Examples to be solved

Example 1. The resistance of a resistor is specified as 500 Ω±10% by a manufacturer. Find out the limits between which its value is guaranteed.

Example 2. A flow meter working on thermal principles has a guaranteed accuracy of ±5% of full scale reading of $5x10^{-6}$ m^3/s. The flow measured by this meter is $2.5x10^{-6}$ m3/s. Calculate the limiting error in percent. Comment upon the results.

Example 3. A pressure gauge having a range 1000 kN/m^2 has an error of ±1% of full scale deflection. If the true pressure is 100 kN/m^2, what would be the range of readings? Suppose the error is specified as percentage of true value, what would, be the range of the readings.

Example 4. A Bourdon-tube pressure-gauge has a scale from 0 to 5 kN/m^2. During a dead weight calibration test, the data as shown below was recorded:

Calibration Pressure kN/m^2	Scale Value kN/m^2
0.0	0.00
0.5	0.50
1.0	0.98
1.5	1.48
2.0	1.99
2.5	2.51
3.0	3.01
3.5	3.53
4.0	4.02
4.5	4.51
5.0	5.00

Determine the maximum error as:

(i) Percentage of full scale (fudicial) value,

(ii) Percentage of scale value.

Draw the calibration curve. Can the gauge be adjusted to an accuracy of ±0.5% of full scale deflection?

Example 5. Two resistors 250 ±2.1 Ω and; 100 ±1.5 Ω. Are connected in series. Find the limiting error of the resultant resistance in ohm and in per cent.

Example 6. The resistance of a circuit is found by measuring current flowing and the power fed into the circuit. Find the limiting error in the measurement of resistance when the limiting errors in the measurement of power and current are respectively,±1.5% and ±1.0%.

Example 7. The solution for the unknown resistance for; Wheatstone bridge is : $R_4 = \frac{R_2 R_3}{R_1}$, where R_1 = 100 ±0.5%Ω R_2 = 1000 ±0.5% Ω R_3 = 842 ±0.5% Ω.
Determine the magnitude of the unknown resistance and the limiting error in per cent and in ohm for the unknown resistance R_4.

Example 8. A set of independent length measurements were taken by six observers and were recorded as 12.8 m, 12.2 m, 12.5 m, 13.1 m, 12.9 m, and 12.4 m. Calculate (a) the arithmetic mean, (b) the deviations from the mean, (c) the average deviation, and, (d) the standard deviation and (e) variance.

Example 9. In a test, temperature is measured 100 times with variations in apparatus and procedures. After applying the known corrections, the results are:

T ^oC	397	398	399	400	401	402	403	404	405
Frequency	1	3	12	23	37	16	4	2	2

Calculate: (a) arithmetic mean, (b) mean deviation, (c) standard deviation, (d) the probable error of one reading, (e) the standard deviation and the probable error of the mean, (f) the standard deviation of the standard deviation.

Example 10. A certain resistor draws 110.2 V and ±5.3 A. The uncertainties in the measurements are ±0.2 V and ±0.06 A respectively. Calculate the power dissipated in the resistor and the uncertainty in power.

Example 11. Two resistors R1 and R2 are connected in series then in parallel. The values of resistances are: R1 =100.0±0.l Ω and R2 = 50±0.03 Ω.
Calculate the uncertainty in the combined resistance for both cases series and parallel arrangement.

Example 12. A 250 Ω, a 500 Ω and a 375 Ω resistors are connected in parallel. The 250 Ω resistor has a +0.025 fractional error, the 500 Ω, resistor has a -0.036 fractional error, and the 375 Ω. has a +0.014 fractional error. Determine (a) the total resistance neglecting errors, (b) total resistance considering the error of each resistor and (c) the fractional error of the total resistance based upon rated values.