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

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

(2)

2. Answer any *one* of the following questions : 6

  (a) (i) Evaluate :

$$\left(\frac{\Delta^2}{E}\right)x^3 \quad \text{(Take } h = 1\text{)}$$ 2

    (ii) Prove that

$$u_1 x + u_2 x^2 + u_3 x^3 + \cdots = \left(\frac{x}{1-x}\right)u_1 + \left(\frac{x}{1-x}\right)^2 \Delta u_1 + \left(\frac{x}{1-x}\right)^3 \Delta^2 u_1 + \cdots$$

    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. $\Delta + \nabla = \dfrac{\Delta}{\nabla} - \dfrac{\nabla}{\Delta}$. Prove. 2

UNIT—II

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

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

x	0	1	2	3	4	5
$f(x)$	12	15	20	27	39	52

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

(Continued)

(3)

  (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

x	:	2	3	4	5
$f(x)$	:	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

x	:	0	1	2	5
$f(x)$	:	2	3	12	147

UNIT—III

5. Answer any *two* of the following questions : 2×2=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.

(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 $x^3 - 4x - 8\cdot95 = 0$ 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.

(**6**)

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

$$5x_1 - x_2 + x_3 = 10$$
$$2x_1 + 4x_2 = 12$$
$$x_1 + x_2 + 5x_3 = -1$$

★ ★ ★