P1. Complex DC circuit (20%)

For the electric circuit given on left (Fig. 1), with assumed currents of I_1, I_2, and I_3. Find:

a) The relationship of I_1, I_2, and I_3. Ans.__ $I_1 - I_2 - I_3 = 0$

b) The relationship of I_2 and I_3. Ans._____ $I_3 - I_2 = 1$

c) The value of I_1. Ans. ____ 1 A

d) The value of I_2. Ans. ____0

e) The value of I_3. Ans. ____1 A

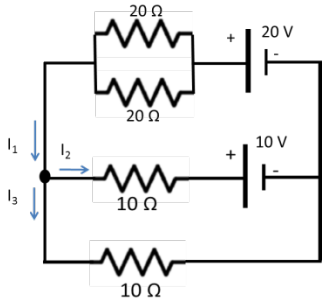


Fig. 1

P2. Magnetic force/field (20%)

As indicated in Fig. 2, a single current-carrying coil is loaded **on a cubic box** under the magnetic field B as indicated. Find:

a) Magnetic force on the segment ab. Ans._____0

b) Magnetic force on the segment bc. Ans. _____8.5 N

c) Magnetic force on the segment cd. Ans._____0

d) Magnetic force on the segment da. Ans._____8.5 N

Note: Indicate the direction of force, if any, on the diagram.

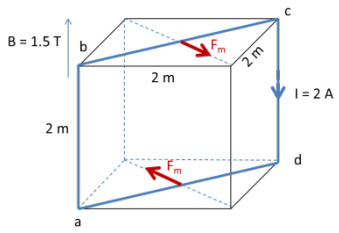


Fig. 2

P3. Faradays' and Lenz's Laws (30%)

A square single coil with length of **1 m**, and **total resistance of 5 ohm** moves into a uniform magnetic field with a constant velocity of **100 m/s**. Find:

a) Emf generated at time t_1 as shown in Fig. 3a. Ans. _____50 V_____

b) Induced current at time t_1 in the coil. Ans. _____10 A_____ Direction : (Indicate it on the diagram)

c) Total magnetic force (**magnitude only**) exerted on the coil at time t_1. Ans. ___5 N_____

d) Total magnetic force exerted on the coil at time t_2 as shown in Fig. 3b. Ans. ___0____

e) Induced emf at time t_3 (Fig. 3c). Ans.____50 V_____

f) Total magnetic force exerted on the coil at time t_3. Value:_____5 N_____ Direction: (Indicate it on the diagram)

Fig. 3a, $t = t_1$

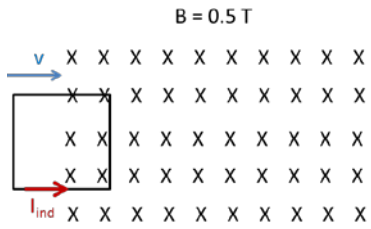


Fig. 3b, $t = t_2$

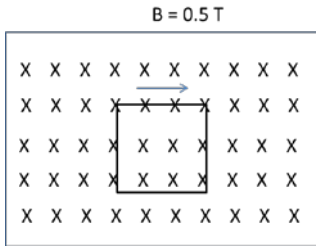
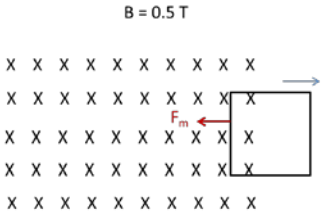


Fig. 3c, $t = t_3$



P4. a.c. circuit (30%)

In Fig. 4, given $V_{s,\,max}$ = 156 V; f = 60 Hz. Find:

a) Angular frequency of the source. Ans._____377 rad./s __

b) Reactance of R and C. Ans. __100 ohm___ and ____2947 ohm____

c) Total impedance for the circuit. Ans. _____2948 ohm_____

d) The expression for Vs (t) including phase. Ans.__156sin(377t – **1.54**)

e) rms voltage of the resistor R. Ans. ____3.7 V____

f) The resonance frequency of the circuit. Ans. ___3063 Hz_____

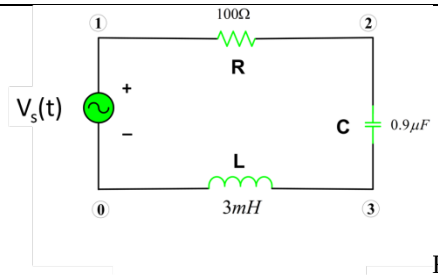


Fig.4

Note: $(88^o/180^o)*\pi = 1.54$ rad.