SECTION C (ANS KEY)

1-Marks Questions

1.(b) We know that $e = \frac{d\phi}{dt}$

But e=iR and $i = \frac{dq}{dt} \Rightarrow \frac{dq}{dt} R = \frac{d\phi}{dt} \Rightarrow dq = \frac{d\phi}{R}$

2. (d) $q = -\frac{N}{R}(B_2 - B_1)A\cos\theta$

$$32 \times 10^{-6} = -\frac{100}{(160+40)}(0-B) \times \pi \times (6 \times 10^{-3})^2 \times \cos 0^o$$

$\Rightarrow B = 0.565\ T$

3. (b) $i = \frac{e}{R} = \frac{-N}{R}\frac{(\phi_2 - \phi_1)}{\Delta t} = \frac{-n(W_2 - W_1)}{5Rt}$

4. (c) Since the magnetic field is uniform therefore there will be no change in flux hence no current will be induced.

5. (d) $e = -\frac{NBA(\cos\theta_2 - \cos\theta_1)}{\Delta t}$

$= -\frac{800 \times 4 \times 10^{-5} \times 0.05\ (\cos 90^o - \cos 0^o)}{0.1} = 0.016$ V

6. (b) The relation of induced emf is $e = \frac{Ldi}{dt}$ and current i is given by $i = \frac{e}{R} = \frac{1}{R}.\frac{L.di}{dt} \Rightarrow$

$\frac{di}{dt} = i\frac{R}{L} = \frac{i}{L/R}$.

In order to decreases the rate of increase of current through solenoid. We have to increase the time constant $\frac{L}{R}$.

7. (c) The manner in which the two coils are oriented, determines the coefficient of coupling between them.

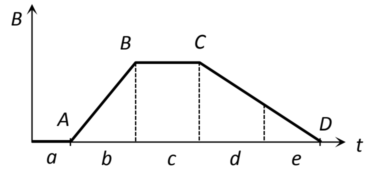
$M = K^2.L_1L_2$

When the two coils are wound on each other, the coefficient of coupling is maximum and hence mutual inductance between the coil is maximum.

8. (b) As the magnet moves towards the coil, the magnetic flux increases (nonlinearly). Also

there is a change in polarity of induced emf when the magnet passes on to the other side of the coil.

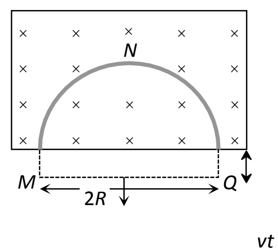
9. (b) Induced emf $e = A\frac{dB}{dt}$



i.e. $e \propto \frac{dB}{dt}$(= slope of B – t graph)

In the given graph slope of AB > slope of CD, slope in the ‘a’ region = slope in the ‘c’ region = 0, slope in the ‘d’ region = slope in the ‘e’ region $\neq 0$. That’s why $b > (d = e) > (a = c)$

10 (d) Rate of decrease of area of the semicircular ring $-\frac{dA}{dt} = (2R)\,V$



According to Faraday's law of induction induced emf

$$e = -\frac{d\phi}{dt} = -B\frac{dA}{dt} = -B\,(2RV)$$

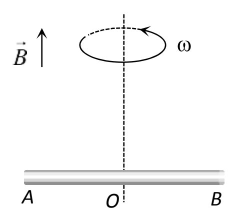
The induced current in the ring must generate magnetic field in the upward direction. Thus Q is at higher potential.

11.(d) Potential difference between

O and A is $V_0 - V_A = \frac{1}{2}Bl^2\omega$

O and B is $V_0 - V_B = \frac{1}{2}Bl^2\omega$

so $V_A - V_B = 0$



2-MARKS QUESTIONS

12. .ε = --dφ/dt

ε = --d(BA)/dt

ε = --AdB/dt

0<t<2 I= -- (3.14x 0.12x0.12x1)/2x 8.5= --0.0026A

2<t<4 I=0

4<t<6 I=0.0026A

13. $M= \mu_0 n_1 n_2 \pi a^2 L$

3-Marks Questions

14. $Q = CV = C (Bvl) = 10 \times 10^{-6} \times 4 \times 2 \times 1 = 80\ \mu C$

According to Fleming's right hand rule induced current flows from Q to P. Hence P is at higher potential and Q is at lower potential. Therefore A is positively charged and B is negatively charged.

15. As the rod is rotated, free electrons in the rod move towards the outer end due to Lorentz force and get distributed over the ring. Thus, the resulting separation of charges produces an emf across the ends of the rod. At a certain value of emf, there is no more flow of electrons and a steady state is reached. Using Eq. (6.5), the magnitude of the emf generated across a length dr of the rod as it moves at right angles to the magnetic field is given by

$dE = BV\,dr$. Hence $E=\int dE = \int BVdr = \oint_0^R BVdr$

$V= \omega r$

$E= B\omega \oint_0^R r\,dr = \frac{B\omega R^2}{2}$

16. Coefficient of Self-Induction

Consider current I flowing through a long solenoid of area A,

Let N be the total number of turns in the solenoid,

Total flux, $\phi=NBA$

Here, $B=\mu_0 nI$

Where, n is no. of turns per unit length of the solenoid

$N=nl \Rightarrow \phi=nl\times\mu_0 nIA$

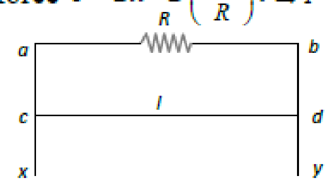
$\Rightarrow\phi=\mu_0 n^2 AlI$......... (1)Also,

$\phi=LI$ ....(2)

From equation (1) & (2) $\mu_0 n^2 Al=L \Rightarrow L=\mu_0 n^2 Al$

$L=\mu_0 N^2 A / l$ ----this equation show that it is independent on emf and current

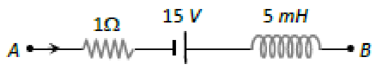
17. (b) Due to magnetic field, wire will experience an upward force $F = Bil = B\left(\frac{Bvl}{R}\right)l \Rightarrow F = \frac{B^2vl^2}{R}$



If wire slides down with constant velocity then

$$F = mg \Rightarrow \frac{B^2vl^2}{R} = mg \Rightarrow v = \frac{mgR}{B^2l^2}$$

18. (c) By using Kirchoff's voltage law



$$V_A - iR + E - L\frac{di}{dt} = V_B \Rightarrow V_B - V_A = 15\ volt.$$