1. Derive curl A ($\nabla \times \mathbf{A}$) by using the line integral in the perpendicular coordinates **(10%)**, express $\nabla \times \mathbf{A}$ in the cylindrical coordinates **(10%)**, Explain the Stoke's theorem **(10%)**.
2. Derive the capacitance of a coaxial cylinder (L, length; a, inner radius; b, outer radius), which is filled with a homogeneous dielectric with permittivity ε. Assume the inner and outer conductors carry +Q and –Q, respectively. **(20%)**

3. A charged particle of mass 2kg and charge 4 Coulomb starts at point (1,1,0) with initial velocity ($3\ \mathbf{a}_x + 4\ \mathbf{a}_z$ m/s) in an electrical filed ($6\ \mathbf{a}_x + 5\ \mathbf{a}_y$ V/m). At time t=2 second, determine (a) the acceleration of the particle, (b) its velocity, (c) its kinetic energy, (d) its position. **(20%)**
4. In free space, $\mathbf{E}=10\cos(\omega t-20x)\ \mathbf{a}_y$ V/m. Calculate (a) displacement current density $\mathbf{J}_d$, (b) magnetic field density **H**. **(10%)**
5. In a lossless medium for which $\eta=40\pi$, $\mu_r=2$, and $\mathbf{H}=-0.2\cos(\omega t-z)\ \mathbf{a}_x+\sin(\omega t-z)\ \mathbf{a}_y$ A/m, calculate ε_r, ω, and **E**. **(20%)** [$\eta=(\mu/\varepsilon)^{0.5}$, $\beta=\omega(\mu\varepsilon)^{0.5}$, $\varepsilon_0=(1/36\pi)\times10^{-9}$, $\mu_0=4\pi\times10^{-7}$]

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