Student Name:……..…..……
Student ID:……

QUESTIONS

Q1. (20 marks)

In Figure 1, the cube is 20.0 cm on each side. Four segments of wire—ab, bc, cd, and da—form a closed loop that carries a current I = 20 A. A uniform magnetic field of magnitude B = 0.02cos(5t) T in the (+y) direction is in the (+y) direction, where *t* is time in second (*s*). Determine the electromotive force induced in the closed loop (acd)

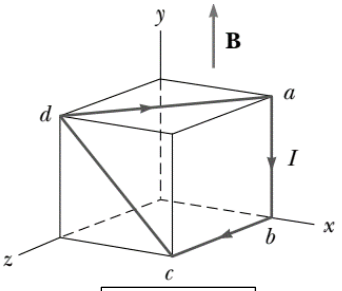

Figure 1

Q2. (20 marks)

A rectangular wire loop is pulled in the region of a uniform magnetic field $\boldsymbol{B_{in}}$ = 5.0 T with a uniform velocity **v** = 2.0 m/s (see Figure 2). Assume that $\boldsymbol{l}$ = 2 m and $\boldsymbol{w}$ = 1 m.

(a) If the wire loop has a resistance $\boldsymbol{R}$ = 15 Ω, what is the current on the loop during movement.

(b) Plot the diagram of current $\boldsymbol{I}$ versus time $\boldsymbol{t}$. Assume that the time t_0 = 0 s when the loop enters the region.

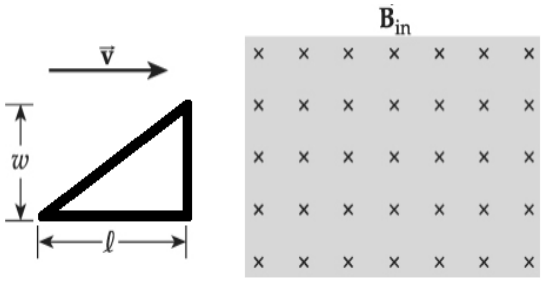

Figure 2

Q3. (20 marks)

The switch is open for $\boldsymbol{t} < 0$ and then closed at time $\boldsymbol{t} = 0$ (see Figure 3). Find the current in the inductor as functions of time right after the switch is closed.

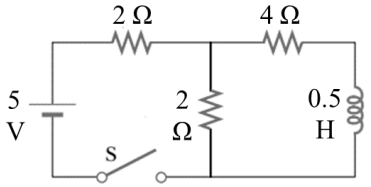

Figure 3

Q4. (20 marks)

Two parallel conducting wires carry currents I_1 = 2.0 A and I_2 = 3.0 A, both directed into the page in Figure 4. Determine the magnitude and direction of the magnetic field at P in vector form. Assume that $\boldsymbol{l_1}$ = 7 cm , $\boldsymbol{l_2}$ = 24 cm and $\boldsymbol{l_3}$ = 25 cm

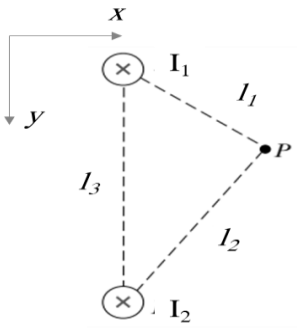

Figure 4

Q5. (20 marks)

The Figure 5 represents the RLC circuit used in common speaker. The resistance $\boldsymbol{R}$ is equal to 6.0 Ω. The source produces AC signals of uniform amplitude V_{in} of 5.0 V at all frequencies. To obtain desired output voltage at resistors, the inductor and capacitor are used to obtain the ratio V_{out}/V_{in} =1/2 at 4.0 kHz. (a) Find the value of C if the inductance L = 435.0 μH. (b) Find the maximum value of the ratio V_{out}/V_{in} (c) Find the phase difference between V_{in} and V_{out} at 4.0 kHz. Plot the phasor diagram. (d) Find the average power transferred to the resistor at 4 kHz.

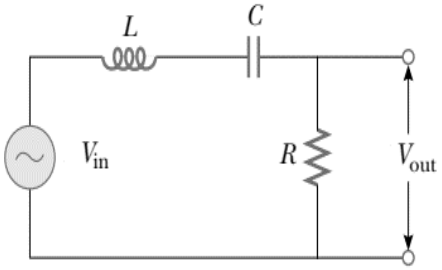

Figure 5

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