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**University Examinations 2014/2015**

SECOND YEAR, FIRST SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE (GENERAL) PHYSICS OPTION

**SPH 2201: ELECTRICITY AND MAGNETISM II**

**DATE: DECEMBER 2014 TIME: 2 HOURS**

**INSTRUCTIONS:** *Answer question* ***one*** *and any other* ***two*** *questions*

**QUESTION ONE (30 MARKS)**

1. State Lenz’s law (2 marks)
2. Find the amount of energy stored in a 5uf capacitor when it is connected across a 120 V line (3 marks)
3. Differentiate between absolute and secondary instruments (4 marks)
4. State three applications of oscillations (3 marks)
5. Calculate the magnetic flux though each turn of a 300-turn, 7.2 mH coil when the current in the coil is 10mA. (4 marks)
6. Show that the energy stored in a capacitor is given by  (5 marks)
7. An alternating current is given by $i=120sin 120πt$. Find:
8. Maximum value (1 mark)
9. Frequency (2 marks)
10. Time period (2 marks)
11. State **four** conditions which must be satisfied in order to apply Gauss’s law on a surface. (4 marks)

**QUESTION TWO (20 MARKS)**

1. At t=0, a 40MH inductor is placed in series with a resistance R=3.0 $Ω$ and a charged capacitor C=4.8 uf.
2. Show that this circuit will oscillate (5 marks)
3. Determine the frequency (4 marks)
4. What are the advantages of permanent magnet moving coil instruments (7 marks)
5. Calculate the inductance of an inductor if has a stored energy of 1.5 J when there is a current of 2.5 A in it. (4 marks)

**QUESTION THREE (20 MARKS)**

1. Show that the differential form of Gauss’s law is given by 

where  is the volume charge density. (6 marks)

1. A parallel-plate capacitor has an area of 2 cm2 and plate separation of 2mm. How much charge does this capacitor store when connected to a 6 V battery?(5 marks)
2. The switch in a series RL circuit in which R=6$Ω,$ L=3H and E=24 V is closed at t=0. Calculate
3. Maximum current in the circuit (1 mark)
4. Current when ==0.5 sec. (4 marks)
5. Distinguish between self and mutual inductance (4 marks)

**QUESTION FOUR (20 MARKS)**

1. A coil is placed near an electromagnet as shown below:

Find the direction of induced current in the coil

1. At the instant the switch is closed (2 marks)
2. After the switch has been closed for several seconds (2 marks)
3. When the switch is open (2 marks)
4. A coil has an inductance of 3mH and a current through it changes from 0.2A to 1.5A in a time of 0.2 sec. Find the magnitude of the average induced emf in the coil during this time (5 marks)
5. A moving coil instrument has a resistance of 10 Ω and gives full-scale deflection when carrying a current of 50 mA. Show that it can be adopted to measure voltage up to 750 V and current up to 100 A (7 marks)
6. State two types of moving coil instruments (2 marks)