

# Shantilal Shah Engineering College, Bhavnagar

B.E. Sem-IV (IT)

Sub : NSM for IT

Tutorial :1 of 5

Topic : Roots of equations & Soln of ODE

Ex-1 Find the positive root of  $x = \cos x$  correct upto three decimal places by **bisection method**.

Ex-2 Perform the five iteration of the **bisection method** to obtain a root of the equation  $f(x) = \cos x - xe^x = 0$ .

Ex-3 Find the positive root of  $x^3 - 4x - 9 = 0$  using the bisection method In four stages.

Ex-4 Find the negative root of  $x^3 - 7x + 3 = 0$  correct upto three decimal places by bisection method.

Ex-5 Using **Regula-Falsi method**, find the real root of the equation correct upto three decimal places.

Ex-6 Find the real root of the following equations correct upto three decimal places **By Iteration method** :

(1)  $x^3 + x - 1 = 0$  (2)  $\cos x + 1 = 3x$ . (3)  $x^3 - \cos x = 0$ .

Ex-7 Obtain the **Newton-Raphson formula** from Taylor's theorem.

Ex-8 Develop a recurrence formula for finding  $\sqrt{N}$ , using Newton Raphson method, hence find  $\sqrt{27}$  to three decimal places.

Ex-9 Find root of the following equations by Newton-Raphson method :

(1)  $x - \cos x = 0, x > 0$  to three decimal places.

(2)  $\sin x = e^{-x}$  with  $x_0 = 0.6$  to four decimal places.

Ex-10 Find a root of  $x^4 - x^3 + 10x + 7 = 0$  correct to three decimal places between  $a = -2$  &  $b = -1$  by Newton Raphson method.

Ex-11 Compute the real root of

(1)  $f(x) = x - 2 \sin x = 0$ , starting from  $x_0 = 2, x_1 = 1.9$ .

(2) Cube root of 50

(3)  $f(x) = x^3 - 2x - 1 = 0, x_0 = 1.5$  &  $x_1 = 2$ . by the **secant method**.

Ex-12 Derive **secant method** and solve  $xe^x - 1 = 0$  correct to three decimal Places between 0 and 1.

Ex-13 Use **power method** to find the largest of Eigen values of the following matrix

(1)  $A = \begin{bmatrix} 4 & 2 \\ 1 & 3 \end{bmatrix}$  (2)  $A = \begin{bmatrix} 3 & -5 \\ -2 & 4 \end{bmatrix}$ , perform four iterations only.

Ex-14 Using **Taylor's series method**, find correct to four decimal places

(1) the value of  $y(0.1)$ , given  $\frac{dy}{dx} = x^2 + y^2$  &  $y(0) = 1$ .

(2) the value of  $y(0.03)$ , given  $\frac{dy}{dx} = x^2 y - 1$  &  $y(0) = 1$ .

Ex-15 Using **Picard's method**, find a solution of  $\frac{dy}{dx} = 3 + 2xy, y(0) = 1$  for  $x = 0.1$

Ex-16 Describe Euler's method for first order ODE.

Ex-17 Using **Euler's method** to find: (1)  $y(1.4)$  given  $\frac{dy}{dx} = xy^{1/2}, y(1) = 1$

(2)  $y(0.2)$  given  $\frac{dy}{dx} = y - \frac{2x}{y}, y(0) = 1$

(3)  $y(1)$  given  $\frac{dy}{dx} = x + y, y(0) = 1$ .

Ex-18 Using **Modified Euler's (Heun's) method** to solve  $\frac{dy}{dx} = 1 - y, y(0) = 0$ ,

And tabulate the solutions at  $x = 0.1$  &  $0.2$ . Compare the answer with Exact solution.

Ex-19 Use **second order Runge-Kutta method** to find:

$y(0.2)$  given  $\frac{dy}{dx} = x - y^2, y(0) = 1$  &  $h = 0.1$ .

Ex-20 Use **Fourth order Runge-Kutta method** to find:

(1)  $y(0.2)$  given  $\frac{dy}{dx} = x + y, y(0) = 1$  &  $h = 0.1$ .

(2)  $y(1.1)$  given  $\frac{dy}{dx} = x - y, y(1) = 1$  &  $h = 0.05$ .

(3)  $y(0.2)$  given  $\frac{dy}{dx} = x^2 + y^2, y(0) = 1$  &  $h = 0.1$ .

⊗ ⊗ ⊗ ⊗ ⊗ ⊗ ⊗ ⊗

# Shantilal Shah Engineering College , Bhavnagar

B.E. Sem-IV (IT)

Sub : NSM for IT

Tutorial :2 of 5

Topic Interpolation (Ex-1 to 16)

Ex-1 Compute  $\cosh(0.56)$  from the following data and estimate error :

$x$	0.5	0.6	0.7	0.8
$\cosh x$	1.127626	1.185465	1.255169	1.337435

Ex-2 Find the value of  $\sin 52^\circ$  from the following table:

$\theta^\circ$	45	50	55	60
$\sin \theta^\circ$	0.7071	0.7660	0.8192	0.8660

Ex-3 The table below gives the values of function  $y = \tan x$  .

Obtain the value of  $\tan(0.40)$

$x$	0.10	0.15	0.20	0.25	0.30
$y = \tan x$	0.1003	0.1511	0.2027	0.2553	0.3093

Ex-4 Find the third divided difference with arguments 2,4,9,10 of the

function  $f(x) = x^3 - 2x$

Ex-5 Compute  $f(9.2)$  from the following values using NDD formula: ☺

$x$	8.0	9.0	9.5	11.0
$f(x)$	2.079442	2.1974225	2.251292	2.397895

Ex-6 From the following table, find  $f(x)$  using NDD formula☺

$x$	1	2	7	8
$f(x)$	1	5	5	4

Ex-7 Determine the interpolating polynomial of degree three using Langranges interpolation for the table .

$x$	-1	0	1	3
$f(x)$	2	1	0	-1

Ex-8 Find the Langrange interpolation polynomials from the following data :

$x$	0	1	4	5
$f(x)$	1	3	24	39

Ex-9 Employ Stirling formula to compute  $y(35)$  from the following table:

$x$	20	30	40	50
$y$	512	439	346	243

Ex-10 Obtain the value of  $f(8)$  &  $f(15)$  from the following table:

$x$	4	5	7	10	11	13
$f(x)$	48	100	294	900	1210	2028

Ex-11 Express the function  $\frac{3x^2 - 12x + 11}{(x-1)(x-2)(x-3)}$  as a sum of partial fraction, using Lagrange's formula.

Ex-12 Using Langrange formula to fit a polynomials to the data:

$x$	-1	0	2	3
$f(x)$	8	3	1	12

Ex-13 The shear stress in kips,per square foot(ksf) for 5 specimens in a clay stratum are:

Depth m	1.9	3.1	4.2	5.1	5.8
Stress- ksf	0.3	0.6	0.4	0.9	0.7

Use NDD interpolating polynomials to compute the stress at 4.5 m depth.

Ex-14 If  $f(x) = \frac{1}{x}$  ,find the divided difference [a,b] and [a,b,c].

Ex-15 Let  $f(40) = 836, f(50) = 682, f(60) = 436, f(70) = 272$ . Use Stirling formula to find  $f(55)$ .

Ex-16 Using Langranges-interpolation formula to fit a polynomials to the data:

$x$	0	1	4	5
$f(x)$	1	3	24	39

☺ ☺ ☺ ☺ ☺ ☺ ☺ ☺ ☺

# Shantilal Shah Engineering College , Bhavnagar

B.E. Sem-IV (IT)

Sub : NSM for IT

Tutorial :3 of 5

Topic : Numerical Int & Linear Algebraic Equations

Ex-1 State Trapezoidal rule with n=10 and evaluate (1)  $\int_0^1 e^{-x^2} dx$ . (2)  $\int_0^1 e^x dx$ .

Ex-2 Evaluate  $\int_0^6 \frac{1}{1+x} dx$ . taking h=1 using Simpson's  $\frac{1}{3}$  rule .Hence obtain an approximate value of  $\log_e 7$ .

Ex-3 Evaluate  $\int_0^3 \frac{1}{1+x} dx$ . with n=6 using Simpson's  $\frac{3}{8}$  rule and hence

Calculate  $\log_e 2$ . Estimate the bound of the error involve in the process.

Ex-4 The speed v meters per second ,of a car ,t seconds after it starts,is shown in the following table

t	0	12	24	36	48	60	72	84	96	108	120
v	0	3.60	10.08	18.60	21.60	18.54	10.26	4.50	4.5	5.4	9.0

Using Simpson's  $\frac{1}{3}$  rule,find the distance travelled by the car in 2 minutes.

Ex-5 A river is 80 m wide .the depth d in meters at a distance x meters from one bank is given by following table .Calculate the are of cross-section

of the river using Simpson's  $\frac{1}{3}$  rule.

x	0	10	120	30	40	50	60	70	80
d	0	4	7	9	12	15	14	8	3

Ex-6 Evaluate the integral  $\int_4^{5.2} \log_e x dx$  using Simpson's  $\frac{3}{8}$  rule.

Ex-7 Consider following tabular values

X	25.0	25.1	25.2	25.3	25.4	25.5	25.6
F(x)	3.205	3.217	3.232	3.245	3.268	3.268	3.280

Determine the area bounded by the given curve and X-axis between X=25 to X=25.6 by Trapezoidal rule and Weddle's rule.

Ex-8 Consider the following values,

X	10	11	12	13	14	15	16
y	1.02	0.94	0.89	0.79	0.71	0.62	0.55

Find  $\int_{10}^{16} y dx$  by using Simpson's  $\frac{1}{3}$  rule and Weddle's rule.

Ex-9 Evaluate:(1)  $\int_0^3 \sin x dx$  using Gauss Quadrature of five points.

(2)  $\int_0^1 e^{-x^2} dx$  by using Gauss Integration formula with n=3.

Ex-10 Solve the following equations using partial pivoting by Gauss-Elimination method.

$$\begin{aligned} x + y + z &= 9, & -a + 3b - 4c &= 3, \\ (1) \quad 2x - 3y + 4z &= 13, & (2) \quad 3a + 2b - c &= 8, \\ 3x + 4y + 5z &= 0. & 2a - b + 2c &= 1. \end{aligned}$$

Ex-11 Solve the following equations by Gauss-Seidel method.

$$\begin{aligned} 27x + 6y - z &= 85, & 10x + y + z &= 12, \\ (1) \quad 6x + 5y + 2z &= 72, & (2) \quad 2x + 10y + z &= 13, \\ x + y + 54z &= 110. & 2x + 2y + 10z &= 14. \end{aligned}$$

⊗ ⊗ ⊗ ⊗ ⊗ ⊗ ⊗ ⊗