

Total: 20 points

Time: 1hr

****Vector quantities must be represented with an overhead arrow, vector calculus operators must be written correctly, dot and cross products must be written properly. In case of any of these mistake -1 will be awarded in each question with such mistake.**

NO credit will be given to the answers that do not accompany proper explanation.

Any case of copying/cheating will be dealt as per institute guidelines.

- Q1. A certain material has a conductivity of $5 \times 10^6 \text{ S/m}$ and a permittivity of $5F/m$. A total charge of $1C$ is distributed uniformly throughout the volume of a sphere made of this material. The radius of the sphere is $5m$. How much would be the surface charge density after $2\mu s$? ($1\mu s = 10^{-6}S$) [5 points]
- Q2. An electron has a charge-to-mass ratio of $1.759 \times 10^{11} C/kg$. If the electron is moving with a speed of $3.518 \times 10^5 m/s$ perpendicular to a uniform magnetic field of 1 Tesla, what is the radius of the cyclotron motion? [4 points]
- Q3. Consider two infinite parallel plates kept at $x = 0$ and $x = d$, respectively. The first plate is connected to $5V$ and the second one to $-5V$. Calculate the potential distribution between them. [3 points]
- Q4. An infinite plane carries a uniform surface charge σ . Find its electric field. [3 points]
- Q5. A charge distribution has volume density $\rho = \frac{\rho_0 r}{R}$ for $0 \leq r \leq R$ and 0 for $r > R$. Find the electric field for both regions. [2.5 + 2.5 = 5 points]