Electronics Lab

Solution Lab Test 1

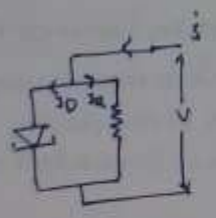
stion 1:- A resistor R is placed parallel to a Ge tunnel diode The tunnel diode has

$$\left|\frac{di_d}{dv}\right|_{max} = \frac{1}{10}\ \mho$$

Find the value of R so that the combination does not exhibit negative resistance region in Volt ampere characteristics

Sol. The combination is called as tunnel resistor. If VI characteristics were to exhibit no negative resistance region, the slope of the curve

$$\left|\frac{di}{dv}\right| \geq 0 \quad \text{for all } v$$




$$I = i_D + i_R$$

$$I = I_D + \frac{V}{R}$$

$$\frac{di}{dv} = \frac{di_D}{dv} + \frac{1}{R} \geq 0$$

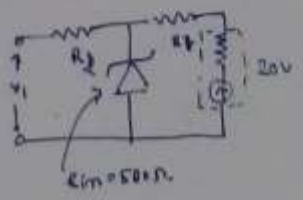
$$\frac{1}{R} \geq \left|\frac{di_d}{dv}\right|$$

But it is given that $\left|\frac{di_D}{dv}\right|_{max} = \frac{1}{10}\ \mho$

Therefore R should be at least 10Ω, so that there is no negative resistance region in characteristics

Question:- The zener diode can be used to prevent overloading of sensitive meter movement without affecting meter linearity The circuit shown represents a DC voltmeter which read 20V full scale

The meter resistance is 500Ω and $R_1 + R_2 = 39.5\ k\Omega$. If the diode is 16 V zener, find $R_1$ and $R_2$ so that when $V_i > 20V$, the zener diode conduct and the overload current is shunted away from the meter




Solution:

When $V_i = 20V$, the zener diode should not conduct.

$$I_D = (R_1 + R_2 + R_m) \times I = (39.5 + 0.5) \times 10^3 \times I$$

$$I = \frac{20}{40k} = 200\ \mu A \text{ on full scale}$$

When $V_i > 20V$, the voltage across $R_1$ and $R_m$ must be equal to zener voltage $V_Z = 16$

$$(R_1 + R_m) I = 16V$$

$$R_1 + R_m = \frac{16}{200\mu} = 80k\Omega$$

$$\Rightarrow R_1 = 80K - 500\Omega = 79.5k$$

$$R_2 = 39.5K - 79.5K = 20\ K\Omega$$

estion2:- overwhat range of input voltage will the zener regulator circuit maintain 30V across 2kΩ resistor, assuming $R_S = 200\Omega$ and maximum zener current is 25mA

Sol:- $I_L = \frac{30V}{2k\Omega} = 15mA$

Max zener current = 25mA

Total current = 25+15 = 40 mA

$V_{max} = 30V + R_S I = 30V + 200(15+25)$

$V_{max} = 38V$

estion4:- Differentiate between

1. Avanche breakdown due to high KE of electron at high voltage
2. Zener breakdown due to high EF at low voltage in high dopes
3. Thermal breakdown. due to thermal generate electron of high KE

Questions5:- a) Tunnel diode exhibit negative resistance characteristics.

b) varactor diode are operate in reverse and their Transition/depletion junction capacitance varies with the voltage.

c) zener diodes operate reverse bias for voltage regulation.