18/ENG04/008.

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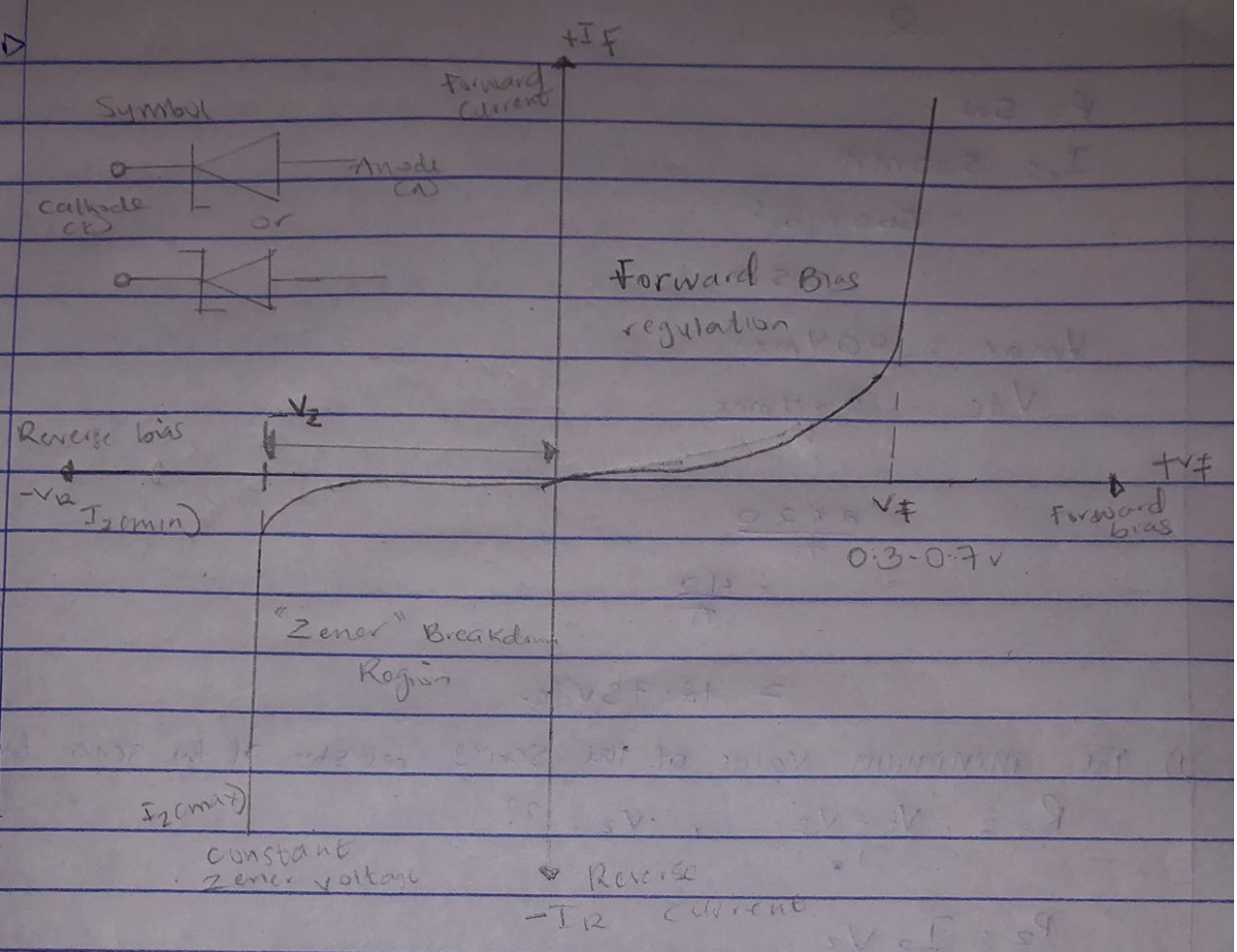
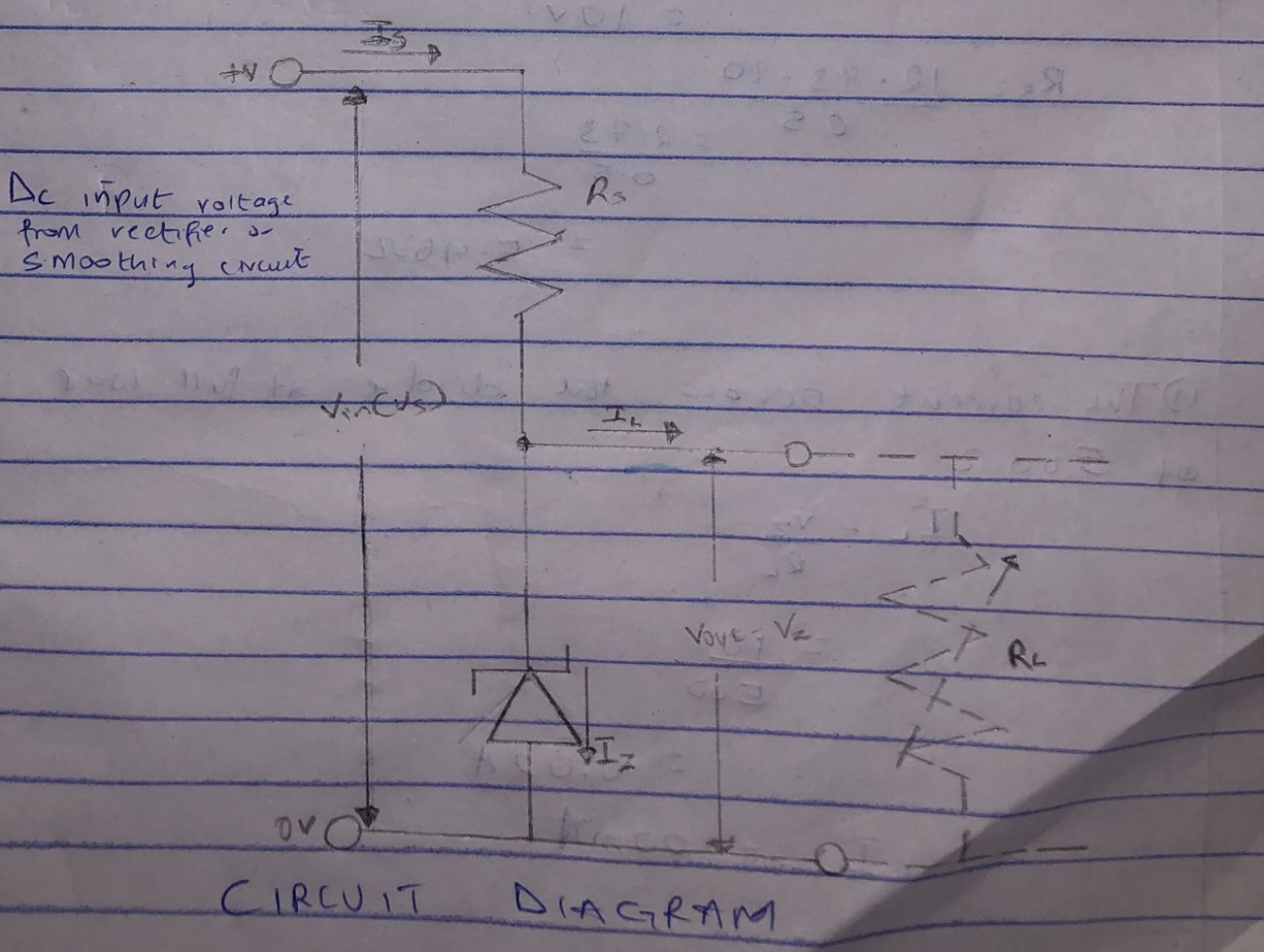
Assignment.

1) Zener diodes are used as voltage references and as shunt regulators to regulate the voltage across small circuits, when connected in parallel with a variable voltage source, so that it is reversed biased. The zener diode is the simplest form of voltage regulator, It is like a signal diode, consisting of a Silicon PN junction. When biased in the forward direction, it behaves like a normal signal diode passing through the rated current, but as soon as a reverse voltage applied across the zener diode exceeds the rated voltage of the device, the diodes breakdown voltage is reached at which a point 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 ability for a zener diode regulate to control itself can be used to great effect to regulate or stabilize a voltage source against supply or load variations. The function of a 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 diodes current falls below minimum $I_{Z(min)}$ value in the reverse breakdown region.



ZENER DIODE I-V CHARACTERISTICS CURVE.



CIRCUIT DIAGRAM

2.

$P = 5W$

$I_z = 500mA$

$= 500 \times 10^{-3}$

$= 0.5A$

$V_{max} = 20V_{max.}$

$V_{dc} = \frac{2 \times V_{max}}{\pi}$

$= \frac{2 \times 20}{\pi}$

$= \frac{40}{\pi}$

$= 12.73V_{dc.}$

i) The minimum value of the series resistor of the zener diod

$R_s = \frac{V_s - V_z}{I_z}$, $V_z = ??$

$P_z = I_z V_z$

$V_z = \frac{P_z}{I_z} = \frac{5}{0.5}$

$= 10V.$

$R_s = \frac{12.73 - 10}{0.5}$

$= \frac{2.73}{0.5}$

$= 5.46\Omega$

ii) The current across the diode at full load of 500Ω

$I_L = \frac{V_z}{R_L}$

$= \frac{10}{500}$

$= 0.02A$

$\therefore I_L = 20mA$