

Reg. No. :

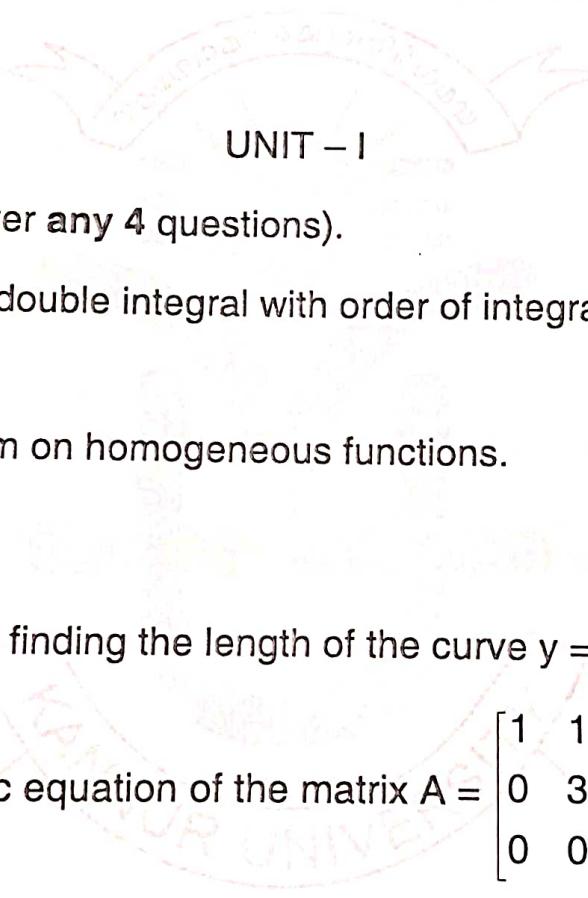
Name :

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

**COMPLEMENTARY ELECTIVE COURSE IN MATHEMATICS
2C02 MAT-CH : Mathematics for Chemistry – II**

Time : 3 Hours

Max. Marks : 40



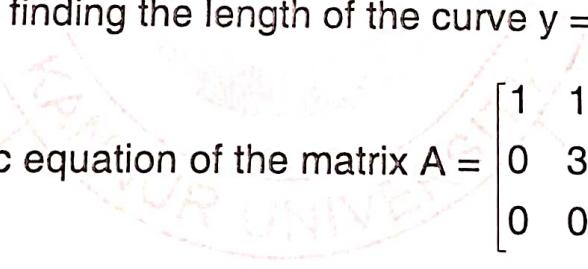
UNIT – I

Short answer type (Answer any 4 questions).

1. Write an equivalent double integral with order of integration reversed :

$$\int_0^1 \int_y^{\sqrt{y}} dx dy.$$
2. State Euler's theorem on homogeneous functions.
3. Evaluate $\int_0^{\frac{\pi}{2}} \sin^{10} t dt.$
4. Set up an integral for finding the length of the curve $y = x^2$, $-1 \leq x \leq 2$.

5. Find the characteristic equation of the matrix $A = \begin{bmatrix} 1 & 1 & 3 \\ 0 & 3 & -3 \\ 0 & 0 & -4 \end{bmatrix}$. $(4 \times 1 = 4)$



UNIT – II

Short essay type (Answer any 7 questions).

6. Change the Cartesian integral $\int_0^6 \int_0^y x dx dy$ into an equivalent polar integral.
7. Find $\frac{\partial^2 z}{\partial y \partial x}$ if $z = x^3 + y^3 - 3axy$.
8. Evaluate $\iint_R \frac{\sin x}{x} dA$, where R is the triangle in the xy-plane bounded by the x-axis, the line $y = x$ and the line $x = 1$.

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9. Evaluate $\int \frac{x^4 dx}{\sqrt{9 - x^2}}$.

10. Evaluate $\int \frac{\sin^4 \theta}{(1 + \cos \theta)^2} d\theta$.

11. Find a polar coordinate equation for the circle $x^2 + (y - 4)^2 = 16$.

12. Find the product of the eigenvalues of the matrix : $\begin{bmatrix} 1 & -2 & 0 \\ 3 & 2 & 0 \\ 6 & 1 & 1 \end{bmatrix}$.

13. Verify Cayley Hamilton theorem for the matrix $A = \begin{bmatrix} 1 & 4 \\ 2 & 3 \end{bmatrix}$.

14. If $z = \cos(x + ct)$, prove that $\frac{\partial^2 z}{\partial t^2} = c^2 \frac{\partial^2 z}{\partial x^2}$.

15. If $z = u^2 + v^2$ and $u = at^2$, $v = 2at$, find dz/dt . (7x2=14)

UNIT - III

Essay type (Answer any 4 questions).

16. Find the eigenvalues and eigen vectors of the matrix : $\begin{bmatrix} 5 & 4 \\ 1 & 2 \end{bmatrix}$

17. Find the area of the region enclosed by the parabola $y = 2 - x^2$ and the line $y = -x$.

18. Evaluate $\int_0^2 x^3 (2ax - x^2)^{3/2} dx$.

19. Evaluate $\int \sec^{2/3} x \csc^{4/3} x dx$.

20. Prove that any square matrix A and its transpose A' have the same eigenvalues.
21. Show that $x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y} = 2u \log u$ where $\log u = (x^3 + y^3)/(3x + 4y)$.
22. Find the length of the Cardioid $r = 1 - \cos\theta$. $(4 \times 3 = 12)$

UNIT – IV

Lone essay type (Answer any 2 questions).

23. If $\sin^{-1} \frac{x+y}{\sqrt{x+y}}$, prove that $x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y} = \frac{1}{2} \tan u$, and
 $x^2 \frac{\partial^2 u}{\partial x^2} + 2xy \frac{\partial^2 u}{\partial x \partial y} + y^2 \frac{\partial^2 u}{\partial y^2} = -\frac{\sin u \cos 2u}{4 \cos^3 u}$.
24. a) Find the length of the curve $y = (x/2)^{2/3}$ from $x = 0$ to $x = 2$.
b) Find the area enclosed by the lemniscate $r^2 = 4 \cos 2\theta$.
25. Reduce the matrix $A = \begin{bmatrix} -1 & 2 & -2 \\ 1 & 2 & 1 \\ -1 & -1 & 0 \end{bmatrix}$ to the diagonal form.
26. If $I_n = \int_0^a (a^2 - x^2)^n dx$ and $n > 0$, prove that $I_n = \frac{2na^2}{2n+1} I_{n-1}$. $(2 \times 5 = 10)$