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.

P.T.O.

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

Problems, answer **any 4** questions. **Each** question carries **3** marks.

15. Show that $A \times B$ is solenoidal if A and B are both irrotational.

16. Find divergence and curl of the function $F = (r\cos\theta)\,\hat{r} + (r\sin\theta)\,\hat{\theta} + (r\sin\theta\cos\phi)\hat{\phi}$.

17. Obtain the expression for an infinitesimal volume element in spherical polar 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)**

PART – D

Long Essay Questions. Answer **any 2** questions. **Each** question carries **5** marks.

21. Describe volume integral, surface integral and line integral. Explain the fundamental theorems in gradient, divergence and curl.

22. Explain the cylindrical polar coordinate system. Express the differential displacement vector, differential area vector, and differential volume vector in cylindrical polar coordinates.

23. What is a linear ODE ? Explain how a general solution is obtained in the case of homogenous and non-homogeneous linear ODEs.

24. Distinguish between random errors and systematic errors. Explain how uncertainty is calculated in a function of several variables. **(2×5=10)**