ELECTRO MAGNETIC INDUCTION

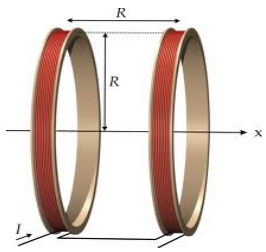
1) A Circular coil is placed near a current carrying conductor. The induced current is anti clock wise when the coil is,

1. Stationary
2. moved away from the conductor
3. Moved towards the conductor *
4. when the current in the conductor increases.

2) A Circular coil is placed near a current carrying conductor. The induced current is clock wise when the coil is,

1. Stationary
2. moved away from the conductor*
3. moved towards the conductor
4. when the current in the conductor increases.

3) Two coils carrying currents I_1 and I_2 placed with their planes parallel [I_1 and I_2 are in the same sence] approach each other.

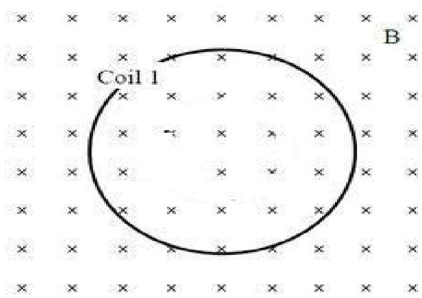


1. Both I_1 and I_2 will increase.
2. I_1 increases and I_2 will decrease
3. I_1 decreases and I_2 will increase.
4. Both I_1 and I_2 will decrease *

4) Two coils carrying currents I_1 and I_2 placed with their planes parallel [I_1 and I_2 are in the opposite sence] approach each other.

1. Both I_1 and I_2 will increase. *
2. I_1 increases and I_2 will decrease
3. I_1 decreases and I_2 will increase.
4. Both I_1 and I_2 will decrease

5) A circular coil of radius R in the plane of the paper is moved perpendicular to a magnetic field B. the magnitude of the induced emf is



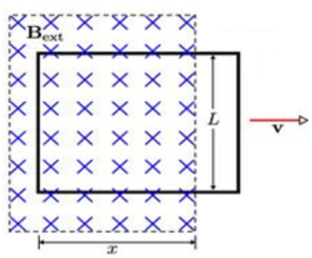
1. πR^2[dB/dt]*. 2. $2\pi R$[dB/dt]

3. $2\pi R$[dR/dt] Ø = BA, 4. 2R[d π /dt] mod e = d/dt(Ø)

Ans: e = d/dt(BA) , A = πR^2

e = πR^2[dB/dt]

6) When a rectangular coil moved out of a region of magnetic intensity B with a velocity v, the induced emf is e= Blv.If R is the resistance of the coil, force required to pull the coil out with constant velocity v is,



1. $B^2 l^2 v/R$* 2. B l v^2/R

3. B l v/R 4. B lv/R

Ans: current i = e/R = Blv/R

F = Bil = BlxBlv/R = $B^2 l^2 v/R$

7) A coil of wire is held with its plane horizontal to the earth's surface and a small bar magnet dropped vertically down through it. The magnet will fall with a;

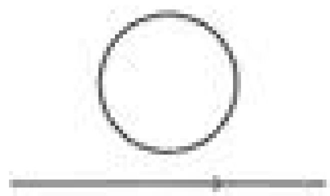
1. constant acceleration = g 2. constant acceleration > g

3. constant acceleration < g 4. Non uniform acceleration < g*

8) An electron moves along a straight line [from west to east in the plane of the paper] which lies in the same plane as circular loop of conducting wire. What will be the direction of the induced current in the loop?

1. Anticlockwise*
2. Clockwise
3. Alternating
4. No current will be induced in the loop.

Ans: Real current [motion of electron] - west to East – conventional Current - east to West – mag-field in to the paper - Increase in flux – anticlockwise current in the loop.



9) Magnetic flux Ø in a closed circuit of resistance 14 Ω varies with time in accordance to the equation, $Ø = 12t^2 - 5t - 5$. The magnitude of the induced current in the circuit at t = 0.15 second is

1) 100mA*
2) 10mA e
3) 1mA
4) 1000mA

10) A circuit has a self inductance of 1 H and carries a current of 2A. To prevent sparking when the circuit is broken, a capacitor which can withstand 400 volts is used. The least capacitance of the capacitor connected across
the switch is,

1. 12.5μF
2. 25μF *
3. 2.5μF
4. 5μF

11) A 10 Ω resistor and a 20 Ω resistor are in series with a 2V battery and
a key. An ideal inductor of 10 mH is connected across 20 Ω resistor. The key is inserted at t=0. The final value of current in 10 Ω resistor is

1. 2 A
2. 200mA*
3. 100mA
4. 3/40A

12) An inductance coil has a resistance of 100 Ω. When an ac signal of 1kHz is applied across the coil, the current lags behind the voltage by 45^0.

The inductance of the coil is,

1. 10mH 2. 12mH

3. 16mH * 4. 20mH

Ans:- tan Ø = ωL/R = 2πfL/R, Ø = 45 1 = 2πfL/R, L = R/2 πf = 1/20 π = 15.923 = 16mH

13) The ac voltage applied to an impedance of 50 Ω is given by v = 100 sin (50 πt). Ac meters are connected to the circuit reads,

1.70V, 1.4A* 2. 100V, 2A

3. 140V, 2A 4. 50V, 5 A

Ans: Ac meters read rms values.

$V = V_0 \sin \omega t$, $V_0 = 100$,

$V_{rms} = 100/\surd 2 = 70V$ I_{rms}

$= V_{rms} / R = 70/50 = 1.4A$

14) An RLC circuit consists of R = 40Ω, L = 5H, C = 80μF. The resonance frequency is

1.20/π Hz 2. 25/π Hz *

3. 2.5/π Hz 4. 200/π Hz

Ans: $f_r = 1/2\ \pi\surd[LC]$

$= 1/2\ \pi\surd[5x0.8x10^{-4}]$

$= 1/2\ \pi[100/2]$

$f_r = 50/\ 2\pi= 25/\ \pi$

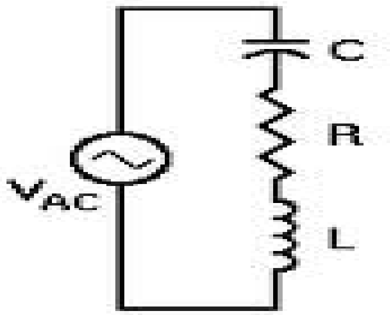
15) A series RLC circuit consists of R = 40 Ω, L = 5H, C = 80μF. The impedance at resonance f_r = 25/ π Hz At resonance Z = R

1. 40 Ω,* 2. 80 Ω,

3. 125 Ω, 4. 85 Ω,

16) A series RLC circuit consists of R = 40 Ω, L = 5H, C = 80μF connected to an ac source v_{rms} = 200V. f = 25/π Hz

The max value of current and rms pd across the inductance at resonance is



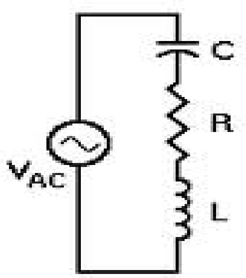
1. 5√2 A,1250V *
2. √5 A,125V
3. √2 A, 12.5V
4. 5A,1.25V

Ans: I_0 =√2 V_{rms} / R =√2 x200 /40 = √2 x5= 5√2A

I_{rms} = 200/40 = 5A.rms pd = I_{rms} x 2πf_r

L = 5x2π x 25 / π x5 = 1250V

17) A series RLC circuit consists of R = 40 Ω, L = 5H, C = 80μF connected to an ac source v_{rms} = 200V. F = 25/π Hz The rms value of current and rms pd across the resistor at resonance is

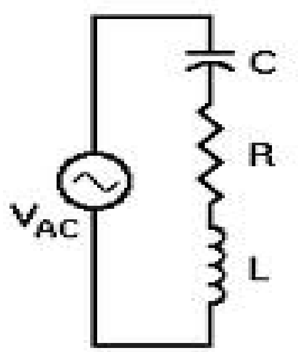


1. √2 x5 A,1250V
2. √5 A,125V
3. √2 A, 12.5V
4. 5A,200V*

Ans: I_0 = √2 V_{rms} /R I_0 = √2 x200 /40 =

√2x5 A I_{rms}= 200/40 = 5A. v_{rms} = 200V.

18) A series RLC circuit consist of R = 40Ω, L = 5H,C = 80μF connected to an ac source v_{rms} = 200V,f = 25/π Hz The max value of current and rms pd across the capacitor at resonance is



1.√2 x5 A,1250V *   2. √5 A,125V3.
3. √2 A, 12.5V   4. 5A,1.25V

Ans: $I_0 = \sqrt{2}\, v_{rms}/R = \sqrt{2} \times 200/40 = \sqrt{2} \times 5$ A

$I_{rms} = 200/40 = 5$A.

rms pd across the capacitor

$= I_{rms} \times 1 / 2\pi f_r C$

$= [5 \times [1/(2\pi \times 25/\pi \times 80 \times 10^{-6})]] = 1250$V

19) At resonance in a series resonance circuit the phase difference between pd across the inductor and the pd across the capacitor is

1. 90^0 2. 100^0
3. 180^0

20) At resonance in a series resonance circuit the phase difference between pd across the resistor and the pd across the capacitor is

1. 90^0 *   2.100^0
3. 180^0 4.190^0

21) At resonance in a series resonance circuit the phase difference between pd across the resistor and the pd across the inductor is

1. 90^0 *   2. 100^0
3. 180^0 4. 190^0

22) In an inductor the current varies with time as I = 6+16t and induces an emf of 16mV in the inductor. The self inductance of the coil is

1. 5mH　　2. 5mH

3. 6.25mH　　4. 1Mh*

Ans:- mod e = L dI / dt , 16mV =L

d / dt[6+16t] 16 x10^{-3}= Lx16

L = 1mH

23) In an inductor the current varies with time as I = 6+16t and induces an emf of 16mV in the inductor .The power supply to the inductor at t = 9 second is

1. 1mW　　2. 21mW

3. 2.4W *　　4. 24W

Ans: p = VI = 16 x10^{-3} x[6+16t]→t= 9

p = 16 x10^{-3} x150 = 2400 x 10^{-3}

2.4 watt.

24) Two coils have self inductance of 16 mH and 9mH. The coupling coefficient between them is 1.2. the mutual inductance between the two coils is

1. 14.4mH*　　2. 1.4.mH

3. 4mH　　4. 1mH

Ans:- M = k $\sqrt{(L_1 L_2)}$

25) The impedance of an ideal LC circuit at resonance is

1. Infinity　　2. Zero*

3. $\sqrt{(X_L^2 - X_C^2)}$　　4. $\sqrt{(X_L - X_C)}^2$

26) The frequency at which the inductive reactance of a pure inductance coil [L = 21/66 mH] is 500 ohm is

1. 2.5 kHz　　2. 125 kHz

3. 250 kHz*　　4. 12.5 kHz $X_L = 2\pi fL$

Ans: 500 = 2x[22/7]x f x [21/66]x 10^{-3}

f = 5x10^5 / 2 = 2.5x10^5 f=250 kHz

27) A current I flows through an inductance coil of self inductance L henry. The dimension of I^2L is:

1. $MLT^{-2}A$　　2. $ML^2T^{-2}A^2$

3. $ML^2 T^{-2}$*　　4. MLT^{-2}

28) A voltmeter measures a pd of V volt across a capacitor of capacitance C, The unit of V^2 C is

1. Ampere metre　　2. Volt per coulomb

3. Joule per vol　　4. Joule*

29) In a series RLC circuit the PD across the resistor is 80V, across the inductor is 40V and across the capacitor is 100V. The EMF of the AC source (f = 50Hz) is

1. 220V
2. 140V
3. 20V
4. 100V*

Ans: $V^2 = V_R^2 + [V_L - V_C]^{2,}$

$V^2 = [80^2 + (40 - 100)^2$

$V^2 = 10000$ V = 100V

30) A current of 5A is flowing at 220V in the primary coil of a transformer. If the voltage across the secondary is 2200V when the power loss is 50% the current in the secondary is

1. 5A
2. 1A*
3. 0.5A
4. 0.25A

Ans: $V_p I_p = [50/100] \times V_s I_s$

$= [50/100] \times V_s I_s 220 \times 5$

$= 0.5 \times 2200 \times I_s I_s = 1A$

31) The resonant frequency of a series RLC circuit is 10 k Hz. The values of the capacitance and the inductance are increased to 4 times their original value the new resonance frequency in kHz will be

1. 2.5
2. 40*
3. 1.25
4. Zero

32) A vertical copper disc of diameter √(7/22) metre makes 600 revolutions per minute about a horizontal axis passing through its center a uniform magnetic field of 0.22 tesla acts at an angle $30^o$to the normal to the plane of the disc. The PD between the center and the rim of the disc is

1) 200V
2) 350V
3) 35V
4) 0.275V*

33) The rails of a railway track are 2m apart and assumed to be insulated from one another. The dip at the place is $45^o$and the horizontal component of the earth's magnetic field is 0.0004 tesla. If the velocity of the train is 90 kmph the emf induced is V

1) 2,5V
2) 0.25V
3) 0.8V
4) 0.08V*

34) The frequency at which the capacitive reactance of a capacitor at 10 kHz becomes 3.14 % of its original value is f = 10000 Hz

1. 50 Hz
2. 100Hz
3. 200Hz
4. 314Hz*

Ans: 1/2πfC = [3.14/100]

[1/2πf'C]

f '/f = [3.14/100]

f ' = [3.14/100] x f

= [3.14/100] x 10000

= 314Hz

35) The reactance of a coil which exhibits an effective opposition of 25 Ω to AC (50Hz) and 20 Ω to DC is

1.25 Ω　　　2. 20 Ω

3. 15 Ω *　　　4.10 Ω

Ans: $Z^2 = \{(R^2 + X_L^2) = \{(R^2 + X_L)^2\}$

$(25)^2 = (20)^2 + X_L^2$ X_L=15 ohm

36) The impedance of a ideal LC circuit at resonance is

1. Maximum　　　2. √2 times the original value

3. 1/√2 times the original value　　　**4. zero***

37) The frequency at which the inductive reactance of a coil at 10000 Hz becomes 3.14% of its original value is

1. 50 Hz　　　2. 10×10^4Hz

3. 21.87×10^4Hz　　　**4. 31.85×10^4 Hz ***

Ans: 2πfL = [3.14/100] [2πf'L]

f' = f x 100/3.14

$10000 \times [100/3.14] = 31.85 \times 10^4$ Hz