VIT
Vellore Institute of Technology

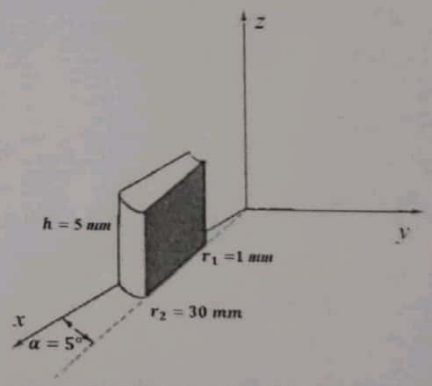
School of Electronics Engineering

B. Tech (ECE) – CAT-II Examination – FS 2019-20, Electromagnetic Field Theory, (ECE1003)

Time: 90 Min. Marks: 50

F1-Slot

Answer all the questions

1	a) Atomic hydrogen contains 5.5×10^{25} atoms/m^3 at a certain temperature and pressure. When an electric field of 4 kV/m is applied, each dipole formed by the electron and the positive nucleus has an effective length of 7.1×10^{-19} m. Find (a) Polarization and (b) Dielectric constant of the material. [7] b) For $x<0$, the polarization is 5 sin (βy) a_x . Calculate the ρ_{ps} and ρ_{pv} . Here, β is constant. [3]	[10]
2	a) In an semiconductor device the volume charge density is $\rho_v = \rho_{vo}(x/a)r^{-\lvert x\rvert/a}$. Find the electric filed intensity (Ex) if V(0)=0 and $Ex \rightarrow 0$ as x$\rightarrow\infty$. [5] b) In an aluminum the drift velocity of 5.3×10^{-4} m/s is found. What is the corresponding current density and electric field intensity in aluminum? (Assume conductivity is 3.82×10^7 m/s and mobility is 0.0014 m^2/V.s). [5].	[10]
3	The surface x=0 separates two perfect dielectrics. For x>0 , ε_{r1}=3, while ε_{r2}=5 where x<0. If E_1=80a_x-60a_y-30a_z V/m. Calculate: (a) tangential and normal components of electric filed in two dielectric regions. (b) the angle between the E_1 and normal to the surface.	[7]
4	In the capacitor shown in figure. The region between the plates filled with the dielectric having the ε_r=4.5.Find: (a) the capacitance between the plates. [10] (b) the resistance for the given question. [3] Here, ***h=5mm, r1=1mm, r2=30mm*** *and* ***α=5⁰*** 	[13]
5	A circular conductor of radius r_0 = 1cm has an internal magnetic field of $H = \frac{10^4}{r}\left(\frac{1}{a^2}\sin ar - \frac{r}{a}\cos ar\right)a_\phi$ A/m, where $a = \pi/2r_0$. Find the total current in the conductor.	[10]

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