K23U 1994

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 : $\int_0^1\int_y^{\sqrt{y}} dxdy$.

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 $y = x^2, -1 \le x \le 2$.

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

UNIT – II

Short essay type (Answer any 7 questions).

6. Change the Cartesian integral $\int_0^6\int_0^y x\,dxdy$ 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=

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 $\int \sec^{2/3} x \operatorname{cosec}^{4/3} x\, dx$.

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 $r = 1 - \cos\theta$. (4×3=12)

UNIT – IV

Lone essay type (Answer any 2 questions).

23. If $\sin^{-1}\frac{x+y}{\sqrt{x}+\sqrt{y}}$, 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 $I_n = \frac{2na^2}{2n+1} I_{n-1}$. (2×5=10)