Sources of errors

- Formulation errors
- Inherent errors
- Truncation errors
- Rounding errors
- Chopping errors
- Accumulated errors

The numerical solution for any problem is approximate value to the exact value

Numerical solution = exact solution + error

There are two methods for measuring errors

- **Absolute error** Let represents the approximate value to the exact value p , then the absolute error is defined as =
- **Relative error** = . p 0

Example If p = 0.300010 and = 0.310010 then = 0.1 and = 0.33

Accumation in error to estimate errors in the four operations

- **Addition**

(x+y) = (x+y)- () = (x-)+(y-) = x+ y

= = + x+ y

- **Subtraction**

(x-y) = (x-y)- () = (x-)-(y-) = x- y

= = = - = x- y

3)Multiplication

(xy) = (xy)- () =(xy)-)x - x)(y-y= (xy – xy+xy+ y x +xy= xy+ y x +xy = xy+ y x

= = = + = + x

4)Division

() = - = - = - = –( )() = –( )(1+) = –(+ y - -) = - - = - = (-)

= = = = - y

Floating point formula

Let x be a real number .There are two formulas for numbers in the floating point. In the first formula the number is written as x = A

Example x = 25149 = 0.25149

Y = - 0.0125 = - 0.125

z = -78.439 = - 0.78439

k = 0.733 = 0. 733

Let x = , y = . To addition or subtraction x and y must the conditions satisfies = ,

= . To multiplication or division x and y must the condition = .

Example If x = 22.159 , y = 0.03 and z = 111

Find 1) k =2x + 2) k = – yz 3) k = x – 2y + xz

x = 22.159 = 0.22159

y = 0.03 = 0.3

z = 111 = 0.111

2x = 2(0.22159) = 0.44318

y+z = 0.3 + 0.111 = 0.00003 + 0.111 = 0.11103

= = 0.501060517

2x + = 0.44318 + 0.501060517 = 0.44318 + 0.0501060517 = 0.4932860517