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ENG 222 (BASIC ELECTRICITY) ASSIGNMENT

1 Describe a zener diode regulator

The important application of the zener diode as a voltage regulator is that the voltage across the diode in the breakdown region is almost constant.

The function of the regulator is to provide a constant output voltage to a load connected in parallel with it in spite of the ripples in the supply voltage or the variation in the load current and the zener diode will continue to regulate the voltage until the diode current falls below the minimum Iz (min) value in the reverse breakdown region.

In the zener diode regulator, the resistor, RS is connected in series with the zener diode to limit the current flow through the diode with the voltage source Vs, connected across the combination. The stabilised output voltage Vout is taken from across the zener diode. The zener diode is connected with its cathode terminal connected to the positive rail of the DC supply so it is reverse biased and will be operating in its breakdown condition. Resistor RS is selected so to limit the maximum current flowing in the circuit.

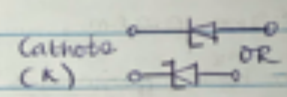
With no load connected to the circuit, the load current will be zero, (IL=0) and all the circuit current will pass through the zener diode which in turn dissipates its maximum power.

Also, a small value of the series resistor RS will result in a greater diode current when the load resistor RL is connected and large as this will increase the power dissipation requirement of the diode.

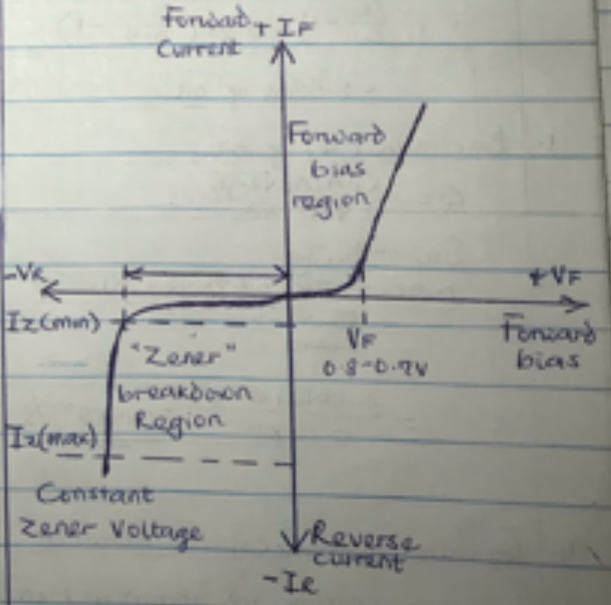
The load is connected in parallel with the zener diode, so the voltage across RL is always the same as the zener voltage (VR = VZ)

i Sketch the symbol & I-V characteristics curve

Symbol



I-V characteristic curve



N/B: Drawings were done with pen to aid visibility

2. max power = 5W , $V_s = 20V$

Max current (I_z) = 500mA

i Minimum value of the series resister to the diode

$$V_z = \frac{P_{max}}{I_z} = \frac{5}{500 \times 10^{-3}} = 10V$$

$$R_s = \frac{V_s - V_z}{I_z} = \frac{20 - 10}{500 \times 10^{-3}} = \frac{10 \times 10^3}{500} = \frac{10000}{500} = 20\Omega$$

ii. Current across the diode at full load of 500Ω

$$I_L = \frac{V_z}{R_L} = \frac{10}{500} = 0.02A \text{ or } 20mA$$

$$I_z = I_s - I_L$$

$$I_z = (500 - 20)mA = 480mA \text{ or } 0.48A$$

Minimum value of the series resistor to the diode = 20Ω

Current across the diode at full load of 500Ω = 480mA