

# PHYSICS

1. Consider the  $2 \times 2$  matrix  $A = \begin{pmatrix} \cos \theta & -\sin \theta \\ \sin \theta & \cos \theta \end{pmatrix}$ . The matrix  $A$  is
- (A) Hermitian (B) orthogonal  
(C) symmetric (D) None of (A), (B) and (C)
2. The integral  $\int_{-\infty}^{\infty} (a+bx+cx^2)\delta(x)dx$  is equal to
- (A) 0 (B)  $a$   
(C) 1 (D) None of (A), (B) and (C)
3. The integral  $\int_0^{\infty} t^{3/2} e^{-t} dt$  is equal to
- (A)  $\frac{\sqrt{\pi}}{2}$  (B)  $\sqrt{\pi}$   
(C) 0 (D) None of (A), (B) and (C)
4. Which of the following complex functions is not analytic?
- (A)  $f(x,y) = 2x+2iy$  (B)  $f(x,y) = 1$   
(C)  $f(x,y) = x^2 - y^2 + 2ixy$  (D)  $f(x,y) = x^2/4 - y^2/4 - ixy/2$
5. Consider the Legendre polynomial,  $P_n(x)$  of degree  $n$ . It satisfies the relation
- $$\int_{-1}^1 [P_n(x)]^2 dx = 2/7.$$
- The value  $n$  is
- (A) 1 (B) 2  
(C) 3 (D) 7
6. The square of the distance between the two points  $A(r, \theta, \phi)$  and  $B(r+dr, \theta+d\theta, \phi)$  in spherical polar coordinates is given by
- (A)  $ds_{AB}^2 = dr^2 + r^2 d\theta^2 + r^2 \sin^2 \theta d\phi^2$  (B)  $ds_{AB}^2 = dr^2 + r^2 d\theta^2$   
(C)  $ds_{AB}^2 = dr^2 + r^2 d\phi^2$  (D)  $ds_{AB}^2 = r^2 d\theta^2 + r^2 \sin^2 \theta d\phi^2$
7. Consider the Lagrangian :  $L = \alpha q \dot{q}$ . The momentum conjugate to  $q$  is equal to
- (A)  $m\dot{q}$  (B)  $\alpha\dot{q}$   
(C)  $\alpha q$  (D) None of (A), (B) and (C)