

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

**SET
A**

Duration: 1:30 hrs.

Full Marks: 35

Time: 15 mins.

Marks: 10

(Objective)

Choose the correct answer from the following:

1×10=10

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

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[Descriptive]

Time : 1 hr. 15 mins.

Marks : 25

[Answer question no.1 & any two (2) from the rest]

1. Establish the relation $\Delta \log\{f(x)\} = \log\{1 + \frac{\Delta f(x)}{f(x)}\}$ 5
2. a. Prove that $(E^{\frac{1}{2}} + E^{-\frac{1}{2}})(1 + \Delta)^{\frac{1}{2}} = 2 + \Delta$ 5+5=10
 b. Show that $\Delta = \frac{1}{2}\delta^2 + \delta\sqrt{1 + \frac{\delta^2}{4}}$
3. a. State Newton Gregory's forward interpolation formula and calculate the population of the city in the decimal census, as given below Year 5+5=10

Year	1961	1971	1981	1991	2001
Population (Thousands)	46	66	81	93	101

Estimate the population for the year 1975

b. Show that the $\sqrt[k]{N}$ iterative formula is

$$x_{n+1} = \frac{1}{k}[(k-1)x_n + N/x_n^{k-1}]$$

4. State the definition of the Divided difference and find the third divided difference with the arguments 2, 4, 9, 10 of the function $f(x^2 - 2x)$

3+7=10

5. Solve by factorization method of the equations

10

$$3x + 2y + 7z = 4$$

$$2x + 3y + z = 5$$

$$3x + 4y + z = 7$$

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