

Mathematics

Course 14 B - ADVANCED NUMERICAL METHODS

(Regular)

Max. Marks : 75

Time : 3 Hours

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SECTION- A

Answer any FIVE questions.

Each question carries 5 marks.

(Marks : 5 × 5 marks = 25 marks)

1. Find $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$ at $x=1$ using Newton's forward difference for the following data:

x : 1 2 3 4 5 6

y : 1 8 27 64 125 216

2. Evaluate the integral $\int_0^1 \frac{1}{1+x} dx$ by Trapezoidal rule.

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3. State and prove Simpson's Three-English rule.

4. Solve the equation $x + 2y = 10$; $2x - y = 15$ by matrix inversion method.

5. Solve the system of equations $5x + 2y + z = 12$; $x + 4y + 2z = 15$; $x + 2y + 5z = 20$ by Gauss-Jordan method.

6. Solve the following equations by Gauss-Jacobi method
 $10x - y + z = 12$; $x - 10y + z = 12$; $x + y - 10z = 12$ by.

7. Solve the differential equation $\frac{dy}{dx} = x + y$, with $y(0) = 1$, $x \in [0, 1]$ by Taylor series expansion to obtain y for $x = 0.1$.

8. Compute $y(0.2)$ upto 4 decimals, using Euler method when $\frac{dy}{dx} = 1 + y^2$ and $y(0) = 0$.

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[P.T.O.]

SECTION - B

Answer FIVE of the following questions.

Each question carries 10 marks.

(Marks : 5×10 marks = 50 marks)

UNIT I

9. (a) Find the first and second derivative of $x = 1.5$ from the following table.

$x :$	1.5	2.0	2.5	3.0	3.0	4.0
$f(x) :$	3.375	7.000	13.625	24.000	38.875	59.000

Or

- (b) Find $f'(1.5)$ from the following table.

$x :$	0.0	0.5	1.0	1.5	2.0
$f(x) :$	0.3989	0.3521	0.2420	0.1245	0.0540

UNIT II

10. (a) Evaluate $I = \int_3^7 x^2 \log x \, dx$, by using Simpson's $\frac{3}{8}$ rule.

Or

- (b) Evaluate the integral $\int_0^a \frac{1}{1+x^2} dx$ by using weddle's rule.

UNIT III

11. (a) Solve the equation $3x + 2y + 4z = 7; 2x + y + z = 7; x + 3y + 5z = 2$ by matrix inversion method.

Or

- (b) Solve the system of equation $2x + 3y - z = 5; 4x + 4y - 3z = 3; 2x - 3y + 2z = 2$ by Gauss-Jordan method.

UNIT IV

12. (a) Solve the equations $2x + 3y + z = 9, x + 2y + 3z = 6, 3x + y + 2z = 8$ by Factorization method.

Or

- (b) Solve the equations $10x + 2y + z = 9, x + 10y - z = -22, -2x + 3y + 10z = 22$ by Gauss-Jacobi method correct to 3 decimals.

UNIT V

13. (a) If $\frac{dy}{dx} = y - x^2$, $y(0) = 1$, compute $y(0.1)$ and $y(0.2)$ using Picard's method.

Or

- (b) If $\frac{dy}{dx} = 1 + y^2$, when $y = 0$ when $x = 0$ then find $y(0.2)$, $y(0.4)$ and $y(0.6)$ using Runge-Kutta fourth order method.

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