(7 pages) **Reg. No. :**.....

Code No. : 20582 E **Sub. Code : SMMA 65**

B.Sc. (CBCS) DEGREE EXAMINATION, APRIL 2021.

Sixth Semester

Mathematics — Core

NUMERICAL METHODS

(For those who joined in July 2017 onwards)

Time : Three hours Maximum : 75 marks

PART A — (10 × 1 = 10 marks)

Answer ALL questions.

Choose the correct answer.

1. In Newton-Raphson method x_{n+1} = _____.

(a) $x_n + \frac{f(x_n)}{f'(x_n)}$ (b) $x_n - \frac{f(x_n)}{f'(x_n)}$

(c) $x_n - \frac{f'(x_n)}{f(x_n)}$ (d) $x_n + \frac{f'(x_n)}{f(x_n)}$

2. Condition for a root of $f(x)=0$ to lie between a and b is

(a) $f(a)>0$ and $f(b)>0$

(b) $f(a)>0$ and $f(b)<0$

(c) $f(a)<0$ and $f(b)<0$

(d) none of the above

3. Which of the following is true?

(a) $\Delta x^r = rh \cdot x^{r-1}$ (b) $\Delta x^{(r)} = rh \cdot x^{(r-1)}$

(c) $\Delta^n e^x = e^x$ (d) none of the above

4. $\nabla^2 y_2$ = _____.

(a) $y_2 + 2y_1 + y_0$ (b) $y_2 - 2y_1 + y_0$

(c) $y_2 - 2y_1 - y_0$ (d) y_2

5. For unevenly spaced point we use _____ formula.

(a) Newton (b) Gauss

(c) Sterling (d) Lagrange

6. Newton's forward interpolation formula is used to find the values of y

(a) near the end of the tabulated values

(b) in the middle of the tabulated values

(c) near the beginning of the tabulated values

(d) none

7. $\left(\frac{dy}{dx}\right)_{x=x_0} = \frac{1}{h}\left[\frac{\Delta y_0}{1} - \frac{\Delta^2 y_0}{2} + \frac{\Delta^3 y_0}{3} - \ldots.\right]$ is _____.

(a) Newton's forward differentiation formula

(b) Bessel's formula

(c) Newton's backward differentiation formula

(d) None

8. The error in the Trapezoidal rule is of order

(a) h (b) h^2

(c) h^3 (d) none

9. Form the difference equation by eliminating the constant from $y_n = a3^n$

(a) $y_{n+1} - y_n$ (b) $y_{n+1} - 2y_n$

(c) $y_{n+1} - 3y_n$ (d) $y_{n+1} - 4y_n$

10. Solve $y_{n+2} - 8y_{n+1} + 15y_n = 0$

(a) $y_n = C_1 3^x + C_2 5^x$ (b) $y_n = C_1 7^x + C_2 8^x$

(c) $y_n = C_1 2^x + C_2 4^x$ (d) None

PART B — (5 × 5 = 25 marks)

Answer ALL questions, choosing either (a) or (b).

11. (a) Find a root of $x^3 + 3x - 1 = 0$ by Newton-Raphson Method.

Or

(b) Solve by Gauss elimination method :

$x + y = 2$, $2x + 3y = 5$.

12. (a) Prove that $\Delta^n e^x = \left(e^{h-1}\right)^n e^x$.

Or

(b) Prove that $\Delta^3 y_2 = \nabla^3 y_5$.

13. (a) Find y when $x = 5$ by using Newton's forward interpolation formula.

x :	4	6	8	10
y :	1	3	8	16

Or

(b) Find y when $x = 6$ by Lagrange's Method.

x :	3	7	9	10
y :	168	120	72	63

14. (a) Find $\frac{dy}{dx}$ at $x = 51$.

x :	50	60	70	80	90
y :	19.96	36.65	58.81	77.21	94.61

Or

(b) Taking $h = 0.2$, find $\int_0^1 \frac{dx}{1+x^2}$ by Trapezoidal rule.

15. (a) Solve $y_{n+2} - 3y_{n+1} + 2y_n = 5^n$.

Or

(b) Solve $y_{n+2} - 5y_{n+1} + 6y_n = 6^n$.

PART C — (5 × 8 = 40 marks)

Answer ALL questions, choosing either (a) or (b).

16. (a) Find the root of $x \log_{10} x - 1.2 = 0$ which lies between 2 and 3 by false position method.

Or

(b) Solve by Gauss-Seidel method.

$10x + 2y + z = 9$

$x + 10y - z = -22$

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

17. (a) Prove the following :

(i) $\Delta = \frac{1}{2}\delta^2 + \delta\sqrt{1 + \frac{\delta^2}{4}}$.

(ii) $\mu\delta = \frac{1}{2}\Delta + \frac{1}{2}\Delta E^{-1}$.

Or

(b) Prove :

$\Delta\left(5x^4 + 6x^3 + x^2 - x + 7\right) = 20x^{(3)} + 108x^{(2)} + 108x^{(1)} + 11$

18. (a) Find y when $x = 84$.

x :	40	50	60	70	80	90
y :	184	204	226	250	276	304

Or

(b) Find $f(8)$ by using Newton's divided difference formula.

x :	4	5	7	10	11	13
$f(x)$:	48	100	294	900	1210	2028

19. (a) Find $\frac{dy}{dx}$, $\frac{d^2y}{dx^2}$ when $x = 550$.

x :	500	510	520	530	540	550
y :	6.2146	6.2344	6.2538	6.2729	6.2916	6.3099

Or

(b) Evaluate $\int_0^1 \frac{dx}{1+x}$ using (i) Simpson's $\frac{1}{3}$ rule (ii) Simpson's $\frac{3}{8}$ rule, taking $h = \frac{1}{6}$ for all cases.

20. (a) Solve : $4y_{n+2} - 4y_{n+1} + y_n = 2^n + 2^{-n}$.

Or

(b) Solve : $y_{n+2} - 8y_{n+1} + 16y_n = 4^n$.

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