OEMT111

Reg. No.

I Semester B.Sc. (NEP) Degree Examination, April - 2023

MATHEMATICS

Mathematics (Open Elective)

Paper : I

Time : 2½ Hours **Maximum Marks : 60**

Instructions to Candidates:

Answer all the questions.

I. Answer any **Five** questions. **(5×3=15)**

1. Define symmetric and skew symmetric matrices.
2. Verify whether the system of equations.

$$x+y-2z=5$$
$$x-2y+z=-2$$
$$-2x+y+z=4$$

are consistent.

3. Find the eigen values of the matrix $A=\begin{bmatrix} 4 & 1 \\ -1 & 2 \end{bmatrix}$.
4. Find the value of C by using Rolle's theorem for the function $f(x)=8x-x^2$ in [2,6].
5. Find the right hand limit of the function $f(x)=\begin{cases} 3x-2 \text{ when } x \le 1 \\ 4x^2-3x \text{ when } x>1 \end{cases}$ at x = 1.
6. Evaluate $\underset{x\to 0}{Lim}\left(\frac{1-\cos x}{x^2}\right)$ by using L'Hospital's rule.
7. Find the arc length of the catenary $y=a\cosh\left(\frac{x}{a}\right)$ from x = 0 to x =a.
8. Find the area of the loop of the curve $ay^2=x^2(a-x)$ about x-axis between x =0 to x=a.
9. Write the formula for finding the volume of solid obtained by revolving the curve $y=f(x)$ about the x-axis between x = a and x = b.

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II. Answer any **Three** questions. (3×5=15)

10. Find the rank of the matrix

$$A = \begin{bmatrix} 1 & 0 & 1 & 1 \\ 0 & 1 & 1 & -1 \\ 2 & 1 & 3 & 1 \\ 1 & 2 & 3 & -1 \end{bmatrix}$$ by reducing to the Echelon form.

11. Find the non - trivial solution of the system of equations.

$$x+2y+4z=0$$
$$x+4y+5z=0$$
$$x+2y+7z=0$$

12. For what values of λ and μ the system of equations

$$x+2y+3z=5$$
$$x+3y-z=4$$
$$x+4y+\lambda z=\mu$$

have (i) no solution (ii) unique solution (iii) infinitely many solutions.

13. Find the eigen values and its corresponding eigen vectors of the matrix A.

$$A = \begin{bmatrix} 5 & 4 \\ 1 & 2 \end{bmatrix}.$$

14. Verify Cayley Hamilton's theorem for the matrix $A = \begin{bmatrix} 2 & -1 \\ -1 & 2 \end{bmatrix}$.

III. Answer any **Three** of the following. **(3×5=15)**

15. Examine the continuity of the function

$$f(x) = \begin{cases} x^2+3 \; for \; x>1 \\ 2x+2 \; for \; x\le 1 \end{cases} \text{ at } x=1.$$

16. Discuss the differentiability of the function.

$$f(x) = \begin{cases} x^2 & x\le 3 \\ 6x-9 & x>3 \end{cases} \text{ at } x=3.$$

17. Verify the Lagrange's mean value theorem for the function $f(x) = x^2 - 3x + 2$ in [-2,3].

18. Find the Taylor's series expansion for $f(x) = \sin x$ in powers of $\left(x - \frac{\pi}{2}\right)$.

19. Evaluate

i. $\lim_{x \to 0} \left(\frac{a^x - b^x}{x}\right)$. ii. $\lim_{x \to 0} \left(\frac{x - \sin x}{x^3}\right)$.

by using L'Hospital's rule.

IV. Answer any **Three** questions. **(3×5=15)**

20. Find the entire length of the curve $x^{2/3} + y^{2/3} = a^{2/3}$.

21. Find the area bounded by the parabolas $y^2 = 4x$ and $x^2 = 4y$ between x = 0 and x = 4.

22. Find the surface area of the sphere of radius 'a'.

23. Find the surface area generated by revolving the curve $x = y^3$ about the y-axis from y = 0 to y = 2.

24. Find the volume of the solid generated by revolution of the loop of the curve $2ay^2 = x(x-a)^2$ about the x-axis between x = 0 to x = a.