23/3/2018

DOON UNIVERSITY, DEHRADUN
Mid Semester Examination, Second Semester, 2017-18
Department of Physics, School of Physical Sciences
Integrated M.Sc. Physics
Course: PHC-151: (Electricity and Magnetism Theory)

Time Allowed: 2 Hours　　　　　　　　　　　　　　　**Maximum Marks: 30**

Note: Attempt All Questions from Sections A, C.

SECTION: A　　　　　　　　　　　　　　　　　　　　　　*(Marks:1 X 9=9)*

1. Write down the expression for force experienced by a dipole in non-uniform electric field.
2. Field produced due to a point charge is uniform or not?
3. Write down the expression for potential Energy due to uniform distribution of charges without neglecting or simplifying any term in the expression.
4. Calculate Divergence of $\vec{r}$.
5. Write an example where electric field is non zero even though the potential is zero.
6. Write Gauss's Law for electrostatic field in integral form.
7. State yes or no, whether torque experienced by an electric dipole is same for uniform as well as non uniform field.
8. The divergence of any vector field is zero. The same field can be expressed as a dot or cross product of another vector field?
9. State whether the electric field induced due to change in magnetic field can be expressed as – gradient of any scalar potential or not?

SECTION: B　　　　　(Attempt any 3 Question)　　　　　　*(Marks: 3 X 3=9)*

10. A long cylinder is carrying a charge which is proportional to the distance from its axis i.e $\rho = kr$. Using Gauss law find out electric field at a distance r from its axis.

11. Two parallel sheets of charge, each having same surface density of charge, face each other. Calculate the electric intensity at a point (not near the edges) lying (i) to the left of sheets, (ii) in between the sheets, and to the right of the sheets.

12. Is it possible for the electric potential in a charge-free region to be given by (i) $V=x^2+y^2+z^2$, (ii) $V= x^2-y^2+z^2$? If not, find the charge density.

13. A vector function has the following components: $E_x= 6xy$, $E_y= 3x^2-3y^2$, $E_z=0$. Is it a possible electrostatic field? If yes, find potential.

SECTION: C　　　　　　　　　　　　　　　　　　　　　　*(Marks: 6X 2=12)*

14. Derive an expression for the electric potential due to an electric dipole at any point in space. Hence, determine the electric field due to dipole at a distance r from the center on a line making an angle Θ with the axis of dipole.

15. (i)Derive an expression for the electrostatic energy of a uniformly charged sphere.
    (ii) Three charges q, 2q and -4q are placed at the corners of an equilateral triangle of side a= 0.1 m. Compute the potential energy of the structure.