

**Indian Institute of Information Technology, Allahabad**  
**Department of Electronics and Communication Engineering**

**Course Name: Electronics Measurement and Instrumentation**

**EXPERIMENT NO: 07**

**Objective:** To calculate accuracy, precision, standard deviation and variance for any resistance.

**Materials Required:**

Resistance, Bread board, DC power supply, connecting wires.

**Theory:**

**Accuracy:** It is degree of closeness of the measured to the true value. High accuracy is always preferred as measurement in electronic instrument can lead to adverse effects.

$$\text{Accuracy} = \text{error/true value} \times 100\%$$

**Precision:** It is how close two or more measurements to each other. Precision doesn't guarantee accuracy and can't correct by calibration.

$$\text{Precision} = \text{Mean value} \pm \text{Average deviation}$$

**Standard deviation:** It is square root of individual deviation squared divided by the number of readings. The standard deviation ( $\sigma$ ) is given by:

$$\sigma = \sqrt{\frac{\sum(X - \mu)^2}{n}}$$

Where,  $\mu$  = population mean,  $n$  = number of scores in sample

**Variance:** It is square of standard deviation.

$$\text{Variance} = \sigma^2 = \sum d^2/n$$

**Observation table:**

Voltage ( V )	Current (A)	R=V/I (k $\Omega$ )
10	0.084	119.04
11	0.092	119.56
12	0.101	118.81
13	0.11	118.18
14	0.12	116.66
15	0.13	115.38
16	0.14	114.28
17	0.15	113.33
18	0.16	112.50
19	0.17	111.76
20	0.18	111.11

**Calculation:**

Average resistance ( $\mu$ )

$$= 119.04 + 119.56 + 118.81 + 118.18 + 116.66 + 115.38 + 114.28 + 113.33 + 112.50 + 111.776 + 111.11 / 11 = 115.51 \, \Omega$$

$$\text{Accuracy} = 120 - 115.51 / 120 \times 100 = 3.74\%$$

$$\text{Precision} = (115.51 \pm 2.670) \, \Omega$$

$$\text{Average deviation} = 3.53 + 4.05 + 3.30 + 2.67 + 1.15 + 0.13 + 1.23 + 2.18 + 3.01 + 3.75 + 4.4 / 11 = 2.670$$

$$\text{Variance} = \Sigma(X_i - \mu)^2 / N = 96.948 / 11 = 8.813$$

X <sub>i</sub>	μ	X <sub>i</sub> -μ	(X <sub>i</sub> -μ) <sup>2</sup>
119.04	115.51	3.53	12.46
119.56		4.05	16.40
118.81		3.30	10.89
118.18		2.67	7.12
116.66		1.15	1.32
115.38		-0.13	0.016
114.28		-1.23	1.512
113.33		-2.18	4.75
112.50		-3.01	9.06
111.76		-3.75	14.06
111.11		-4.4	19.36
			Σ(X <sub>i</sub> -μ) <sup>2</sup> =96.948

$$\text{Standard deviation} = \sqrt{\text{variance}} = \sqrt{8.813} = 2.968$$

**Result:** We have successfully calculated the value of mean, accuracy, precision, standard deviation and variance.

**Precautions:**

- (a) All connections should be neat and tight.
- (b) The True value should be measured.