K24U 1774

Reg. No. : ....

Name : ....

Second Semester B.Sc. Degree (CBCSS – Supplementary/One Time Mercy Chance) Examination, April 2024
(2014 – 2018 Admissions)
COMPLEMENTARY COURSE IN MATHEMATICS
2C02MAT-PH : Mathematics for Physics and Electronics – II

Time : 3 Hours | Max. Marks : 40

SECTION – A

All the **first 4** questions are **compulsory**. They carry **1** mark **each**. **(4×1=4)**

1. Write reduction formula for $I_n = \int_0^{\frac{\pi}{4}} \tan^n x dx$.
2. Write the formula for arc length of a curve given by x = f(t), y = g(t) where $a \le t \le b$.
3. What is the rank of the matrix $\begin{bmatrix} 1 & 1 & 1 \\ 2 & 2 & 2 \\ 3 & 3 & 3 \end{bmatrix}$?
4. If 2 and 3 are eigen values of a 2×2 matrix A, then write the eigen values of –A.

SECTION – B

Answer **any 7** questions from among questions **5** to **13**. These questions carry **2 marks each**. **(7×2=14)**

5. Evaluate $\int_0^3 \frac{27x^4}{\sqrt{9-x^2}} dx$.
6. Find $\int \operatorname{cosec}^4 x dx$.

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7. Find the area bounded by the ellipse $\frac{x^2}{9} + \frac{y^2}{16} = 1$.
8. Find the area of the surface generated by revolving the arc of the curve y = coshx for $0 \le x \le 1$.
9. Evaluate $\int_0^6 \int_0^x \int_0^y z dz dy dx$.
10. Find the area of the region R on the right side of y axis, bounded by the lines x + y – 1 = 0 and x – y – 1 = 0.
11. Prove or disprove the statement for a 2×2 matrix A that "$A^2 = 0 \Rightarrow A = 0$".
12. Write the characteristic equation of the matrix $A = \begin{bmatrix} 0 & 1 & 1 \\ 1 & 0 & 1 \\ 1 & 1 & 0 \end{bmatrix}$.
13. Prove that the eigen values of a diagonal matrix are its diagonal entries.

SECTION – C

Answer **any 4** questions from among the questions **14** to **19**. These questions carry **3 marks each**. **(4×3=12)**

14. Find the length of the curve y = log cosec x for $x \in \left[\frac{\pi}{6}, \frac{\pi}{2}\right]$.
15. Find the volume of the solid generated by $y = x^2 + x$, $0 \le x \le 1$ about the x-axis.
16. Solve the system of equations
    3x + 4y + 5z = 5
    2x – y – 3z = 6
    x + 3y – 2z = 7
17. Define linear independence of vectors. Prove that the vectors (1, 3, 2), (0, 1, 1) and (1, 2, 1) is not a basis for $\mathbb{R}^3$.

18. Obtain diagonalisation of $\begin{bmatrix} 2 & 1 \\ 2 & 3 \end{bmatrix}$.
19. If $A = \begin{bmatrix} 2 & 5 \\ 1 & 3 \end{bmatrix}$, find A^3 and A^4 in terms of A and $I_2 = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$.

SECTION – D

Answer **any 2** questions from among the questions **20** to **23**. These questions carry **5 marks each**. **(2×5=10)**

20. Find the length of the curve given by the parametric equation $x = e^t \sin t, y = e^t \cos t; 0 \le t \le \frac{\pi}{2}$.
21. Evaluate $\int_0^1 \int_x^1 \sin(y^2) dy dx$ by writing the integral in the reverse order.
22. Solve the system x – 2y + z = 7, 2x + y + 2z = 9, 3x + 2y – z = 1 by using Cramer's rule.
23. Verify Cayley Hamilton theorem for the matrix $A = \begin{bmatrix} 1 & 1 & 2 \\ 3 & 0 & 5 \\ 2 & 0 & 7 \end{bmatrix}$.