Reason for arising error

Due to different reason error will arise. There are 3 types of error arise.

(I) Inherent error

(II) Round-off error

(III) Truncation error.

(I) Inherent error :—

This type of error is already present in the statement of problem before its solution.

This is also due to the physical measurement of the parametres of the problem.

Ex In mathematical problem we use π, but we put the value of $\pi = \frac{22}{7} = 3.14$ which is not exact value. In that problem error will arise. That error is called inherent error.

Ex Similarly when we solve mathematical problem we use $e = 2.718$ which is not exact value. In that problem inherent error will arise.

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(II) Round-off error :-

This type of error will arise due to the rounding off numbers to certain places.

This rounding is obtained either by chopping or by rounding.

Ex Consider a number

$x = 0.2357$

we have to make 3 digit standard form.

$\therefore x = 0.235$ (chopping)

$x = 0.236$ (rounding)

In this case when we put the value of x in any problem

round-off error will arise.

(iii) Truncation error :-

This type of error will arise due to the truncation of mathematical expression.

Ex we have

$$e^x = 1 + \frac{x^1}{1!} + \frac{x^2}{2!} + \frac{x^3}{3!} + \cdots + \frac{x^n}{n!} + \cdots$$

which is a infinite series.

If we take to solve our problem

$$e^x = 1 + \frac{x^1}{1!} + \frac{x^2}{2!}$$

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Then error will arise.

That error is called

Truncation error.

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Ex We know

$$\sin x = x - \frac{x^3}{3!} + \frac{x^5}{5!} - \frac{x^7}{7!} + \cdots$$

infinite series

If we take

$$\sin x = x - \frac{x^3}{3!}$$ for our

Calculation of a problem

then error will arise.

That error is called

Truncation error.

Define Significant digit.

Significant digits :-

The number of digits including first non-zero digit and the digits to the right of a decimal number is called significant digit of that number.

Ex 1, .01, .001, .00003
These are all one-significant digit.

Ex 12, 0.012, 0.010, 0.000023
These are all two-significant digit.

Ex 133, 0.0133, 0.330
0.0320, 0.00145
0.205, 0.0205
These are all 3-significant digit.

mark :-
Any number can be expressed as in two different ways

(I) fixed point form

(II) floating point form

(1) Fixed point form :—

In this form, we write the number as the sum of the product of the power of the base and the numbers at that place.

Ex

$$(X)_\beta = \alpha_1 \beta^{-1} + \alpha_2 \beta^{-2} + \alpha_3 \beta^{-3} + \cdots + \alpha_n \beta^{-n}$$

$$= (\cdot \alpha_1 \alpha_2 \cdots \alpha_n)_\beta$$

Here $0 \le \alpha_1, \alpha_2, \alpha_3 \cdots \alpha_n \le 9$

$\beta \rightarrow$ base.

Ex $(0.1234)_{10} = 1 \times 10^{-1} + 2 \times 10^{-2} + 3 \times 10^{-3} + 4 \times 10^{-4}$

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(11) **Floating point form :-**

In this form, a number can be expressed as

$$\cdot d_1 d_2 d_3 \cdots d_t \times \beta^e$$

where $0 \leq d_i < \beta$

for $i = 1, 2, 3 \cdots t$

Ex $46.5186 = 0.465186 \times 10^2$

Ex $3.147 = 0.3147 \times 10^1$

Ex $216.78 = 0.21678 \times 10^3$