24. a) Prove that $\underset{x \to 1}{Lt} \left[\dfrac{x^x - x}{x - 1 - \log x} \right] = 2$.

b) Evaluate $\underset{x \to 0}{Lt} \ (1+x)^{1/x}$.

25. a) Reduce the matrix $A = \begin{bmatrix} 1 & 3 & 40 \\ 4 & 8 & 80 \\ 2 & 2 & 41 \end{bmatrix}$ into its normal form and hence

find its rank.

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

26. a) Fit a second degree parabola to the following data:

x =	1	1.5	2	2.5	3	3.5	4
y =	1.1	1.3	1.6	2	2.7	3.4	4.1

b) 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

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**I Semester B.Sc. Degree (CBCSS (OBE)-Regular)
Examination, November -2019
(2019 ADMISSIONS)
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 Marks.   **(4 × 1 = 4)**

1. Find the derivative of $2x^5 - x^3 - \sin x$.

2. Write the maclaurin's series of $\tan \theta$.

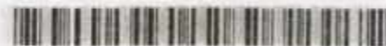3. Find the rank of the matrix $A = \begin{bmatrix} 3 & 3 & 3 \\ 2 & 2 & 2 \\ 1 & 1 & 1 \end{bmatrix}$.

4. Give an example of a linear law.

5. Convert $y = ae^{bx}$ into a linear form.

PART - B
Short Essay

Answer **any Seven** questions out of questions. Each question carries 2 Marks.   **(7 × 2 = 14)**

6. Find the derivative of $y = \dfrac{1 - x^2}{1 + x^2}$.

7. Find the derivative of $y = x^{\sin x}$.

8. Verify Rolle's theorem for $f(x) = \sin x$ in $[0, \pi]$.

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

10. For what values of λ, the matrix $A = \begin{bmatrix} 7 & 11 \\ 14 & 22 \\ 21 & \lambda \end{bmatrix}$ has rank 2? Give reason for your answer.

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

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 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 method of least squares.

PART - C

(Essay)

Answer any **four** questions out of **seven** questions. Each question carries 3 marks.　　　　　　　　　　　　　　　　　　　　$(4 \times 3 = 12)$

16. If $x^y = e^{x-y}$, prove that $\dfrac{dy}{dx} = \dfrac{\log x}{(1 + \log x)^2}$.

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

18. Expand $e^{\sin x}$ in powers of x upto the term in x^4.

19. In the mean value theorem $\dfrac{f(b) - f(a)}{(b-a)} = f'(c)$, determine c lying between a and b, if $f(x) = \sqrt{x-1}$, $a = 1$ and $b = 3$.

20. Solve the equations $3x + y + 2z = 3$, $2x - 3y - z = -3$, $x + 2y + z = 4$ by Cramer's rule.

21. Are the vectors $x_1 = (1,1,1)$, $x_2 = (2,2,2)$ and $x_3 = (3,3,3)$ 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	70	100	120

PART- D

(Long Essay)

Answer any **two** questions out of **four** questions. Each question carries 5 marks.　　　　　　　　　　　　　　　　　　　$(2 \times 5 = 10)$

23 a) Find the derivative of $y = (x^3 + 2)(x^2 + 2x + 1)$ by

　　i) Using product rule

　　ii) Without using product rule.

　b) If $y = \left[x^{\tan x} + (\sin x)^{\cos x} \right]$, then find $\dfrac{dy}{dx}$