K23U 2001

Reg. No. : .....

Name : .....

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

(2019 Admission Onwards)

CORE COURSE IN PHYSICS

2B02PHY : Mathematical Physics and Error Analysis

Time : 3 Hours Max. Marks : 40

PART – A

Short answer questions. Answer **all** questions. **Each** question carries **1** mark.

1. Define the curl of a vector function.
2. Express del operator in Cartesian coordinate system.
3. Give an expression for infinitesimal volume in spherical polar coordinates.
4. What is the geometrical meaning of a first-order ordinary differential equation ?
5. What do you mean by directional field ?
6. What do you mean by the standard deviation of a set of measurements ? **(6×1=6)**

PART – B

Short Essay Questions. Answer **any 6** questions. **Each** question carries **2** marks.

7. Explain divergence – less field.
8. Compute $(\hat{r}.\nabla)\,\hat{r}$ where $\hat{r}$ is the unit displacement vector.
9. Express the Laplacian operator in a spherical polar coordinate system and cylindrical coordinate system.

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10. Explain the fundamental theorem for gradients.
11. Explain population dynamics using a logistic equation.
12. Find a general solution of $\frac{dy}{dx} = 2y - 4x$.
13. Solve $\frac{dy}{dx} + 36y = 0$.
14. Discuss the uncertainty rules in sum and difference operations. **(6×2=12)**

PART – C

Answer **any 4** questions. **Each** question carries **3** marks.

15. Show that A and B are both irrotational.
16. Find divergence and curl of the function $\ldots \hat{\theta} + (r\sin\theta\cos\phi)\hat{\phi}$.
17. Obtain the expression for an infinitesimal volume element in spherical co-ordinates and cylindrical coordinates.
18. Solve the initial value problem and sketch the curve $4'' + 25y = 0$

    $y(0) = 3.0,\ y'(0) = -2.5,\ \cos(2.5x),\ \sin(2.5x)$.
19. The curve y(x) of an inextensible flexible cable hanging between two fixed points is obtained by solving $y'' = k(1 + 2^*y')3/2$ where k depends on weight. Find and graph y(x) assuming k<<1 and the fixed points are (–1, 0) and (1, 0) in a vertical XY plane.
20. A student measures the length of the simple pendulum five times in cm 57.3, 61.1, 73.2, 83.7 and 95.0. Calculate the mean length and its standard deviation. **(4×3=12)**