Postgraduate Programme

Model Question Paper

M.Sc. (Physics)

Time: 2 Hours **Max. Marks : 75**

Choose the correct answer and WRITE IN CAPITAL LETTER viz., A, B, C, D or E in the space provided with each question.

SAMPLE QUESTIONS

Section A (25 marks) - 25 questions

1. If the Cartesian coordinates (x, y, z) of a point are (4, 3, 1), its cylindrical polar coordinates (ρ, φ, z) will be ( )

A) (5, 36.9°, 1)
B) (5, 53.1°, 1)
C) (4, 3, 1)
D) (√7, 36.9°,1)

2. $V(r,\theta) = \dfrac{k\cos\theta}{r^2}$, $\overline{\nabla} V$ = ( )

A) $-\dfrac{k}{r^3}(2\cos\theta\,\hat{e}_r + \sin\theta\,\hat{e}_\theta)$ B) $-\dfrac{k}{r^3}(2\cos\theta + \sin\theta)$

C) $-\dfrac{k}{r^3}\sqrt{3\cos^2\theta + 1}$ D) $-\dfrac{k}{r^3}(2\cos\theta\,\hat{e}_r + r\sin\theta\,\hat{e}_\theta)$

3. The essential singularity of the differential equation: $x^2(x^2-1)y'' + \dfrac{x}{x+1}y' + \dfrac{y}{x-1} = 0$ is/are at ( )

A) x = 0 B) x = +1 C) x = –1 D) x = 0, ±1

4. The eigen values of the matrix $\begin{bmatrix} 0 & 1 \\ -1 & 0 \end{bmatrix}$ are ( )

A) 0,1 B) +1, –1 C) +i, –i D) 1, i

5. $\Im\{f(t-A)\} = e^{i\omega a} F(\omega)$ is called the ——— property of the Fourier transformation ( )

A) Attenuation B) time Shifting
C) Convolution D) Parseval

6. In emitter bias configuration for a transistor, $V_{BB} = 5V$, $V_{CC} = 15V$, $R_E = 1k\Omega$ and $R_C = 2k\Omega$ The collector-emitter voltage V_{CE} is

( )

A) 2.1V B) 4.3V C) 6.4V D) 8.6V

7. $\overline{\overline{A}\ \overline{B}\ \overline{C}}$ is equivalent to

( )

A) $\overline{A \cdot B \cdot C}$ B) $\overline{A} \cdot \overline{B} \cdot \overline{C}$ C) $\overline{A + B + C}$ D) $A+B+C$

8. Consider the following: Reaction: $HCl_{(aq)}$ + $NaOH_{(aq)}$ $\rightarrow$ $H_2O_{(l)}$ + $NaCl_{(aq)}$ The rate of this reaction could be determined by monitoring the change of concentration of:

( )

A) H^+
B) Cl^-
C) Na^+
D) H_2O

9. Which of the following gives the value stored at the address pointed to by pointer a?

( )

A) a; B) val(a); C) *a; D) &a;

SECTION B – 50 MARKS – (50 QUESTIONS)

SAMPLE QUESTIONS

1. A particle of mass 100 gm moves on the x-axis under the force field whose potential energy is $V = \frac{x(x-3)^2}{3}$. The points of stable equilibrium occur at

A) x = 3, B) x = 1 C) x = 1 and 3 D) does not exist

2. A particle moves under the influence of the potential $(x) = {}^{A}/_{x^2} - {}^{B}/_{x}$. The frequency of small oscillations around the equilibrium point is

A) $\sqrt{8mA^3B^4}$ B) $8mB^4$ C) $\sqrt{\frac{B^4}{8mA^3}}$ D) $\sqrt{\frac{8mA^3}{B^4}}$

3. Part of the equation of a plane EM wave travelling in the negative Y direction can be

( )

A) $E=A\cos(wt-ky)\hat{\imath}$ B) $E=A\cos(wt-ky)\hat{\jmath}$ C) $E=A\cos(wt+ky)\hat{\imath}$
D) $E=A\cos(wt+ky)\hat{\jmath}$ E) $E=A\cos(ky-wt)\hat{\imath}$

4. Which of the following equation does not change from one medium to another ( )

A) $\vec{\nabla}\cdot\vec{B}=0$ B) $\vec{\nabla}\cdot\vec{D}=0$ C) $\vec{\nabla}\mathrm{x}\vec{E}=-\partial\vec{B}/\partial t$
D) $\vec{\nabla}\mathrm{x}\vec{H}=\partial\vec{D}/\partial t$ E) $\vec{\nabla}\cdot\vec{E}=\rho/\epsilon$

5. The ABCD matrix of a thin lens of focal length f is ( )

A) $\begin{pmatrix}1 & 1/f\\ 1 & 0\end{pmatrix}$ B) $\begin{pmatrix}1 & -1/f\\ 0 & 1\end{pmatrix}$
c) $\begin{pmatrix}1 & 0\\ -1/f & 1\end{pmatrix}$ D) $\begin{pmatrix}1 & 1/f\\ 0 & 1\end{pmatrix}$ E) $\begin{pmatrix}-1/f & 1\\ 0 & 1\end{pmatrix}$

6. The electric field in a certain region is given by $\vec{E}=A(yz\hat{\imath}+xz\hat{k})$, where A= 10Nm^{-2}/C and the potential at the origin of the coordinates is 20 Volts. What will be the potential at a point x=2, y= 1, z=1? (all coordinates are in meters) ( )

A) 10 Volts B) -30 Volts C) 30 Volts D) -10 Volts E) 0 volts

7. A mathematical approach to the first law of thermo dynamics produced which equation? ( )

A) W + Q = U B) Q = U + W C) U = Q - W
D) all the above E) None of the above

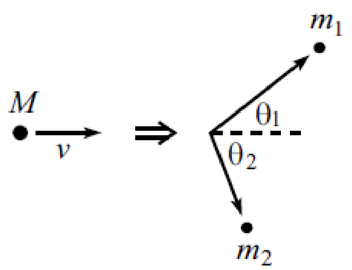
8. A nucleus ZXA has mass M kg. If Mp and Mn denote the mass (in kg) of proton and neutron respectively, the binding energy in joule is ( )

A) $[ZMp + (A - Z)Mn - M]c^2$ B) $[ZM_p + ZM_n - M]c^2$
C) $M - ZM_p - (A - Z)M_n$ D) $[M - ZM_p - (A - Z)M_n]c^2$
E) $A[Mp + Mn]c^2$

9. The eigen values of the operator L_z are ( )

A) $\ell(\ell+1)\hbar^2$ B) $\ell(\ell+1)\hbar$ C) $m\hbar$ D) $m\hbar^2$ E) Zero

10. A mass *M* moves with speed *V* in the x-direction. It explodes into two pieces that go off at angles θ_1, θ_2 as shown in figure. What are the magnitudes of the momenta of the two pieces? ( )



A) $p_1=\dfrac{P\sin\theta_2}{\sin(\theta_1+\theta_2)}$, $p_2=\dfrac{P\sin\theta_1}{\sin(\theta_1+\theta_2)}$ B) $p_1=\dfrac{P\sin\theta_2}{\cos(\theta_1+\theta_2)}$, $p_2=\dfrac{P\sin\theta_1}{\cos(\theta_1+\theta_2)}$
B) $p_1=\dfrac{P\sin\theta_2}{\sin(\theta_1-\theta_2)}$, $p_2=\dfrac{P\sin\theta_1}{\sin(\theta_1-\theta_2)}$ D) $p_1=\dfrac{P\sin\theta_2}{\cos(\theta_1-\theta_2)}$, $p_2=\dfrac{P\sin\theta_1}{\cos(\theta_1-\theta_2)}$