

Reg. No. : .....

Name : .....

**Second Semester B.Sc. Degree (CBCSS – OBE-Regular/Supplementary/  
Improvement) Examination, April 2024  
(2019 Admission Onwards)  
COMPLEMENTARY ELECTIVE COURSE IN MATHEMATICS  
2C02MAT-CH : Mathematics for Chemistry – II**

Time : 3 Hours

Max. Marks : 40

## UNIT – I

Short answer type. Answer **any 4** questions. Each question carries 1 mark. (4×1=4)

- Find the natural domain of the function  $z = \sqrt{1-x^2-y^2}$ .
- Find  $\lim_{(x,y) \rightarrow (0,0)} \frac{3x^2 - y^2 + 5}{x^2 + y^2 + 2}$ .
- Evaluate  $\int \cos^4 x \, dx$ .
- Define a circle in polar co-ordinates.
- Define eigen values of the matrix A.

## UNIT – II

Short essay type. Answer **any 7** questions. Each question carries 2 marks. (7×2=14)

- Show that the function  $f(x, y) = x\sqrt{3} - 5y^2$  is continuous every where in the plane.
- If  $f(x, y) = y \exp x$ , find the first order partial derivatives of f.

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- Use the chain rule to find the derivative of  $w = xy$  with respect to  $\theta$  along the path  $x = \cos \theta$ ,  $y = \sin \theta$ .

- Evaluate  $\int_0^{\pi/2} \sin^8 x \, dx$ .

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

- Find the volume of the solid generated by revolving the region between the y-axis and the curve  $x = 2/y$ ,  $1 \leq y \leq 4$ , about the y-axis.
- Find the area bounded between the curve  $y = x^2$  above the x-axis and below the line  $y = 2$ .

- When can you say that a quadratic form is positive definite ?

- Find the eigen values of the matrix  $\begin{bmatrix} 3 & 0 & 0 \\ 5 & 4 & 0 \\ 3 & 6 & 1 \end{bmatrix}$ .

- State any one method for identifying non-diagonalizable matrices.

## UNIT – III

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

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

- Evaluate  $\int_0^{\pi/4} (\cos 2\theta)^{3/2} \cos \theta \, d\theta$ .

- Evaluate  $\int_0^1 x^2(1-x^2)^{3/2} \, dx$ .

- The region between the curve  $y = \sqrt{x}$ ,  $0 \leq x \leq 4$ , and the x-axis is revolved about the x-axis to generate a solid. Find its volume.
- Find a polar equation for the circle  $x^2 + (y-3)^2 = 9$ .

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- Find a linearly independent eigenvectors of the matrix  $\begin{bmatrix} 3 & 2 \\ -5 & -4 \end{bmatrix}$  and diagonalize it.
- If  $\lambda$  is a characteristic root (eigen value) of a non-singular matrix A, then prove that  $\lambda^{-1}$  is a characteristic root of  $A^{-1}$ .

## UNIT – IV

Long essay type. Answer **any 2** questions. Each question carries 5 marks. (2×5=10)

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

- If  $I_n = \int_0^{\pi/3} \tan^n x \, dx$  show that  $(n-1)(I_n + I_{n-2}) = (\sqrt{3})^{n-1}$ .

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

- Diagonalize the matrix  $A = \begin{bmatrix} 10 & 3 \\ 4 & 6 \end{bmatrix}$ . Also find  $A^3$ .