

If any quantity which is obtained from infinite process (series or sequence) and we approximate it by replacing its finite terms, then such replacement is called the truncation. For example, if we want 13.658 to approximate upto 4 significant digits, then:

- i) 13.66 come after rounding off the digits, and
- ii) 13.65 come after truncation.

Further, the Taylor series of  $f(x) = e^x$  at  $x = 0$  is given by;

$$\begin{aligned} f(x-0) = e^{(x-0)} &= \sum_{n=0}^{\infty} \frac{(x-0)^n}{n!} = 1 + (x-0) + \frac{(x-0)^2}{2!} + \frac{(x-0)^3}{3!} + \frac{(x-0)^4}{4!} + \dots \\ &= 1 + x + \frac{x^2}{2!} + \frac{x^3}{3!} + \frac{x^4}{4!} + \dots \end{aligned}$$

Then truncation upto four terms is:  $f_t(x) = 1 + x + \frac{x^2}{2!} + \frac{x^3}{3!}$ , and Truncation error is given as:

$$\begin{aligned} \text{Truncation error} &= f(x) - f_t(x) = \left(1 + x + \frac{x^2}{2!} + \frac{x^3}{3!} + \frac{x^4}{4!} + \dots\right) - \left(1 + x + \frac{x^2}{2!} + \frac{x^3}{3!}\right) \\ &= \frac{x^4}{4!} + \frac{x^5}{5!} + \frac{x^6}{6!} + \dots \end{aligned}$$