G-A

First Exam for Electromagnetic I

2 hours (04/01/2024)
Answer all questions

(Note: Open Book Exams, Don't use answers notes, don't use your friend tools, and don't use the computer and smart phones)

Q1

Find a unit vector C that is perpendicular to both $A = \mathbf{a}_x 4 + \mathbf{a}_y 5 - \mathbf{a}_z 3$ and $B = \mathbf{a}_x 2 - \mathbf{a}_y 7 - \mathbf{a}_z 1.5$

Q2

A position vector $r = \mathbf{a}_x\sqrt{2} - \mathbf{a}_y\sqrt{2} - \mathbf{a}_z\sqrt{2}$, Determine its spherical components r, θ, φ and its cylindrical components ρ, φ, z.

Q3

A field is given as $\mathbf{G} = (25/(x^2 + y^2))(x\mathbf{a}_x + y\mathbf{a}_y)$. Find (a) a unit vector in the direction of G at P(3, 4,−2); (b) the angle between G and $\mathbf{a}_x$ at P; (c) the value of the following double integral on the plane y=7.

$$\int_0^4 \int_0^2 \mathbf{G} \cdot \mathbf{a}_y \, dx dz$$

Q4

The racially dependent volume charge density $\rho_v = \frac{100}{r^3}$ C/m^3 exists within a sphere of radius $r = 4$ cm. Find the total charge q contained by that sphere.

Good luck

$$Q = \iiint \rho_v \, dv$$