College of Industrial Technology

King Mongkut's University of Technology North Bangkok

Final Examination of Semester 1 **Year:** 2013

Subject: 340151 Electrical Materials and Calculation **Section:** 5-6

Date: 4 October 2013 **Time:** 10.00-12.00

Name:_____ ID:_____ Class:_____

Instructions:

1. Cheating will result in failure of all classes registered for the current semester. Students who are caught cheating will also be denied registering for the following semester.
2. No documents are allowed to be taken out of the examination room.
3. Text books and dictionaries are NOT allowed.
4. Calculator is permitted.
5. Electronic communication devices are NOT allowed in the exam room.
6. The examination has 4 pages (including this page), 10 questions and a total score of 35 points.
7. Write solutions and answers on the answer sheets.

Part A: General comprehension. Give a clear answer for each question. (13 points)

1. What are the functions of the following cable parts? **(5 points)**

   1.1 Conductor Screen

   1.2 Bedding/Inner Sheath

   1.3 Armour

   1.4 Individual Screen

   1.5 Filter

2. How can N-type and P-type semiconductors be made? (Please answer with giving an example) **(5 points)**

3. What are the functions of the following power transformer components? **(3 points)**

   3.1 Silica Gel

   3.2 Rubber Bag

   3.3 Insulating Oil

Part B: General comprehension. Note that the answers of these questions must be written in the answer sheet by drawing the directions or giving a short answer for each question. (7 points)

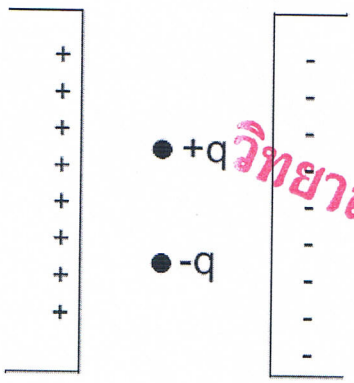

Figure 1: Electric Field

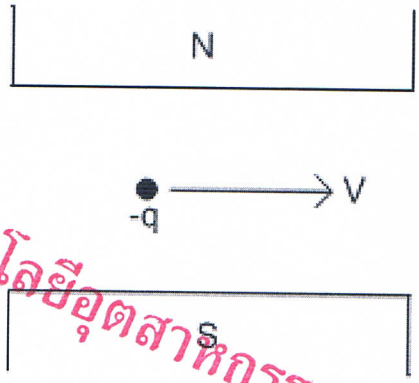

Figure 2: Magnetic Field

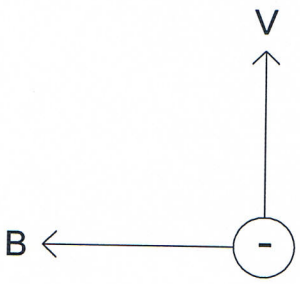

Figure 3: Magnetic Field

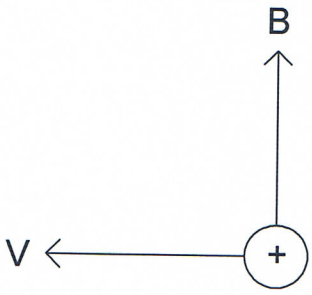

Figure 4: Magnetic Field

4. From Figure 1, please draw the directions of:

   4.1 Electric field (E)

   4.2 Electric force (F_e) of positive charge (+q)

   4.3 Electric force (Fe) of negative charge (-q)

5. From Figure 2, please draw (or write a short answer) the directions of:

   5.1 Magnetic field (B)

   5.2 Magnetic force (Fm)

6. From Figure 3, please draw (or write a short answer) the directions of:

   6.1 Magnetic force (F_m)

7. From Figure 4, please draw (or write a short answer) the directions of:

   7.1 Magnetic force (Fm)

Part C: General comprehension. Please show step-by-step how to get the solutions of the following questions. Answer requires both quantity and unit. Answering without unit causes subtraction of 0.5 point for each answer. (15 points)

8. What is the total capacitance of the combination of capacitors as shown in Figure 5? The value of each capacitor is 5 μF. (5 points)

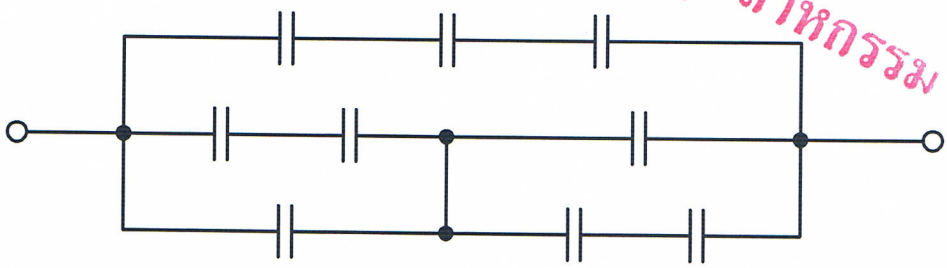

Figure 5: Combination of Capacitors

9. From Figure 6, charges of -50 and +80 μC are placed at two of the vertices of an equilateral triangle with sides 0.2 m in length. Assume that $k=9\times10^9$ $N.m^2/C^2$. **(6 points)**

   9.1 What is the electric field at the "P" point with a positive charge? **(4 points)**

   9.2 What is the force when a charge of +4 μC is placed at the "P" point? **(2 points)**

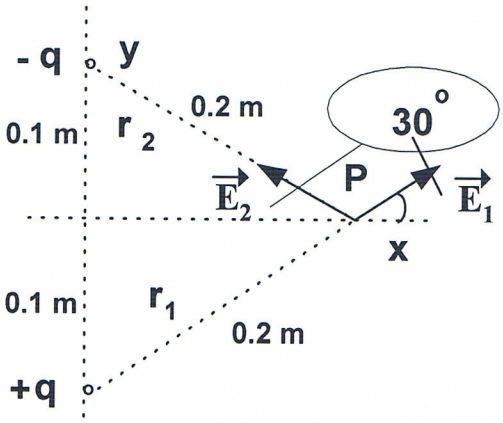

Figure 6: Electric Field by Charges

10. From Figure 7, magnetic field lines are passing through the sphere. The diameter is equal to 63.5 mm, while the magnetic flux is 40 webers. The negative charge with 8.5 μC moves perpendicular to the magnetic field from top to bottom of the sphere with the speed equal to 5.6 m/s. **(4 points)**

    10.1 What is the magnetic field? **(1 point)**

    10.2 What are the magnitude and the direction of the magnetic force? **(3 points)**

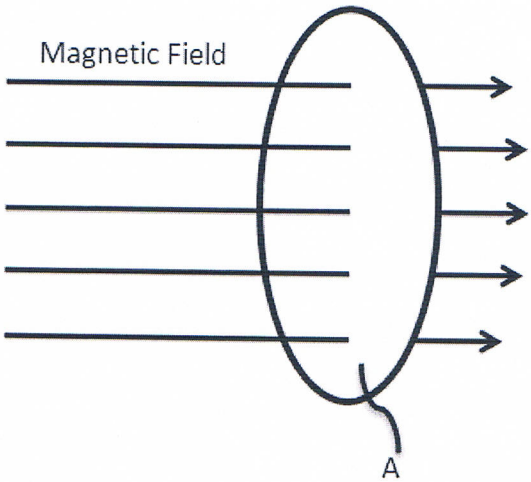

Figure 7: Magnetic Field Area