

EE - 402
B.E. IV Semester
Examination, June 2014
Electro-Magnetic Theory

Time: Three Hours

Maximum Marks: 70

- Note:** i) Answer five questions. In each question part A, B, C is compulsory and D part has internal choice.
- ii) All parts of each question are to be attempted at one place.
- iii) All questions carry equal marks, out of which part A and B (Max. 50 words) carry 2 marks, part C (Max. 100 words) carry 3 marks, part D (Max. 400 words) carry 7 marks.
- iv) Except numericals, Derivation, Design and Drawing etc.

Unit - I

1. a) Specify the significance of the dot and cross product. 2
- b) Write down the values of the electric field intensity in a case of point, line, sheet and volume charge density. 2
- c) Describe the Gauss's law. 3
- d) Prove divergence theorem. Find the divergence of the vector. $\vec{D} = e^{-x} \sin y \vec{a}_x - e^{-x} \cos y \vec{a}_y + 2z \vec{a}_z$

OR

Find the surface charge density at P(2, 5, 0) on the conducting plane $z = 0$, if there are a line charge of 30hc/m , located at $x = 0, z = 3$. 7

Unit-II

2. a) Describe dipole and dipole moment. 2
- b) Derive for the Poisson's equation starting from the Gauss's law. 2
- c) Prove for the Laplace's equation continuing from the Poisson's equation. 3
- d) Derive for the energy density in the static electric field. 7

OR

A parallel plate capacitor as shown in the figure contains three dielectric layer where

$$\epsilon_r = 1$$

$$d_1 = 0.2\text{mm}$$

$$\epsilon_r = 2$$

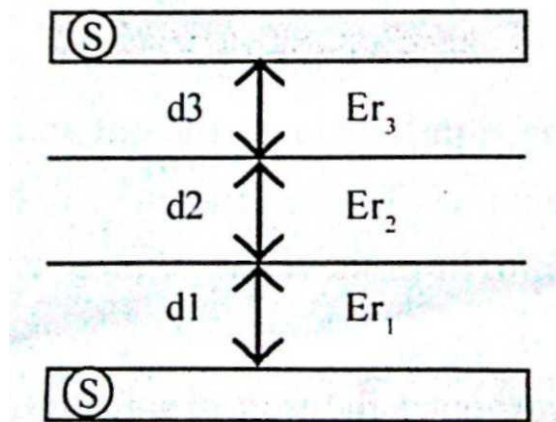
$$d_2 = 0.3\text{mm}$$

$$\epsilon_r = 3$$

$$d_3 = 0.4\text{ mm}$$

Where S = surface area of plate = 20cm^2

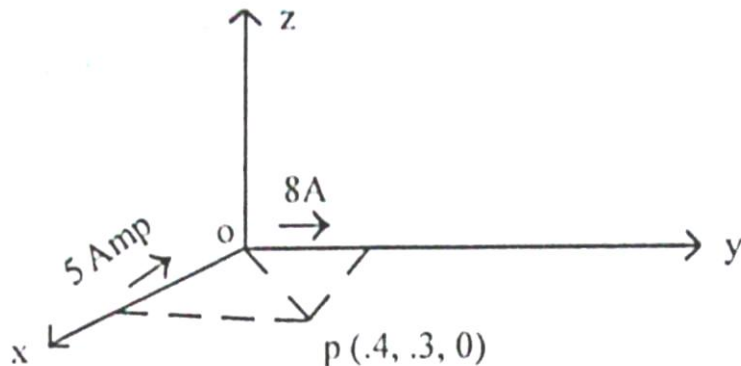
Find the total capacitance. 7



Unit-III

3. a) State BiotSavart law and write. 2
- b) Define the term $\sim B \& H$ and surface current density. 2
- c) Write ampere circuital law. What are its applications?

- d) Determine \vec{H} at P2 (.4, .3, 0) in the field of an 8 Amp filamentary' current directed in words from ∞ to origin on the +ve z axis and the out words to ∞ along y axis as shown below, 7



OR

Derive for the field at # any point (P) due to ∞ long current carrying straight conductor. 7

Unit-IV

4. a) Define scalar and vector magnetic potential. 2
- b) What is Lorentz force equation. 2
- c) Comment on the inductance and the mutual inductance.

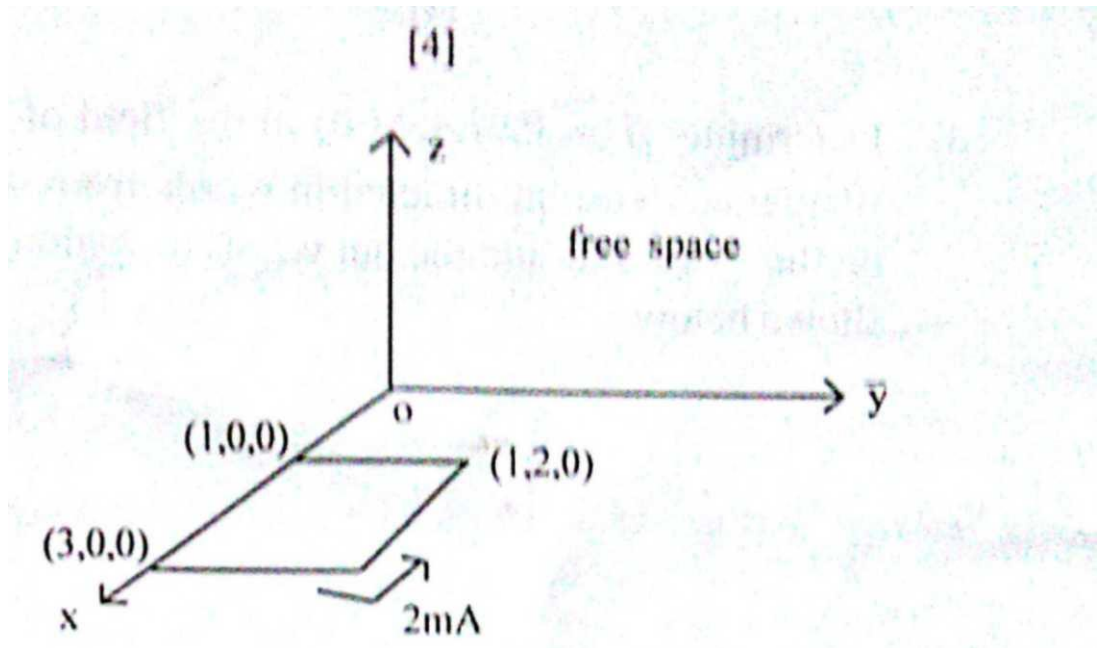
3

- d) What is faraday law? Derive Maxwell's equation through it. 7

OR

In the wired square loop as shown below carrying 2mA current and loop is in $Z = 0$ plane.

Calculate total force on the loop due to this. 7



Unit - V

5. a) What do you mean by polarization? What are the types of it?

2

b) Define plane wave and uniform plane wave. 2

c) Derive for the wave equation in a case of electric field E .

3

d) What is Poynting vector. State Poynting theorem? Derive it.

7

OR

Describe normal, oblique incidence and skin effect, Given a non magnetic material having $\epsilon_r = 2.25$ and $\sigma = 10^{-4} \text{ mhos/m}$ in. find numerical values at 2.5 MHz , for loss tangent. 7