College of Industrial Technology
King Mongkut's University of Technology North Bangkok

เลขที่นั่งสอบ

Final Examination of Semester 1 **Year:** 2017
Subject: 340151 Electrical Materials and Calculation **Section:** 5-6
Date: 4 December 2017 **Time:** 10.00-12.00
Name..... ID..... EP.....

Instructions:

1. The examination has 9 pages (including this page), 11 questions and a total score of 70 points.
2. Write all your solution and answers on this examination sheet.
3. This is a closed book examination.
4. You are not allowed to leave the exam room during the first 1 hour after the beginning of the exam.
5. You are not allowed to open the exam papers or start to answer before the proctor's permission.
6. You are not allowed to use the restroom during the exam except in case of an emergency.
7. No documents are allowed to be taken out of the examination room.
8. Calculator is allowed in the examination.
9. Electronic communication devices are NOT allowed in the examination room.

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

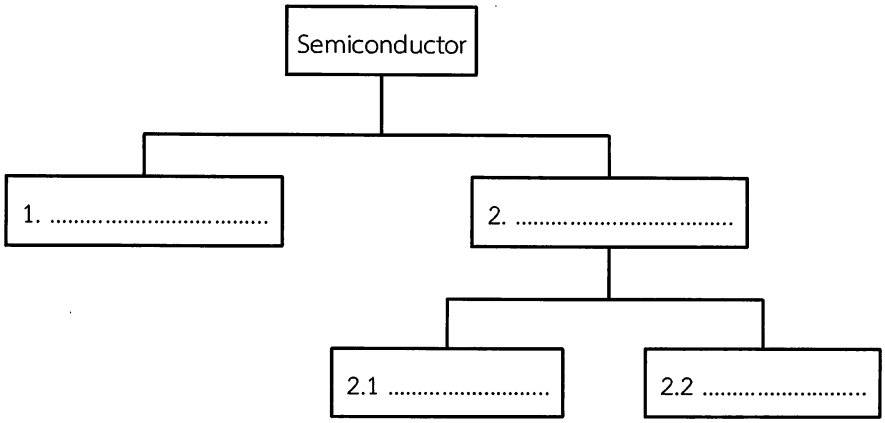
1. Match the function of the cable components as written in Table 1 with the alphabet as follows. (13 points)

A. Armour
B. Bedding
C. Conductor
D. Conductor screen
E. Conductor sheath
F. Drain wire
G. Filter
H. Insulating enamel
I. Insulating paper
J. Insulating plastics
K. Insulating silk & cotton
L. Insulation screen
M. Overall screen

Table 1: Definition

No.	Alphabet	Definition
1	.....	To minimize electrostatic stresses
2	.....	To protect the insulated conductor bundle
3	.....	To keep the bundle together
4	.....	To wrap around conductors and soak with oil
5	.....	To insulate Magnet wire
6	.....	To shield against noise and radiation
7	.....	To wrap around individual conductors and cover with special wax
8	.....	To keep electromagnetic radiation
9	.....	To protect conductor bundle
10	.....	To control electric field for MV/HV power cables
11	.....	To insulate for flexible quality such as Thermoplastic
12	.....	To assist in the termination of the screen
13	.....	To allow the current flow

2. Fill in the semiconductor types as shown in the diagram. (4 points)



3. In Table 2, please fill in the effect of doping into the semiconductor by material group 3 and group 5. (8 points)

Table 2: Doping

Doping	Electron	Current	Resistor	Semiconductor Type
by group 3	.....	.....	.....	.....
by group 5	.....	.....	.....	.....

4. In Table 3, fill in the effect of transformer oil temperature. (4 points)

Table 3: Oil Temperature Effect

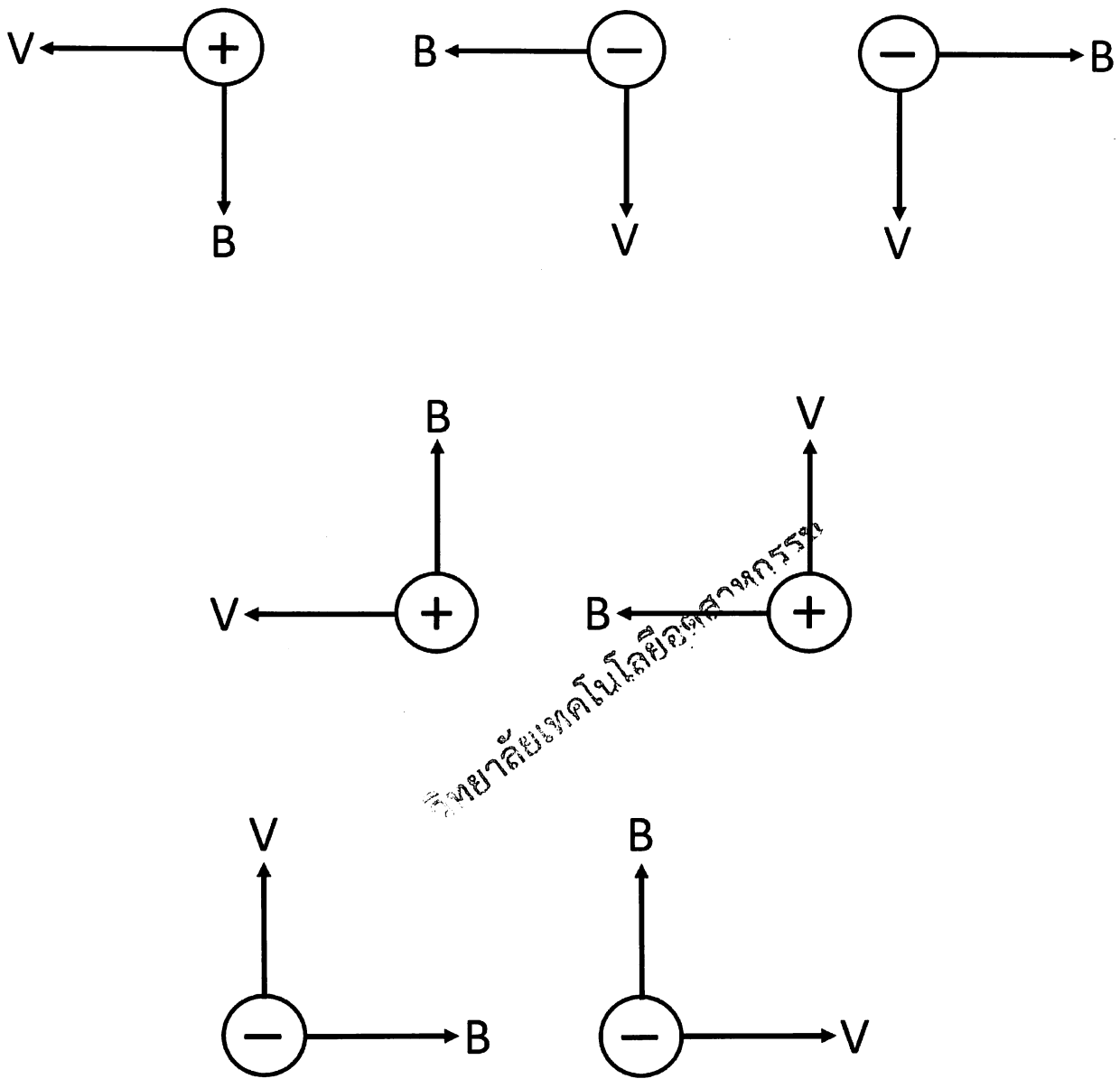
Oil Temperature	Oil Volume	Air Flowing
increasing	.....	.....
decreasing	.....	.....

5. In Table 4, please fill in the function and the location of the following transformer components. (4 points)

Table 4: Transformer Component

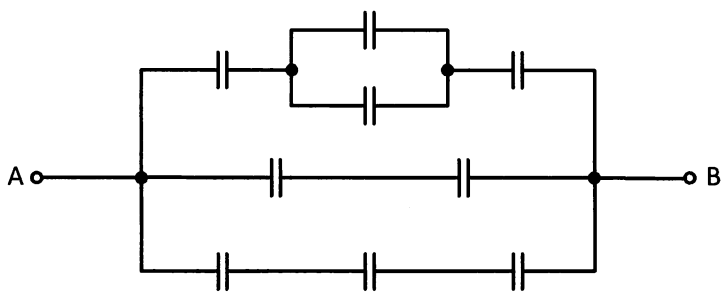
Component	Function	Location
Rubber Bag	.....	.....
Silica Gel	.....	.....

6. Please draw the direction of the magnetic force of the figures below. Also, specify "in" or "out" on those force direction. (7 points)



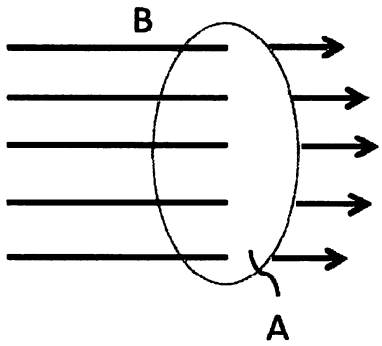
Note: In question 7-10, please show step-by-step how to get the solutions. Both quantity and unit must be answered. (30 points)

7. What is the total capacitance of the capacitor combination? Assume that the value of each capacitor is 2 nF. (5 points)



8. A parallel plate capacitor includes two plates separated 0.3 cm of each other with fiber dielectric medium and a total surface area of 50 cm^2. The power supply to the capacitor is 10 V. What are the values of the capacitance and the energy stored in the capacitor? Assume that ε_0 and ε_r of fiber are 8.84×10^{-12} F/m and 6, respectively. (5 points)

9. The magnetic field lines in the figure below are passing through the sphere with the diameter equal to 5 cm and the magnetic flux of 45 weber. Assume that the electron that is 1.6×10^{-19} C moves perpendicular to the magnetic field from the bottom to the top of the sphere with 15 m/s. What is the magnetic force? (5 points)



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10. The proton moves with 4.5 m/s velocity into the magnetic field. The angle between the velocity and the magnetic field is 45°. What is the magnetic field if the magnetic force is 32 μN? When can the magnetic force be maximum? (5 points)

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11. The charges of +90 μC and -50 μC are placed at q_1 and q_2, respectively, in the figure below, while another charge of +40 μC is placed at the "P" point. What are the electric field and the force at the "P" point? Assume that $k=9\times10^9$ N.m^2/C^2. (10 points)