



Reg. No. : .....

Name : .....

**First Semester B.Sc. Degree (C.B.C.S.S. – OBE-Supplementary/  
Improvement) Examination, November 2024  
(2019 to 2023 Admission)  
COMPLEMENTARY ELECTIVE COURSE IN MATHEMATICS  
1C01MAT-CH : Mathematics for Chemistry – I**

Time : 3 Hours

Max. Marks : 40

## SECTION – A

Questions 1-5, answer **any four** questions. **Each** question carries **one** mark. (4×1=4)

1. If  $y = (ax + b)(cx + d)$ , show that  $2y_1 y_2 = y_2^2$ .
2. State Lagrange's mean value theorem.
3. Find the rank of the matrix  $\begin{pmatrix} 1 & 2 & 3 \\ 2 & 4 & 6 \end{pmatrix}$ .
4. Does the matrix  $\begin{pmatrix} 0 & 1 \\ 1 & 1 \end{pmatrix}$  is an elementary matrix? Justify your answer.
5. Show that the matrices  $A = \begin{pmatrix} 1 & 2 \\ 1 & 3 \end{pmatrix}$  and  $B = \begin{pmatrix} 1 & 2 \\ 0 & 1 \end{pmatrix}$  are equivalent matrices.

## SECTION – B

Questions 6-15, answer **any seven** questions. **Each** question carries **two** marks.

(7×2=14)

6. Show that  $D^n (\sin(ax + b)) = a^n \sin(ax + b + n\pi/2)$ .
7. If  $x = a(\cos t + t \sin t)$ ,  $y = a(\sin t - t \cos t)$ , find  $\frac{d^2y}{dx^2}$ .
8. Evaluate  $\lim_{x \rightarrow 0} \frac{1 - \cos 2x}{1 - \cos 4x}$ .

P.T.O.

K24U 4021

-2-



9. Prove that  $\cos x = 1 - \frac{x^2}{2!} + \frac{x^4}{4!} - \dots$ .
10. Find the normal form of the matrix  $\begin{pmatrix} 1 & 2 & -1 \\ 1 & -2 & 1 \\ 2 & 0 & 0 \end{pmatrix}$ .
11. Determine the value of  $p$  such that the rank of the matrix  $\begin{pmatrix} 1 & 2 & 0 \\ 2 & p & 0 \\ 0 & 0 & 0 \end{pmatrix}$  is 1.
12. If  $A$  is orthogonal, show that  $|A| = \pm 1$ .
13. Convert the curve  $y = 3e^{2x}$  in to a straight line.
14. Write the normal equations corresponding to the straight line  $y = ax + b$ .
15. Explain briefly on the method of least squares to fit the parabola  $y = a + bx + cx^2$ .

## SECTION – C

Questions 16-22, answer **any four** questions. **Each** question carries **three** marks.

(4×3=12)

16. Given that  $y = e^{a \sin^{-1} x}$ . Show that  $(1 - x^2) y_2 - xy_1 - a^2 y = 0$ .
17. If  $y = x^n \log x$ . Prove that  $y_{n+1} = n!/x$ .
18. Expand  $\log_e x$  in terms of  $x - 1$  and evaluate  $\log_e 1.1$  correct to four decimal places.
19. Verify the result of Cauchy's mean value theorem for the functions  $\sin x$  and  $\cos x$  in the interval  $[a, b]$ .
20. Solve the system of equations :  $2x + y + z = 2$ ,  $x - y + z = 0$ ,  $-x - y + 3z = 2$  using the Cramer's rule.
21. Reduce the matrix  $A$  to its normal form where  $A = \begin{pmatrix} 0 & 1 & -3 & -1 \\ 1 & 0 & 1 & 1 \\ 3 & 1 & 0 & 2 \\ 1 & 1 & -2 & 0 \end{pmatrix}$  and hence find the rank of  $A$ .



-3-

K24U 4021

22.  $R$  is the resistance to maintain a train at speed  $V$ , find a law of the type  $R = a + bV^2$  connecting  $R$  and  $V$ , using the following data.

V	R
10	8
30	15
40	21
50	30

## SECTION – D

Questions 23-26, answer **any two** questions. **Each** question carries **five** marks.

23. If  $y = \tan^{-1} x$ , prove that  $(1 + x^2) y_{n+1} + 2nxy_n + n(n-1)y_{n-1} = 0$ . (2×5=10)
24. Show that  $\lim_{x \rightarrow 0} \frac{x^x - x}{x - 1 - \log x} = 2$ .
25. Show that the equations  $5x + 3y + 7z - 4 = 0$ ,  $x + 26y + 2z - 9 = 0$ ,  $7x + 2y + 10z - 5 = 0$  are consistent and solve.
26. Fit a second degree parabola to the following data.

x	y
0	1
1	1.8
2	1.3
3	2.5
4	6.3