

## II B.Tech I Semester Supplementary Examinations, November 2005

## ELECTROMAGNETIC FIELDS

(Electrical &amp; Electronic Engineering)

Time: 3 hours

Max Marks: 80

Answer any FIVE Questions  
All Questions carry equal marks

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1. (a) Derive laplace and poisson's equations.  
 (b) A spherical volume charge density distribution is given by  
 $\rho_v = \rho_o(1 - r^2/a^2)$  for  $r \leq a$   
 $= 0$  for  $r > a$   
 Find E  
 i. inside the charge distribution.  
 ii. outside the charge distribution. [7+9]
2. (a) Calculate the capacitance of a parallel plate capacitor with following details.  
 Plate area = 100 sq.cm.  
 Dielectric  $\epsilon_{r1} = 4$ ,  $d_{12} = 2\text{mm}$   
 Dielectric  $\epsilon_{r2} = 3$ ,  $d_{12} = 3\text{ mm}$   
 If 200 V is applied across the plates what will be the voltage gradient across each dielectric.  
 (b) The permittivity of the dielectric of parallel plate capacitor increases uniformly from  $\epsilon_1$  at one plate to  $\epsilon_2$  at the other. If A is the surface areas of the plate and d is the thickness of dielectric, derive an expression for capacitance. [8+8]
3. (a) Derive the integral form of continuity equation and also write its meaning.  
 (b) What is the Capacitance of a Capacitor consisting of two parallel plates 30 cm by 30 cm, Separated by 5 mm in air. What is the energy stored by the capacitor if it is charged to a potential difference of 500 volts. [8+8]
4. (a) Derive an expression for the force between two current carrying conductors in the same direction.  
 (b) Derive the boundary conditions at the magnetic interfaces and show that  
 $\tan \theta_1/\theta_2 = \mu_{r1}/\mu_{r2}$ . [8+8]
5. A current strip 2cm wide carries a current of 15 amps in the  $\bar{a}_x$  direction, as shown in figure 1. Find the force on the strip of unit length if the uniform field is  $\bar{B} = 0.20\bar{a}_y$  Tesla. [16]
6. A wire is bent in to the form of a circle of radius 10 cm. A d.c current of 10 Amps flows in the coil. Find vector magnetic potential at the centre of the coil Medium is air. [16]

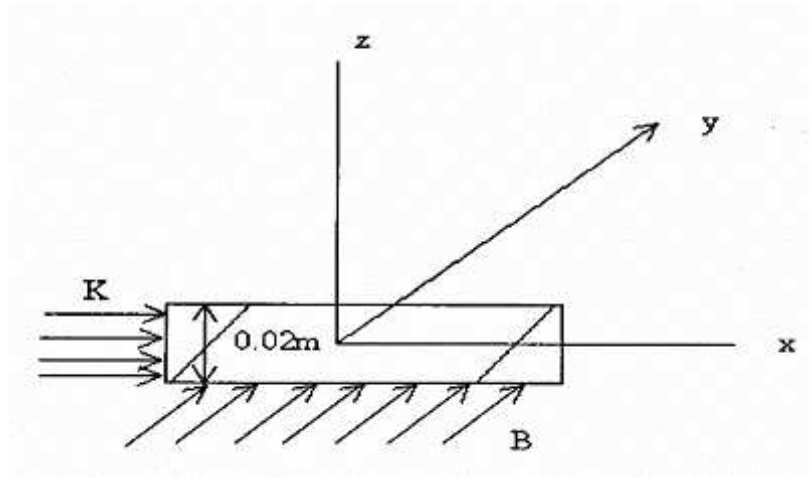


Figure 1:

7. Show that the electric field  $E$  induced by a time varying magnetic field  $B$  is given by the expression.  $\Delta \times E = \frac{-\partial B}{\partial t}$  [16]
8. (a) Derive the general solution of wave equation.
- (b) Prove that the average poynting vector is given by  $P_{avg} = \frac{1}{2}(H_m)^2 R_e(\eta)$ . Find the value of  $P_{avg}$  for free space, dielectric medium and conducting medium.

[8+8]

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