K21U 6800

Reg. No. : .....

Name : .....

I Semester B.Sc. Degree (CBCSS – OBE – Regular/Supplementary/ Improvement) Examination, November 2021
(2019 Admission Onwards)
COMPLEMENTARY ELECTIVE COURSE IN MATHEMATICS
1C01 MAT-CH : Mathematics for Chemistry – I

Time : 3 Hours

Max. Marks : 40

PART – A

Questions **1 – 5**, Answer **any 4** questions. **Each** question carries **1** mark.

1. Find the n^{th} derivative of $y = x^2 \log 3x$.
2. Find the Maclaurin series expansion for $f(x) = \tan^{-1}x$ upto term containing x^3.
3. Verify Rolle's theorem for the function $f(x) = \frac{\sin x}{e^x}$ in the interval $[0, \pi]$.
4. If A and B are orthogonal square matrices of same size, then prove that AB is orthogonal.
5. Evaluate $\lim_{x \to 0} \frac{1 - \cos x}{x^2}$.

PART – B

Questions **6 – 15**, Answer **any 7** questions. **Each** question carries **2** marks.

6. If $y = \sin(\sin x)$, prove that $\frac{d^2y}{dx^2} + \tan x \frac{dy}{dx} + y \cos^2 x = 0$.
7. Find the n^{th} derivative of $y = e^{2x} \sin x \sin 2x$.
8. If x is positive, prove that $x > \log(1 + x) > x - \frac{x^2}{2}$.
9. Verify Mean value theorem for the function $f(x) = x - \frac{1}{x}$ in the interval $[3, 4]$.

P.T.O.

10. Prove that $\sec x = 1 + \frac{x^2}{2!} + \frac{5x^4}{4!} + \ldots$

11. Evaluate $\lim_{x \to 0} \left(\frac{1}{x} - \frac{1}{e^x - 1} \right)$.

12. Find the rank of the matrix $A = \begin{bmatrix} 1 & 1 & -1 \\ 1 & 2 & -4 \\ -2 & 3 & -13 \end{bmatrix}$.

13. Find the value of λ for which the system of homogeneous linear equations $2x + 3y + 5z = 9$; $7x + 3y - 2z = 0$; $2x + 3y + \lambda z = 9$ has non-trivial solutions.

14. Solve the system of equations $2x - 3y = 7$; $4x + 2y = 6$ using matrix inversion method.

15. Express the vector $a = (3, 12, 7)$ as a linear combination of vectors $x_1 = (3, 6, 2)$ and $x_2 = (-1, 0, 1)$.

PART – C

Questions **16 – 22**, Answer **any 4** questions. **Each** question carries **3** marks.

16. If $x = a(\cos t + t \sin t)$ and $y = a(\sin t - t \cos t)$, find $\frac{d^2y}{dx^2}$.

17. Find the n^{th} derivative of $y = x \log \frac{x-1}{x+1}$.

18. Find the inverse of the matrix $A = \begin{bmatrix} 3 & 2 & 4 \\ 2 & 1 & 1 \\ 1 & 3 & 5 \end{bmatrix}$ using Gauss – Jordan method.

19. Solve the system of linear equations $2x + 4y - z = 7$; $x - 2y + z = 0$; $2x + 3y - 3z = -1$ using Cramer's Rule.

20. Find the best value of a and b if $y = ax + b \log_{10} x$ is the curve which represents most closely the observed values given below :

x	2	3	4	5	6
y	3.74	5.99	7.47	8.92	9.86

21. Find the straight line $y = a + bx$ that best fits the following data :

x	50	70	100	120
y	12	15	21	25

Also compute y when x = 150.

22. Fit the curve $y = ae^{bx}$ using following data :

x	2.30	3.10	4.00	4.92	5.91	7.20
y	33.0	39.1	50.3	67.2	85.6	125.0

PART – D

Questions **23 – 26**, Answer **any 2** questions. **Each** question carries **5** marks.

23. If $y = e^{m\sin^{-1}x}$, prove that $(1 - x^2)\, y_{n+2} - (2n + 1)\, xy_{n+1} - (m^2 + n^2)y_n = 0$.

24. i) Prove that $e^x \cos x = 1 + x - \frac{2x^3}{3!} - \frac{2^2x^4}{4!} + \ldots$

ii) Evaluate $\lim_{x\to 0}(1+\sin x)^{1/x}$.

25. Test the consistency of the system of linear equations : $2x - 3y + 7z = 5$; $3x + y - 3z = 13$; $2x + 19y - 47z = 32$. If consistent, find solutions.

26. Fit the parabola of the form $y = ax^2 + bx + c$ using following data :

x	1.0	1.5	2.0	2.5	3.0	3.5	4.0
y	1.1	1.3	1.6	2.0	2.7	3.4	4.1

———————