

AE-745

M.Sc. (Previous)
Term End Examination, 2016-17

PHYSICS

Paper - I

Mathematical Physics and Classical Mechanics

Time : Three Hours] [Maximum Marks : 100
[Minimum Pass Marks : 36

Note : Answer any **five** questions. All questions carry equal marks.

1. (a) What do you mean by orthogonal matrix? Show that the matrix A is defined as under is orthogonal matrix

$$A = \frac{1}{3} \begin{bmatrix} 1 & 2 & 2 \\ 2 & 1 & -2 \\ -2 & 2 & -1 \end{bmatrix}$$

(2)

- (b) What do you mean by unitary matrix ?
Describe and show that matrix

$$A = \begin{bmatrix} \cos \theta & i \sin \theta \\ i \sin \theta & \cos \theta \end{bmatrix}$$

is unitary matrix.

2. (a) Describe about eigenvalues and eigenvectors with the properties of eigenvalues.
(b) Find the eigenvalues and eigenvectors with the property for any one eigenvalue of given matrix

$$A = \begin{bmatrix} -2 & 2 & -3 \\ 2 & 1 & -6 \\ -1 & -2 & 0 \end{bmatrix}.$$

3. Describe about symmetric tensor.
4. Describe about equation of geodesic.
5. (a) Find out Hermite's differential equation formula.
(b) Prove that the following recurrence formula for Hermite's polynomial :
(i) $H'_n(x) = 2nH_{n-1}(x)$, $n \geq 1$
(ii) $2xH_n(x) = 2nH_{n-1}(x) + H_{n+1}(x)$

(3)

6. (a) Find out Legendre's differential equation.
(b) Prove the following recurrence formula for Legendre's equation :
 - (i) $(2n + 1)xP_n = (n + 1)P_{n+1} + nP_{n-1}$
 - (ii) $nP_n = xP'_n - P'_{n-1}$
 7. Derive Lagrange's equation of motion for D'Alembert's principle and explain motion of one particle using Cartesian co-ordinate.
 8. Describe about principle of least action in detail.
 9. Describe about generating function property and group property.
 10. Explain Poisson bracket with examples and write its properties. Prove that Poisson bracket is invariant with respect to canonical transformation.
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