



K23U 1998

Reg. No. : .....

Name : .....

II Semester B.Sc. Degree (CBCSS – OBE – Regular/Supplementary/  
Improvement) Examination, April 2023  
(2019 Admission Onwards)

COMPLEMENTARY ELECTIVE COURSE IN MATHEMATICS  
2C02 MAT – BCA : Mathematics for BCA – II

Time : 3 Hours

Max. Marks : 40

PART – A

Answer any 4 questions.

(4×1=4)

1. Evaluate  $\lim_{\substack{x \rightarrow 1 \\ y \rightarrow 1}} \frac{x(y-2)}{y(x-2)}$ .
2. Write the reduction formula for  $\int \sin^n x \, dx$ .
3. State Fubini's theorem.
4. State Cayley-Hamilton theorem.
5. What can you say about the eigenvalues of a triangular matrix ?

PART – B

Answer any 7 questions.

(7×2=14)

6. Evaluate  $\frac{\partial z}{\partial x}$  and  $\frac{\partial z}{\partial y}$  for  $z = x^2 + 3xy + y - 1$ .
7. If  $z = xe^y + y + 1$ , find  $\frac{\partial^2 z}{\partial x \partial y}$ .
8. Integrate  $xe^x$ .
9. Integrate  $\cos^3 x \sin x$ .
10. Integrate  $1 - 6x^2y$  over the rectangle  $0 \leq x \leq 2, -1 \leq y \leq 1$ .

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11. Write an iterated integral for  $\iint_R dA$  over the region bounded by  $y = \sqrt{x}$ ,  $y = 0$  and  $x = 9$  using both vertical and horizontal cross sections.
12. Find the eigenvalues of the matrix  $\begin{bmatrix} 5 & 4 \\ 1 & 2 \end{bmatrix}$ .
13. Define similarity of matrices.
14. Find the matrix corresponding to the quadratic form  $2xy + 2yz + 2zx$ .
15. Prove that any square matrix and its transpose have the same eigenvalues.

## PART - C

Answer any 4 questions.

(4×3=12)

16. If  $z = f(x + ct) + \phi(x - ct)$ , prove that  $\frac{\partial^2 z}{\partial t^2} = c^2 \frac{\partial^2 z}{\partial x^2}$ .
17. If  $u = \frac{x^3 y^3 z^3}{x^3 + y^3 + z^3} + \log \left( \frac{xy + yz + zx}{x^2 + y^2 + z^2} \right)$ , find the value of  $x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y} + z \frac{\partial u}{\partial z}$ .
18. If  $I_n = \int_0^{\pi/3} \tan^n x \, dx$ , show that  $(n-1)(I_n + I_{n-2}) = (\sqrt{3})^{n-1}$ .
19. Evaluate  $\int_0^{\pi/6} \cos^6 3\theta \sin^2 6\theta \, d\theta$ .
20. Find the volume of the region bounded by the elliptical paraboloid  $z = 10 + x^2 + 3y^2$  and below by the rectangle  $0 \leq x \leq 1, 0 \leq y \leq 2$ .
21. Evaluate  $\int_0^{\sqrt{2}} \int_0^{3y} \int_{x^2+3y^2}^{8-x^2-y^2} dz \, dx \, dy$ .
22. Find the eigenvectors of  $\begin{bmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{bmatrix}$ .



PART – D

Answer any 2 questions.

(2×5=10)

23. Transform the equation  $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$  into polar coordinates.

24. Evaluate  $\int_0^a (a^2 + x^2)^{5/2} dx$ .

25. Find the average value of  $F(x, y, z) = xyz$  throughout the cubical region D bounded by the coordinate planes and the planes  $x = 2$ ,  $y = 2$  and  $z = 2$  in the first octant.

26. Verify Cayley Hamilton theorem for the matrix  $\begin{bmatrix} 1 & 4 \\ 2 & 3 \end{bmatrix}$  and hence obtain  $A^{-1}$ . Also express  $A^5 - 4A^4 - 7A^3 + 11A^2 - A - 10I$  as a linear polynomial in A.

