Homework 3 :

AC voltage

DC voltage

DC milivolts

Resistance

Diode Test

AC current

DC current

3.17. In order to determine the power dissipated across a resistor, the current flow and resistance values are measured separately. If $I = 3.2$ A and $R = 1000\ \Omega$ are measured values, determine the uncertainty if the following instruments are used:

Instrument	Resolution	Uncertainty (% of reading)
Voltmeter	1.0 mV	0.5%
Ohmmeter	1.0 Ω	0.1%
Ammeter	0.1 A	0.5%

Assume.. $V_{nom} = I \cdot R = 3200V$

$$P = I^2 \cdot R \rightarrow \left| \begin{array}{l} Ammeter \\ Ohmmeter \end{array} \right.$$

$$P = I \cdot V \rightarrow \left| \begin{array}{l} Ammeter \\ Voltmeter \end{array} \right.$$

- ***Which method is more Accurate?***
- ***What is largest contributing Error source?***

Hints:

$$P = I^2 \cdot R \rightarrow \begin{array}{|l} Ammeter \\ Ohmmeter \end{array}$$

$Assume..V_{nom} = I \cdot R = 3200V$

Use Error Propagation Formula:

$$P = I \cdot V \rightarrow \begin{array}{|l} Ammeter \\ Voltmeter \end{array}$$

$$z = f(x, y, u, v)$$

$$U_z^2 \cong U_x^2 \left(\frac{\partial f}{\partial x}\right)^2 + U_y^2 \left(\frac{\partial f}{\partial y}\right)^2 + U_u^2 \left(\frac{\partial f}{\partial u}\right)^2 + U_v^2 \left(\frac{\partial f}{\partial v}\right)^2 + \cdots$$

$$\rightarrow \begin{array}{|l} U_x^2 = \left(U_{x\_resolution}\right)^2 + \left(U_{x\_uncertainty}\right)^2 \\ U_y^2 = \left(U_{y\_resolution}\right)^2 + \left(U_{y\_uncertainty}\right)^2 \\ \cdots \end{array}$$