SoE.

KATHMANDU UNIVERSITY
End Semester Examination
March, 2025

Marks Scored:

Level : B.E.
Year : I

Course : PHYS 102
Semester : II

Exam Roll No. :

Time: 30 mins.

F. M. : 15

Registration No.:

Date 25 MAR 2025

SECTION "A"
[15Q. × 1 = 15 marks]

Choose and Mark [X] in the most appropriate answer.

1. If the divergence of a vector function is zero, then the vector function can be expressed as
   [ ] the divergence of some other vector function.
   [ ] the curl of some other vector function.
   [ ] the gradient of other vector function.
   [ ] the gradient of a scalar function.

2. A hollow metallic sphere of radius 0.1 m has 10^{-8} C of charge uniformly spread over it. The electric field intensity (in N/C) at point 7 cm away from the center is
   [ ] $\frac{90}{7^2}$ [ ] $\frac{90}{(0.07)^2}$ [ ] zero [ ] $\frac{90}{0.07}$

3. A charge q is located at the center of a cube. The electric flux through any face is
   [ ] $\frac{1}{4\pi\varepsilon_0}\frac{\pi q}{6}$ [ ] $\frac{1}{4\pi\varepsilon_0}\frac{4\pi q}{6}$ [ ] $\frac{1}{4\pi\varepsilon_0}\frac{q}{6}$ [ ] $\frac{1}{4\pi\varepsilon_0}\frac{q}{6\varepsilon_0}$

4. The electrostatic potential energy of configuration of four charges +q, -2q, -q and +2q placed at four corners A, B, C and D of a square of side 'a' is
   [ ] $-\frac{1}{4\pi\varepsilon_0}\left[\frac{5q^2}{a\sqrt{2}}\right]$ [ ] $-\frac{1}{4\pi\varepsilon_0}\left[\frac{5q^2}{2a^2}\right]$
   [ ] $-\frac{1}{4\pi\varepsilon_0}\left[-\frac{5q^2}{a\sqrt{2}}\right]$ [ ] $\frac{1}{4\pi\varepsilon_0}\left[\frac{5q^2}{2a^2}\right]$

5. When does a magnetic dipole possess maximum potential energy inside a magnetic field?
   [ ] Magnetic moment and magnetic field are antiparallel
   [ ] Magnetic moment and magnetic field are parallel
   [ ] The magnetic moment is zero
   [ ] The magnetic field is zero

6. Suppose that the magnetic field points in the y-direction, and the electric field in the z-direction. A charged particle is released from the origin. The path followed by the particle is
   [ ] a circle on xy-plane [ ] a cycloid on xz-plane
   [ ] a cycloid on yz-plane [ ] a cycloid on xy-plane.

7. What is the magnitude of the magnetic field at point P if $a = R$ and $b = 2R$?

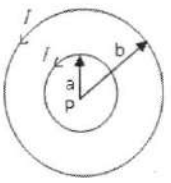

Figure A.1

[ ] $\frac{3\mu_0 I}{4R}$ [ ] $\frac{\mu_0 I}{4R}$ [ ] $\frac{2\mu_0 I}{4R}$ [ ] $\frac{3\mu_0 I}{4\pi R}$

8. The retentivity in ferromagnetic substance is
[ ] the area of the hysteresis loop
[ ] the state of magnetic saturation
[ ] the magnetic field required to cancel out the magnetization
[ ] the magnetization left even after the removal of magnetizing field

9. The direction of induced emf is given by
[ ] Fleming's left hand rule. [ ] Fleming's right hand rule.
[ ] Lenz's law. [ ] Biot- Savart law.

10. The electron emitted in β – radiation originates from _____
[ ] Inner orbits of atoms
[ ] Free electrons existing in nuclei
[ ] The decay of a neutron in nuclei
[ ] Photon escaping from the nucleus

Fill in the blanks.

11. If the current changes from 5A to 3A in 2 seconds and the inductance is 10H, then induced emf is_____.

12. The dimension of $\frac{1}{\mu_o \epsilon_o}$ is_____.

13. A solenoid of length 0.5 m has a radius of 3 cm and is made up of 1000 turns. If it carries current of 2 A, then the magnitude of the magnetic field outside the solenoid is_____.

14. The half-life of radon is 3.8 days. After how many days will only $\frac{1}{20}$ of a radon sample be left over_____.

15. Lead has a superconducting transition temperature of 7.26 K. If initial field at 0 K is 50 $\times 10^3$ Am^{-1}, then the critical field at 6 K is_____.