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-PH : Mathematics for Physics – II

Time : 3 Hours　　　　　　　　　　　　　　　　　　　　　Max. Marks : 40

UNIT – I

Short answer type. Answer **any 4** questions. **Each** question carries 1 mark.

(4×1=4)

1. Find the natural domain of the function $z = \sqrt{3x^2 - 5y^2}$.

2. Find the degree of the homogeneous function $f(x, y) = x^n \sin\frac{y}{x}$.

3. Evaluate $\int \sin^5 x\, dx$.

4. Find the Cartesian equivalent of the Polar equation $r \cos \theta = 2$.

5. Define characteristic polynomial of a matrix A.

UNIT – II

Short essay type. Answer **any 7** questions. **Each** question carries 2 marks.

(7×2=14)

6. Show that the function $f(x, y) = x\sqrt{3} - 5y^2$ is continuous every where in the plane.

7. Verify Euler's theorem for $z = ax^2 + 2hxy + by^2$.

8. Find $\frac{dz}{dt}$ using chain rule, when $z = xy$ with $x = \cos t$ and $y = \sin t$.

9. Evaluate $\int_0^{\pi/2} \sin^4 \theta\, d\theta$.

10. Evaluate $\int_0^{\pi/2} \cos^2 \theta\, d\theta$.

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11. Evaluate $\int_{\pi/4}^{\pi/2} \cot \theta \csc^2 \theta\, d\theta$.

12. Graph the sets of points whose polar coordinates satisfy the following conditions $1 \le r \le 2$ and $0 \le \theta \le \frac{\pi}{2}$.

13. Write the Cartesian equation of the polar equation $r \cos \theta = -4$.

14. Find the eigen values of the matrix $A = \begin{bmatrix} 10 & 3 \\ 4 & 6 \end{bmatrix}$.

15. Obtain the quadratic form associated with the matrix $A = \begin{bmatrix} 1 & 4 \\ 4 & -2 \end{bmatrix}$.

16. State Cayley-Hamilton Theorem.

UNIT – III

Essay type. Answer **any 4** questions. **Each** question carries 3 marks.　　(4×3=12)

17. Describe the level surfaces of $f(x, y, z) = x^2 + y^2 + z^2$.

18. Evaluate $\int_0^a \frac{x^4 dx}{\sqrt{a^2 - x^2}}$.

19. Show that $\int_0^a x^3(a^2 - x^2)^{3/2}\, dx = \frac{\pi a^8}{32}$.

20. The line segment $x = 1 - y$, $0 \le y \le 1$, is revolved about the $y$ – axis to generate a cone. Find its lateral surface area.

21. Find the length of the cardioid $r = 1 - \cos\theta$.

22. Find the eigen values and corresponding eigen vectors of $A = \begin{bmatrix} 8 & -6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & 3 \end{bmatrix}$.

23. Prove that the eigen values of a diagonal matrix are the same as its diagonal elements.

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UNIT – IV

Long essay type. Answer **any 2** questions. **Each** question carries 5 marks.

(2×5=10)

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

25. Evaluate $\int \csc^5 x\, dx$.

26. The line segment $x = 1 - y$, $0 \le y \le 1$, is revolved about the $y$-axis to generate the cone in figure. Find its lateral surface area (which excludes the base area).

27. Diagonalize the matrix $A = \begin{bmatrix} 1 & -6 \\ 2 & 2 \end{bmatrix}$.

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