Ain Shams University Credit Hours Engineering Program

Engineering Measurement MDP 141

Assignment 5

Analysis of measured data

Q1: Ten measurement of a resistor gave 101.2 Ω, 101.7 Ω, 101.3 Ω, 101.0 Ω, 101.5 Ω, 101.3 Ω, 101.2 Ω, 101.4 Ω, 101.3 Ω, 101.1 Ω. Assume that only random errors are present

a) Test the data for peak removal
b) Eliminate the inconsistent points.
C) Determine the Arithmetic mean.
d) Determine the Standard deviation
e) Express the mean value and the uncertainty (68% confidence level) of the measured values.

Q2: A set of independent length measurements were taken by six observers and were recorded as 12.8 mm, 12.2 mm, 12.5 mm, 13.1 mm, 12.9 mm, and 12.4 mm;

a) Test the data for peak removal
b) Eliminate the inconsistent points.
C) Determine the Arithmetic mean.
d) Determine the Standard deviation
e) Express the mean value and the uncertainty (95% confidence level) of the measured values.

Q3: The following ten observations were recorded when measu length, 41.7 mm, 42.0 mm, 41.8 mm, 42.0 mm, 42.1 mm, 41.9 mm, 42.0 mm, 41.9 mm, 42.5 mm, and 41.8 mm.

a) Test the data
b) Eliminate the inconsistent points.
C) Determine the Arithmetic mean.

d) Determine the Standard deviation
e) Express the mean value and the uncertainty (99.7% confidence level) of the measured values.

Q4: A certain length measurements were made and the results are tabulated below. It is required to ;

Reading No	1	2	3	4	5	6	7	8	9	10
Length m	493.6	501.2	489.9	492.4	492.6	508.6	491.8	498.9	493.3	493.9

a) Test the data
b) Eliminate the inconsistent points.
C) Determine the Arithmetic mean.
d) Determine the Standard deviation
e) Express the mean value and the uncertainty (99.7% confidence level) of the measured values.

Q5: The following data points are expected to follow a functional variation of $y=mx+c$

- Plot the data on normal scale .
- Obtain the values of c and m using least square method
- Plot the regression line over the data.
- Predict the y value at x=50 both analytical

X	Y
10.0	42.0
20.0	57.0
40.0	105.0
60.0	132.0
80.0	180.0
100.0	225.0

Q6: In an experiment to determine the temperature distribution along a length of heated pipe, the following data were recorded :-

Distance from the pipe end mm	100	200	300	400	500
Temperature C°	110	190	290	390	505

a) plot the date.

b) Using the least square method , determine the equation of the linear relation T=a+bL

c) Plot the regression line over the data.

d) Predict the temperature at a distance of 250 mm

Q7: The force deflection data of a certain concrete beam were as follows :-

Applied force (F) KN	100	200	300	400	500
Deflection (δ) mm	1.3	2.4	3.2	4.6	5.0

a) plot the date on linear scale.

b) Using the least square method , determine the equation of the linear relation δ =a+bF

c) Plot the regression line over the data.

d) calculate the correlation coefficient

Least Square Method Equation:

According to this method the constants of the linear function could be determined by Eq.

$$y = c + mx$$

$$c = \frac{\sum y \sum x^2 - \sum xy \sum x}{n\sum x^2 - \left(\sum x\right)^2}$$

$$m = \frac{n\sum xy - \sum y \sum x}{n\sum x^2 - \left(\sum x\right)^2}$$

Simple correlation **coefficient**

$$r = \frac{\sum xy - \frac{\sum x \sum y}{n}}{\sqrt{\left(\sum x^2 - \frac{(\sum x)^2}{n}\right).\left(\sum y^2 - \frac{(\sum y)^2}{n}\right)}}$$