Shantilal Shah Engineering College , Bhavnagar

B.E. Sem-IV (IC) **Sub : NTSM**

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

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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 $\sin 52^o$ from the following table:

θ^o	45	50	55	60
$\sin\theta^o$	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 interploting 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 $\dfrac{3x^2 - 12x + 11}{(x-1)(x-2)(x-3)}$ 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-13The 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 $f(x) = \dfrac{1}{x}$,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

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Tutorial :3 of 5 **Topic : Numerical Int & Linear Algebric Equations**

Ex-1 State Trapezoidal rile 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 $\int_{10}^{16} ydx$ by using Simpson's $\frac{1}{3}$ rule and Weddle's rule.

Ex-9 Evaluate:(1) $\int_1^3 \sin x dx$ 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.

(1) $x+y+z=9,\ 2x-3y+4z=13,\ 3x+4y+5z=0.$ (2) $-a+3b-4c=3,\ 3a+2b-c=8,\ 2a-b+2c=1.$

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

(1) $27x+6y-z=85,\ 6x+5y+2z=72,\ x+y+54z=110.$ (2) $10x+y+z=12,\ 2x+10y+z=13,\ 2x+2y+10z=14.$

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