Special Problem 3.4-12

Consider this shunt regulator, made with a zener diode whose breakdown voltage is 15.0 V, and whose incremental resistance is 1.0 Ω (i.e., \( r_z = 0.001 \text{K} \)).

1. If the source voltage is 25.0 V (i.e., \( V_s = 25.0 \text{ V} \)), determine the minimum value of load resistor \( R_L \) required for the output to be regulated at a voltage of \( V_0 = 15.0 \text{ V} \).

2. Determine the minimum value of source voltage \( V_s \) required to provide a regulated output voltage of \( V_0 = 15.0 \text{ V} \) if the load current is \( i_L = 150 \text{ mA} \).

3. Determine the precise change in regulated output voltage \( V_0 \) if the source voltage \( V_s \) is increased by 2.0 Volts.

4. Determine the precise change in the regulated output voltage \( V_0 \) if the load current \( i_L \) is increased by 10 mA.

Hint: the answer to parts 3 and 4 is not zero.