PROBLEM SHEET 2

Capacitance and inductance in a d.c. circuit

1. A 100 μF capacitor is connected in series with an 800 Ω resistor. The combination is connected suddenly to a 100 V d.c. supply. Determine:
   a) The time constant of the circuit;
   b) The initial rate of rise of the potential difference across the capacitor;
   c) The initial charging current;
   d) The ultimate charge in the capacitor;
   e) The ultimate energy stored in the capacitor.
2. A 2 μF capacitor is connected in series with a 2 MΩ resistor to a d.c. supply of 100 V. The capacitor is initially uncharged.
   a) Plot a current-time graph using the graph paper;
   b) Calculate the current flowing in the circuit at the end of an interval of 4 sec from the start.
   c) Calculate the energy stored in the capacitor at the end of an interval of 4 sec from the start.
3. A large electromagnet is wound with 1000 turns. A current of 2 A produces a flux of 0.03 Wb through each turn of the coil.
   a) Calculate the inductance of the electromagnet;
   b) If the current in the coil is reduced from 2 A to zero in 0.1 s, what average EMF will be induced in the coil?
4. A coil wound with 600 turns has a resistance of 2 Ω. It is found that a current of 3 A produces a flux of 500 μWb through each turn. Calculate:
   a) The inductance of the coil;
   b) The time constant of the circuit;
   c) The average EMF induced in the coil when the current is reversed within 0.3 s.
5. **ASSIGNMENT**. A coil having a resistance of 25 Ω and an inductance of 2.5 H is connected across a 50 V d.c. supply. Plot the graph of the current as a function of time using the graph paper. Determine **graphically**:
   a) The initial rate of the growth of the current;
   b) The value of the current after 0.15 s;
   c) The time required for the current to grow to 1.8 A.