

18024

B.C.A. Examination, November-2019

NUMERICAL METHODS

(BCA-504)

Time : Three Hours

[Maximum Marks : 75]

Note : Attempt questions from *all* sections as per instructions. Calculator is allowed.

Section-A

(Very Short Answer Questions)

Note : Attempt all *five* questions. Each question carries 3 marks. Very short answer is required not exceeding 75 words. $5 \times 3 = 15$

1. Evaluate the following for $h = 1$:

$$E = e^{hD}$$

2. Construct a divided difference table for the following data :

x	3	5	9	15
y	2	14	38	74

3. Write the formula for Simpson's $3/8^{\text{th}}$ rule.
4. Write the formula for Runge-Kutta method for 4^{th} order.

18024

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(2)

5. Perform two iterations of Picard's method to find an approximate solution of the initial value problem :

$$\frac{dy}{dx} = x - y, \quad y(0) = 1$$

Section-B

(Short Answer Questions)

Note : Answer any *two* questions out of the following three questions. Each question carries $7\frac{1}{2}$ marks. Short answer is required not exceeding 200 words.

 $2 \times 7\frac{1}{2} = 15$

6. Using Euler's method find an approximate value of y for $x = 1$, considering $h = 0.5$, given that

$$\frac{dy}{dx} = x + y, \quad \text{and } y(0) = 1$$

7. Apply Newton's divided difference method to obtain an interpolatory polynomial for the following data :

x	3	5	7	9	11	13
f(x)	31	51	17	19	90	110

18024

(3)

8. Find the first two derivatives of $f(x)$ at $x = 1$ from the following table :

x	-2	-1	0	1	2	3	4
$f(x)$	104	17	0	-1	8	69	272

Section-C
(Detailed Answer Questions)

Note : Attempt any three questions out of the following five questions. Each question carries 15 marks. Answer is required in detail. $3 \times 15 = 45$

9. Derive Newton-Raphson's method to find a root of the equation $f(x) = 0$. Prove that this method has Quadratic Convergence.
10. Solve the following system of linear equations using Gauss-Seidel method :

$$10x + 3y + 7z = 41$$

$$3x + 20y + 17z = 101$$

$$x + 19y + 23z = 201$$

perform three iterations.

11. Define Lagrange's interpolation formula. Obtain Lagrange's interpolatory for the following data :

x	1	3	5	7	10
$f(x)$	13	31	25	37	101

18024

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(4)

12. State Runge-Kutta method of second order. Using Runge-Kutta method of fourth order find the values of $y(0.2)$, $y(0.4)$ and $y(0.6)$ for the following initial value

$$\frac{dy}{dx} = x^3 - y^3$$

Write Condition that $y(0) = 1$.

13. Evaluate

$$\int_0^1 \frac{dx}{1+x^2}$$
 by using

- (a) Trapezoidal rule
- (b) Simpson's 1/3 rule