

**M.Sc. MATHEMATICS
FIRST SEMESTER
NUMERICAL ANALYSIS
MSM – 104 IDMN
[USE OMR FOR OBJECTIVE PART]**

**SET
A**

Duration: 1:30 hrs.

Full Marks: 35

Time: 15 mins.

(Objective)

Marks: 10

Choose the correct answer from the following:

1×10=10

- The forward difference operator (Δ) is defined as
 - $\Delta f(x) = f(x+h) - f(x)$
 - $\Delta f(x) = f(x) - f(x-h)$
 - $\Delta f(x) = f(x+h) + f(x)$
 - $\Delta f(x) = f(x) - f(x+h)$
- The backward difference operator (∇) is defined as:
 - $\nabla f(x) = f(x+h) - f(x)$
 - $\nabla f(x) = f(x) - f(x-h)$
 - $\nabla f(x) = f(x) - f(x+h)$
 - $\nabla f(x) = f(x-h) - f(x)$
- The central difference operator (δ) is defined as:
 - $\delta f(x) = f(x+h) - f(x-h)$
 - $\delta f(x) = f(x+h) + f(x-h)$
 - $\delta f(x) = f(x) - f(x-h)$
 - $\delta f(x) = f(x+h) - 2f(x) + f(x-h)$
- The relationship between Δ and the shift operator E is
 - $\Delta = E + 1$
 - $\Delta = E - 1$
 - $\Delta = 1 - E$
 - $\Delta = E^2 - 1$
- The second forward difference of a function $f(x)$ is:
 - $\Delta^2 f(x) = f(x+2h) - f(x)$
 - $\Delta^2 f(x) = f(x+2h) - 2f(x+h) + f(x)$
 - $\Delta^2 f(x) = f(x+2h) + f(x)$
 - $\Delta^2 f(x) = f(x+2h) - 2f(x) + f(x+h)$
- The Newton forward interpolation formula is based on
 - Forward differences
 - Backward differences
 - Central differences
 - Divided differences
- The Newton backward interpolation formula is most suitable when
 - The value to be interpolated is near the beginning of the table
 - The value to be interpolated is near the middle of the table
 - The value to be interpolated is near the end of the table
 - None of the above
- The order of the finite difference approximation of the first derivative $f'(x)$ using central difference is:
 - first order
 - second order
 - Third order
 - Fourth order

9. The error term in the first-order forward difference approximation of $f'(x)$ is proportional to:
- a. h b. h^2
- c. $\frac{1}{h}$ d. h^3
10. If $f(x) = x^3$ and $h = 1$, what is the first forward difference $\Delta f(x)$ at $x = 2$?
- a. 15 b. 17
- c. 18 d. 19

Descriptive

Marks : 25

1. Establish the relation $\Delta \log\{f(x)\} = \log\{1 + \frac{\Delta f(x)}{f(x)}\}$ 5

B. Construct a backward difference table from the following data

3. A. State Newton Gregory's forward interpolation formula and calculate the population of the city in the decimal census, as given below Year 10

Estimate the population for the year 1975.

4. If $f(x) = \frac{1}{x(x+4)(x+8)}$, find $\Delta f(x)$ taking interval of difference as unity. 10

5. A. $\left(\frac{\Delta^2}{E}\right)x^3 = 6x$ 5+5=10

B. Using Newton's backward interpolation formula, find a polynomial of degree x from the following data

x	2	3	4	5
y	27	60	95	32

== *** ==