Reg. No ..... Name **25P114**

M.Sc. DEGREE END SEMESTER EXAMINATION- NOVEMBER 2025

SEMESTER 1 : PHYSICS

COURSE : **24P1PHYT01 : MATHEMATICAL METHODS IN PHYSICS - I**

(For Regular - 2025 Admission and Improvement/Supplementary 2024 Admission)

Time : Three Hours Max. Weights: 30

PART A

Answer any 8 questions Weight: 1

1.	Write short notes on Hermitian operators.	(R)
2.	Show that Eigen values of a Hermitian matrix are real and Eigen vectors are orthogonal.	(U)
3.	Write a note on centrifugal potentials.	(R)
4.	What is meant by unitary transformation?	(U)
5.	Give the expression for segmental length in spherical polar coordinates.	(A)
6.	What is a linear vector space?	(U)
7.	Show that every square matrix can be uniquely written as the sum of a hermitian and skew hermitian matrices.	(U)
8.	Write a note on scalar potentials.	(R)
9.	Write the metric tensor in cylindrical coordinates.	(A)
10.	Explain geodesic in Riemannian space and arrive at geodesic equation.	(R)

(1 x 8 = 8)

PART B

Answer any 6 questions Weights: 2

11.	Explain the differences between Binomial, Poisson and normal distributions.	(U)
12.	Explain elementary probability theory. Find out the probability of getting a sum 9 from two throws of a dice?	(A)
13.	Determine the eigen values of the following matrix: $\begin{bmatrix} 1 & 2 & 3 \\ 2 & -1 & 4 \\ 3 & 1 & 1 \end{bmatrix}$	(A)
14.	Prove that velocity and acceleration are contra variant tensors of rank one	(An)
15.	Calculate the elements of metric tensor in spherical polar coordinates. Hence find differential length and differential volume .	(A)
16.	What are curvilinear coordinates? State the elementary lengths and volume elements in cylindrical and spherical polar coordinate system.	(U)
17.	Find the constant p for which $A \times B = C$ where $A = I + 2k$, $B = i + pj - k$, $C = -2i + 3j + k$.	(A)
18.	Find the inverse of the given matrix by Gauss–Jordan method: $\begin{bmatrix} 2 & -1 & 1 \\ -1 & 2 & -1 \\ 1 & -1 & 2 \end{bmatrix}$	(A)

(2 x 6 = 12)

PART C

Answer any 2 questions **Weights: 5**

19. Find the inverse of the given matrix using Cayley Hamilton Theorem and verify it using $\frac{AdjA}{DetA}$:

$$\begin{bmatrix} -1 & 1 & 2 \\ 0 & -2 & 1 \\ 0 & 0 & -3 \end{bmatrix}$$ (A)

20. State and prove Gauss' divergence theorem and Stoke's theorem. Hence deduce Gauss law in electrostatics. (R)

21. Establish the expression for gradient and divergence in general curvilinear coordinates and find Div A and Grad V in spherical polar coordinates. (A)

22. Explain Gaussian distribution. Derive the expression for median and mode in Gaussian distribution. (A)

(5 x 2 = 10)

OBE: Questions to Course Outcome Mapping

CO	Course Outcome Description	CL	Questions	Total Wt.

Cognitive Level (CL): Cr - CREATE; E - EVALUATE; An - ANALYZE; A - APPLY; U - UNDERSTAND; R - REMEMBER;