INSTITUTE OF INFORMATION TECHNOLOGY

JAHANGIRNAGAR UNIVERSITY

Lab Report : 02

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Course Tittle : Numerical Analysis Lab

Course Code : ICT - 2106

Submitted To

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Exercise 1.

Code:

```
x=1;
sum1=0;
 for n=0:1:4    %approximate upto 5 terms
   m=(((-1)^n)*(x^(2*n)))/factorial(2*n);
   sum1=sum1+m;
 end
 sum1;
 true_value=cos(x);
 absolute_error=abs(true_value-sum1);
 relative_error=absolute_error/true_value;

 sum2=0;
 for i=0:1:11    %approximate upto 12 terms
   m=(((-1)^i)*(x^(2*i)))/factorial(2*i);
   sum2=sum2+m;
end
sum2;
absolute_error=abs(true_value-sum2);
relative_error=absolute_error/true_value;
```

Output:

```
sum1 =
       0.540302579365079
true_value =
       0.54030230586814
absolute_error =
    2.73496939540152e-07
relative_error =
    5.06192434438543e-07

sum2 =
       0.54030230586814
absolute_error =
    1.11022302462516e-16
relative_error =
     2.0548182241075e-16
```

Exercise 2.

Code:

```
x=1;
sum=0;
sum1=cos(x); %true value
n=0;

 while abs(sum1-sum)/sum1 > (0.5 * 10^-8);
   sum=sum+((-1)^n * x^(2*n))/(factorial(2*n));
   n=n+1;
 end

N=n+1; %number of terms
N;
sum;
e=abs(sum1-sum)/sum1; %error at x=0.1
```

Output:

```
sum1 =
       0.54030230586814
N =
    7
sum =
      0.540302303791887
e =
    3.84276117786801e-09
```

The value of error at this point is 3.84276117786801e-09.

Exercise 3.

Code:

```
xi1=1;  %value of x(i+1)
xi=0;   %value of x(i)
h=xi1-xi;
f=cos(xi1);
f0=cos(xi);
syms x;
f=cos(x);

y=diff(f);
y_val=vpa(subs(y,x,xi));
y1=diff(diff(f));
y1_val=vpa(subs(y1,x,xi));
y2=diff(diff(diff(f)));
y2_val=vpa(subs(y2,x,xi));
y3=diff(y2);
y3_val=vpa(subs(y3,x,xi));
y4=diff(y3);
y4_val=vpa(subs(y4,x,xi));
y5=diff(y4);
y5_val=vpa(subs(y5,x,xi));
y6=diff(y5);
y6_val=vpa(subs(y6,x,xi));

format shortg;
approximated_value= f0+ h*y_val + ((h^2)/factorial(2))*y1_val +
((h^3)/factorial(3))*y2_val + ((h^4)/factorial(4))*y3_val +
((h^5)/factorial(5))*y4_val + ((h^6)/factorial(6))*y5_val +
((h^7)/factorial(7))*y6_val;
maximum_error= cos(xi1)-approximated_value;
previous_error=abs( 0.995004165278026-0.995004166666667);
```

Output:

```
h =
    1
f =
        0.54030230586814
f0 =
    1
y =
-sin(x)
y_val =
```

0.0

y1 =
-cos(x)
y1_val =
-1.0

y2 =
sin(x)
y2_val =
0.0

y3 =
cos(x)
y3_val =
1.0

y4 =
-sin(x)
y4_val =
0.0

y5 =
-cos(x)
y5_val =
-1.0

y6 =
sin(x)
y6_val =
0.0

approximated_value =
0.54028

maximum_error
2.4528e-05

previous_error =
    1.3886e-09