College of Industrial Technology

King Mongkut's University of Technology North Bangkok

Final Examination of Semester 1 **Year:** 2012

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

Date: 4 October 2012 **Time:** 13.00-15.00

Name:_____ ID:_____Field of Study:_____

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 are NOT allowed.
4. Dictionaries and calculator are permitted.
5. No any electronic communication devices allow in the exam room.
6. Write solutions and answers on the answer sheets.
7. The examination has 4 pages (including this page), 24 questions and a total score of 30 points.

Part A: General comprehension. Give a short answer for each question to get one point each. (14 points)

1. What is cable that is used in electrical engineering field?
2. There are normally several important parts of the cable. Please give at least 4 parts of the cable.
3. Regarding to insulation, what are the differences between "thermoplastic" and "thermosetting"?
4. What is the main function of "armour" used in the cable?
5. What is the function of "bedding or inner sheath" used in the cable?
6. According to physics of dielectrics, please explain how to form a capacitor?
7. What is the capacitor in electrical circuit used for?
8. What is the major function of electronic materials?
9. How can we make N-type and P-type semiconductors?

10. What are the differences between intrinsic and extrinsic semiconductors?
11. Please explain the resistance effect of doping the 4th group materials by "Boron".
12. What are the significant components of power transformer? At least 4 components must be answered.
13. What are the functions of insulating oil used in power transformer?
14. Which material can be used for absorbing moisture away from going through inside power transformer?

Part B: General comprehension. Figure 1 is used for the question 15 and 16, while Figure 2 is used for the question 17 and 18. 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 to get one point each. (6 points)

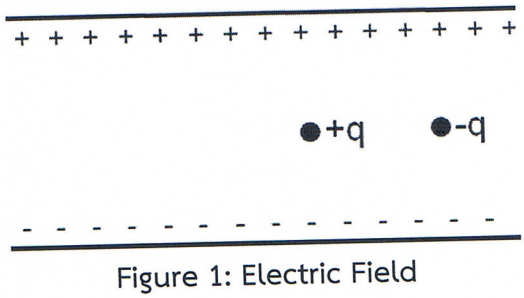

Figure 1: Electric Field

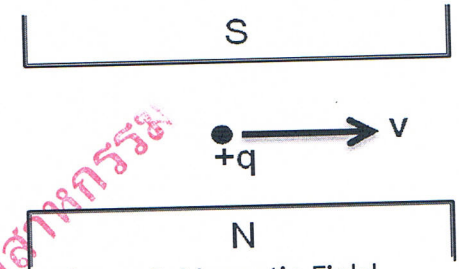

Figure 2: Magnetic Field

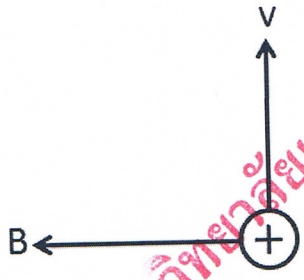

Figure 3: Magnetic Field

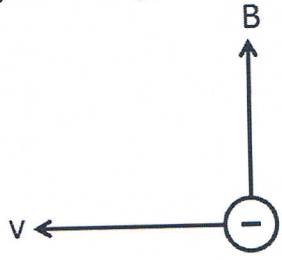

Figure 4: Magnetic Field

15. What is the direction of "electric field (E)"?
16. What are the directions of "electric force (F_e)" of positive charge (+q) and negative charge (-q)?
17. What is the direction of "magnetic field (B)"?
18. What is the direction of "magnetic force (F_m)"?
19. According to Figure 3, what is the direction of "magnetic force (F_m)"?
20. According to Figure 4, what is the direction of "magnetic force (F_m)"?

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. (10 points)

21. A parallel plate capacitor consists of two plates with a total surface area of 100 cm^2. What will be the capacitance in pF of the capacitor if the plate separation is 0.3 cm; and the dielectric medium used is cellulose? (dielectric constant of cellulose =3.70, ε_0=8.84x10^{-12} F/m) (2 points)

22. Please determine the total capacitance of the combination of capacitors as shown in the Figure 5. The value of each capacitor is 5 μF. (2 points)

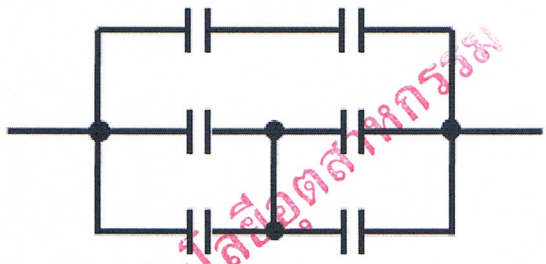

Figure 5: Combination of Capacitors

23. Please determine the magnitude and the direction of the electric field created by the charges B and C at point A, as shown in Figure 6. (4 points)

Assume that there is a negative charge at point A, d=45 cm, q=3.5 μC, and k=9x10^9 N.m^2/C^2.

Figure 6: Electric Field by Charges

24. There are the magnetic field lines passing through the sphere as shown in Figure 7. The area of the sphere is equal to 520.42 mm^2, while the magnetic flux is 25 webers.

    If the positive charge, 9.44 nC, moves perpendicular to the magnetic field from the top to the bottom of the sphere with 7.24 m/s, please determine the magnitude in μN unit and the direction of the magnetic force. (2 points)

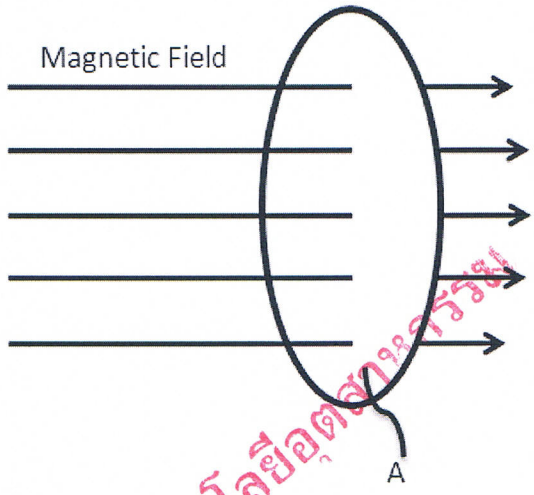

Figure 7: Magnetic Field Area