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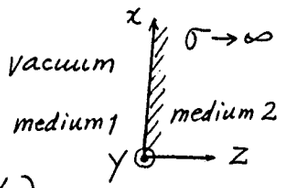
國立成功大學79學年度電研所考試(物理學 試題) 共 1 頁 第 1 頁

1. A positive point charge q of mass m is injected with a velocity $\vec{v} = \hat{j}V$ into the $y>0$ region where a uniform magnetic field $\vec{B} = \hat{i}B$ exists. Obtain the equation of motion of the charge, and describe the path that the charge follows. (10%)

2. A plane wave traveling in the z-direction is incident on a perfect conductor as shown in the figure. Find the total electric and magnetic field in medium 1. Find the average power carried by this electromagnetic plane wave. (15%)



3. Derive wave equation for electric field from Maxwell's equations. (10%)

4. Find the energy required to assemble a uniform sphere of charge of radius R and volume charge density ρ. (15%)

5. If a silicon oxide layer of thickness x is grown from thermal oxidation, what is the thickness of silicon being consumed? Given molecular weight and density of Si are 28.1 g/mole and 2.33 g/cm^3 respectively. Density of SiO_2 is 2.21 g/cm^3. (10%)

6. Explain (a) Lightly doped drain (LDD) structure FET, (b) Graded index channel (GRINCH) laser, (c) Silicon on insulator (SOI) device, (d) Metal semiconductor field effect transistor (MESFET), (e) Thyristor. (20%)

7. A 0.4-μm-thick sample of GaAs is illuminated with monochromatic light of $h\nu = 2.3$ eV. The absorption coefficient α is 5.3×10^4 cm^{-1}. The power incident on the sample is 12 mW.
   (a) Find the total energy absorbed by the sample per second (J/s).
   (b) Find the rate of excess thermal energy given up by the electrons to the lattice before recombination. (10%)

8. How to control threshold voltage of MOS transistor? (10%)

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