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Department: Computer Engineering

Course code: ENG 222

Course Title: Basic Electrical Engineering II

Assignment

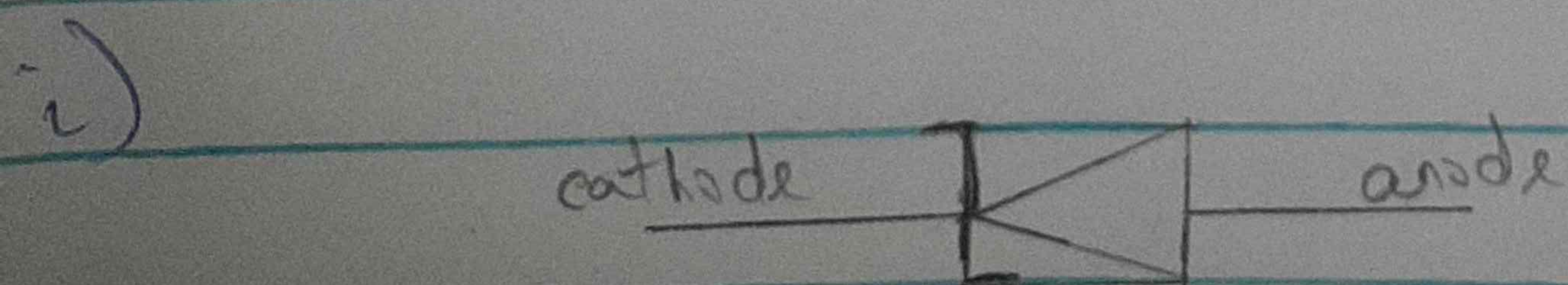
1. Describe a Zener diode regulator and:

i) Sketch the symbol and I-V characteristics curve

ii) Sketch and label the circuit diagram.

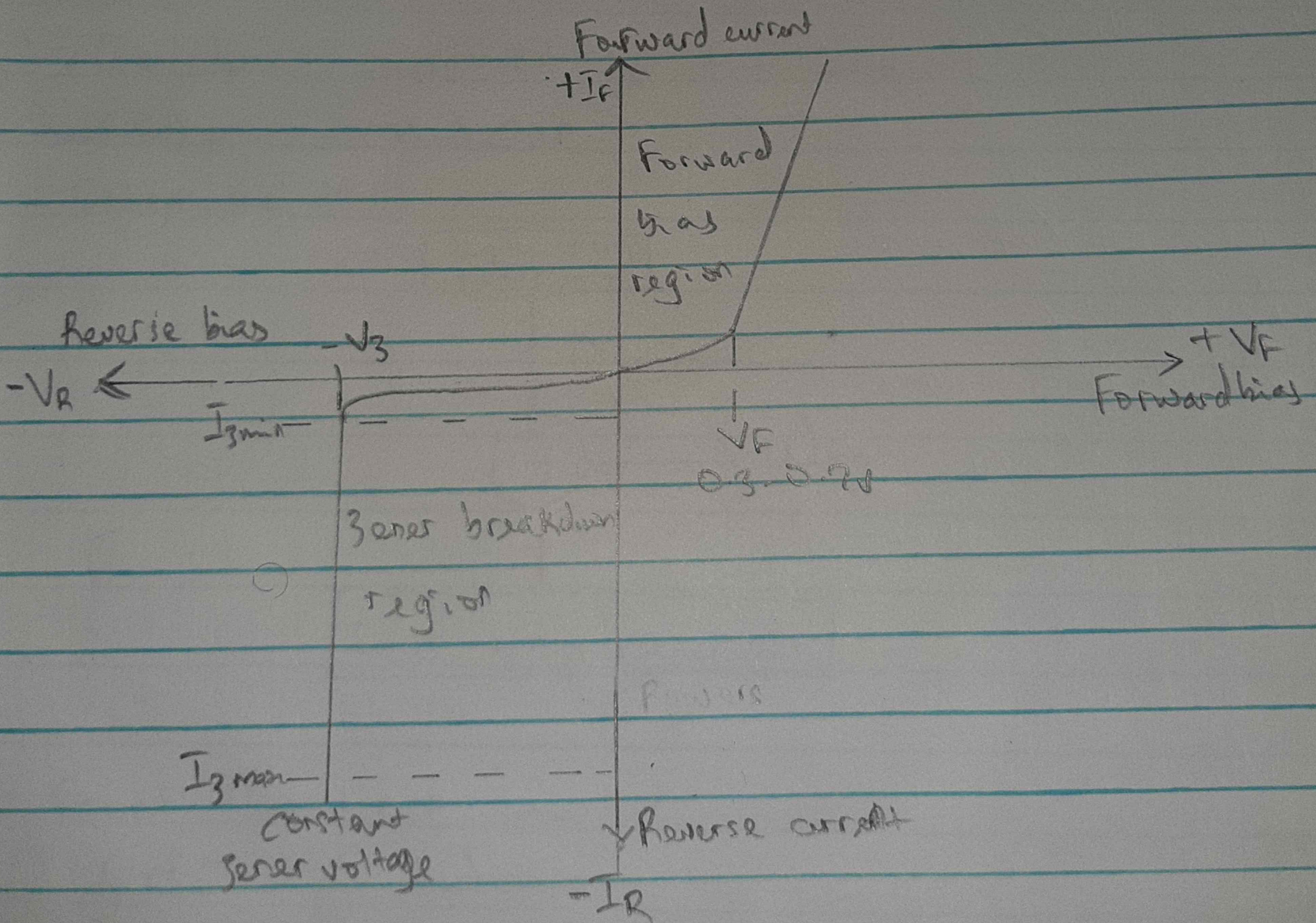
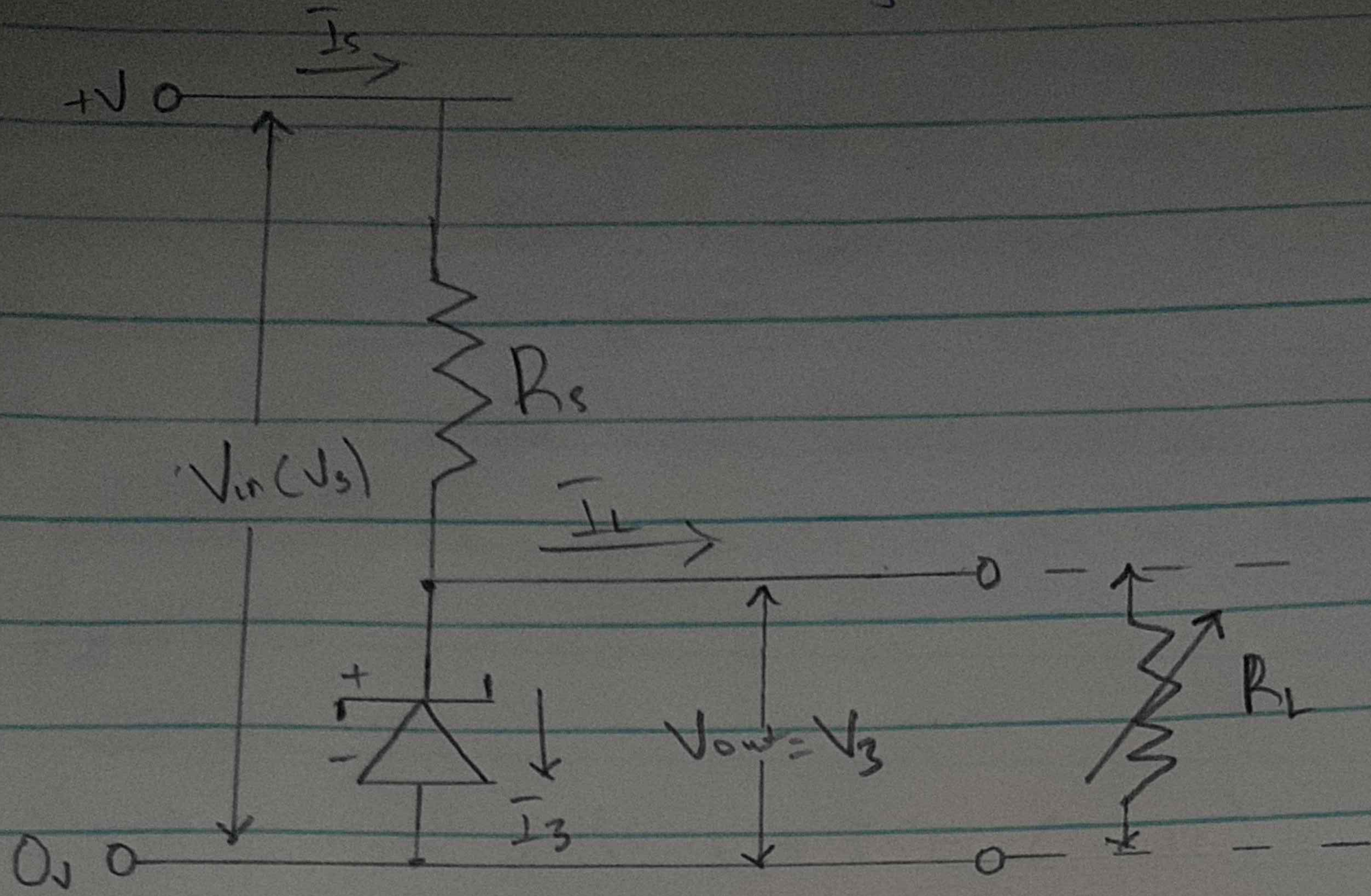
1) Zener diodes can be used to produce a stabilised voltage output with low ripple under varying load current condition. By passing a small current through the diode from a voltage source, via a suitable current limiting resistor (R_s), the Zener diode will conduct sufficient current to maintain a voltage drop of V_{out} .

The Zener diode is used in its reverse biased or reverse breakdown mode. i.e. the diode anode connects to the negative supply. This diode has the ability to control itself and can therefore be used in effects to regulate or stabilize a voltage source against supply or load variation. The function of a regulator is to produce 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, the Zener diode will continue to regulate the voltage until the diode current falls below the minimum ~~value~~.



Zener diode symbol

Zener diode circuit diagram



Zener diode $I-V$ characteristics Curve

2. A 5W maximum rated Zener diode has 500mA maximum current flowing through it. If a 20V max bridge rectifier is connected as input to the regulator circuit - Calculate:

- The minimum value of the series resistor to the Zener diode
- The current across the diode at full load of 500mA

Solution

$$\text{Maximum current} = \frac{\text{Power}}{\text{Voltage}}, \quad 500 \text{ mA} = 0.5 \text{ A} = I_Z$$

$$I_Z = \frac{P}{V_Z}$$

$$V_S = 20 \text{ V}$$

$$P = 5 \text{ W}$$

$$R_L = 500 \Omega$$

$$V_Z = \frac{P}{I_Z} = \frac{5}{0.5} = 10 \text{ V}$$

- minimum value of the series resistor, R_S

$$R_S = \frac{V_S - V_Z}{I_Z} = \frac{20 - 10}{0.5} = 20 \Omega$$

- The current across the diode at full load of 500mA

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

$$I_Z = I_S - I_L = 500 - 200 = 300 \text{ mA}$$

Zener current at full load = 300mA