K24U 1622

Reg. No.: .....

Name : .....

**Second Semester B.Sc. Degree (CBCSS – OBE-Regular/Supplementary/ Improvement) Examination, April 2024**
**(2019 Admission Onwards)**
**COMPLEMENTARY ELECTIVE COURSE IN MATHEMATICS**
**2C02 MAT-ST : Mathematics for Statistics – II**

Time : 3 Hours Max. Marks : 40

SECTION – A

Answer **any 4** from the following 5 questions. **Each** question carries **1** mark.

1. Given that $z = x^2 + y^2 + 2xy + 4x - 3y + 8$. Find $\frac{\partial^2 z}{\partial y^2}$.
2. Evaluate $\int \sin^2 x \cos x dx$.
3. Evaluate $\int_0^1 \int_0^1 x^2 y^2 dxdy$.
4. Give an example of diagonal matrix.
5. State Euler's theorem for homogeneous functions. **(4×1=4)**

SECTION – B

Answer **any seven** questions from the following 10 questions. **Each** question carries **2** marks.

6. Show that the function $u = \sin(x - ct)$ is a solution of $\frac{\partial^2 u}{\partial t^2} = c^2 \frac{\partial^2 u}{\partial x^2}$.
7. Suppose $z = xy$, $x = t^2$, $y = t$. Find $\frac{dz}{dt}$.
8. Does the function $f(x, y) = \sin(xy) + x + y$ is continuous at the point (0, 0) ? Justify your answer.
9. Find $\int_0^{\pi/2} \sin^3 x \, dx$.
10. Evaluate $\int \tan^2 x \sec^4 x \, dx$.

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11. Use polar coordinates to evaluate the double integral $\int_0^1 \int_0^{\sqrt{1-x^2}} (x^2 + y^2) dydx$.
12. Use a double integral to find the area enclosed between the parabolas $y^2 = x$ and $x^2 = y$.
13. Find the spherical coordinate equation of the cone $z = \sqrt{x^2 + y^2}$.
14. Given that $A = \begin{bmatrix} 1 & -1 \\ 2 & 3 \end{bmatrix}$. Show that $A^2 - 4A + 5I = 0$.
15. Find the eigenvalues of the matrix $\begin{bmatrix} 1 & 0 \\ 2 & -1 \end{bmatrix}$. **(7×2=14)**

SECTION – C

Answer **any four** questions from the following 7 questions. **Each** question carries **3** marks.

16. Show that a matrix and its transpose having the same eigenvalues.
17. State Cayley-Hamilton Theorem. Using Cayley-Hamilton Theorem, find the inverse of the matrix $A = \begin{bmatrix} 1 & 2 \\ 2 & -1 \end{bmatrix}$.
18. Find the length of the curve $f(x) = x^{3/2}$ from $x = 0$ to $x = 1$.
19. Evaluate $\int \tan^4 x dx$.
20. Given that $u = x^2 - y^2$. Show that $xu_x + yu_y = 2u$.
21. Find the domain and range of the function $f(x,y) = \frac{x^2 - y^2}{x + y}$.
22. Evaluate $\int \sin^4 x \cos^4 x dx$. **(4×3=12)**



SECTION – D

Answer **any two** questions. **Each** question carries **5** marks.

23. Use spherical coordinates to evaluate $\int_{-2}^{2} \int_{-\sqrt{4-x^2}}^{\sqrt{4-x^2}} \int_0^{\sqrt{4-x^2-y^2}} z^2 \sqrt{x^2 + y^2 + z^2} dzdydx$.
24. Given that $u = \frac{x^2 + y^2}{x - y}$. Show that $x^2 \frac{\partial^2 u}{\partial x^2} + 2xy \frac{\partial^2 u}{\partial x \partial y} + y^2 \frac{\partial^2 u}{\partial y^2} = 0$.
25. Reduce the matrix $A = \begin{bmatrix} 3 & 4 \\ 0 & -2 \end{bmatrix}$ to the diagonal form.
26. Show that $\int \sec^n x dx = \frac{\sec^{n-2} x \tan x}{n-1} + \frac{n-2}{n-1} \int \sec^{n-2} x dx$. **(2×5=10)**