



DOON UNIVERSITY, DEHRADUN
Mid Semester Examination, Second Semester, 2015-16
School of Physical Sciences
Generic Elective test paper of 5 Year (Integrated) MSc Program
Course: PHG-151: Electricity and Magnetism (Elective)

Time Allowed: 2Hours

Maximum Marks: 30

Note: Attempt All Questions from Sections A, B, C.

SECTION: A

(Marks: 1 X 6 = 6)

1. Suppose the current density in the wire is proportional to the distance from the axis ($J = ks$). The total current in the wire
(a) $2\pi ka^3$ (b) $\frac{2\pi ka^3}{3}$ (c) $\frac{3\pi ka^3}{2}$ (d) πka^3
2. If two conductors carry steady current in opposite direction these will
(a) Attract each other (b) Repel each other
(c) There is no force between them (d) None of the above
3. The ratio of the intensity of the magnetic field at the centre of a very long solenoid to that at the extreme ends is
(a) 2 (b) $\frac{1}{2}$ (c) $\frac{1}{4}$ (d) 4
4. A dipole consists of two charges $+q$ and $-q$ separated by a distance d . Draw the electric lines of force due to dipole.
 $+q \text{-----} -q$
5. The electric field at a point inside a charged hollow spherical conductor is _____.
6. An ebonite rod rubbed with fur is brought near a glass rod rubbed with silk, then (a) two will attract each other (b) repel each other (c) none of the above

SECTION: B

(Marks: 3 X 4 = 12)

7. Obtain an expression for the magnetic field along the axis at z distance from the centre of circular coil carrying current I .
8. State and prove integral and differential form of the Ampere's circuital law i.e.,
$$\oint B \cdot dl = \mu_0 I \text{ and } \nabla \times B = \mu_0 J$$
9. What do you understand by gradient of a scalar function? Establish the relation $E = -\nabla V$.
10. Find the potential difference between the centre and the corner B of a square, if on the other three corners A, C, D charges $-7, +2, +3 \mu\text{C}$, respectively are placed. Given the length of each side of a square is 3m .

SECTION: C

(Marks: 6 X 2 = 12)

11. State the Biot-Savart law? Apply it to determine the magnetic field (a) due to a wire of finite length carrying current I , (b) due to a long straight wire carrying current I . Find the force on a square loop placed as shown Fig. 1 near an infinite straight wire. Both the loop and the wire carry a steady current I .

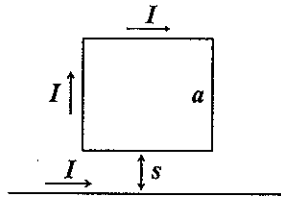


Figure 1

12. (a) What is an electric dipole? Obtain an expression for the potential at any point due to dipole.
- (b) Calculate the potential due to a dipole moment $4.5 \times 10^{-10} \text{ C/m}$ at a distance 1 meter from it, on its axis.
- (c) If the electric field is given by $\vec{E} = 10x + 9y + 4z$, calculate the electric flux through a surface of area 50 units lying in x-y plane.