Standard Deviation :

It is denoted by σ. The concept of standard deviation was introduced by Karl Pearson in 1893. It is also known as "Mean Error" or "Mean Square Error" or "Root mean square error". It is defined as the square root of the arithmetic mean. It means, S.D is only computed around a mean.

The square of the standard deviation i.e., σ^2 is known as the variance.

In Case of Individual Series :-

$$S.D = \sigma = \sqrt{\frac{\Sigma(x-\bar{x})^2}{n}}$$

In case of Discrete and Continuous Series :

$$\sigma = \sqrt{\frac{\Sigma f(x-\bar{x})^2}{N}}$$

Direct Method

$$S.D = \sigma = \sqrt{\frac{\Sigma f(x)^2}{N} - \left(\frac{\Sigma fx}{N}\right)^2}$$

Shortcut Method

$$S.D = \sigma = \sqrt{\frac{\Sigma f(dx)^2}{N} - \left(\frac{\Sigma fdx}{N}\right)^2}$$

$$dx = x - A$$

Step-deviation Method (Common factor)

$$\sigma = i \times \sqrt{\frac{\Sigma f(ds)^2}{N} - \left(\frac{\Sigma fds}{N}\right)^2}$$

$ds = \frac{dx}{i}$, i = Common factor coefficient of standard deviation -

$$\frac{S.D}{Mean} = \frac{\sigma}{\bar{x}}$$

coefficient of variation -

$$\frac{S.D}{Mean} \times 100$$

combined standard deviation -

$$= \sqrt{\frac{N_1(\sigma_1^2+d_1^2) + N_2(\sigma_2^2+d_2^2) + N_3(\sigma_3^2+d_3^2)}{N_1 + N_2 + N_3}}$$

Where, $\bar{x} = \dfrac{N_1\bar{X_1} + N_2\bar{X_2} + N_3\bar{X_3}}{N_1 + N_2 + N_3}$

$$d_1 = \bar{X_1} - \bar{X}$$
$$d_2 = \bar{X_2} - \bar{X}$$
$$d_3 = \bar{X_3} - \bar{X}$$