07/06/2L.

Voltage Multiplier circuits :

$\dfrac{20V}{IIP}$ O/P

$40V = 20V \times 2 \Rightarrow$ Voltage Doubler
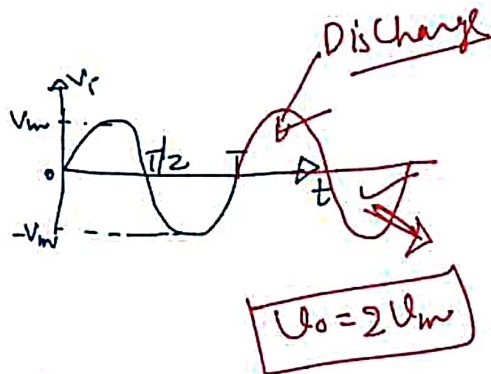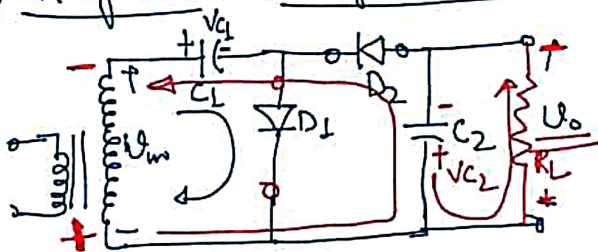
$60V = 20V \times 3 \Rightarrow$ Voltage Tripler

$80V = 20V \times 4 \Rightarrow$ Voltage Quadrupler.

Voltage Doubler
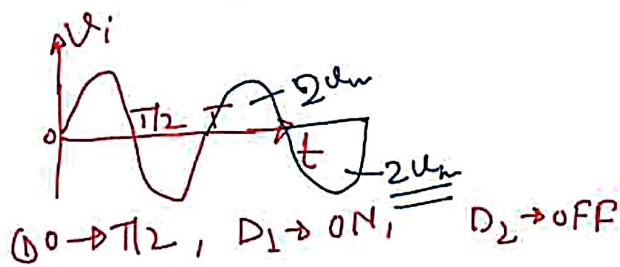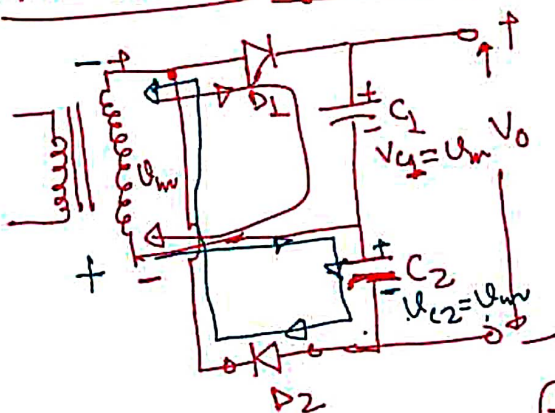
① Half-wave Voltage Doubler

② Full wave Voltage Doubler.

① Half Wave Voltage Doubler

$$V_o = 2V_m$$

① $0 \to T/2$ $D_1 \to ON$, $D_2 \to OFF$

$$\vartheta_m - V_{C_L} = 0 \Rightarrow \boxed{V_{C_1} = \vartheta_m}$$

② $T/2 \to T$ $D_1 \to OFF$, $D_2 \to ON$

$$V_m - V_{C_2} + V_{C_1} = 0 \Rightarrow V_{C_2} = V_m + V_{C_1} = V_m + V_m = 2V_m$$

$$\vartheta_o = \vartheta_{C_2} = 2\vartheta_m = 2V_i \qquad \boxed{V_o = 2V_i}$$

② Full Wave Voltage Doubler

① $0 \to T/2$, $D_1 \to ON$, $D_2 \to OFF$

$$\vartheta_m - V_{C_1} = 0$$

$$\boxed{V_{C_1} = \vartheta_m}$$

② $T/2 \to T$, $D_1 \to OFF$, $D_2 \to ON$

$$\vartheta_m - \vartheta_{C_2} = 0 \Rightarrow \boxed{V_{C_2} = \vartheta_m}$$

$$\vartheta_0 = V_{C_1} + V_{C_2} = \vartheta_m + \vartheta_m = 2\vartheta_m = 2V_i$$

$$\vartheta_0 = V_{C_1} + \vartheta_{C_2} = \vartheta_m + \vartheta_m = 2\vartheta_m = 2V_i$$

$$\boxed{\vartheta_0 = 2\vartheta_i}$$

Voltage Triplev and Quadrupler :-

① 1st Half cycle ⇒ $\vartheta_m - V_{C_1} = 0$ ⇒ $V_{C_1} = \vartheta_m$

② 2nd Half cycle ⇒ $\vartheta_m - V_{C_2} + \vartheta_m = 0$ ⇒ $\vartheta_{C_2} = 2\vartheta_m$

③ 3rd Half cycle ⇒ $\vartheta_m - \vartheta_{C_1} - \vartheta_{C_3} + \vartheta_{C_2} = 0$

$$\boxed{\vartheta_{C_3} = \vartheta_m + \vartheta_{C_2} - \vartheta_{C_1} = \vartheta_m + 2\vartheta_m - \vartheta_m = 2\vartheta_m}$$

4th Half cycle

$$\vartheta_m - \vartheta_{C_2} - \vartheta_{C_4} + \vartheta_{C_3} + \vartheta_{C_1} = 0$$

$$\vartheta_{C_4} = \vartheta_m - \vartheta_{C_2} + \vartheta_{C_3} + \vartheta_{C_1}$$
$$= \vartheta_m - 2\vartheta_m + 2\vartheta_m + \vartheta_m = 2\vartheta_m$$

$$\boxed{\vartheta_{C_4} = 2\vartheta_m}$$
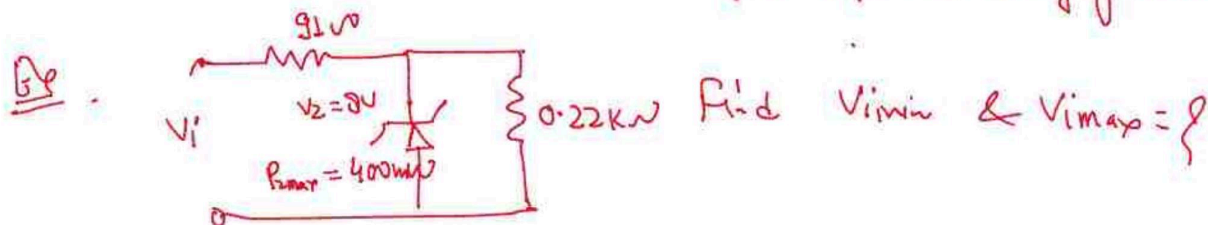
Voltage Regulator.

B1)

220Ω $V_2 = 10V$

20V $P_{max} = 400mW$
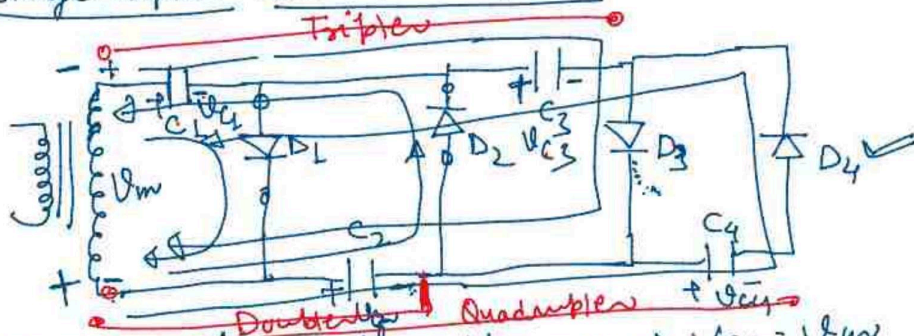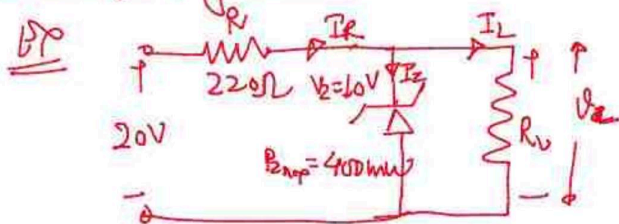
① Determine, I_L, V_L, I_Z, I_R
   H $R_L = 180\Omega$.

② if $R_L = 470\Omega$

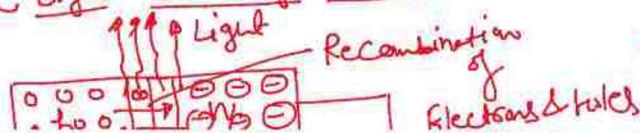③ Find $R_{L\,maximum}$ and R_{Lmin}
   for proper working of Zener.

B2).

91Ω

V_i $V_Z = 8V$ 0.22KΩ   Find V_{imin} & $V_{imax} = ?$

$P_{max} = 400mW$

08/06/21.
Special Diodes .

1. LED (Light Emitting Diode)

Light — Recombination of Electrons & holes

LASER

E — Light

Recombination of Electrons & holes
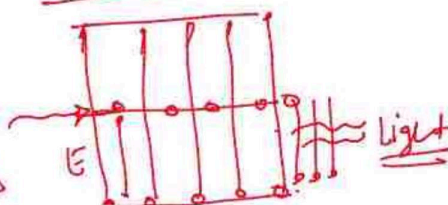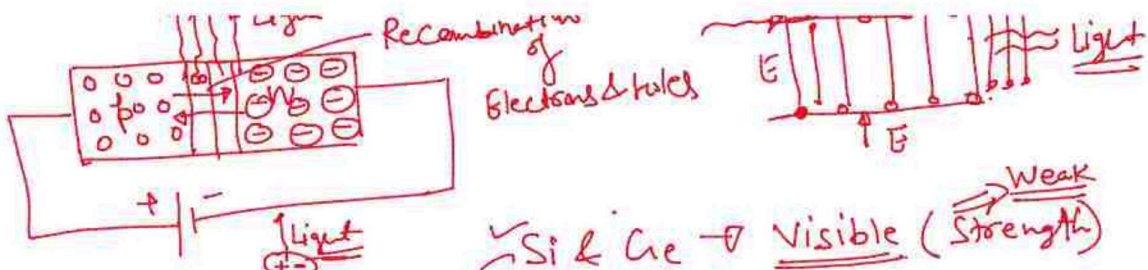
Light

Wavelength

Recombine

Si & Ge → Visible (Strength) Weak

GaAs → Invisible (infrared)

GaAsP
GaP

High
Intensity → weak

{ GaN ──────→
  GaP ──────→ ▷
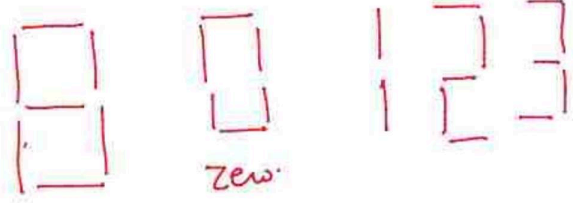 GaAsP ────→ ▷ } Visible, good Strength
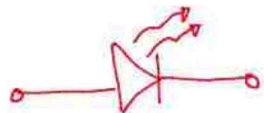
Forward Biased

LED   Symbol
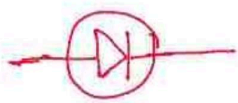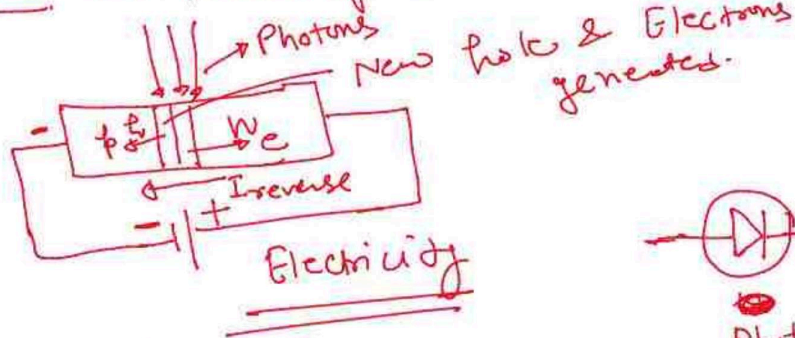
Application :- ① Traffic Signal
              ② Display Board
              ③ Light

Seven Segment Display →

Zero

LED → LCD
old   New

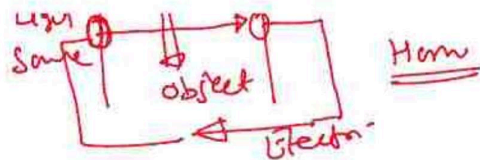2. Photodiodes → Reverse of LED → Recombination

→ Photons
New hole & Electrons generated

p⁺ | n⁻

I reverse

Electricity

Photodiodes

① Solar Light
② Counting of object
③ Scanning System

Light Source

object

Photodiodes

Here

(3) Security System

• 1+1+1

UV Source → object → PQ → Horn

← detector
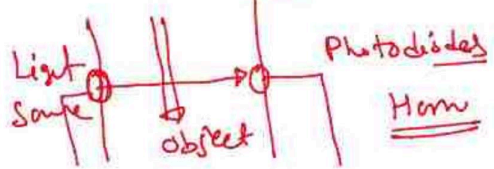
(3) VARACTOR (VARICAP) DIODES

Variable Capacitance

$$C_T = \frac{\varepsilon A}{W_d}$$

$V \uparrow \quad W_d = \uparrow \quad \downarrow C_T$

$$C_T = \frac{K}{(V_T + V_R)^n}$$
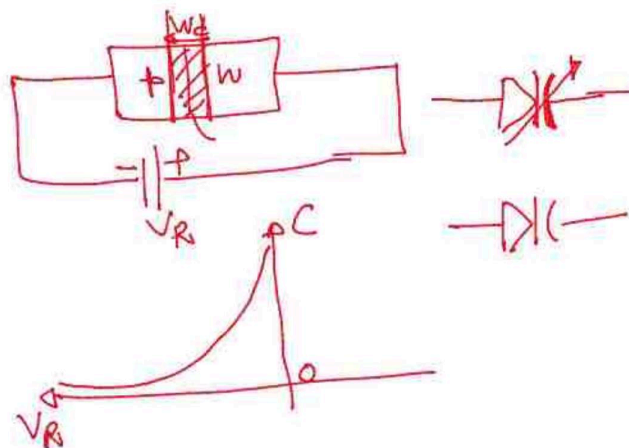
Application ① Tunning of oscillator → Communication.

$$f = \frac{1}{2\pi\sqrt{LC}}$$

$$\boxed{f \propto \frac{1}{\sqrt{C}}}$$
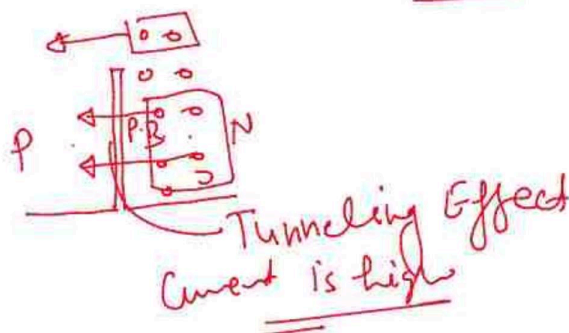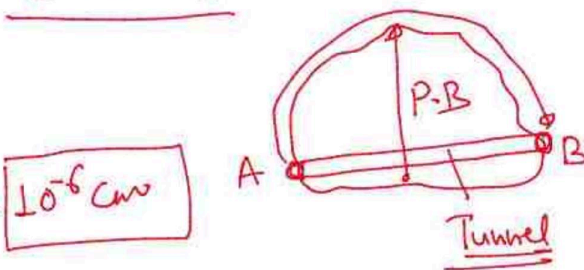
(4) Tunnel Diodes

Normal Diodes	Tunnel Diodes
Doping Concentration is Less	Doping Concentration is very High
	1000times

≈

10^{-6} cm

P.B

A ●——————● B

Tunnel

2 Electron

Normal Diode

Tunneling Effect
Current is high

I [line]

Normal Diode

Current is high

I

I_P

Negative Resistance

Normal Diode

V_P V_V V_D

E_C
P-side
E_V
N-Side
P-B
o o o o o o E_C
o o o o E_V

Normal Diode

E_C
P-Side
E_V
N-Side
o o o o o E_C
E_V
①

Tunnel Diode

E_C
E_V
P-side
N Side
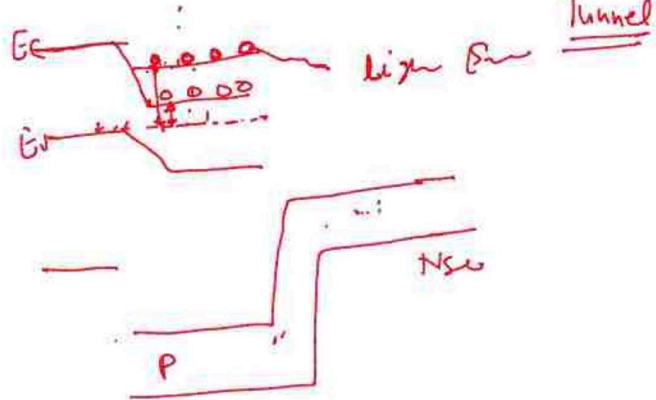o o o o E_C
E_V
②

E_C
E_V
o o o o
o o o o
Light Em
Tunnel

P
N Side
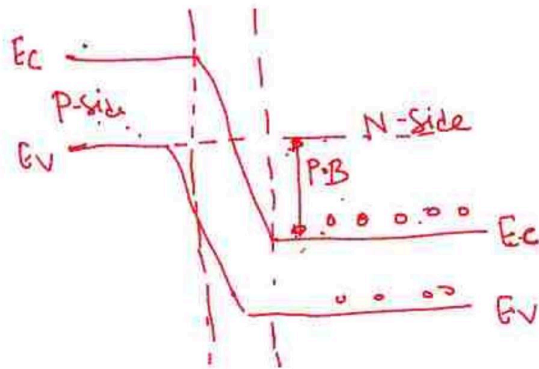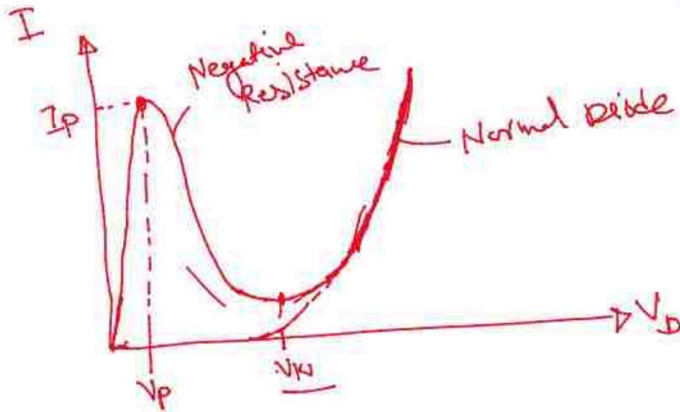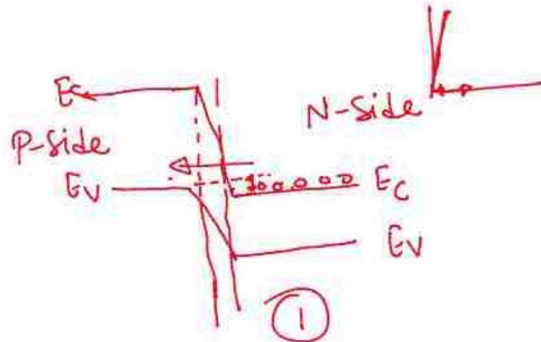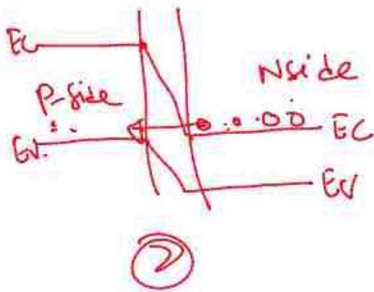
Application ① High Speed Devices (Switching time)
② Microwave Device (High frequ.)
MHz