



K25U 1328

Reg. No. : .....

Name : .....

**II Semester B.Sc. Degree (C.B.C.S.S. – OBE – Supplementary/  
Improvement) Examination, April 2025  
(2019 to 2023 Admissions)  
CORE COURSE IN PHYSICS  
2B02PHY : Mathematical Physics and Error Analysis**

Time : 3 Hours

Max. Marks : 40

**PART – A**Short answer type. **Each** carries **1** mark. Answer **all** questions.

1. Sketch vectors with positive, negative and zero divergence.
2. The angle between  $\vec{A}$  and  $\vec{B}$  is  $0$ . What is the value of the triple product  $(\vec{A} \times \vec{B}) \cdot \vec{A}$ ?
3. What are the limiting values of  $r$ ,  $\theta$ ,  $z$  in cylindrical coordinate system?
4. Give an example of linear differential equation of second order.
5. Explain the uncertainty in  $q = ab^r$ ?
6. State the square root rule for counting experiments. (6×1=6)

**PART – B**Short essay questions. **Each** carries **2** marks. Answer **any 6** questions.

7. How are the errors propagated in the measurement of difference of two quantities?
8. A student measures the acceleration due to the gravity, five times with the results (all the results in  $\text{m/s}^2$ ) 9.9, 9.8, 9.7, 9.6 and 9.5. Find the mean of the readings.
9. Explain the fundamental theorem for gradients.
10. What is the physical significance of divergence of a vector field?
11. Show that vectors  $\vec{A} = \hat{i} + 4\hat{j} + 3\hat{k}$  and  $\vec{B} = 4\hat{i} + 2\hat{j} - 4\hat{k}$  are perpendicular to each other. P.T.O.

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12. Solve the equation :  $(x+y)^2 \left( x \frac{dy}{dx} + y \right) = xy \left( 1 + \frac{dy}{dx} \right)$ .

13. Which are three surfaces at a spherical polar coordinate system?

14. The voltage across a wire is  $(150 \pm 5)\text{V}$  and the current passing through it is  $(15 \pm 0.2)\text{A}$ . Find the resistance of the wire. (6×2=12)

**PART – C**Short Essay/Problem. **Each** carries **3** marks. Answer **any 4** questions.

15. Find the scalar product of the vectors represented by  $(6, -2, 3)$  and  $(2, 9, 6)$ .
16. Find a unit vector perpendicular to the surface  $x^2 + y^2 + z^2 = 3$  at the point  $(1, 1, 1)$ .
17. Solve  $(x+1) \frac{dy}{dx} = x(y^2+1)$ .
18. Convert the rectangular coordinates  $(1, -3, 5)$  to cylindrical co-ordinates.
19. In an experiment the values of the two resistances are measured to be  $R_1 = (15 \pm 0.2) \Omega$ ,  $R_2 = (270 \pm 0.3) \Omega$ . Find the value of total resistance in series and parallel with limits of uncertainty.
20. Find the mean and standard deviation for the following test scores, 85, 100, 92, 96, 87, 94, 75. (4×3=12)

**PART – D**Long Essay Type. **Each** carries **5** marks. Answer **any 2** questions.

21. Define curl of a vector field and mention its geometrical interpretation. If  $\vec{F} = 2xz^2\hat{i} - yz\hat{j} + 3xz^3\hat{k}$ , find  $\nabla \times \vec{F}$  at the point  $(1, 1, 1)$ .
22. Express  $zi - 2x\hat{j} + y\hat{k}$  in cylindrical co-ordinates.
23. Define mean, standard deviation and standard deviation of the mean. A student measures the value of  $g$ , acceleration due to gravity ten times, with the results (all in  $\text{m/s}^2$ ) 9.9, 9.7, 9.6, 9.4, 9.7, 9.5, 9.9, 10.1, 9.4, 9.8. Calculate the mean, standard deviation and standard deviation of the mean of the above data.
24. Solve  $x^2dy + y(x+y)dx = 0$ . (2×5=10)