1.) Zener diode regulator:

A Zener diode is always operated in its reverse biased condition. As such a simple voltage regulator circuit can be designed using a Zener diode to maintain a constant DC output voltage across the load in spite of variations in the input voltage or changes in the load current. The Zener diode behaves just like a normal general-purpose diode consisting of a silicon PN junction and when biased in the forward direction, that is Anode positive with respect to its Cathode, it behaves just like a normal signal diode passing the rated current.

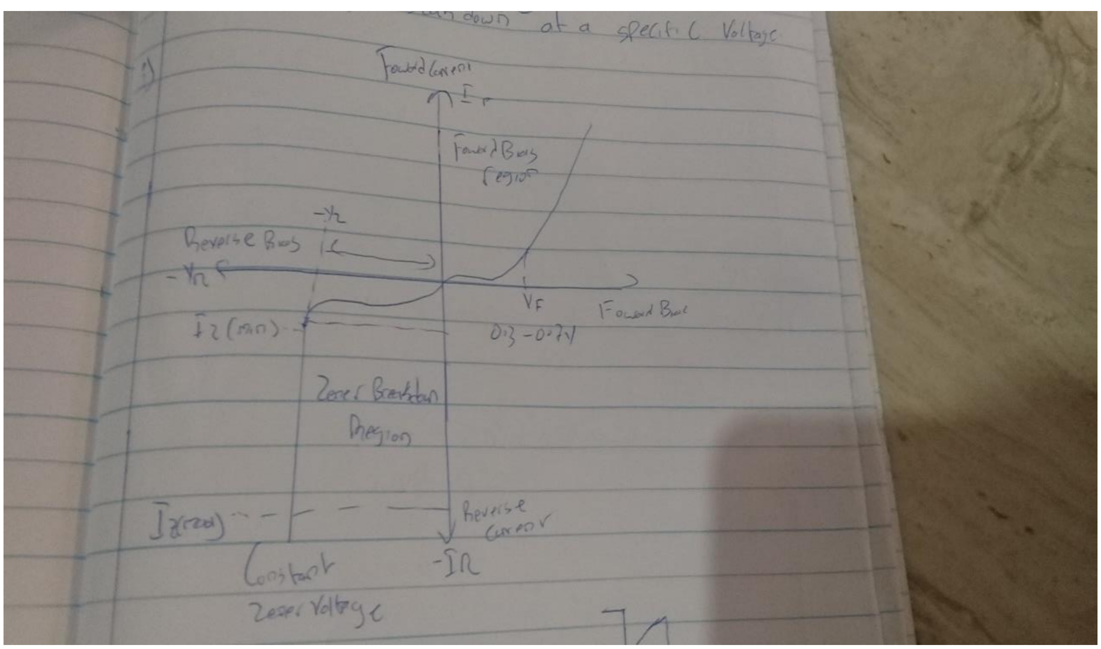
However, unlike a conventional diode that blocks any flow of current through itself when reverse biased, that is the Cathode becomes more positive than the Anode, as soon as the reverse voltage reaches a pre-determined value, the Zener diode begins to conduct in the reverse direction.

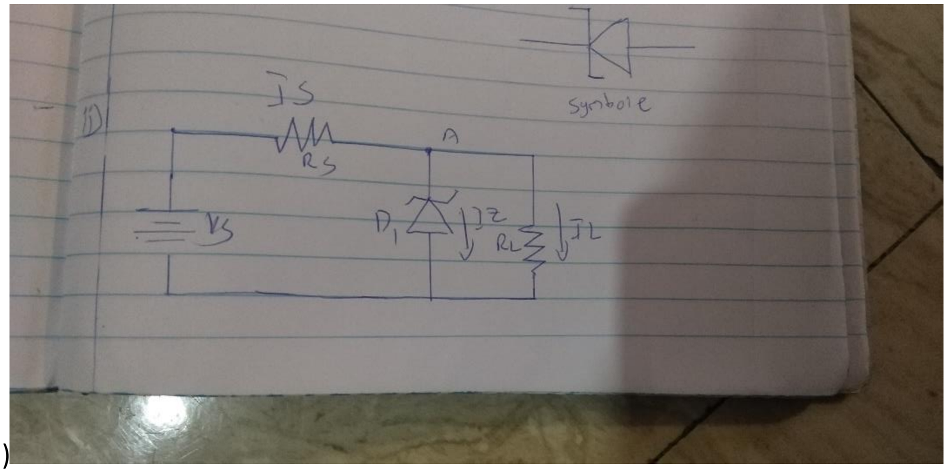
This is because when the reverse voltage applied across the Zener diode exceeds the rated voltage of the device a process called Avalanche Breakdown occurs in the semiconductor depletion layer and a current starts to flow through the diode to limit this increase in voltage.

The current now flowing through the Zener diode increases dramatically to the maximum circuit value (which is usually limited by a series resistor) and once achieved, this reverse saturation current remains fairly constant over a wide range of reverse voltages. The voltage point at which the voltage across the zener diode becomes stable is called the “zener voltage”, (Vz) and for zener diodes this voltage can range from less than one volt to a few hundred volts.

The point at which the zener voltage triggers the current to flow through the diode can be very accurately controlled (to less than 1% tolerance) in the doping stage of the diodes semiconductor construction giving the diode a specific *zener breakdown voltage*, (Vz) for example, 4.3V or 7.5V. This zener breakdown voltage on the I-V curve is almost a vertical straight line.

I)



ii) 

2.)

Pz=5w

Max current=Watts/voltage=500mA

Voltage to be produced=Watts/500mA=5/500mA=10V

i)maximum value of the series resistor=(Vs-Vz)/Iz=(20-10)/500mA=20Ω

ii)IL=Vz/Rl=10/500=0.02A

Iz=Is-IL=0.5A-0.02A=0.48A