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

Code No. : 10430 E **Sub. Code : CMMA 65**

B.Sc. (CBCS) DEGREE EXAMINATION,
APRIL 2024.

Sixth Semester

Mathematics — Core

NUMERICAL METHODS

(For those who joined in July 2021-2022)

Time : Three hours Maximum : 75 marks

PART A — (10 × 1 = 10 marks)

Answer ALL questions.

Choose the correct answer.

1. The rate of convergence of Gauss-Seidel method is roughly ———— times that of Gauss-Jacobi method.

   (a) 1 (b) 2

   (c) 3 (d) $\frac{1}{2}$

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

3. The value of $\Delta^2(e^x)$ is ————

   (a) $e^x(e^h - 1)$ (b) e^x

   (c) $e^x(e^h + 1)$ (d) $e^x(e^h - 1)^2$

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's (b) Gauss's

   (c) Sterling's (d) Lagrange's

6. Divided difference $f(x_0, x_1) =$ _____

(a) $\dfrac{f(x_1)-f(x_0)}{x_1-x_0}$ (b) $\dfrac{f(x_1)+f(x_0)}{2}$

(c) $\dfrac{f(x_1)-f(x_0)}{2}$ (d) $\dfrac{f(x_0)-f(x_1)}{2}$

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

(a) Newton's forward differentiation formula

(b) Bessel's formula

(c) Newton's backward differentiation formula

(d) Newton's differentiation formula

8. The error in Simpson's one third rule is of order _____

(a) h^4 (b) h^5

(c) h^2 (d) linear

9. The order of the difference equation

$y_{n+3} + 6y_{n+2} + 11y_{n+1} - 5y_n = \cos nx$ is = _____

(a) 2 (b) 3

(c) 1 (d) 4

10. The solution of $y_{n+2} - 8y_{n+2} + 15y_n = 0$ is

(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) $y_n = c_1 x + c_2 5^x$

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) Find an iterative formula for $\sqrt{N}$ where N is a positive.

12. (a) Find the sixth term of the sequence 8, 12, 19, 29, 42,....

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) From the following data, find the value of y when $x = 84$ using Newton backward formula.

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

14. (a) Find $\frac{dy}{dx}$ at the mid point of

x :	0	300	600	900	1200	1500	1800
y :	134	149	157	183	201	205	193

Or

(b) Find $y'(0.5)$ for the following data.

x	0	1	2	3	4
$y(x)$	1	1	15	40	85

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

Or

(b) Solve : $y_{n+1} = \sqrt{y_n}$.

PART C — ($5 \times 8 = 40$ 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

$$27x + 6y - 5 = 85$$

(b) Solve $6x + 15y + 2z = 72$

$$x + y + 54z = 110$$

by Gauss Jacobi method.

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

18. (a) From the following table estimate $e^{0.544}$ to five places of decimals using Bessel's formula. Also find e^x at $x = 0.638$.

x :	0.61	0.62	0.63	0.64
y :	1.840431	1.858928	1.877610	1.896481
x :	0.65	0.66	0.67	
y :	1.915541	1.934792	1.954237	

Or

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

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

19. (a) For the following data, find $y'(6)$ and the maximum value of y.

x :	0	2	3	4	7	9
y :	4	26	58	112	466	922

Or

(b) Evaluate $\int_0^{\frac{\pi}{2}} \sin x dx$ by Simpson's $\frac{1}{3}$ rule dividing the range into six equal parts.

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

Or

(b) Solve : $y_{n+2} + y_{n+1} - 56y_n = 2^n (n^2 - 3)$.
