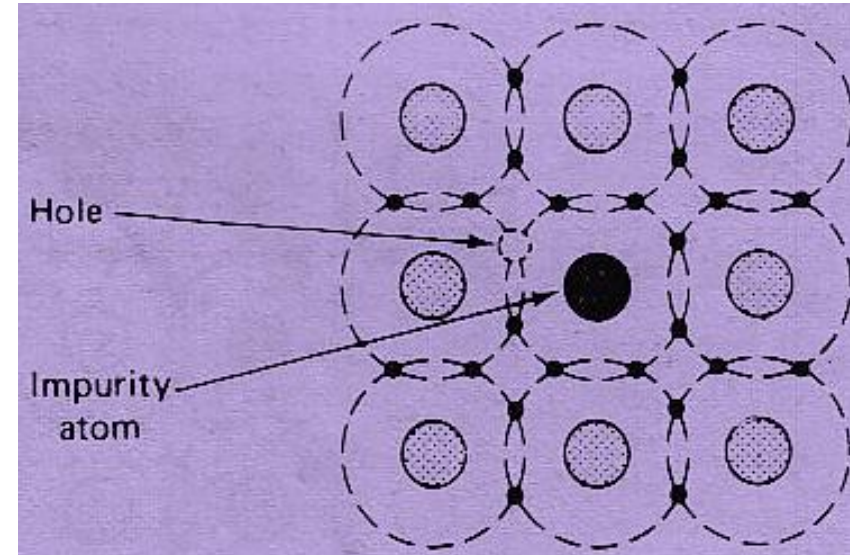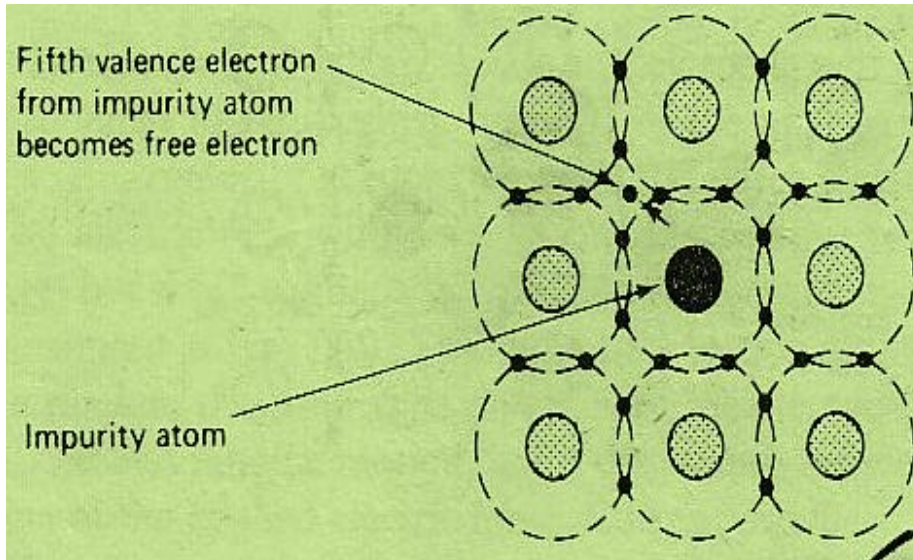**University of Dhaka** | **APECE DU**

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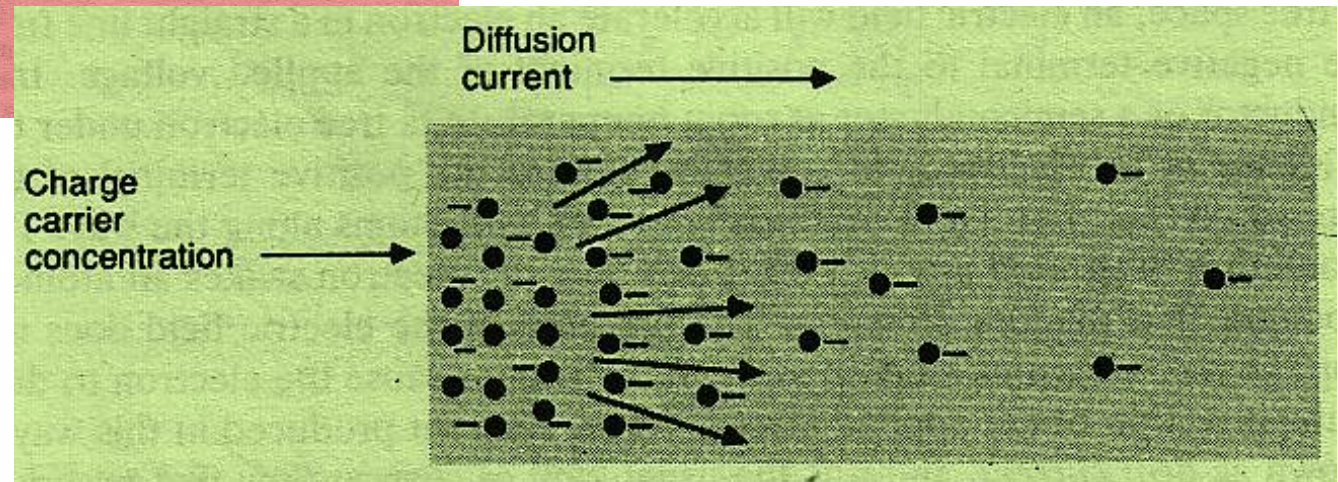
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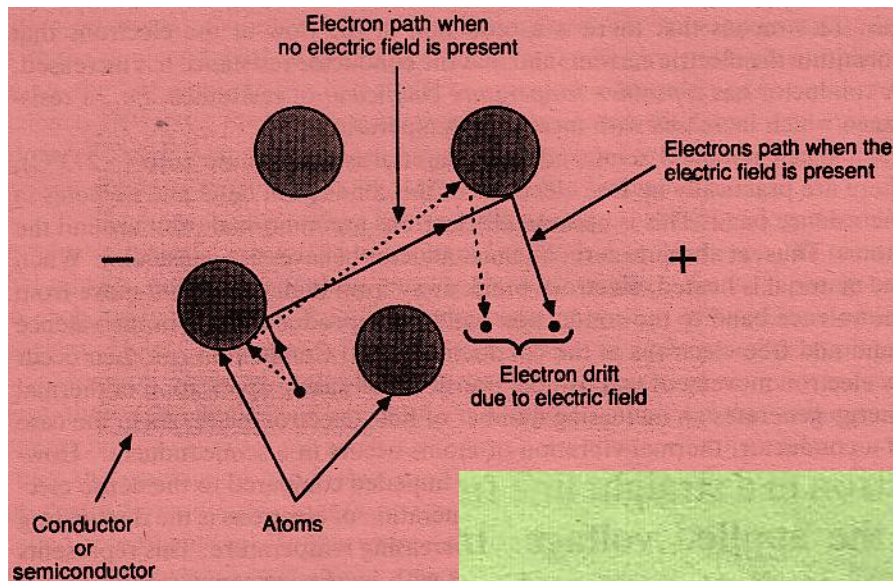
P-type and N-type Semiconductors

❑ Intrinsic: pure semicon

❑ Extrinsic: w. impurity by doping

❑ Donner doping: 5 electrons and 3 holes in valance shell

   ❑ N-type semicon

   ❑ Conduction is largely by electron motion

   ❑ Ex: Sb, P, As

❑ Acceptor doping: 3 electrons and 5 holes

   ❑ P-type

   ❑ Conduction is largely by holes

   ❑ Ex: B, Al, Ga
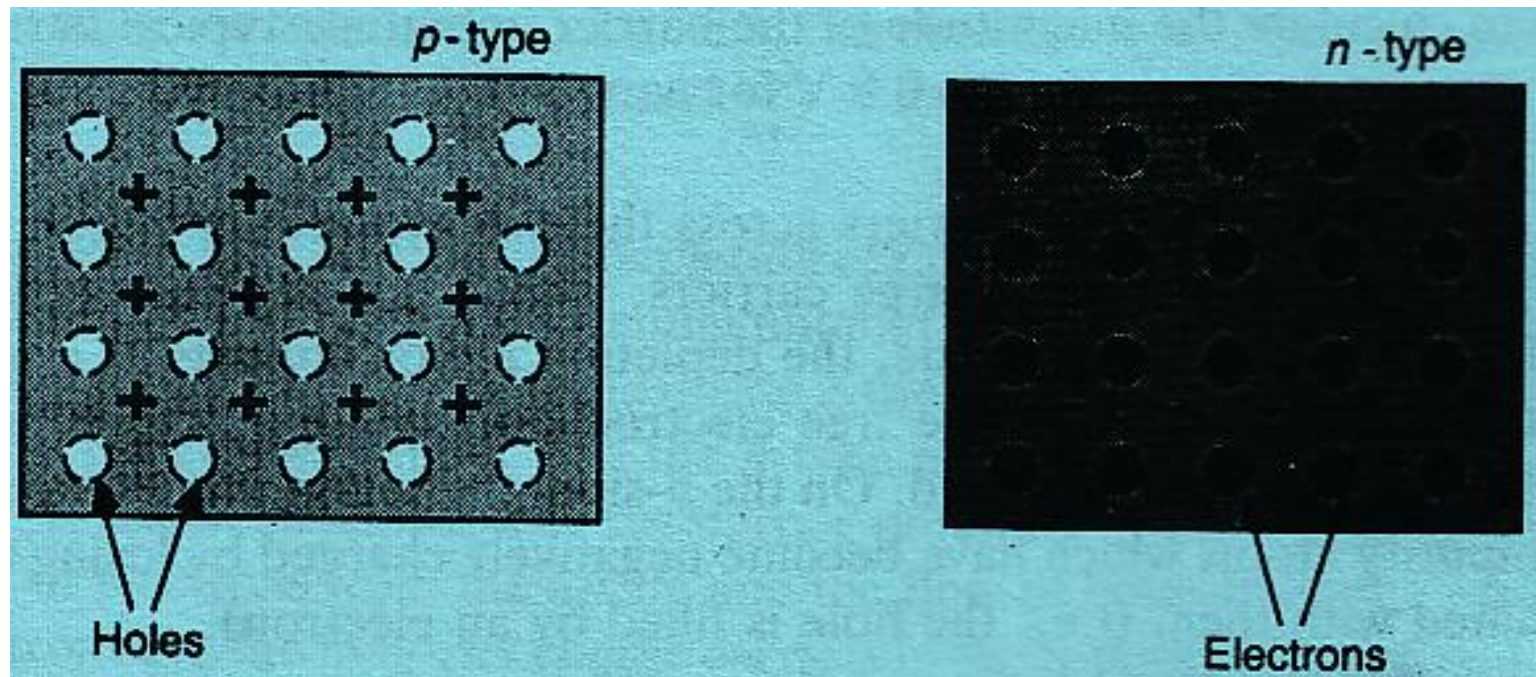
P-type and N-type Semiconductors

- ❑ Conductor: Positive temperature coefficient of resistance
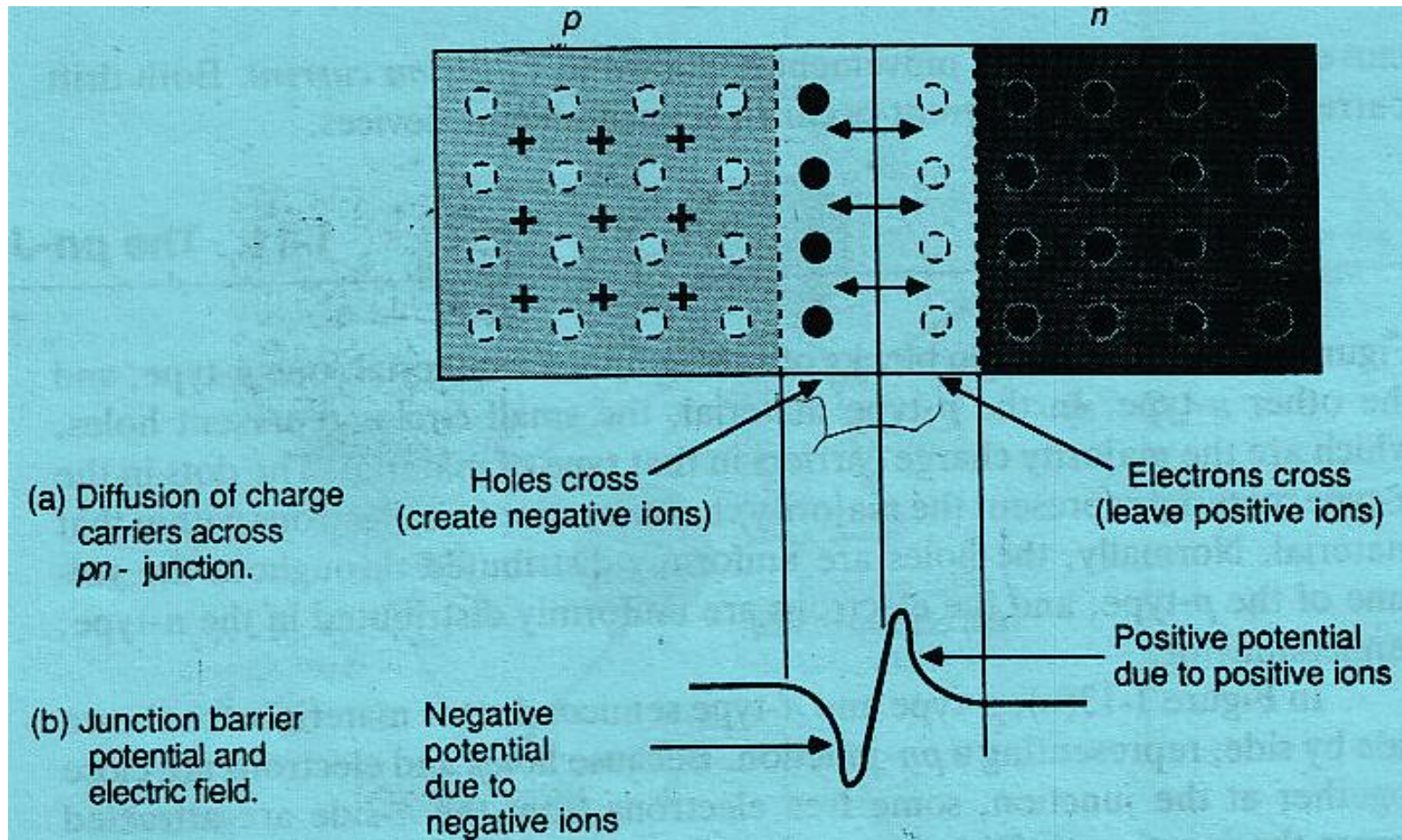- ❑ Semiconductor: Negative temperature coefficient of resistance

# Drift Current and Diffusion Current

The PN-Junction

The PN-Junction

(a) Diffusion of charge carriers across *pn* - junction.

Holes cross (create negative ions)

Electrons cross (leave positive ions)

(b) Junction barrier potential and electric field.

Negative potential due to negative ions

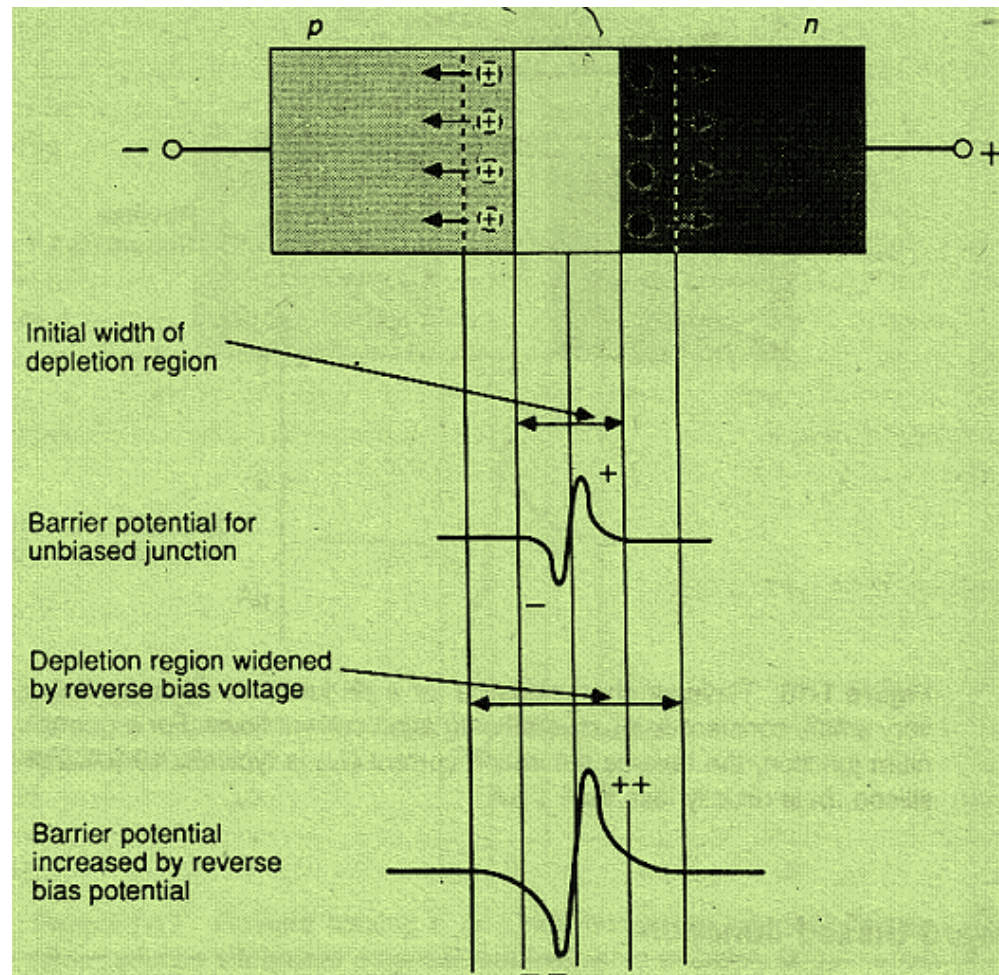Positive potential due to positive ions

The PN-Junction

- The barrier potential prevents the flow of majority carriers and assists the flow of minority carriers from each side of the junction.
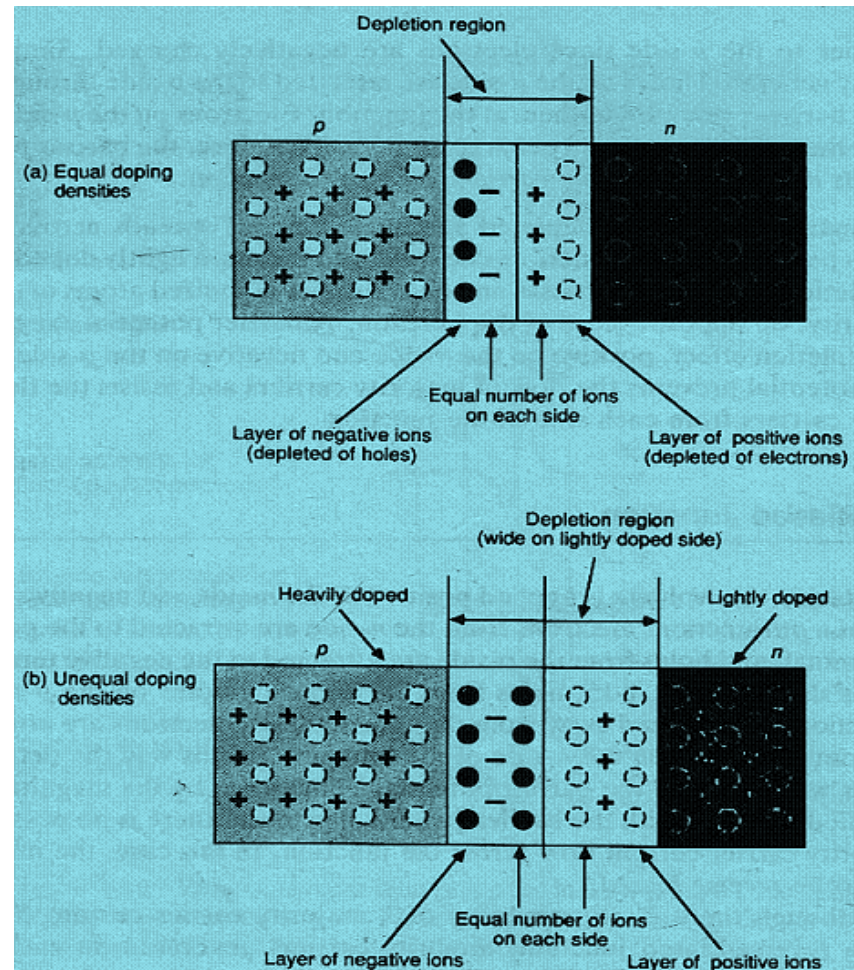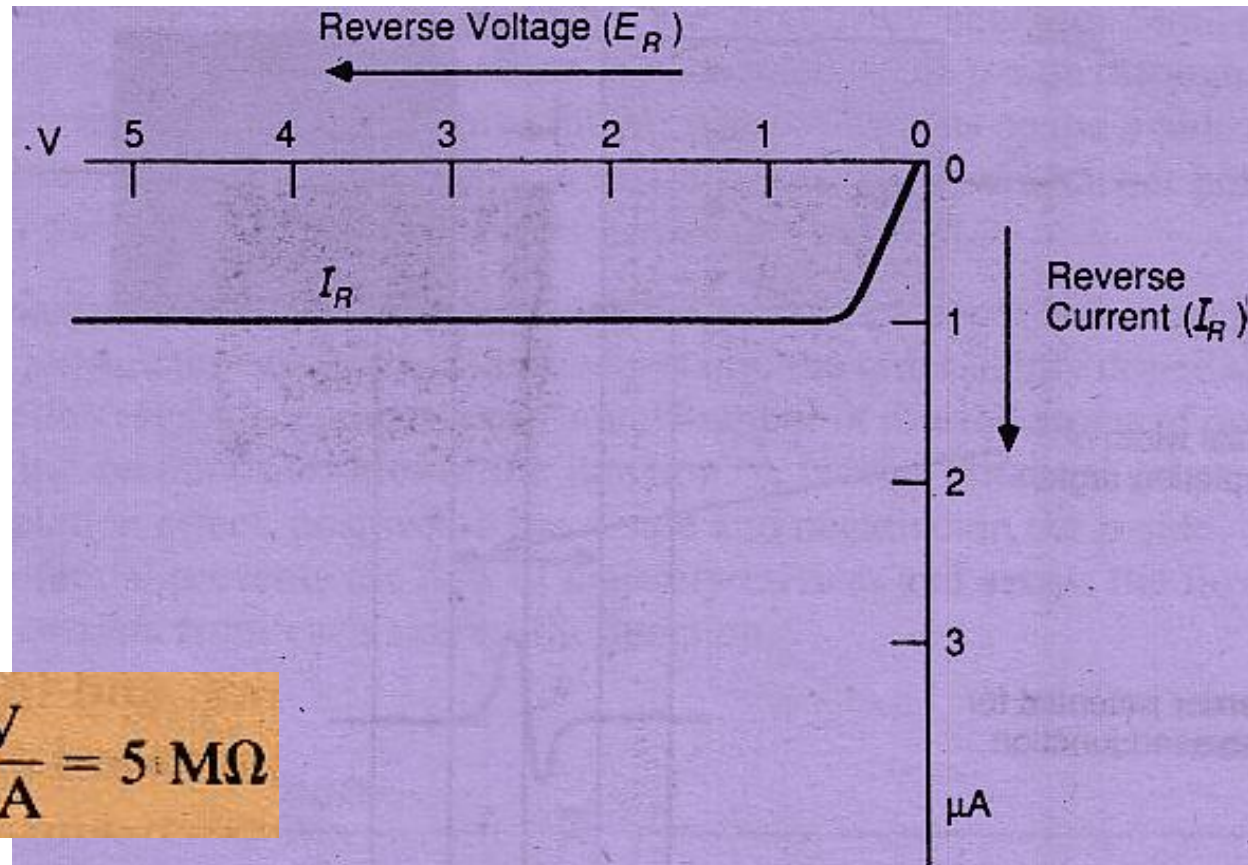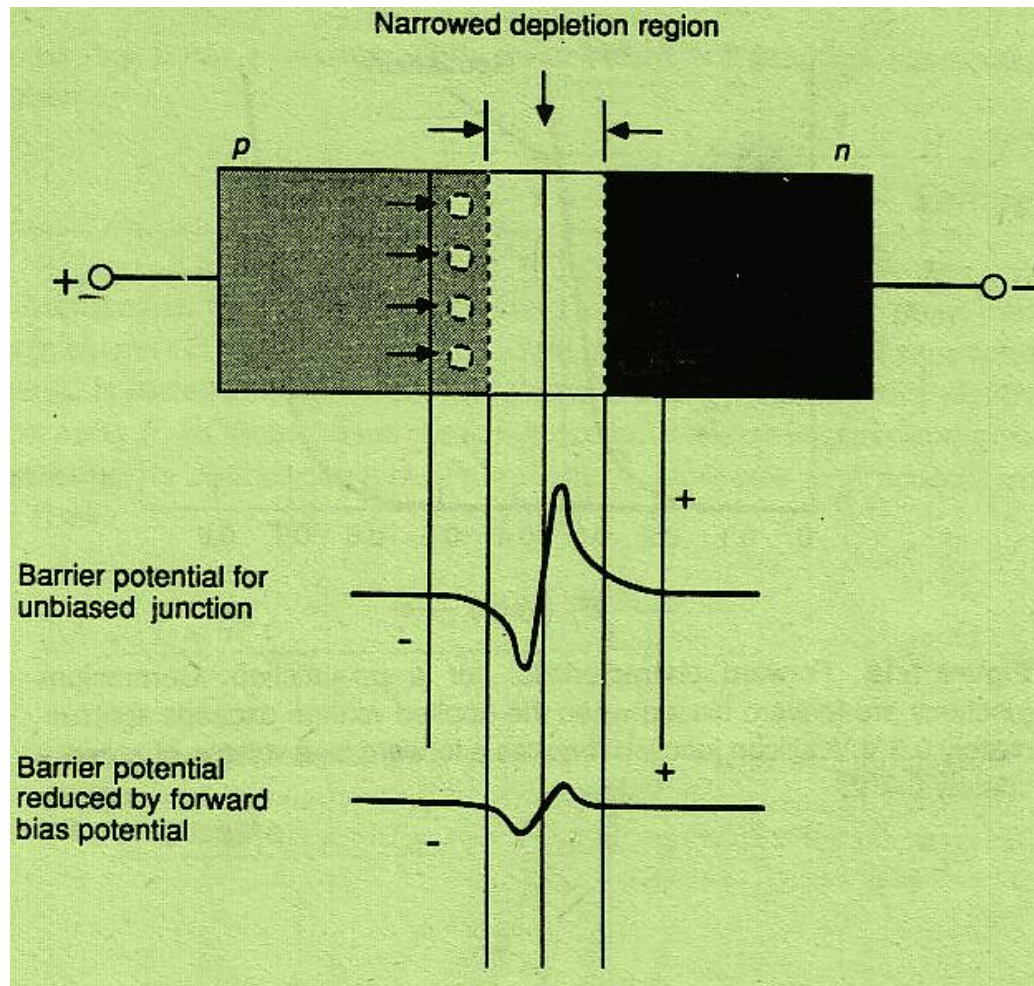
Reversed-Biased Junction

Reversed-Biased Junction

- ❑ For Si, I_R is less than 1 microA and may be as low as 1 nA.
- ❑ For Ge, I_R may exceed 10 microA.
- ❑ Represented by a very large resistance

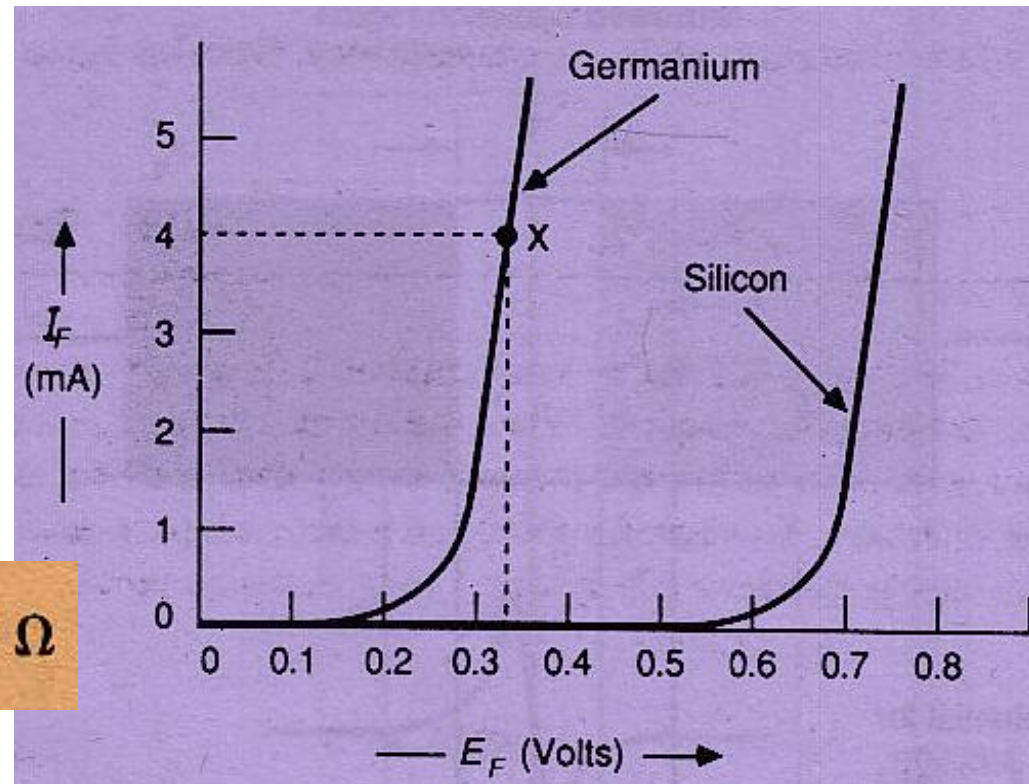$$R_R = \frac{5\text{ V}}{1\ \mu\text{A}} = 5\text{ M}\Omega$$

Forward-Biased Junction
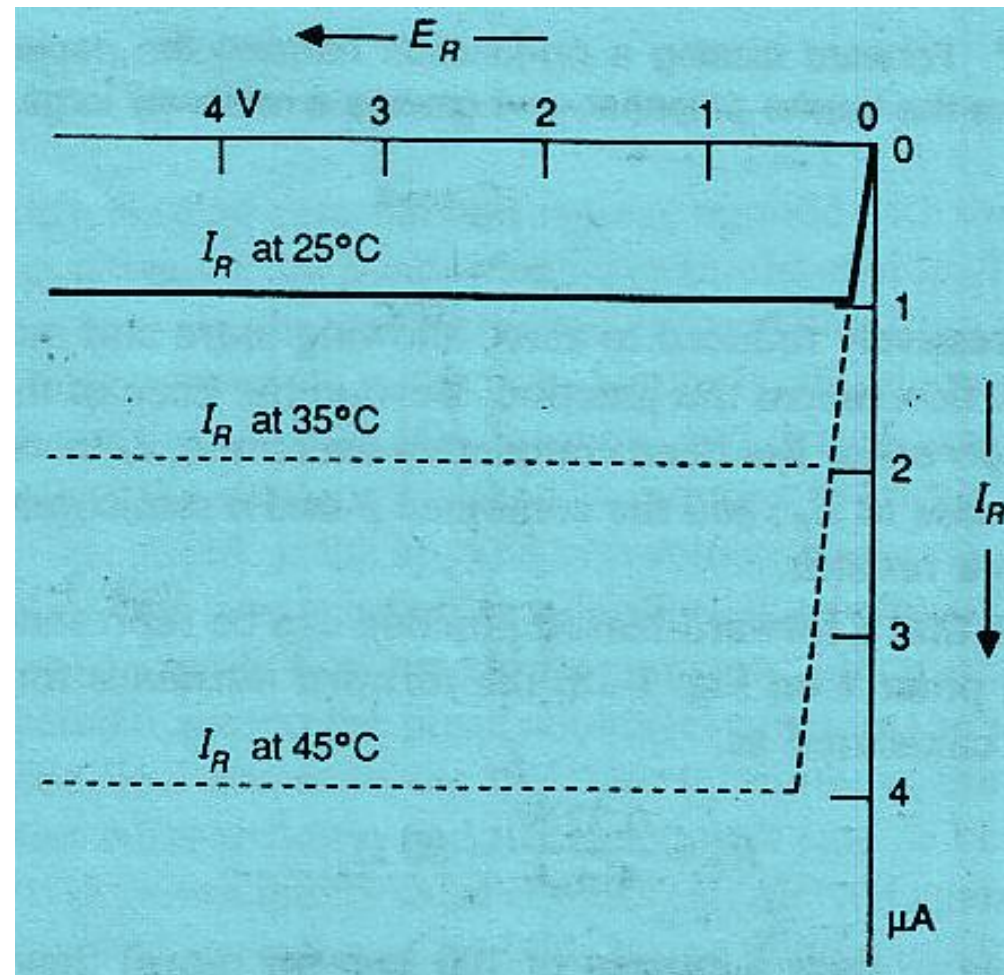
Forward-Biased Junction

- Possible to have 100 mA current.

- FB: low resistance

- RB: high resistance

$$R_F \approx \frac{0.32 \text{ V}}{4 \text{ mA}} = 80 \ \Omega$$
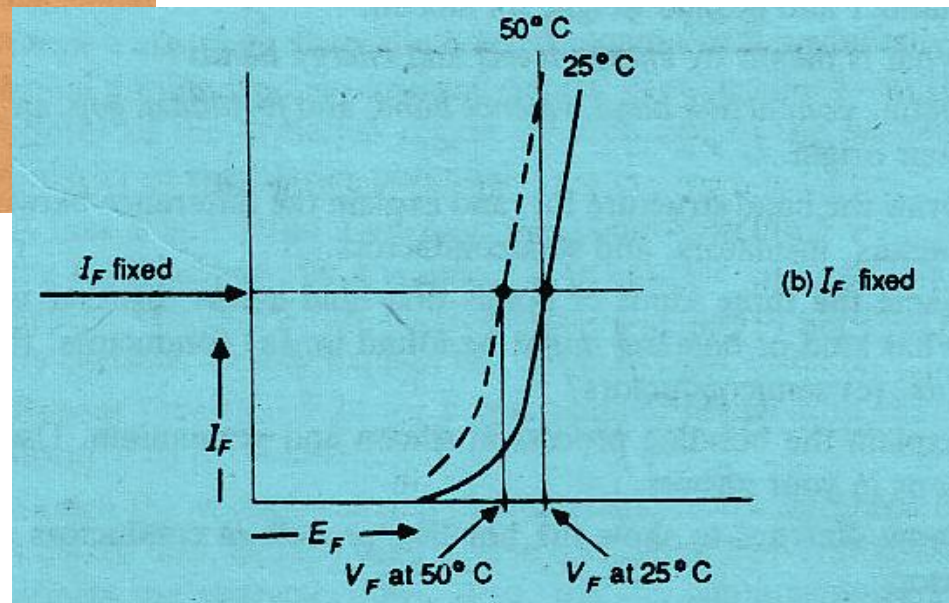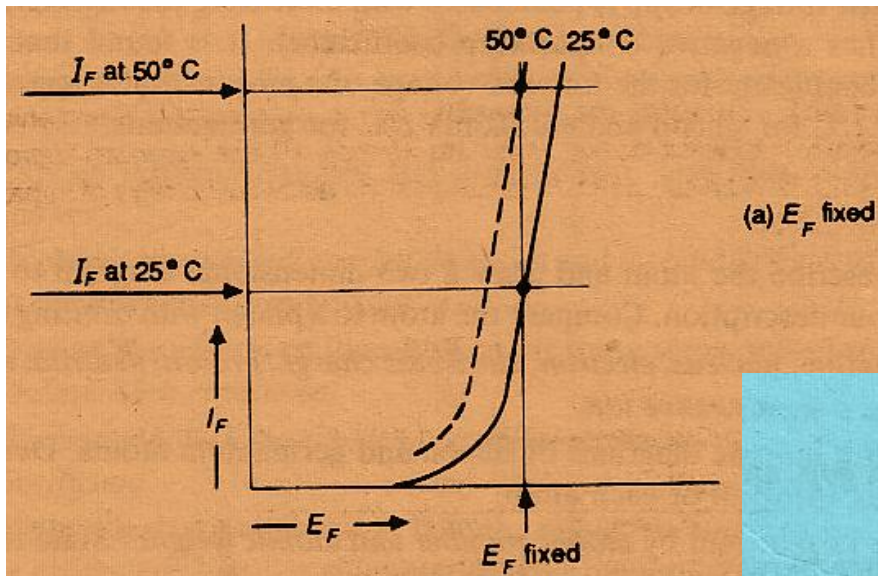
Temperature Effect

❑ I_R depends upon electronic charge, doping density, junction area and temp.

❑ IR approx. doubles for each 10 deg C increase in temp.

Temperature Effect

Q & A