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

**BCACAC 264**

## Credit Based Fourth Semester B.C.A. Degree Examination, September 2022
## (Common to all Batches)
## COMPUTER ORIENTED NUMERICAL ANALYSIS (Elective – I)

Time : 3 Hours Max. Marks : 80

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

*ii) **Scientific** calculator is **allowed**.*

PART – A

1. a) Define Absolute and Relative Error. **(10×2=20)**

b) Define Interpolation and Extrapolation.

c) If $Y_1 - Y_0 = \delta Y_{1/2}$ then $\delta\, {}^3Y_{7/2}$.

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

e) Write the Simpson's 1/3 rule for $\int_{x0}^{xn} y\,dx$.

f) Write Newton's forward difference formula for $\left[\frac{dy}{dx}\right]x = x_0$ and $\left[\frac{d^2y}{dx^2}\right]x = x_0$.

g) Define upper triangular. Give example.

h) Given the matrix $A = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix}$ find $||A||_2$ .

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

j) Write Runge-Kutta 4$^{th}$ order formula.

k) Write Milne's Predictor formula.

l) Define square matrix. Give example.

PART – B

**Unit – I**

2. a) Find the real root of the following equation: $f(x) = x^3 - 2x - 5 = 0$ using Bisection method.

   b) In the table below the values of y are consecutive terms of a series of which the number 21.6 is the $6^{th}$ term. Find the first term of the series using Newton's forward difference interpolation formula.

| **X** | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|
| **Y** | 2.7 | 6.4 | 12.5 | 21.6 | 34.3 | 51.2 | 72.9 |

   c) Find the $7^{th}$ term of the series 3, 9, 20, 38, 65 using Lagrange Interpolation formula. **(5+5+5)**

3. a) Use the method of Iteration to find a positive root, between 0 and 1 of the equation $xe^x = 1$.

   b) Find a root of the equation $x \sin x + \cos x = 0$ using Newton-Raphson method.

   c) Given the set of tabulated points (1, –3), (3, 9), (4, 30) and (6, 132). Obtain the value of y when x = 2 using Newton's divided difference Formula. **(5+5+5)**

**Unit – II**

4. a) Certain experimental values of x and y are given below.

| **X** | 0 | 2 | 5 | 7 |
|---|---|---|---|---|
| **Y** | –1 | 5 | 12 | 20 |

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

   b) Calculate the first and second derivatives of the function tabulated below at the point x = 2.2 using Newton's backward 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 $I = \int_0^1 1/(1+x)\,dx$ by trapezoidal rule when h = 0.25, correct to three decimal places. **(5+5+5)**

5. a) Determine the constants a and b by the method of least squares such that $y = ae^{bx}$, fit the following the data.

| **x** | 2 | 4 | 6 | 8 | 10 |
|---|---|---|---|---|---|
| **y** | 4.077 | 11.084 | 30.128 | 81.897 | 222.62 |

b) From the following table of values of x and y, obtain $d(J_0)/dx$ and at x = 0.1 using Newton's forward difference formula.

| **X** | 0.0 | 0.1 | 0.2 | 0.3 | 0.4 |
|---|---|---|---|---|---|
| **$J_0(x)$** | 1.0000 | 0.9975 | 0.9900 | 0.9776 | 0.9604 |

c) Evaluate $I = \int_1^3 \frac{1}{x} dx$ by Simpson's 1/3 rule with 4 strips. **(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) Solve the following system using Jacobi's method. Carry out 3 iterations.

$10x + 2y + z = 9$

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

$-2x + 3y + 10z = 22$

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 following system using Gauss-Jordan method.

$5x - 2y + z = 4$

$7x + y - 5z = 8$

$3x + 7y + 4z = 10$

c) Solve the following system using Gauss-Seidal 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) Using Euler's method solve the differential equation $(dy/dx) + 2y = 0$, where $h = 0.1$ and obtain $y(0.1)$, $y(0.2)$.

   c) Given $(dy/dx) = y - x$ where $y(0) = 2$, $xo = 0$ and $h = 0.1$. Find $y(0.1)$ using Runge-Kutta fourth order formula. **(5+5+5)**

9. a) Using Adams-Moulton formula, solve $y' = 1 + y^2$ where $y = 0$ when $x = 0$, and $h = 0.1$. Find $y(0.8)$. Given that $y(0.1) = 0.0052$, $y(0.2) = 0.0214$, $y(0.3) = 0.0499$.

   b) Using Milne's formula solve $y' = 1 + y^2$ where $y(0) = 0$, and $h = 0.2$. Find $y(1.0)$. Given that $y(0.2) = 0.2027$, $y(0.4) = 0.4228$, $y(0.6) = 0.6841$.

   c) Solve the boundary value problem $y'' - 64y + 10 = 0$ with boundary conditions $y(0) = y(1) = 0$, by using Finite-Difference method. Compute the value of $y(0.5)$ **(5+5+5)**

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