K20U 3322

Reg. No. : ....

Name : ....

I Semester B.Sc. Degree CBCSS(OBE) Reg./Sup./Imp. Examination, November 2020
(2019 Admn. Onwards)
COMPLEMENTARY ELECTIVE COURSE IN MATHEMATICS
1C01 MAT–CH : Mathematics for Chemistry – I

Time : 3 Hours Max. Marks : 40

PART – A (Short Answer)

Answer **any four** questions out of five questions. **Each** question carries **1** mark.

1. Find the derivative of $x^4 + x^7 - \sin x$.

2. Write series expansion of $\log(1 + t)$.

3. Find the rank of the matrix $A = \begin{bmatrix} 1 & 2 \\ -1 & 0 \end{bmatrix}$.

4. Give an example of a linear law.

5. Convert $y = ax^n + b \log x$ to the linear form. **(4×1=4)**

PART – B (Short Essay)

Answer **any seven** questions out of ten questions. **Each** question carries **2** marks.

6. Find $\frac{dy}{dx}$ when $x^3 + y^3 = 3axy$.

7. If $x = 2\cos t - \cos 2t$ and $y = 2\sin t - \sin 2t$, then find $\frac{dy}{dx}$.

8. Verify Rolle's theorem for $f(x) = x^2 + 1$ in $(-2, 2)$.

9. Find $\underset{x \to 0}{\text{Lt}} \left[\frac{3\sin^2 x}{x} - 2 \right]$.

P.T.O.

10. For what values of λ, the matrix $\begin{bmatrix} 2 & 0 & 0 & 1 \\ 0 & 5 & 0 & 0 \\ 1 & 2 & 1 & \lambda \end{bmatrix}$ has rank 3 ? Give reason for your answer.

11. Using the Gauss-Jordan method, find the inverse of $A = \begin{bmatrix} 1 & 2 \\ 1 & 3 \end{bmatrix}$.

12. Show that the transformation $y_1 = 2x_1 + x_2 + x_3$, $y_2 = x_1 + x_2 + 2x_3$, $y_3 = x_1 - 2x_3$ is regular.

13. Verify that the matrix $A = \begin{bmatrix} \cos\theta & 0 & \sin\theta \\ 0 & 1 & 0 \\ \sin\theta & 0 & \cos\theta \end{bmatrix}$ is orthogonal.

14. Describe the graphical method to plot $y = mx + c$.

15. Describe Principle of least squares. (7×2

PART – C (Essay)

Answer **any four** questions **out of seven** questions. **Each** question carries **3** marks.

16. Prove that $\frac{d}{dx}\left(\sin^{-1} x\right) = \frac{1}{\sqrt{1-x^2}}$, for every $x \in (-1, 1)$.

17. If $x^y \cdot y^x = 1$, then find $\frac{dy}{dx}$.

18. Find the values of a and b such that $\underset{x \to 0}{\mathrm{Lt}} \left[\frac{x(1 + a\cos x) - b\sin x}{x^3}\right] = 1$.

19. In the mean value theorem $f(b) - f(a) = (b - a)f'(c)$, determine c lying between a and b, if $f(x) = x(x-1)(x-2)$, $a = 0$ and . b=½

20. Solve the equations $3x + y + 2z = 3$, $2x - 3y - z = -3$, $x + 2y + z = 4$ by matrix method.

21. Are the vectors $x_1 = (1, 1, 1, 0)$, $x_2 = (2, 2, 2, 0)$, $x_3 = (3, 3, 3, 0)$ and $x_4 = (3, 3, 3, 1)$ linearly dependent ? If so, express one of these as a linear combination of the others.

22. If P is the pull required to lift a load W by means of a pulley block, find a linear law of the form P = mW + c connecting P and W, using the following data.

P = 12	15	21	25
W = 50	80	100	120

(4×3=12)

PART – D (Long Essay)

Answer **any two** questions out of four questions. **Each** question carries **5** marks.

23. If $y^{\cot x} + (\tan^{-1} x)^y = 1$, then show that

$$\frac{dy}{dx} = \frac{y^{\cot x}.\operatorname{cosec}^2 x.\log y - \left[\dfrac{(\tan^{-1}x)^{y-1}.y}{1+x^2}\right]}{(y^{\cot x - 1}.\cot x) + \left[(\tan^{-1} x)^y.\log(\tan^{-1} x)\right]}.$$

24. a) Using Maclaurin's series, expand sinx upto the term containing x^5.

b) Expand $\log(1 + \sin^2 x)$ in powers of upto the term in x^6.

25. a) Using the Gauss-Jordan method, find the inverse of $A = \begin{bmatrix} 1 & 1 & 3 \\ 1 & 3 & -3 \\ -2 & -4 & -4 \end{bmatrix}$.

b) Test for consistency of the linear system of equations $5x + 3y + 7z = 4$, $15x + 9y + 21z = 12$, $10x + 6y + 14z = 0$.

26. If 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(miles/hour) :	10	20	30	40	50
R(lb/ton) :	8	10	15	21	30

(2×5=10)