Reg. No. | | | | | | | | | |

BCACAC 284

Choice Based Credit System Fourth Semester B.C.A. Degree Examination, September 2022
(2020-21 Batch Onwards)
COMPUTER ORIENTED NUMERICAL ANALYSIS

Time : 3 Hours Max. Marks : 80

Note : *1) Answer **any ten** questions from Part – **A** and **one full** question from **each** Unit of Part – **B**.*

*2) **Scientific** calculator is **allowed**.*

PART – A **(10×2=20)**

1. a) Define Interpolation.

b) Define absolute and relative error.

c) What is the general formula for Numerical Integration.

d) If Δ is the forward difference operator then $\Delta^2 Y_2 = ?$

e) Write the equation for fitting a straight line for $\partial S/\partial a_0$ and $\partial S/\partial a_1$.

f) Write the Simpson's rule for $\int_{x0}^{xn} y(x)\,dx$.

g) Define :

i) Square matrix

ii) Upper triangular matrix

h) If $A = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$ $B = \begin{bmatrix} 2 & 3 \\ 4 & 5 \end{bmatrix}$ compute (AB)′.

i) Show that $A = \begin{bmatrix} \cos\theta & -\sin\theta \\ \sin\theta & \cos\theta \end{bmatrix}$ is Orthogonal.

j) Write the Taylors series for y(x).

k) Given y′ = –y, y(0) = 1, h = 0.01. Find y(0.01) using Euler's method.

l) Write Milnes Corrector formula.

P.T.O.

PART – B

Unit – I

2. a) Find the real root of the following equation : $f(x) = x^3 - x - 1 = 0$ using Bisection method.

   b) Derive Newtons forward difference formula to interpolate the set of points $(x_0, y_0), (x_1, y_1)...(x_n, y_n)$.

   c) If $y_1 = 4$, $y_3 = 12$, $y_4 = 19$, $y_x = 7$, find x using Lagrange's interpolation formula. **(5+5+5)**

3. a) Find a real root of the equation $f(x) = x^3 - 2x - 5 = 0$, correct it to three decimal places using method of false position method.

   b) The population of a town in the decennial census was as given below. Estimate the population for the year 1895 using Newton's forward difference interpolation formula.

Year (x)	1891	1901	1911	1921	1931
Population (y) (in thousands)	46	66	81	93	101

   c) Certain corresponding values of x and log10x are (300, 2.4771), (304, 2.4829), (305, 2.4843) and (307, 2.4871). Find log10 301 using Newton's divided difference formula. **(5+5+5)**

Unit – II

4. a) The table below gives the temperature T (in °C) and lengths 1 (in mm) of a heated rod. If $1 = a_0 + a_1T$, find the best values for a_0 and a_1.

T	20°	30°	40°	50°	60°	70°
1	800.3	800.4	800.6	800.7	800.9	801.0

   If $y = a_0 + a_1x$, find approximate values of a_0 and a_1.

   b) From the following table of values of x and y, obtain dy/dx and d^2y/dx^2 for x = 1.6 using Newton's forward difference formula.

X	1.0	1.2	1.4	1.6	1.8	2.0	2.2
Y	2.7183	3.3201	4.0552	4.9530	6.0496	7.3891	9.0250

   c) Evaluate $I = \int_1^3 \frac{1}{x} dx$ by Simpsons 1/3 Rule with 4 strips. **(5+5+5)**

5. a) Fit the polynomial of a second degree to the data points given in the following table.

X	0	1.0	2.0
Y	1.0	6.0	17.0

b) From the following table of values of x and y, obtain dy/dx and d^2y/dx^2 for x = 6 using Newton's backward difference formula.

X	0	1	2	3	4	5	6
Y	6.9897	7.4036	7.7815	8.1291	8.4510	8.7506	9.0309

c) Evaluate $I = \int_0^1 \sqrt{1-x^2}\, dx$ by trapezoidal rule h = 0.2 **(5+5+5)**

Unit – III

6. a) Express the matrix $A = \begin{bmatrix} 1 & 7 & 8 \\ 6 & 2 & 9 \\ 5 & 4 & 3 \end{bmatrix}$ as a sum of symmetric and a skew-symmetric matrix.

b) Find the inverse of the matrix $A = \begin{bmatrix} 3 & 1 & 2 \\ 2 & -3 & -1 \\ 1 & 2 & 1 \end{bmatrix}$.

c) Solve the following system using Gauss Elimination method.

$2x + y + z = 10$

$3x + 2y + 3z = 18$

$x + 4y + 9z = 16$ **(5+5+5)**

7. a) Solve the following equations using matrix inversion method.

$3x + y + 2z = 3$

$2x - 3y - z = -3$

$x + 2y + z = 4$

b) Solve the equations using LU Decomposition method.

$2x + 3y + z = 9$

$x + 2y + 3z = 6$

$3x + y + 2z = 8$

c) Solve the following system using Jacobi's method. Carry out 3 iterations.

$10x + 2y + z = 9$

$2x + 20y - 2z = -44$

$-2x + 3y + 10z = 22$ **(5+5+5)**

Unit – IV

8. a) Given $dy/dx - 1 = xy$ and $y(0) = 1$, obtain the Taylor's series for $y(x)$ and compute $y(0.1)$, correct to four decimal places.

   b) Solve by Euler's method, the equation $dy/dx = x + y$, $y(0) = 0$. Choose $h = 0.2$ and compute $y(0.2)$ and $y(0.4)$.

   c) Tabulate the solution of $dy/dx = x + y$, $y(0) = 0$ for $0.4 \leq x \leq 1.0$ with $h = 0.1$ using Adams-Moulton formula. **(5+5+5)**

9. a) Derive Milne's predictor method.

   b) Given $dy/dx = 1 + y^2$ where $y = 0$ when $x = 0$, and $h = 0.2$. Find $y(0.2)$ using Runge-Kutta fourth order formula.

   c) Solve the boundary value problem $d^2y/dx^2 = y$ with boundary conditions $y(0) = 0$, $y(2) = 3.627$ with $h = 0.5$ by using finite-difference method. **(5+5+5)**