Enrollment No: _____ Exam Seat No:_____

C. U. SHAH UNIVERSITY

Winter Examination-2021

Subject Name: Numerical Analysis

Subject Code: 4SC03NUA1 **Branch: B.Sc. (Mathematics)**

Semester: 3 **Date: 16/12/2021** **Time: 02:30 To 05:30** **Marks: 70**

Instructions:

(1) Use of Programmable calculator & any other electronic instrument is prohibited.
(2) Instructions written on main answer book are strictly to be obeyed.
(3) Draw neat diagrams and figures (if necessary) at right places.
(4) Assume suitable data if needed.

Q-1 **Attempt the following questions:** **(14)**

a) E = _____.

1) $1+\Delta$ 2) $\Delta\nabla$ 3) $\Delta+\nabla$ 4) $\nabla-\Delta$

b) $\Delta x^{[n]}$ isequal to

1) $nx^{[n-1]}$ 2) nx^{n-1} 3) $n!$ 4) None of these

c) $\Delta^2 y_0 =$ _____.

1) $y_2 - 2y_1 + y_0$ 2) $y_2 + 2y_1 + y_0$
3) $y_2 + 3y_1 + y_0$ 4) $y_2 - 3y_1 + y_0$

d) Difference of a constant function is _____.

1) 0 2) 1 3) -1 4) 3

e) $E^n f(x) =$ _____.

1) $f(x-nh)$ 2) $f(x)$ 3) $f(x^n)$ 4) $f(x+nh)$

f) Averaging operator is denoted by _____.

1) E 2) Δ 3) μ 4) δ

g) Which of the relation is true.

1) $\delta = E^{\frac{1}{2}}\nabla$ 2) $\Delta = \nabla E$
3) $\Delta = \delta E^{\frac{1}{2}}$ 4) All are correct.

h) $\left(E^{\frac{1}{2}} + E^{-\frac{1}{2}}\right)(1+\Delta)^{\frac{1}{2}} =$ _____.

1) $2+\nabla$ 2) $2+\Delta$ 3) $2+\delta$ 4) $2+\mu$

i) $[x_0, x_1] =$ _____.

1) $[x_1, x_2]$ 2) $[x_1, x_0]$
3) $[x_{-1}, x_0]$ 4) None of these

j) $[x_0, x_1, x_2, x_3] =$ _____.

1) $\frac{\Delta^2 y_0}{2h^2}$ 2) $\frac{\Delta^3 y_0}{3!h^3}$ 3) $\frac{\Delta^2 y_1}{2h^2}$ 4) $\frac{\Delta^3 y_2}{3!h^3}$

k) Round off the number 0.0044672 up to four significant digits.

l) True or False: $E = e^{hD}$.

m) The difference between true and approximate value is _____.

1) Absolute error 2) Relative error
3) Error 4) Percentage error

n) Which interpolation formula is useful when the range of p is $-\frac{1}{2} < p < \frac{1}{2}$ or $-\frac{1}{4} < p < \frac{1}{4}$?

Attempt any four questions from Q-2 to Q-8

Q-2 **Attempt all questions** **(14)**

a) State and prove Newton's forward interpolation formula. **07**

b) Obtain the estimate of the missing figure in the following data: **04**

x	1	2	3	4	5
y	2	5	7	-	32

c) If $y_0 = 3, y_1 = 12, y_2 = 81, y_3 = 2000, y_4 = 100$ then find $\Delta^4 y_0$. **03**

Q-3 **Attempt all questions** **(14)**

a) Using Bessel's formula find y_{25} from the given data **05**
$y_{20} = 2854, y_{24} = 3162, y_{28} = 3544, y_{32} = 3992$

b) Express $f(x) = x^3 - 2x^2 + x - 1$ in factorial notation. **05**

c) If $R = 10x^3y^2z^2$ and errors in x, y, z are 0.03,0.01,0.02 respectively at $x = 3, y = 1, z = 2$. Calculate the absolute error, relative error and percentage relative error in evaluating R. **04**

Q-4 **Attempt all questions** **(14)**

a) State and prove Gauss Forward interpolation formula. **07**

b) Prove that **04**

i). $\mu^2 = 1 + \frac{\delta^2}{4}$.

ii). $2 + \Delta = \left(E^{\frac{1}{2}} + E^{\frac{-1}{2}}\right)(1 + \Delta)^{\frac{1}{2}}$.

c) If $\frac{2}{3}$ be represented approximately by 0.66666 then find Absolute error, relative error and percentage error. **03**

Q-5 **Attempt all questions** **(14)**

a) State and prove Lagrange's interpolation formula. **05**

b) Show that $\Delta^n x^{[n]} = n!\, h^n$. **05**

c) From the following table find $f(x)$ using Newton's divided difference **04**

formula.

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

Q-6 **Attempt all questions** **(14)**

a) State and prove Laplace-Everett's formula. **05**

b) If $f(x) = \frac{1}{x^2}$ then find the divided difference $[a, b]$ and $[a, b, c]$. **05**

c) If $y = 4x^6 - 5x$ and the error in x is 0.04 then find the percentage error. **04**

Q-7 **Attempt all questions** **(14)**

a) State and prove Newton's divided difference interpolation formula. **07**

b) Using Lagrange's interpolation formula find y when $x = 2$ from the given data: **04**

x	0	1	3	4
y	-12	0	6	12

c) Prove that $\Delta = \frac{1}{2}\delta^2 + \delta\sqrt{1 + \frac{\delta^2}{4}}$. **03**

Q-8 **Attempt all questions** **(14)**

a) Using Sterling's formula, to find $f(35)$ from the following data: **05**

x	10	20	30	40	50
y	600	512	439	346	243

b) Prove that: **05**

i). $\Delta[f(x) \cdot g(x)] = g(x + h) \cdot \Delta f(x) + f(x) \cdot \Delta g(x)$.

ii). $\Delta\frac{f(x)}{g(x)} = \frac{g(x) \cdot \Delta f(x) - f(x) \cdot \Delta g(x)}{g(x+h) \cdot g(x)}; g(x) \neq 0$.

c) Using Gauss forward interpolation formula, find y at $x = 1.7489$ by the given data: **04**

x	1.72	1.73	1.74	1.75	1.76	1.77	1.78
y	0.1791	0.1773	0.1775	0.1738	0.1720	0.1703	0.1686