

QP CODE: 19002390



Reg No :

Name :

M.Sc. DEGREE (C.S.S) EXAMINATION, NOVEMBER 2019

First Semester

Faculty of Science

PHYSICS

Core - PH010101 - MATHEMATICAL METHODS IN PHYSICS - I

2019 Admission Onwards

D6C877AC

Maximum Weight: 30

Time: 3 Hours

Part A (Short Answer Questions)

*Answer any **eight** questions.*

Weight 1 each.

1. Show that the vector field $\vec{V} = (x + 3y)\hat{i} + (y - 3z)\hat{j} + (x - 2z)\hat{k}$ is solenoidal.
2. Give examples of orthogonal curvilinear coordinate systems. In each case, express rectangular coordinates as a function of the orthogonal curvilinear coordinates .
3. Find out the differential volume in cylindrical co-ordinates.
4. Verify Schwarz inequality for the vectors $(1, -3, 4)$ and $(2, 2, -5)$.
5. What are the characteristics of Poisson distribution? Mention any one practical application.
6. If two matrices A and B are diagonal, show that A and B commute.
7. Show that the products of two unitary matrices are also unitary.
8. If $A = \begin{bmatrix} 1 & 2 \\ -1 & 3 \end{bmatrix}$, find A^2 using Cayley - Hamilton theorem.
9. What is meant by line element? How is it related with a metric tensor?
10. Given two tensors, prove that their difference is also a tensor.

(8×1=8 weightage)

Part B (Short Essay/Problems)

*Answer any **six** questions.*

Weight 2 each.

11. Find the scalar potential for the gravitational force on a unit mass m .
12. Express $\nabla^2\phi$ in curvilinear coordinates.





13. Find the inner product of the functions $\sin \theta$ and $\cos \theta$ over the interval 0 to 2π .
14. A vector represented by $|u\rangle = \begin{pmatrix} x \\ 2x \\ -2x \end{pmatrix}$, where x is an arbitrary number. Find x such that $|u\rangle$ is normalized.
15. Find the eigen values λ and the corresponding eigen vectors of the matrix $\begin{bmatrix} 2 & 1 \\ -1 & 4 \end{bmatrix}$.
16. Solve by matrix method, $2x + 3y = 1$, $5x + 7y = 3$.
17. Show that the velocity of a fluid is a tensor, but its acceleration is not.
18. Determine the Christoffel symbols of the first kind in (a) rectangular, (b) cylindrical and (c) spherical coordinates.
- (6×2=12 weightage)

Part C (Essay Type Questions)

Answer any two questions.

Weight 5 each.

19. State and prove Stoke's Theorem.
20. Give the mathematical form and properties of normal distribution. Explain the main features of normal distribution curve.
21. Find the inverse of the matrix $\begin{bmatrix} 1 & 2 & -2 \\ 1 & 1 & 1 \\ 0 & 0 & 1 \end{bmatrix}$ by Gauss- Jordan method.
22. Find the differential equations for the geodesic in (a) cylindrical and (b) spherical coordinates.
- (2×5=10 weightage)

