



Paper ID : 260837

Subject Code: BOE065

Roll No:

BTECH

(SEM. VI) THEORY EXAMINATION 2025-26
COMPUTER BASED NUMERICAL TECHNIQUES

TIME: 3 HRS

M.MARKS: 70

Note: 1. Attempt all Sections. If require any missing data; then choose suitably.

SECTION A1. Attempt *all* questions in brief.

2x7 = 14

(a)	What is normalization in computer arithmetic?	CO-1	K2
(b)	Define truncation error.	CO-1	
(c)	State the relationship between the forward difference operator (Δ) and the shift operator (E), and define the central difference operator (δ).	CO-2	K2
(d)	Find missing term using differences: y:2,?,18,32 (assume polynomial of degree 2).	CO-2	K3
(e)	What is the basic idea of solving PDEs using finite difference methods?	CO-5	K2
(f)	Evaluate $\int_0^2 x \, dx$ using the Trapezoidal Rule with h=1.	CO-3	K3
(g)	Explain boundary value problem.	CO-5	K2

SECTION B2. Attempt any *three* of the following:

7 x 3 = 21

(a)	Find root of $x^3 - x - 2 = 0$ using bisection method (3 iterations).	CO-1	K3
(b)	Compare and contrast the use of Gauss forward and backward interpolation formulas with central difference formulas like Stirling's, Bessel's, and Everett's formulas. When might one type be preferred over the other?	CO-2	
(c)	Evaluate the integral $\int_0^4 x^3 \, dx$ using the Trapezoidal Rule and Simpson's 1/3 Rule with step size h=1. Compare the results with the exact value.	CO-3	K3
(d)	Apply the Predictor-Corrector Method to solve: $\frac{dy}{dx} = x + y, y(0) = 1$ Given y(0.1), y(0.2), and y(0.3), predict and correct the value of y(0.4)	CO-4	K3
(e)	Describe the application of finite difference method to solve eigenvalue problems.	CO-5	K2

P.T.O.

SECTION C

3. Attempt any *one* part of the following:

7 x 1 = 7

(a)	State and derive Simpson's 1/3 rule for numerical integration. What are its advantages and limitations?	CO-3	K2
(b)	Construct the interpolating polynomial of least degree that passes through the points (1,1), (2,8), (3,27), (4,64), and (5,125) using a suitable interpolation method. Hence, evaluate the polynomial at $x=2.5$ to estimate the corresponding value of y .	CO-2	K3

4. Attempt any *one* part of the following:

7 x 1 = 7

(a)	Use the Regula Falsi Method to determine a root of the equation $e^x - 3x = 0$.	CO-1	K3
(b)	Solve the initial value problem using the fourth-order Runge-Kutta Method: $\frac{dy}{dx} = x + y, \quad y(0) = 1$ Compute $y(0.2)$ with step size $h=0.2$.	CO-4	K3

5. Attempt any *one* part of the following:

7 x 1 = 7

(a)	Compare Stirling, Bessel, and Everett methods.	CO-3	K2												
(b)	Using the Gauss Forward Interpolation Formula, estimate the values of y(1.5) for the data: <table><tr><td>x</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td></tr><tr><td>y</td><td>1</td><td>2</td><td>5</td><td>10</td><td>17</td></tr></table>	x	0	1	2	3	4	y	1	2	5	10	17	2	K3
x	0	1	2	3	4										
y	1	2	5	10	17										

6. Attempt any *one* part of the following:

7 x 1 = 7

(a)	Using the Finite Difference Method, solve the boundary value problem: $\frac{d^2y}{dx^2} = -2, \quad y(0) = 0, \quad y(1) = 0$ Divide the interval into four equal parts, compute the approximate solution, and compare with the exact solution.	CO-5	K3
(b)	Explain the significance of numerical methods in solving differential equations. Why are analytical solutions not always feasible, and how do numerical methods address these limitations?	CO-4	K2

7. Attempt any *one* part of the following:

7 x 1 = 7

(a)	Solve $x^3 - x - 2 = 0$ using Newton-Raphson method.	CO-1	K3
(b)	Solve the following system using the Power Method to find the dominant eigenvalue and corresponding eigenvector: $\begin{bmatrix} 4 & 1 \\ 2 & 3 \end{bmatrix}$ Perform at least three iterations and comment on convergence.	CO-5	K3