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I Semester B.Sc. Degree Examination, February/March - 2024

MATHEMATICS - I

(NEP Scheme 2021-22 and Onwards)

Paper : I (OE)



Time : 2½ Hours

Maximum Marks : 60

Instructions to Candidates:

Answer ALL the questions.

I. Answer any FIVE questions.

(5×3=15)

1. Define rank of a matrix.

2. Reduce the matrix $\begin{pmatrix} 1 & 3 & -2 \\ 2 & -1 & 4 \\ 1 & -11 & 14 \end{pmatrix}$, using elementary row transformations, to echelon form.

3. State Cayley - Hamilton theorem.

4. Evaluate $\lim_{x \rightarrow 2} \frac{x^2 - 3x + 2}{x - 2}$

5. Find the Value of K such that the function

$$f(x) = \begin{cases} kx^2 & \text{if } x > 2 \\ 8 & \text{if } x \leq 2 \end{cases} \text{ is continuous at } x = 2.$$

6. Find the value of C using Rolle's theorem for the function $f(x) = 8x - x^2$ in $[2, 6]$ 7. Write the formula to find area enclosed by the curve $y = f(x)$, the x -axis between the lines $x = a$ and $x = b$.8. Obtain the Maclaurin's expansion of e^x upto third degree term.9. Evaluate $\lim_{x \rightarrow \pi/2} (\sec x - \tan x)$

[P.T.O.]



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II. Answer any THREE questions.

(3×5=15)

10. Find the rank of the matrix $\begin{pmatrix} 2 & 1 & 1 & 2 \\ 2 & 1 & -3 & -6 \\ 3 & -3 & 1 & 2 \end{pmatrix}$ by reducing it into the normal form.

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

$$x+2y+4z=0, \quad x+4y+5z=0, \quad x+2y+7z=0.$$

12. For what values of λ and μ the equations $x+y+z=6$, $x+2y+3z=10$ and $x+2y+\lambda z=\mu$ have no solution?

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

$$\begin{pmatrix} -3 & 8 \\ -2 & 7 \end{pmatrix}.$$

14. Verify Cayley - Hamilton theorem for the matrix $\begin{pmatrix} 1 & 4 \\ 2 & 3 \end{pmatrix}$.

III. Answer any THREE questions.

(3×5=15)

15. Show that $\lim_{x \rightarrow 0} x \sin \frac{1}{x} = 0$

16. Discuss the differentiability of the function $f(x) = \begin{cases} x^2, & x \leq 3 \\ 6x-9, & x > 3 \end{cases}$ 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 $f(x) = \sin x$ at $x = \frac{\pi}{2}$ upto fourth degree.

19. Evaluate $\lim_{x \rightarrow \pi/2} (\sin x)^{\tan x}$.



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IV. Answer any THREE questions.

(3×5=15)

20. Find the length of the arc of the curve $y = \log(\sec x)$ from $x = 0$ to $x = \frac{\pi}{3}$.
21. Find the area of the loop of the curve $ay^2 = x^2(a-x)$.
22. Find the surface area of the solid generated by revolution of the astroid $x^{2/3} + y^{2/3} = a^{2/3}$ about x -axis.
23. Find the volume generated by rotating a parabola $y^2 = 4ax$. Lying between its vertex and latus rectum about x - axis.
24. Find the volume of the sphere
 $x^2 + y^2 + z^2 = a^2$.
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