Question bank for Numerical Methods and Computer Programming(BTETPE405)

Ch. 1 : Introduction to Computational Methods and Errors:

1. Define errors. How many different types of errors occur while doing numerical computations? How they can be avoided

2. Explain Roundoff error with example.

3. How does truncation error occurs? Give two examples.

4. What do you mean by relative error? How is it important in error analysis?

5. Find the absolute error & relative error in $\sqrt{6} + \sqrt{7} + \sqrt{8}$ correct to 4 significant digits.

6. Find absolute error if the number X=0.00599826 is

i) Truncated to four decimal digits

ii) Rounded off to four decimal digits

7. Find the relative error if number X=0.004997 is

i) Truncated to three decimal digits

ii) Rounded off to three decimal digits

8. Distinguish between roundoff errors & truncation errors

9. Find the value of $e^{0.5}$ using series expansion

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

Ch. 2 : Solution of Transcendental / Polynomial Equations and System of Linear Equation:

1.Solve by Gauss Seidel Method the system of equations

$$7x + 2y + 4z = 16$$
$$2x + y + 7z = 10$$
$$2x + 3y + 5z = 2$$

2. If $x^2 - e^{-x} = 0$, find real root by Newton Raphson method

3. Apply the Jacobi method to solve : Continue iterations until two successive approximations are identical when rounded to three significant digits

$$5x1 - 2x2 + 3x3 = -1$$
$$-3x1 + 9x2 + x3 = 2$$
$$2x1 - x2 - 7x3 = 3$$

4. Evaluate the following (Correct to four decimal places) By Newton's iteration method

i)$\sqrt{8}$ ii)$4\sqrt{32}$ iii)$(28)^{-1/4}$

5. Solve the following by Gauss elimination method

$$2x+y+z = 10$$
$$3x+2y+3z =18$$
$$X+4y+9z = 16$$

6. Solve the following by Gauss Jordan method

$2x+y+z = 10$

$3x+2y+3z =18$

$X+4y+9z = 16$

7. Solve the following equations by LU decomposition (Factorization method)

$2x+3y+z = 9$

$X+2y+3z = 6$

$3x+y+2z =8$

8. Solve the following equations

$27x+6y-z = 85$

$X+y+54z = 110$

$6x+15y+2z = 72$

By Jacobi's method & Guass Seidal method

Ch. 3 : Interpolation and Polynomial Approximation:

1. Given the values

   X : 5   7   11   13   17

   F(X) : 150   392 1452 2366 5202

   Evaluate f(9) using

   i)   Lagrange's formula
   ii)   Newton's divided difference formula
   2. Determine f(x) as a polynomial in x for the following data

      X : -4   -1   0   2   5

      F(x) : 1245   33   5   9   1335

3.The following values of x & y are given :

X : 1   2   3   4

Y : 1   2   5   11

Find the cubic spline & evaluate y(1.5) also y'(3)

4. The following values of y = f(x) are given

X   : 10   15   20

F(x)   : 1754 2648   3564

Find the value of x for y =3000 by iterative method

5. Fit a second degree parabola to the following data :

X : 1989 1990 1991 1992 1993 1994 1995 1996 1997

Y : 352   356   357   358   360   361   361 360   359

6. Apply Lagrange's formula inversely to obtain a root of the equation f(x)=0, given that f(30)= -30,f(34)= -13, f(38) =3, f(42) =18

7. Find f(3) and f'(3) from following table

X   : 0   1   2   5

F(x) : 2   3   12   147

8. X : 5   6   9   11

   Y : 12   13   14   16

Consider above data points, find y(10) = ?

Ch 4. Numerical Integration and Differentiation:

1. Given dy/dx = y-x / y+x with initial condition y=1 at x=0, find y for x= 0.1 by Euler's method
2. Using Euler's modified method, obtain a solution of the equation dy/dx = x+ I√yI , with initial condition y=1 at x=0 for the range $0 \le x \le 0.6$ in steps of 0.2
3. Solve the following by Euler's modified method

   dy/dx = log(x+y) , y(0) =2

   at x =1.2 & 1.4 with h =0.2

4. Apply Runge kutta 4th order method to find approximate value of y for x =0.2 in steps of 0.1, if dy/dx = x+y² given that y=1 where x =0.
5. A solid of revolution is formed by rotating about x-axis, the lines x = 0 & x= 1 & a curve through the points with the following coordinates :

   X : 0.00   0.25   0.50   0.75   1.00

Y : 1.0000 0.9896 0.9589   0.9089   0.8415

6. Evaluate $\int_0^1 \frac{dx}{1+x^2}$ using
   - Trapezoidal rule
   - Simpson's 1/3rd rule
   - Simpson's 3/8th rule

7. Employ Taylor's method to obtain approximate value of y at x =0.2 for the differential equation dy/dx =2y + 3e^x, y(0) =0.

8. Using Runge-Kutta method of order 4, find y(0.2) given that

   dy/dx = 3x + ½ y , y(0) =1 , taking h=0.1

   Ch. 5 Object Oriented Programming:

   1. What is function overloading? Write Features of function overloading

   2. Explain copy constructor with suitable example. What is importance of destructor

   3. Write a note on operators in C plus plus

   4. Explain in detail inline and virtual function

   5. Define following terms :
   i)   Data hiding
   ii)   Encapsulation
   iii)   Polymorphism
   6. What are the advantages of OOP? List features of OOP

   7. Differentiate between procedural and object oriented approach

   8. What is object and class? Explain with example

   9. What is friend and virtual function? What are default arguments