

Reg. No. :

Name :

II Semester B.Sc. Degree (CBCSS – OBE – Reg./Sup./Imp.)

Examination, April 2021

(2019 Admission Onwards)

COMPLEMENTARY ELECTIVE COURSE IN MATHEMATICS

2C02 MAT-CH : Mathematics for Chemistry – II

Time : 3 Hours

Max. Marks : 40

PART – A

(1×4=4)

Answer any 4 questions :

1. Let $u(x, y) = a \tan^{-1} \left(\frac{y}{x} \right)$. Find the value of $x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y}$.

2. Evaluate $\int_0^{\frac{\pi}{2}} \cos^6 x \, dx$.

3. Plot the set of points whose polar co-ordinates satisfy $1 \leq r \leq 2$ and $0 \leq \theta \leq \frac{\pi}{2}$.

4. Find the value of $\int_0^1 \int_0^2 \int_1^3 dx \, dy \, dz$.

5. If 1, 6 are the eigen values of the matrix $A = \begin{bmatrix} 5 & 4 \\ 1 & 2 \end{bmatrix}$, find the eigen values of the matrix A^{-1} .

PART – B

(2×7=14)

Answer any 7 questions :

6. Let $u = x^y$. Find the value of $\frac{\partial^2 u}{\partial y \partial x}$.

7. If $x^3 + 3x^2y + 6xy^2 + y^3 = 1$, find $\frac{dy}{dx}$.

8. Find the value of $\int_0^1 \frac{x^9}{\sqrt{1-x^2}} dx$.

9. Evaluate $\int_0^{\frac{\pi}{2}} \sin^2 \theta \cdot \cos^4 \theta d\theta$.

10. Graph the region bounded by the curve $y^2(a-x) = x^3$ and its asymptote.

11. Find the arc length of the curve $y^2 = x^3$ from origin to the point (1, 1).

12. Write all polar co-ordinates of the point $P(2, \pi/6)$.

13. Evaluate $\int_0^\infty \int_x^\infty \frac{e^{-y}}{y} dx dy$.

14. Find the average value of the function $f(x, y) = x \cos(xy)$ over the rectangle $R: 0 \leq x \leq \pi, 0 \leq y \leq 1$.

15. Find all eigen values of the matrix $\begin{bmatrix} 1 & 1 & 3 \\ 0 & 5 & 1 \\ 0 & 0 & 1 \end{bmatrix}$.

PART - C

Answer **any 4** questions :

(3x4=12)

16. Investigate the continuity of the function $f(x, y) = \begin{cases} \frac{xy}{x^2 + y^2} & ; (x, y) \neq (0, 0) \\ 0 & ; (x, y) = (0, 0) \end{cases}$ at the origin.

17. If $u = \log \left(\frac{x^5 + y^5}{x^3 + y^3} \right)$, show that $x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y} = 2$.

18. Using reduction formula, evaluate $\int \cos^5 x dx$.

19. Evaluate $\int_0^{\frac{\pi}{6}} \cos^4(3\theta) \sin^3(6\theta) d\theta$.

20. Find the perimeter of the cardioid $r = a(1 - \cos \theta)$.
21. Using Cayley-Hamilton theorem, find the inverse of the matrix

$$A = \begin{bmatrix} 1 & 1 & 3 \\ 1 & 3 & -3 \\ -2 & -4 & -4 \end{bmatrix}.$$

22. Find the nature of the quadratic form $x^2 + 5y^2 + z^2 + 2xy + 2yz + 6zx$.

PART – D

Answer any 2 questions :

(5×2=10)

23. If $u = \tan^{-1} \left[\frac{x^3 + y^3}{x - y} \right]$, prove that $x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y} = \sin 2u$.
24. Evaluate $\int \sin^6 x \, dx$.
25. Find the volume of the solid enclosed by the sphere $x^2 + y^2 + z^2 = a^2$.
26. Verify Cayley-Hamilton theorem for the matrix $A = \begin{bmatrix} 1 & 4 \\ 2 & 3 \end{bmatrix}$. Further express $A^5 - 4A^4 - 7A^3 + 11A^2 - A - 10I$ as a linear polynomial in A .
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