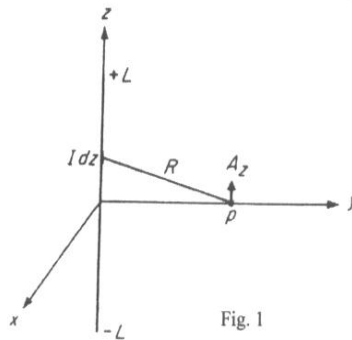


國立中正大學九十三年學年度碩士班招生考試試題
系所別：光機電整合工程研究所 科目：電磁學

第 1 頁，共 2 頁

1. (20%) The general expression for vector potential is: $\vec{A} = \int \frac{\mu_0 \vec{J} dV'}{4\pi R}$

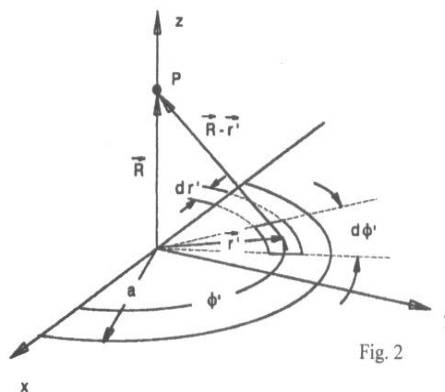
- (a) Use the above expression to calculate the vector potential \vec{A} for a long straight wire carrying a current I as shown in Fig. 1 at the position P .
(b) In the limit of $L \gg y$, what is the vector potential? Find the magnetic field from the vector potential in this limit.



2. (20%) A semi-circular surface charge is located as shown in Fig.2 in the xy plane. The surface charge density is

$$\rho = A \sin \phi, \quad 0 \leq r \leq a, \quad 0 \leq \phi \leq \pi$$

Find the electric field at any point on the z -axis.



國立中正大學九十三年學年度碩士班招生考試試題
系所別：光機電整合工程研究所 科目：電磁學

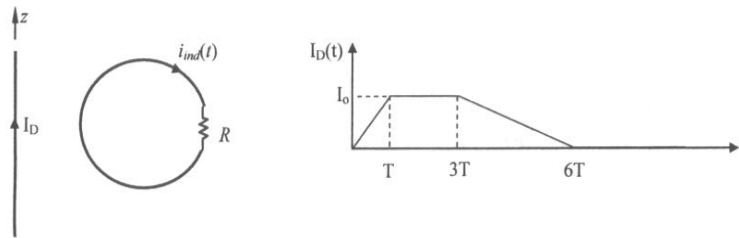
第 2 頁，共 2 頁

3. (10%) Starting with the Faraday's law, $\nabla \times \vec{E} = -\frac{\partial \vec{B}}{\partial t}$, show the following statement: the tangential component of an electric field is continuous at the surface.

4. (20%)

(a) Explain how $i_{ind}(t)$ is induced in the circular conducting loop when I_D flows in the infinitely-long conductor, as shown in the following left figure.

(b) Plot the induced current waveform $i_{ind}(t)$, when I_D has the waveform as shown in the following right figure.



5. (30%) Assume a uniform plane wave $\vec{E} = \hat{x}E_o \sin(2\pi ft - kz)$ is normally incident from Medium 1, where $f=10$ GHz and $E_o = 1$ V/m. Medium 2 of $\epsilon_r=9$ has the thickness d equal to three quarters of its wavelength and is coated on one side with a perfect-conducting film, as shown in the figure.

(5%)(a) What is the thickness d ?

(10%)(b) What is the reflected power density (W/m^2) in medium 1.

(15%)(c) Find the electric field in the medium 2.

