Ex:B.Sc/PHY/12/SO4/90/2019(OLD)

BACHELOR OF SCIENCE EXAMINATION, 2019

(1st Year, 2nd Semester, Old Syllabus)

PHYSICS (SUBSIDIARY)

Paper : SO-4

Time : Two hours Full Marks : 50

The figures in the margin indicate full marks.

Answer any ***four*** questions.

1. (a) State and explain Gauss's theorem.

   (b) By using the Gauss's theorem, derive the expression of electric field at a distance Z from the center of a uniformly charged sphere of radius R which carries uniform volume charge density ρ for the cases (i) Z < R (inside the sphere) (ii) Z > R (outside the sphere).

   (c) Draw the variation of electric field with distance from the center of the sphere. $3+7+2^{1}/_{2}$

2. (a) Find the field intensity due to an electric dipole at a point (a) on the axis of the dipole (b) on the perpendicular bisector of the dipole.

   (b) Two point charges (each +Q) are kept 2d distance apart. A unit +ve charge is placed at the middle point. Find (i) net force on it (ii) show that the motion will be SHM if it is moved slightly in one direction (iii) Find out the frequency of oscillation. $6+6^{1}/_{2}$

(Turn Over)

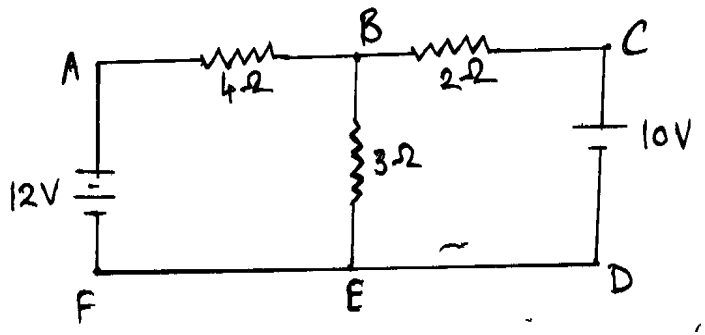
3. (a) Find out the capacitance per unit length of two co-axial cylinders where ε is the dielectric constant of the intervening medium and outer cylinder is earthed.

   (b) Calculate capacitance of parallel plate capacitor.

   (c) Hence find the capacitance of a system of three parallel plates, each of area A m^2, separated by two dielectrics of dielectric constants $\in_1$ and $\in_2$ having thickness d_1 and d_2 meters respectively. $6+4+2^1/_2$

4. (a) State and explain Kirchhoff's laws in electricity.

   (b) Using Kirchhoff's laws, calculate the branch currents in the network shown in figure below :



$4+8^1/_2$

5. Obtain an expression for the magnetic field at x distance along the axis of a flat circular coil carrying current 'i'. Explain clearly how a uniform magnetic field is produced in a Helmholtz coil using this principle. 6_2+6

6. (a) Define the co-efficient of self-inductance and mutual inductance.

   (b) Calculate the equivalent inductance of two coils of self-inductance L_1 and L_2 connected in parallel.

   (c) In a Hydrogen atom the electron is moving round the nucleus in a circular orbit of radius 5.1×10^{11} m. If the angular velocity of the electron is 6.8×10^{15} rps then calculate the magnetic field at the center of the orbit. $3+5+4^1/_2$

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