College of Industrial Technology

King Mongkut's University of Technology North Bangkok

เลขที่นั่งสอบ

Final Examination of Semester 1 Year: 2015

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

Date: 8 December 2015 **Time:** 10.00-12.00

Name:_____ ID:_____ EP:_____

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, but a calculator is permitted.
4. No any electronic communication devices are allowed in the exam room.
5. Write solutions and answers on these question sheets.
6. The examination has 7 pages (including this page), 8 questions and a total score of 50 points.

Part A: General comprehension. Give a clear answer for each question. (16 points)

1. For power transformer, oil temperature affects the volume of the oil and the air flowing. Please fill in the effect in the table below. (4 points)

Oil Temperature	Oil Volume	Air Flowing
Increase	.....	.....
Decrease	.....	.....

2. Please match the items with their functions by writing only the alphabet in the table. (12 points)

A. Armour	G. Filter
B. Bedding	H. Individual Screen
C. Capacitor	I. Insulating Oil
D. Conductor Screen	J. Power Transformer
E. Conductor Sheath	K. Rubber Bag
F. Doping	L. Silica Gel

Item	Function
2.1	To keep bundle together
2.2	To against noise and radiation
2.3	To reduce electrostatic stresses
2.4	To against conductor in the bundle by using soft polymer material
2.5	To keep electromagnetic radiation
2.6	To protect mechanical structure of the bundle
2.7	To store an electrical charge or energy
2.8	To be cooling medium
2.9	To separate transformer insulating oil and air
2.10	To transfer the voltage from one side to another side
2.11	To filter air from moisture
2.12	To make the semiconductor conduct the electricity

Part B: General comprehension. Note that the answers of these questions must be written by drawing the directions for each question. (14 points)

3. Please draw the directions of "Electric Field (E)", "Electric Force (Fe) of positive charge (+q)", and "Electric Force (Fe) of negative charge (-q)" in Figure 1. (6 points)

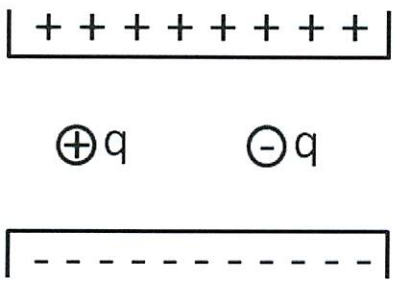

Figure 1: Electric Field

4. Please draw the directions of "Magnetic Field (B)", and "Magnetic Force (Fm)" in Figure 2. (4 points)

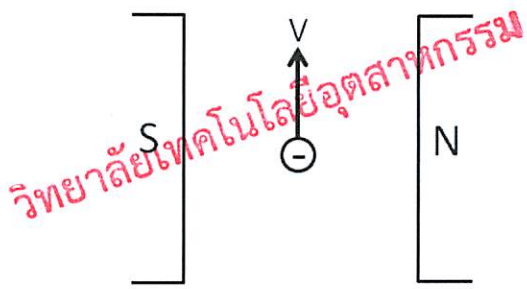

Figure 2: Magnetic Field

5. Please draw the directions of "Magnetic Force (Fm)" in Figure 3 and Figure 4. (4 points)

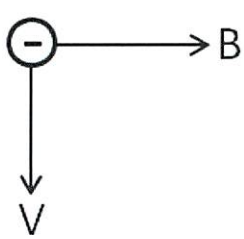

Figure 3

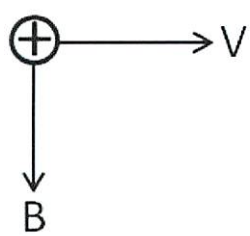

Figure 4

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. (20 points)

6. What is the total capacitance (C_{AB}) of the combination of capacitors as shown in Figure 5? The value of each capacitor is 2 nF. (5 points)

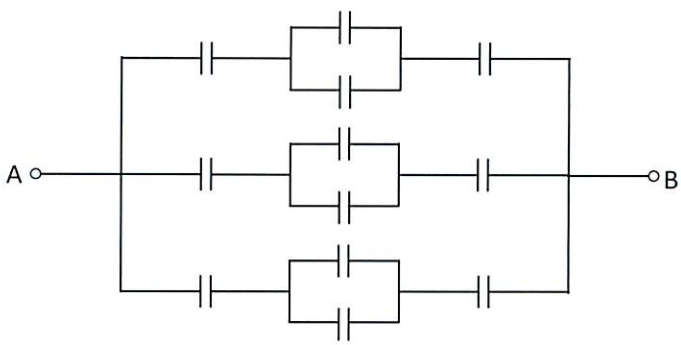

Figure 5: Capacitors

Solution:

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7. The charge "A" is equal to 3q. The charge "C" is equal to -6q, as shown in Figure 6. What is the electric field created by the charges "A" and "C" at point "B"? Assume that there is a negative charge at point "B", d=350 mm., q=4.2 nC and k=9x10^{9} N.m^{2}/C^{2}. (5 points)

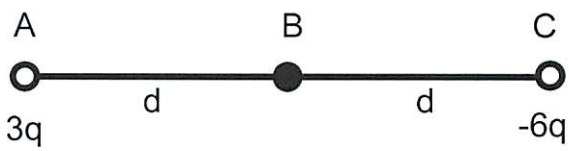

Figure 6: Electric Field

Solution:

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8. The charges of -50 and +80 nC are placed at two of the vertices of an equilateral triangle with sides 0.8 m. in length, as shown in Figure 7. Assume that $k=9x10^9$ $N.m^2/C^2$. (10 points)

8.1 What is the electric field at the "P" point with a positive charge? (8 points)

8.2 What is the force when a charge of +10 nC is placed at the "P" point? (2 points)

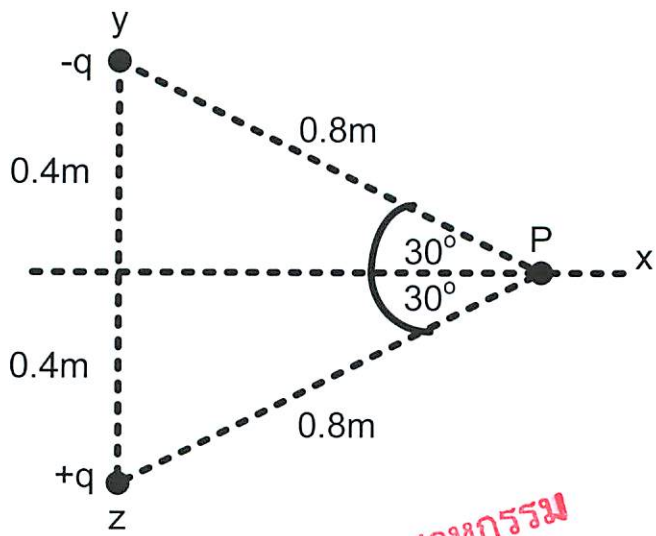

Figure 7: Electric Field by Charges

Solution:

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Asst.Prof.Dr.Rattanakorn PHADUNGTHIN