

Bachelor of Computer Application (B.C.A.) Semester—II (C.B.S.) Examination

NUMERICAL METHODS

Paper—III

Time : Three Hours]

[Maximum Marks : 50

N.B. :— (1) **ALL** questions are compulsory and carry equal marks.

(2) Assume the data wherever necessary.

EITHER

1. (a) Derive the formula for bisection method to find a root of equation. 5
- (b) Use the false position method to find a root of the equation $f(x) = x^2 - x - 2 = 0$ in the range $1 < x < 3$. 5

OR

- (c) Use the Secant method to estimate the root of the equation $x^2 - 4x - 10 = 0$ with the initial estimates $x_1 = 4$ and $x_2 = 2$. 5
- (d) Find the root of the equation $f(x) = x^3 - 2x - 5 = 0$ using Newton-Raphson method. 5

EITHER

2. (a) Use Gauss-Jordan method for system of Linear equations :

$$2x_1 + 4x_2 - 6x_3 = -8$$

$$x_1 + 3x_2 + x_3 = 10$$

$$2x_1 - 4x_2 - 2x_3 = -12$$

5

- (b) Using Gauss elimination with partial pivoting, solve the following system of equations :

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

$$4x_1 + 2x_2 + 3x_3 = 4$$

$$x_1 - x_2 + x_3 = 0$$

5

OR

(c) Discuss the Matrix inversion method. 5

(d) Solve the following system of linear equations by Gauss elimination method :

$$3x_1 + 6x_2 + x_3 = 16$$

$$2x_1 + 4x_2 + 3x_3 = 13$$

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

5

EITHER

3. (a) Find the Lagrange interpolation Polynomial to fit the following data :

i	0	1	2	3
x_i	0	1	2	3
$e^{x_i} - 1$	0	1.7183	6.3891	19.0855

Hence estimate the value of $e^{1.5}$.

5

(b) Derive Linear interpolation formula. Also determine square root of 2.5 from the following table :

x	1	2	3	4	5
$f(x) = \sqrt{x}$	1	1.4142	1.7321	2	2.2361

5

OR

(c) Use the least square regression to fit a straight line to the data :

x	0	2	4	6	8	12	16	20
y	10	12	18	22	20	30	26	30

5

(d) Given the table of data :

x	1	2	3	4
y	0	1	2	3
z	12	18	24	30

Obtain the regression plane to fit the data.

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EITHER4. (a) Compute the integral $\int_0^{\pi/2} \sqrt{\sin x} dx$ using Simpson's 1/3 rule for $n = 4$ and $n = 6$. 5

- (b) Using Runge-Kutta Fourth order method estimate $y(0.4)$ when :

$$\frac{dy}{dx} = x^2 + y^2 \text{ with } y(0) = 0$$

Assume $h = 0.2$.

5

OR

- (c) Derive the formula for composite Trapezoidal rule for numerical integration.

5

- (d) Estimate $y(2)$ using Adams-Bashforth-Moulton method when :

$$y'(x) = \frac{2y}{x} \text{ with } y(1) = 2$$

Given : $h = 0.25$

$$y(1.25) = 3.13, \quad y(1.5) = 4.50$$

$$y(1.75) = 6.13$$

5

5. Attempt **all** the following :

- (a) How does the Secant Method compare with the Newton-Raphson method ?

2½

- (b) Explain about ill conditioned system with an example.

2½

- (c) State whether the following Piecewise Polynomial is spline or not :

$$f(x) = \begin{cases} x^2 + 1 & 0 \leq x \leq 1 \\ 2x^2 & 1 \leq x \leq 2 \\ 5x - 2 & 2 \leq x \leq 3 \end{cases}$$

2½

- (d) Using Trapezoidal rule, evaluate :

$$\int_1^3 \frac{dx}{x}, \text{ for } n = 4$$

2½