Enrollment No: _____ Exam Seat No:_____

C. U. SHAH UNIVERSITY

Winter Examination-2022

Subject Name : Numerical Analysis

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

Semester: 3 **Date: 24/11/2022** **Time: 11:00 To 02:00** **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) If $\Delta y_5 = 20$ and $y_5 = 14$ then $y_6 =$ _____ . **(1)**

b) Gauss Backward Interpolation formula is useful when p lies between ___ **(1)**

c) Difference of a constant function is _____. **(1)**

d) e^{-hD} = _____ **(1)**

(i) $(1 - \nabla)$
(ii) $(1 - \nabla^{-1})$
(iii) $(1 - \nabla)^{-1}$
(iv) None of these

e) In Bessel's formula, for which value of p the coefficients of all odd difference become zero? **(1)**

f) The difference between true value and measured value is _____. **(1)**
(1) Absolute error (2) Relative error
(3) Error (4) Percentage error

g) State Laplace Everett's formula. **(1)**

h) Determine whether the statement is True or False: **(1)**

Divided difference are not symmetric functions of their arguments.

i) Write a relation between Δ and E. **(1)**

j) Round off the number 0.000143468 to four significant figures. **(1)**

k) Which formula is the average of Gauss Forward Interpolation formula Gauss Backward Interpolation formula ? **(1)**

l) State Bessel's formula. **(1)**

m) For which vale of p Sterling's formula is useful ? **(1)**

n) For which vale of p in Laplace Everett's formula accurate results are obtained ? **(1)**

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

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

A Prove: $\Delta = E\nabla = \nabla E = \delta E^{\frac{1}{2}}$. **(07)**

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

Find $\Delta^2\left[\frac{1}{x(x+3)(x+6)}\right]$

B Express $f(x) = x^3 - 2x^2 + x - 1$ into factorial notation and show that $\Delta^4 f(x) = 0$. **(05)**

C (1) Prove : $\nabla = 1 - E^{-1}$ **(02)**

(2) Prove: $\Delta = E - 1$

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

A Derive Newton's Divided Difference formula for unequal intervals. What if arguments are equally spaced? **(07)**

B State and prove Gauss Backward Interpolation formula in the central difference notation. **(07)**

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

A State and prove Lagrange's Interpolation formula. **(05)**

B Show that $\mu = \frac{1}{2}\left(E^{\frac{1}{2}} + E^{\frac{-1}{2}}\right)$ **(04)**

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

C From the following table find y at x=34 using Laplace-Everett's formula: **(05)**

X	20	25	30	35	40
Y	11.4699	12.7834	13.7648	14.4982	15.0463

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

A State and prove Sterling's Interpolation formula. **(05)**

B Prove Bessel's Interpolation formula. **(05)**

C If $f(x) = x^3$ then find $f(1,3,5,7)$. **(04)**

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

A If $f(x) = \frac{1}{x}$ then show that $f(x_0, x_1, \ldots, x_r) = \frac{(-1)^r}{x_0 x_1 \ldots x_r}$ where r is any **(04)**

positive integer.

B Show that $\Delta^n[x]^n = n!$ for h = 1. **(05)**

C Obtain a polynomial satisfied by the following table using Newton's divided formula. **(05)**

x	-4	-1	0	2	5
y	1245	33	5	9	1335

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

A Show that (i) $\delta = \left(E^{\frac{1}{2}} - E^{\frac{-1}{2}}\right)$ **(04)**

(ii) $\Delta = \frac{1}{2}\delta^2 + \delta\sqrt{1 + \frac{\delta^2}{4}}$

B Given **(05)**

$\log 654 = 2.8156$, $\log 658 = 2.8182$, $\log 659 = 2.8189$, $\log 661 = 2.8$

.

Find $\log 656$ using Newton's Divided Difference formula. (log base 10)

C The following data given the percentage of criminals for different age groups: **(05)**

Age	25	30	40	50
% of criminals	52	67.3	84.1	94.4

Using Lagrange's formula find the percentage of criminals at the age of 35.

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

A State and prove Gauss Forward Interpolation formula. **(07)**

B Write down the approximate representation of $\frac{2}{3}$,correct to four significant figures and find (i) Absolute Error ,(ii) Relative Error and (iii) Relative Percentage Error. **(03)**

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 error in evaluating R. **(04)**