Date:

Registration number:

ST. JOSEPH'S COLLEGE (AUTONOMOUS), BENGALURU-27
BCA (BIG DATA ANALYTICS) - III SEMESTER
SEMESTER EXAMINATION- OCTOBER 2021
(Examination conducted in January-March 2022)

BCADA 3221 – NUMERICAL METHODS

Time- 2.5 HRS **Max Marks -70**

This question paper contains FOUR printed pages and THREE parts

PART A

Answer ALL questions **20 X 1 =20**

1. Which of the following is an iterative method?
   a. Gauss Seidel
   b. Gauss Jordan
   c. Factorization
   d. Gauss Elimination

2. If a function is real and continuous in the region from a to b and f(a) and f(b) have opposite signs then there is no real root between a and b.
   a. True
   b. False

3. Which of the following symbol is known as forward difference operator?
   a. ϕ
   b. ∇
   c. Δ
   d. E

4. In gauss forward difference formula, the value of '*p*' always lies between 1 and 0
   a. True
   b. False

5. Which formula can be used for Picard's successive approximation?
   a. $Y_{n+1} = y_0 + \int_{x0}^{x} f(x, yn)dx$
   b. $y_n = y(x_n) = y_{n-1} + hf(x_{n-1}, y_{n-1})$
   c. $y_{n+1} = y(x_n) = y_{n-1} + hf(x_{n-1}, y_{n-1})$
   d. $Y_n = y_0 + \int_{x0}^{x} f(x, yn)dx$

6. Newton's divided difference formula is used when the interval difference is not same for all sequence of values
   a. True
   b. False

7. For exact differential equation of the form $Mdx + Ndy = 0$
   a. $\frac{\partial M}{\partial y} = \frac{\partial N}{\partial x}$
   b. $\frac{\partial M}{\partial y} \neq \frac{\partial N}{\partial x}$
   c. $\frac{\partial M}{\partial y} + \frac{\partial N}{\partial x} = 0$
   d. $\frac{\partial M}{\partial y} - \frac{\partial N}{\partial x} = 0$

8. If we solve x^2 - 2 =0 using Raphson method and the initial guess is x_0=1.0, subsequent estimate of *x* will be
   a. 1.1414
   b. 1.5
   c. 2.0
   d. None of the above

9. The integrating factor of $y\frac{dx}{dy} = -2x + 10y^3$
   a. y
   b. y+1
   c. y+3
   d. None of these

10. Solve the system of equations and comment on the nature of the solution using Gauss Elimination method

$$\begin{gathered} x+y+z = 0 \\ -x-y+3z = 3 \\ -x-y-z = 2 \end{gathered}$$

   a. Infinitely many Solutions
   b. Finite solutions
   c. No solution
   d. Unique Solution

11. Given that $f(2) = 6, f'(2) = -\frac{1}{2}$ and $f''(2) = 10$, what is the most accurate Taylor polynomial approximation of *f(2.2)* that you can find
   a. 5.9
   b. 6.1
   c. 6.2
   d. 7

12. The aim of elimination steps in Gauss elimination method is to reduce the coefficient matrix to ____________
   a. diagonal
   b. identity
   c. lower triangular
   d. upper triangular

13. Identify $Simpson's\frac{1}{3}\ rule$

a. $\frac{h}{2}\ y_0 + 2(y_1+y_2+y_3+\ldots\ldots y_{n-1}) + y_n$

b. $\frac{h}{3}\ y_0 + y_n + 4(y_1+y_3+y_5+\ldots\ldots y_{n-1}) + 2(y_2+y_4+y_6+\ldots\ldots y_{n-2})$

c. $\frac{3h}{8}\ y_0 + y_n + 2(y_3+y_6+\ldots\ldots y_{n-3}) + 3(y_1+y_2+y_4+y_5+\ldots\ldots y_{n-2})$

d. $\frac{3h}{2}\ y_0 + 2(y_1+y_2+y_3+\ldots\ldots y_{n-1}) + y_n$

14. Bessel's central difference interpolation formula is used when the number of arguments are even and the interpolating point is near the middle of the table

a. True

b. False

15. What is the general solution of the differential equation $ydx - (x + 2y^2)dy = 0$

a. $x=y^2+cy$

b. $x=2cy^2$

c. $x=2y^2+cy$

d. None of the above

16. The order of differential equation is always

a. Positive Integer

b. Negative Integer

c. Rational Number

d. Whole number

17. False position method is used to solve

a. Nonlinear equation

b. System of linear equations

c. Quadratic equations

d. Iterative methods

18. If $\frac{dy}{dx} = ax + by + c/\ kx + \rho y + \lambda$, where $\frac{a}{k} = \frac{b}{\rho}$ then is reducible to

a. Homogeneous form

b. Variable separable form

c. Exact form

d. Non- exact form

19. To determine y(0.1) using fourth order Runge-Kutta method we have y(0)=2 and h=0.1 for the given dy/dx= y-x, we then obtain k1=0.2, k2=0.205, k3=0.20525 and k4=0.21053. What would be the value of y(0.2)

a. 0.2052

b. 0.2105

c. 2.4214

d. 2.2105

20. Integrating factor of $dy = \{e^{x-y}(e^x - e^y)\}dx$
   a. e^{e^x}
   b. e
   c. e^x
   d. e^{2x}

PART B

Answer ANY SIX questions **6 X 5 = 30**

21. Solve three iterations of Newton's method to find the root of the equation $cosx - xe^x = 0$
22. Perform four iterations of a Regula-Falsi method to obtain the root of the equation: *f(x)=* x^3*-2x-5 =0*
23. Employ Bessel's formula to obtain y_{25} given y_{20}=24, y_{24}=32, y_{28}=35, y_{32}=40
24. Employ Picard 's method to obtain, correct to four places of decimals the solution of the differential equation
    $\frac{dy}{dx} = x^2 + y^2$ for *x* = 0.4, given that *y* = 0 when *x* = 0.
25. Solve using variable separable method: $(e^y + 1)\cos x\, dx + e^y \sin x\ dy = 0$
26. Apply Gauss forward formula to *find f(30)* given that *f(21)=8.4708, f(25)=7.8144,f(29)=7.1070, f(33)=6.3432 and f(37)=5.5154*
27. Solve the differential equation: $\frac{dy}{dx} - x\,tan(y - x) = 1$
28. Solve Picard's process of successive approximations $\frac{dy}{dx} = 1 + xy$ with *y*(0) = 0 up to third approximation.

PART C

Answer ANY TWO questions **2 X 10 = 20**

29. a). Apply Euler's method to approximate the solution of the initial value problem and calculate *y* (0.1) by using *h*=0.02: $\frac{dy}{dx} = \frac{y-x}{y+x}$, *y* (0) =1.

    b). Apply RK-Method, solve the initial value problem $\frac{dy}{dx} = yx^3 - 1.5y$ From *x*=0 to 2 where *y* (0) =1 by using *h*=1.

30. Solve the following equation using LU decomposition method
    3x + 2y + z=10
    2x + 3y + 2z = 14
    x + 2y + 3z = 14

31. Solve the Linear system Ax=B using Gauss Elimination with pivoting:

$$A = \begin{pmatrix} 1 & 1 & 1 \\ 2 & -3 & 4 \\ 3 & 4 & 5 \end{pmatrix} \qquad B = \begin{pmatrix} 9 \\ 13 \\ 40 \end{pmatrix}$$