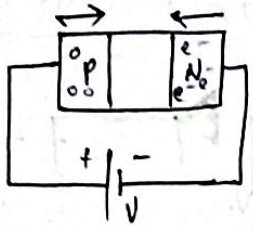
→ Energy Gap : ① Conductors : $E_g = 0$
② Semi-C : $E_g < 3eV$
③ Insulators : $E_g > 3eV$

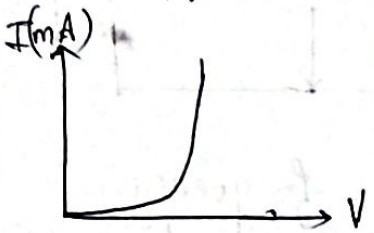
* $I_E = I_C + I_B$

$\alpha = \frac{I_C}{I_E}$ $\quad \beta = \frac{I_C}{I_B}$

$\alpha_{DC} = \frac{\beta_{DC}}{\beta_{DC}+1}$ $\quad \beta_{DC} = \frac{\alpha_{DC}}{1-\alpha_{DC}}$

① Forward Biasing:

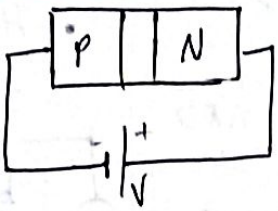


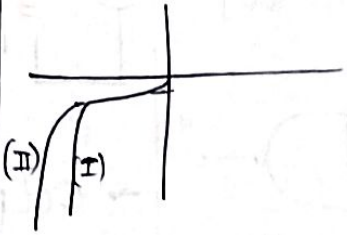


#Diode: Non-ohmic conductors

Ideal $r_f \approx 0$

Reverse Biasing





I → zener Break
II → Avalanche Break

Ideal $r_f \Rightarrow \infty$

→ LED

(AlGaAs) → I.R
(GaAsP) → Red or Yellow
(AlGaP) → red or green
(ZnSe)] → blue light
(SiC)]

Al → Aluminium
P → Phosphide
Se → Selenide
Ga → gallium
Si → Silicon
C → Casbide

Rectifiers

$$\eta = \frac{I_{avg}^2 R_L}{I_{rms}^2 (r_f + R_L)}$$

$$\gamma = \sqrt{\frac{(I_{rms})^2}{(I_{avg})^2} - 1}$$

① Half wave .R

$$\eta = \frac{0.406}{\left(1 + \frac{r_f}{R_L}\right)}$$

$\eta_{max} = 0.406$

$\%\eta_{max} = 41.6\%$

$\gamma = 1.21$

$f = 1.57$

② full wave .R

$$\eta = \frac{0.812}{\left(1 + \frac{r_f}{R_L}\right)}$$

$\eta_{max} = 0.812$

$\%\eta_{max} = 81.2\%$

$\gamma = 0.48$

$f = 1.11$

Zener diode

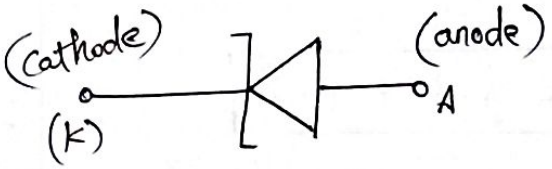
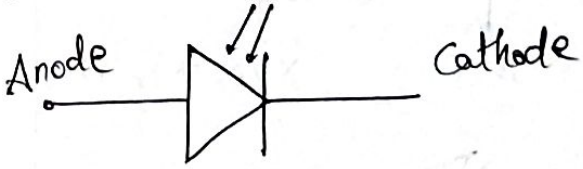
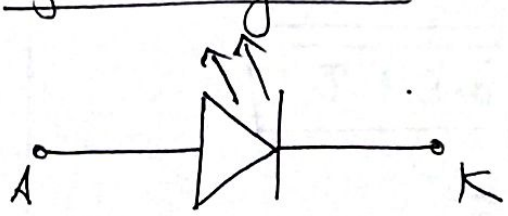


Photo diode:



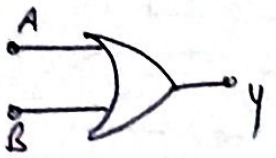
Light Emitting diode [LED]:



LOGIC

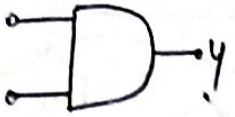
① **OR**

$Y = A + B$



② **AND**

$Y = A \cdot B$

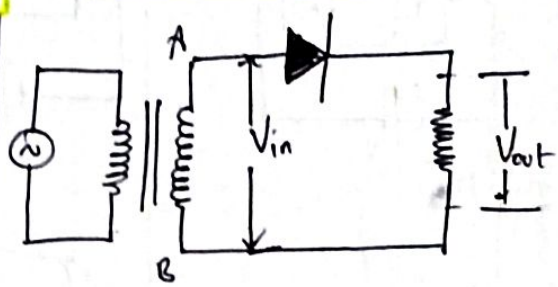


③ **NOT**

$Y = \overline{A}$

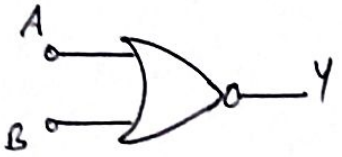
Ripple factor $=$ $\frac{\text{r.m.s of AC component}}{\text{value of DC component}}$

• **Half wave Rectifier:**



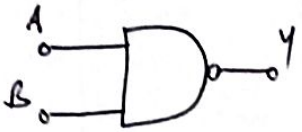
→ Output frequency is same as that of input.

④ **NOR:** → OR + NOT



$Y = \overline{A + B}$

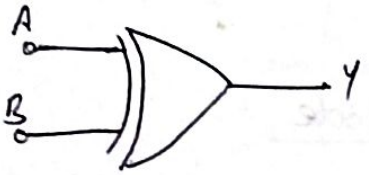
⑤ **NAND** → AND + NOT



$Y = \overline{A \cdot B}$

⑥ **Ex-OR:**

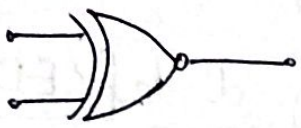
2 NOT + 2 AND + one-OR



$Y = \overline{A} \cdot B + \overline{B} \cdot A$

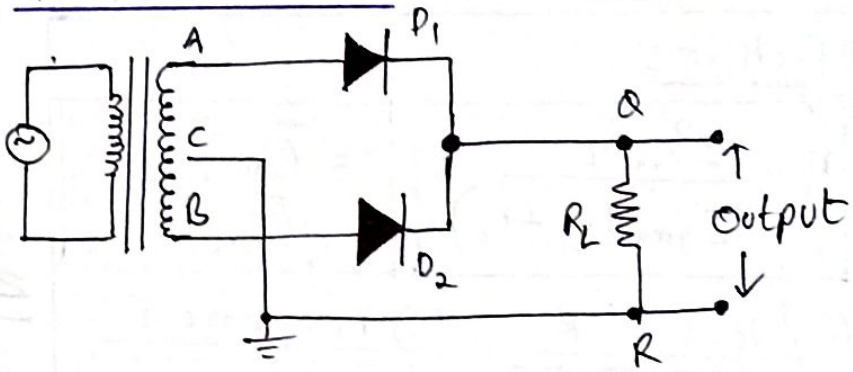
⑦ **Ex-NOR:**

NOT XOR or Ex-OR



$Y = \overline{\overline{A} \cdot B + \overline{B} \cdot A}$

Full wave Rectifier



→ Output frequency is twice that of input frequency.