Seat No.

Final Examination of Semester 1   **Year:** 2019

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

Date: 15 October 2019   **Time:** 10.00-12.00

Name:_____ ID:_____ Class:_____

Directions: The test is designed to measure your comprehension. The test is divided into 1 section. There will be 10 pages (including this page) and they are worth 70 points.

- Answer the questions on this test papers.
- Books, documents and lecture notes are not allowed.
- You must be in the room for one hour after the exam is started and, while taking the exam, you cannot go out except in an emergency case.
- Before leaving, make sure you do not bring this test outside.
- Do not use any electronic communication device.
- Calculators can be used in this test.

Now begin the test.

Cheating in the exam is considered an extremely serious offence which will result in expulsion from the University.

1. Match the definition/function of the components as written in Table 1 with the alphabet as follows. (13 points)

A. Silk and Cotton Fiber
B. Enamel
C. Armour
D. Conductor Sheath
E. Bedding

F. Outer Sheath
G. Conductor screen
H. Individual Screen
I. Thermosetting
J. Thermoplastic

K. Insulating Paper
L. Drain Wire
M. Capacitor

Table 1: Definition/Function

No.	Alphabet	Definition/Function
1	....	To protect weather
2	....	To keep electromagnetic radiation
3	....	To shield against noise
4	....	To assist in the termination of the screen
5	....	To store electrical charge
6	....	To insulate magnet wire
7	....	To be soft when heating and hard again when cooling
8	....	To insulate in communication circuits
9	....	To wrap around conductors inside power transformer
10	....	To protect the conductor bundle
11	....	To be never soft after already hard
12	....	To keep a uniform electric field
13	....	To keep bundle together

2. Fill in the effect of transformer oil temperature in Table 2.   (6 points)

Table 2: Oil Temperature Effect

Oil Temperature	Volume of Oil	Size of Rubber Bag	Flow of Air
increasing	....	....	....
decreasing	....	....	....

3. Fill in the doping process in Table 3 and its doping effect of each semiconductor type. (6 points)

Table 3: Doping Process

Semiconductor Type	Doped by	No. of Electron	No. of Resistor
N-type	....	....	....
P-type	....	....	....

4. Draw the directions of "Electric Field (E)", "Electric Force (Fe) of proton (q1)", and "Electric Force (Fe) of electron (q2)", as shown in Figure 1. (3 points)
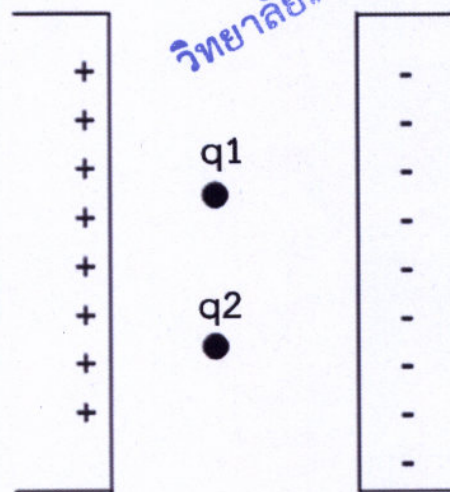
Figure 1: Electric Field

5. Draw the direction of the magnetic force of the figures below. Also, specify "in" or "out" on those force direction. Note: "in" means into the viewer, while "out" means out of the viewer.   (6 points)
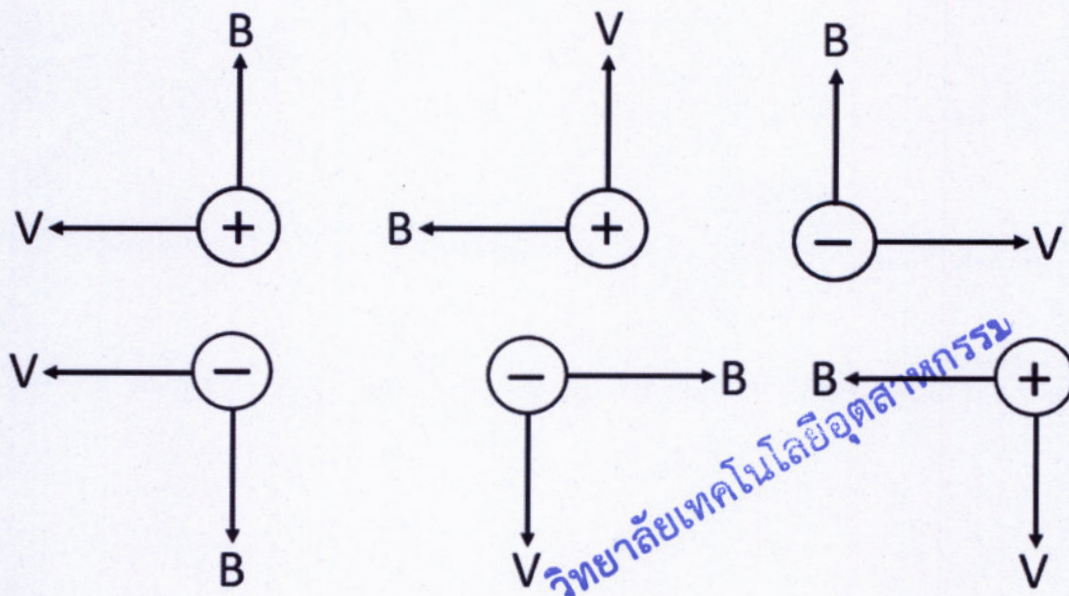
6. Draw the directions of "Magnetic Field (B)", and "Magnetic Force (Fm)" of the electron (q) in Figure 2.   (2 points)
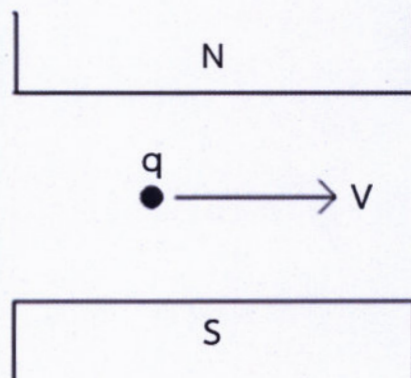
Figure 2: Magnetic Field

7. Fill in the function and the location of the following transformer components as written in Table 4.   (4 points)

Table 4: Transformer Component

Component	Function	Location
Rubber Bag	....	....
Silica Gel	....	....

Note: In question 8-12, please show step-by-step how to get the solutions. Both quantity and unit must be answered.   (30 points)

8. What is the total capacitance of the capacitor combination? Assume that the value of each capacitor is 10 mF.   (5 points)

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9. The capacitor of 65 nF includes two parallel plates separated 0.5 cm of each other with dielectric medium and a total surface area of 6.80 m^2. The power supply to the capacitor is 15 V. Assume that ε_0 is 8.84 pF/m.   (5 points)

9.1 What is the permittivity of the dielectric medium (ε_r)?   (3 points)

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9.2 What is the charge on the plates of the capacitor?   (2 points)

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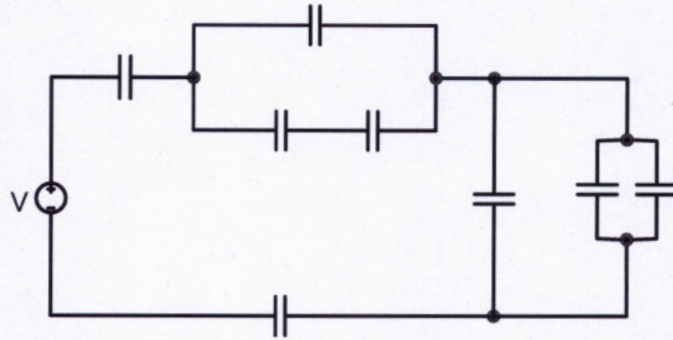
10. The magnetic field lines are passing through the sphere with the diameter equal to 6 cm and the magnetic field of 15×10^3 Tesla. The electron that is 1.6×10^{-19} C moves perpendicular to the magnetic field from the top to the bottom of the sphere with 50 m/s.   (5 points)
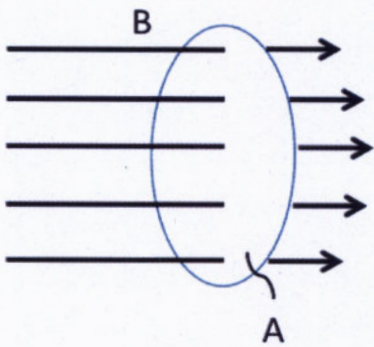
10.1 What is the magnetic flux?   (2 points)

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

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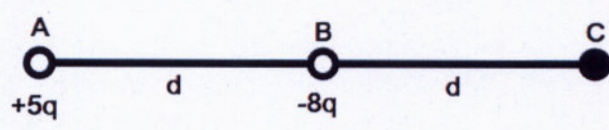
11. The electric field created by the charges "A" and "B" at point "C", as shown in the figure. Assume that there is a negative charge (-q) at point "C", d=600 mm., q=7 μC and k=9x10^9 N.m^2/C^2. What are the magnitude and direction of the Electric Field at Point "C"?   (5 points)

A   B   C

+5q   d   -8q   d

12. The charges of +75 C and -45 C are placed at q_1 and q_2, respectively. Another negative charge is placed at the "N" point. Assume that $k=9\times10^9$ N.m^2/C^2.   (10 points)
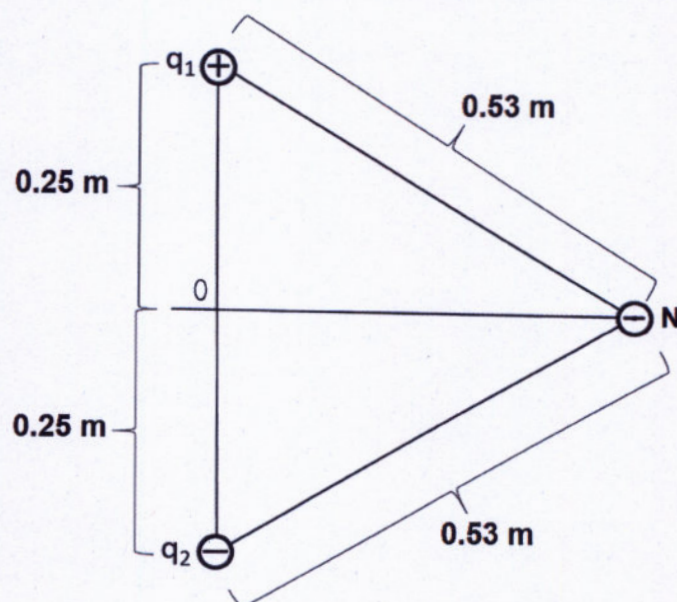
12.1 What is the electric field at the "N" point?   (8 points)

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12.2 What is the electric force at the "N" point when there is +60 C placed at that point?   (2 points)

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Assoc.Prof.Dr. Rattanakorn Phadungthin