

**2024/TDC (CBCS)/EVEN/SEM/
MTMHCC-401T/232**

TDC (CBCS) Even Semester Exam., 2024

MATHEMATICS

(4th Semester)

Course No. : MTMHCC-401T

(Numerical Methods)

Full Marks : 50

Pass Marks : 20

Time : 3 hours

*The figures in the margin indicate full marks
for the questions*

UNIT—I

1. Answer any two of the following questions :

2×2=4

(a) Round off 37.4625 to four significant figures and find absolute error.

(b) (i) $\Delta[f(x)g(x)] = ?$

(ii) $\Delta\left[\frac{f(x)}{g(x)}\right] = ?$

(c) Prove that $(1 + \nabla)(1 - \nabla) = 1$.

24J/835

(Turn Over)



2. Answer any one of the following questions : 6

(a) (i) Evaluate :

(\frac{\Delta^2}{E})x^3 (Take h=1) 2

(ii) Prove that

u_1x + u_2x^2 + u_3x^3 + ... = (\frac{x}{1-x})u_1 + (\frac{x}{1-x})^2 \Delta u_1 + (\frac{x}{1-x})^3 \Delta^2 u_1 + ...

where u = u_x is a function of x and 0 < x < 1. 4

(b) (i) If y = 4x^6 - 5x, find the percentage error in y at x=1, if the error in x = 0.04. 3

(ii) 1. E^{-1}\Delta = \nabla. Prove. 1

2. \Delta + \nabla = \frac{\Delta}{\nabla} - \frac{\nabla}{\Delta}. Prove. 2

UNIT-II

3. Answer any two of the following questions : 2x2=4

(a) Given the following set of values of a function f(x) :

Table with 2 rows: x (0, 1, 2, 3, 4, 5) and f(x) (12, 15, 20, 27, 39, 52)

Construct a forward difference table and write the value of \Delta^4 f(1).

(b) Define interpolation and extrapolation.

(c) State Newton's backward interpolation formula.

4. Answer any one of the following questions : 6

(a) Find, by Newton's forward interpolation formula, the value of f(2.5) from the following data : 6

Table with 2 rows: x (2, 3, 4, 5) and f(x) (14.5, 16.3, 17.5, 18.0)

(b) Find the form of the function f(x) by using Lagrange's interpolation formula, given : 6

Table with 2 rows: x (0, 1, 2, 5) and f(x) (2, 3, 12, 147)

UNIT-III

5. Answer any two of the following questions : 2x2=4

(a) Write the general quadrature formula for numerical integration.

(b) What are the degrees of the approximating polynomials corresponding to Simpson's one-third rule and Simpson's three-eighth rule?

(4)

(c) Evaluate :

$$\int_0^3 x dx$$

by Trapezoidal rule taking $h = 1$.

6. Answer any one of the following questions : 6

(a) Evaluate : 3+3=6

$$\int_0^1 (4x - 3x^2) dx$$

by

(i) Trapezoidal rule

(ii) Simpson's one-third rule

(b) Evaluate :

$$\int_0^{12} \frac{dx}{1+x^2}$$

by Simpson's three-eighth rule by taking 7 ordinates. 6

UNIT—IV

7. Answer any two of the following questions :

2×2=4

(a) Fill in the blanks :

(i) Bisection method is based on _____ theorem of Differential Calculus.

(ii) Bisection method _____ converges.

24J/835

(Continued)

(5)

(b) Give geometrical interpretation of Newton-Raphson method.

(c) Define convergence of an iteration method. What do you mean by rate of convergence?

8. Answer any one of the following questions : 6

(a) Use Bisection method to find a root of the equation $x^3 - 4x - 8.95 = 0$ correct to three decimal places. 6

(b) (i) Compute a real root of the equation $x^3 - 4x - 9 = 0$ by Regula-Falsi method correct up to two decimal places. 3

(ii) Solve $x^4 - x - 10 = 0$ by Newton-Raphson method, the root being near $x = 2$. 3

UNIT—V

9. Answer any two of the following questions :

2×2=4

(a) When is a matrix said to be diagonally dominant?

(b) Write the sufficient conditions for convergence of Gauss-Seidel method and Gauss-Jacobi method.

(c) What is pivoting? Explain.

24J/835

(Turn Over)

10. Answer any one of the following questions : 6

(a) Solve the following by Gauss elimination method : 6

$$2x_1 + 3x_2 + x_3 = 9$$

$$x_1 + 2x_2 + 3x_3 = 6$$

$$3x_1 + x_2 + 2x_3 = 8$$

(b) Solve the following by Gauss-Seidel iteration method (correct up to three places after decimal) : 6

$$5x_1 - x_2 + x_3 = 10$$

$$2x_1 + 4x_2 = 12$$

$$x_1 + x_2 + 5x_3 = -1$$
