Problem HH 2.3

The simplest regulated supply of voltage is a zener such as in the figure below.

Some current must flow through the zener so you choose:

\[
\frac{V_{in} - V_{out}}{R} > I_{out} \text{(max)}
\]

Because \( V_{in} \) is not regulated, you use the lowest value of \( V_{in} \) that might occur for this formula. Also the zener must be able to dissipate power:

\[
P_{zener} = \left( \frac{V_{in} - V_{out}}{R} - I_{out} \right) \times V_{zener}
\]

For worst-case design, you would use \( V_{in}(\text{max}), R_{\text{min}} \) and \( I_{out}(\text{min}) \).

Design a +10 volt regulated supply for load currents from 0 to 100 mA; the input voltage is +20 to +25 volts. Allow at least 10mA zener current under all (worst-case) conditions. What power rating must the zener have?