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Revision

Chapter 4

Alternating Current Circuits

100 Questions

Class sheet

Chapter (4)

AC Circuits

Capacitor — $Q = CV$
- (DC) Charging instantanously untill $V_{capacitor} = V_{battery}$
- (AC) Charge & Discharge

Coil
- (DC) R_L = Value $X_L = 0$ $V_L = IR_L$
- (AC) R_L = Value X_L = Value $V_L = IZ_L$ | $R_L = 0$ X_L = Value $V_L = IX_L$

Resistance
$R = \rho_e \frac{L}{A}$ $V_R = IR$
(Does not depend on frequency)
$P = I^2R$ (Consumes energy (power) as **Thermal energy**)

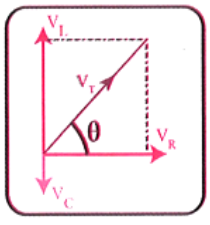
Coil
$X_L = \omega L_{self} = 2\pi f L_{self}$ $V_L = IX_L$
If $(R_L = 0)$ then $P = 0$ (imaginary) (Stores energy (power) as **Magnetic energy**)
If $(R_L$ = value) then $P = I^2R_L$

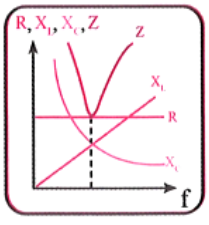
Capacitor
$X_c = \frac{1}{\omega C} = \frac{1}{2\pi f L}$
$V_C = IX_C$
$P = 0$ (imaginary) (Stores energy (power) as **Electrical energy**)

	Vector (Phase) diagram	Graphical (Wave) diagram
* Pure resistance circuit	(V) and (I) in phase $(\theta = 0)$	* Pure resistance circuit
* Pure inductive circuit	(V) leads (I) by $\theta = 90°$(+ve)	* Pure inductive circuit
* Pure capacitive circuit	(V) lags (I) by $\theta = 90°$(−ve)	* Pure capacitive circuit
* (RL) Circuit	(V) leads (I) by $\theta < 90°$(+ve)	
* (RC) Circuit	(V) lags (I) by $\theta < 90°$(−ve)	
* (RLC) Circuit: $X_L > X_C$	(V) leads (I) by $\theta < 90°$(+ve)	
* (RLC) Circuit: $X_L < X_C$	(V) lags (I) by $\theta < 90°$(−ve)	
* (RLC) Circuit: $X_L = X_C$	(V) and (I) in phase $(\theta = 0)$	

RLC Circuit

$Z = \sqrt{R^2 + (X_L - X_C)^2}$ (Total impedence)
$V_R = IR$ $V_C = IX_C$ $V_T = IZ$
$V_T = \sqrt{V_R^2 + (V_L - V_C)^2}$ (Total voltage)
$\tan\theta = \frac{V_L - V_C}{V_R}$ OR $\tan\theta = \frac{X_L - X_C}{R}$ (Phase angle)

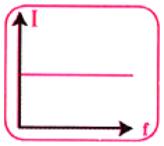
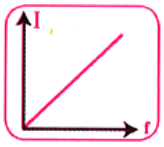
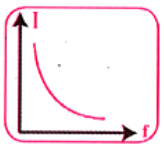
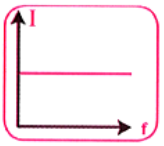
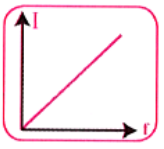
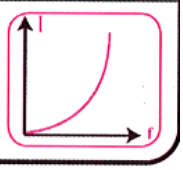




$V_L = IX_L$, If R_L = value $V_L = IZ_L$, $Z_L = \sqrt{R_L^2 + X_L^2}$ (Impedance of coil)

Phase angle (θ)
- (+ve) $V_L > V_C$, $X_L > X_C$ (Circuit behaves as inductive reactance) (V_T leads I by θ) **act as a Coil**
- (−ve) $V_L < V_C$, $X_L < X_C$ (Circuit behaves as capacitive reactance) (V_T lags I by θ) **act as a Capacitor**
- (Zero) $V_L = V_C$, $X_L = X_C$ (Circuit behaves as ohmic reactance) **act as a Resistance**

Relation Between Current and Frequency

Point of Comparison	A.C. Source (constant effective voltage) (variable frequency)	Dynamo (variable effective voltage) (variable frequency)
Resistance	$I = \frac{emf}{R}$ (emf constant) Does not depend on frequency 	$I = \frac{emf}{R}$ $I = \frac{BA(2\pi f)N}{R}$ $I \alpha f$ 
Coil	$I = \frac{emf}{X_L}$ $I = \frac{emf}{2\pi fL}$ $I \alpha \frac{1}{f}$ 	$I = \frac{emf}{X_L}$ $I = \frac{BA(2\pi f)N}{(2\pi f)L}$ $I = \frac{BAN}{L}$ Does not depend on frequency 
Capacitor	$I = \frac{emf}{X_C}$ $I = \frac{emf}{\frac{1}{2\pi fC}}$ $I = emf\,(2\pi fC)$ $I \alpha f$ 	$I = \frac{emf}{X_C}$ $I = \frac{BA(2\pi f)N}{\frac{1}{2\pi fC}}$ $I = BA(2\pi f)^2NC$ $I \alpha f^2$ 

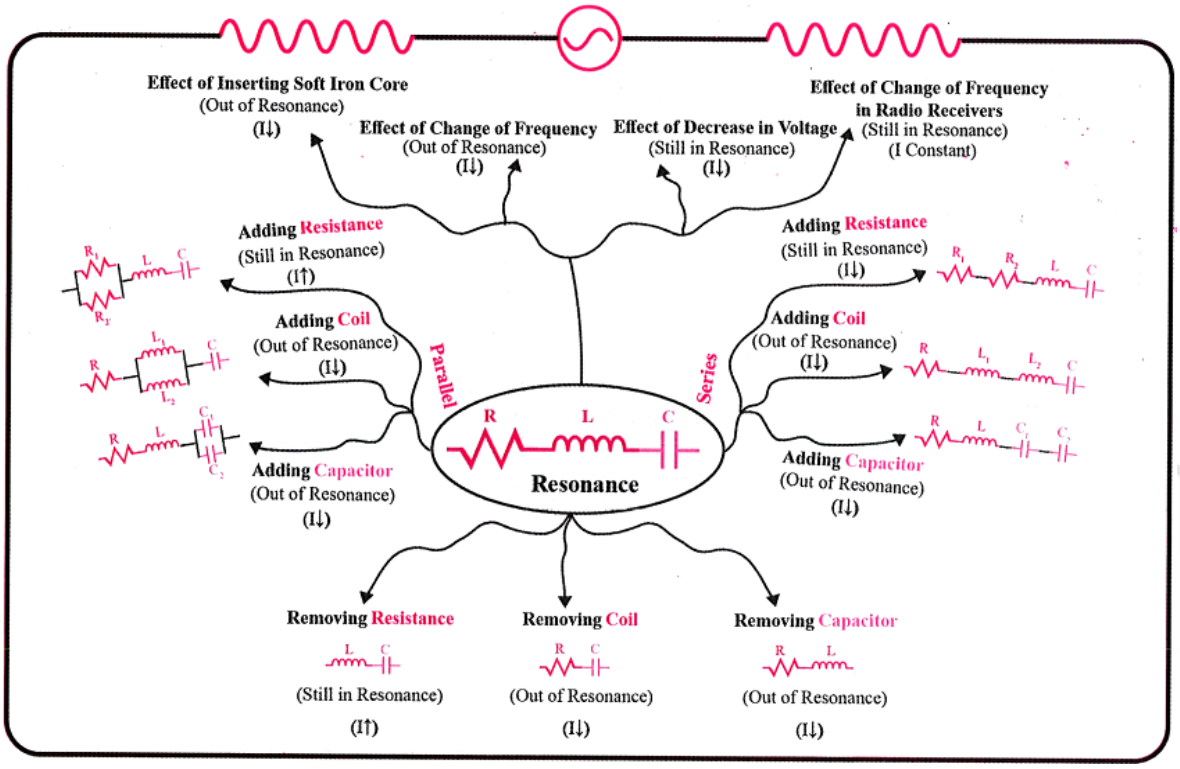
Oscillating and Resonant (Tuned) Circuit

Minimum impedance (Z = Min) & Highest current (I = high) & Phase angle (θ) = 0°

$Z = R$ $X_L = X_C$ $V_T = V_R$ $V_L = V_C$

$f = \frac{1}{2\pi\sqrt{LC}}$ $\omega = \frac{1}{\sqrt{LC}}$ $LC = \frac{1}{4\pi^2 f^2}$ $\frac{f_1}{f_2} = \sqrt{\frac{L_2C_2}{L_1C_1}}$

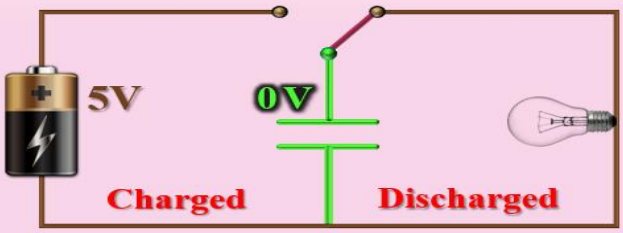
Resonance Tree



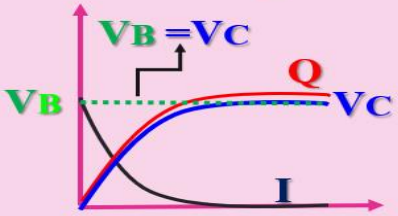
Capacitor

$$Q = C\,V$$

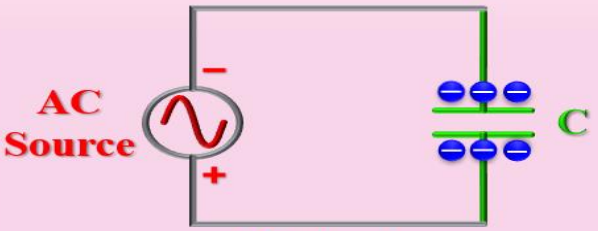
Capacitor in DC Circuit

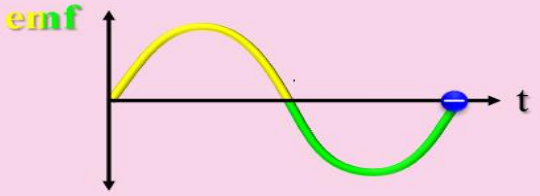


$V_{capacitor}$ = Zero



Capacitor in AC Circuit



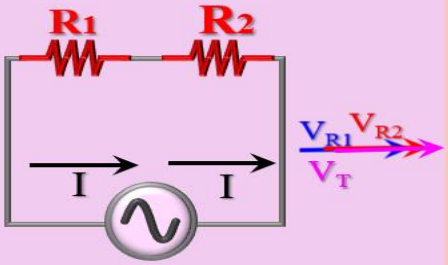


Vectors (Additions)

$$V_T = V_1 + V_2$$

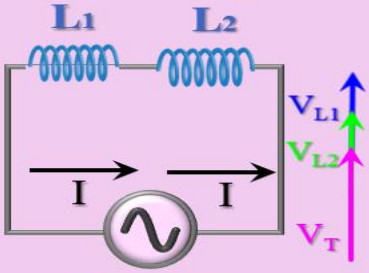
Circuit consist of group of .....only

Resistors (R)



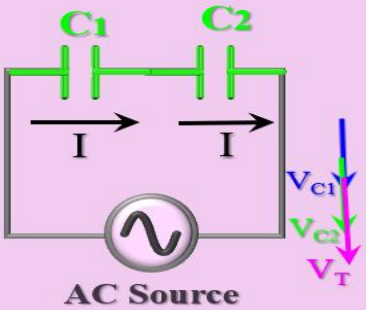
$V_T = V_{R1} + V_{R2}$

Coils (L)



$V_T = V_{L1} + V_{L2}$

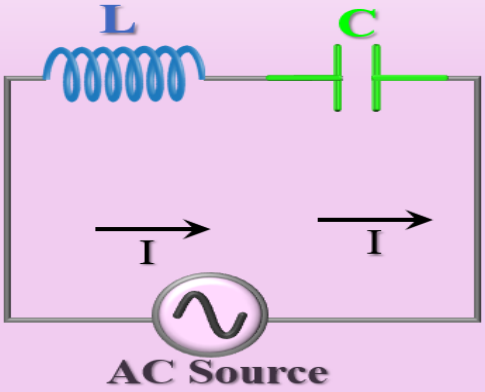
Capacitors (C)

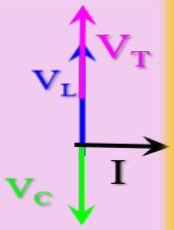


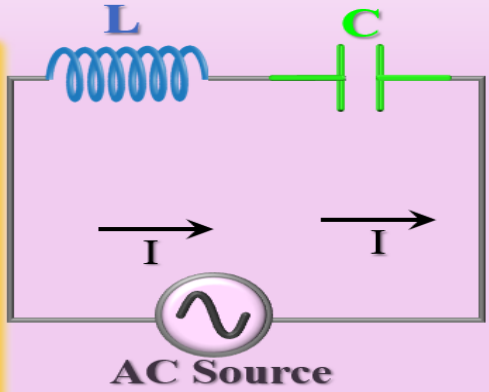
$V_T = V_{C1} + V_{C2}$

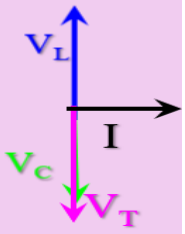
Vectors
(Subtraction's)

Circuit consist of Coil and Capacitor









V_L Leads V_C by 180°

V_T Leads I by 90°

$V_T = V_L - V_C$

$V_L > V_C$
$X_L > X_C$

V_L Lags V_C by 180°

V_T Lags I by 90°

$V_T = V_C - V_L$

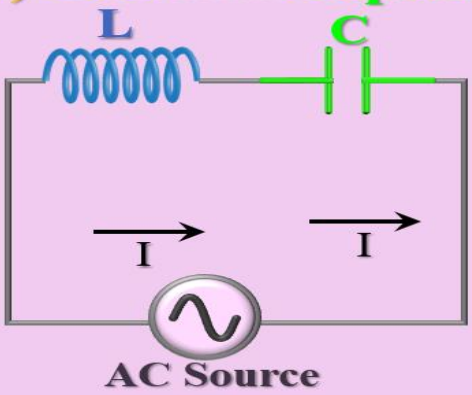
$V_C > V_L$
$X_C > X_L$

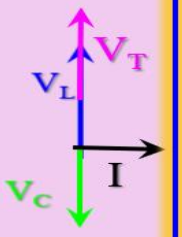
Vectors

V_T Leads I by 90°?

Circuit consist of:

1) Coil and Capacitor

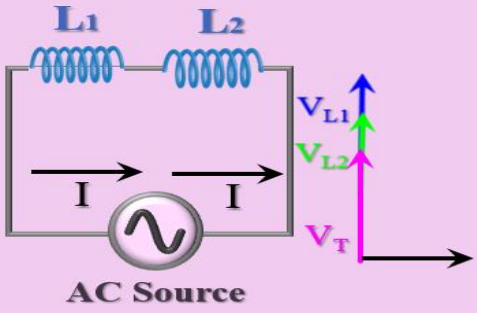




$V_T = V_L - V_C$

$V_L > V_C$
$X_L > X_C$

2) Coils (L)



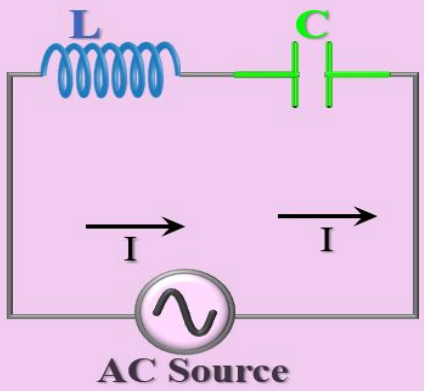
$V_T = V_{L1} + V_{L2}$

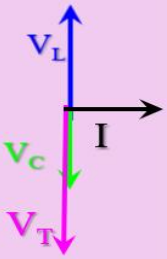
Vectors

V_T Lags I by 90°?

Circuit consist of:

1) Coil and Capacitor

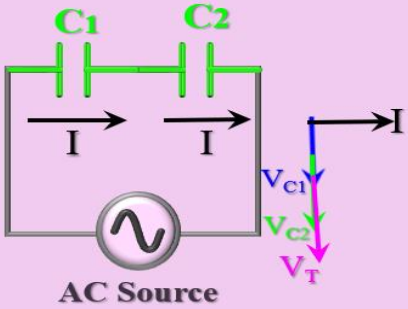




$V_T = V_C - V_L$

$V_C > V_L$
$X_C > X_L$

2) Capacitors (C)



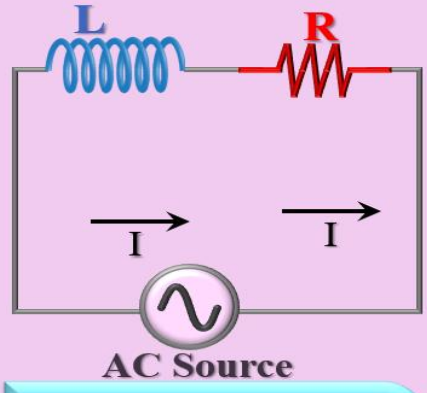
$V_T = V_{C1} + V_{C2}$

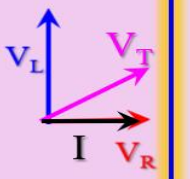
Vectors

$$V_T = \sqrt{V_1^2 + (V_2)^2}$$

Circuit consist of:

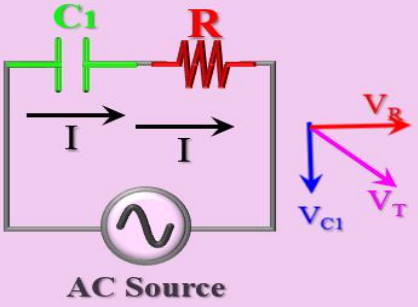
1) R L circuit





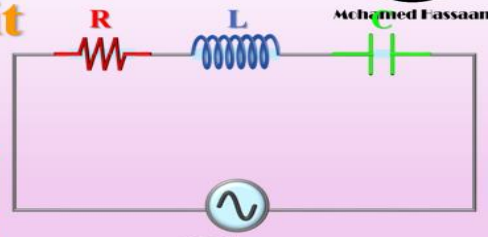
$$V_T = \sqrt{V_R^2 + (V_L)^2}$$

2) R C Circuit



$$V_T = \sqrt{V_R^2 + (V_C)^2}$$

(R L C) Circuit



$X_L = 2\pi f L$

$X_C = \frac{1}{2\pi f C}$

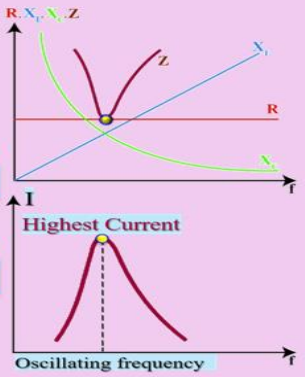
$V_T = \sqrt{V_R^2 + (V_L - V_C)^2}$

$\tan\theta = \frac{V_L - V_C}{V_R}$

$Z = \sqrt{R^2 + (X_L - X_C)^2}$

$\tan\theta = \frac{X_L - X_C}{R}$

Oscillator Resonance Tuning Circuit

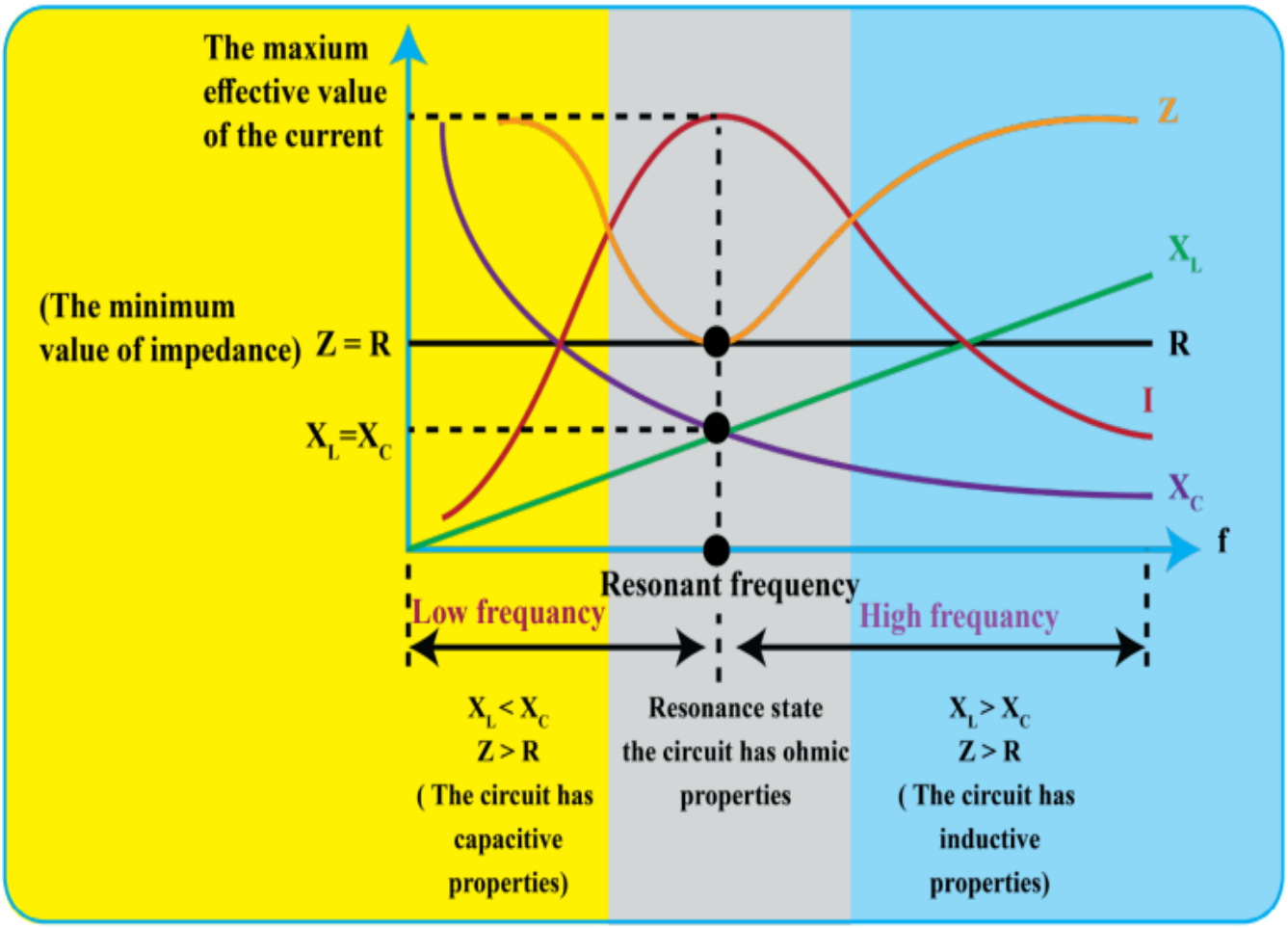


$Z = R$ | $X_L = X_C$ | $f = \frac{1}{2\pi\sqrt{LC}}$ | Minimum Z

$V_T = V_R$ | $V_L = V_C$ | $LC = \frac{1}{4\pi^2 f^2}$ | Highest I

V& I In phase | $\theta = 0$ | $P = \frac{V_T^2}{R}$ | $I = \frac{V_T}{R}$

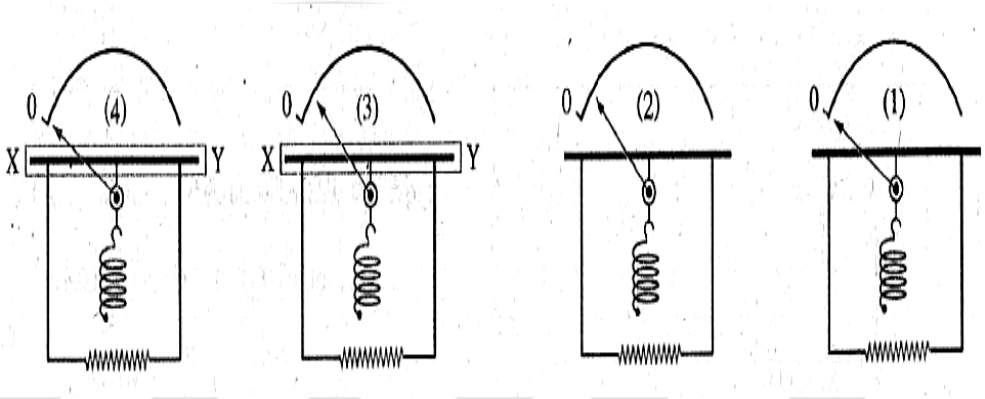
Relation between I, Z with the frequency



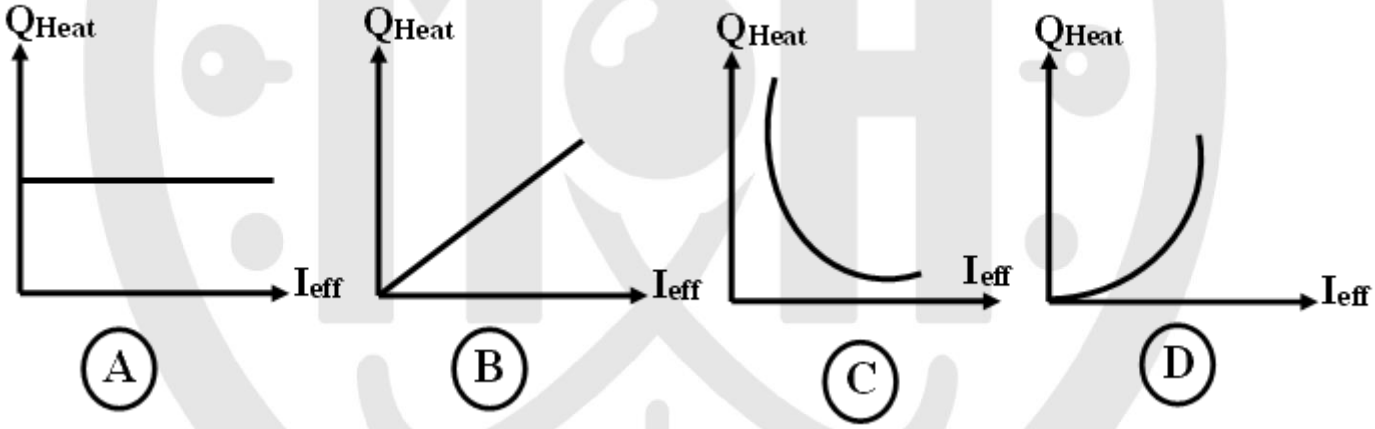
1) Final Exams (2 nd Session-22)

In a country with very hot weather, a student wanted to use a hot wire ammeter in a laboratory in a school which is not air conditioned. Which two figures show the correct position of the hot wire ammeter pointer at the laboratory temperature? (Note that XY is a strip of material that has the same expansion coefficient as platinum and iridium wire)

(A) 4, 2
(B) 3, 1
(C) 2, 3
(D) 1, 4



2) Which of the following graph represent the relation between heat energy and effective value of the current in hot wire ammeter



3) Electric circuit as shown in figure contain two ammeters A_1 is a Hot wire ammeter, A_2 is sensitive ammeter ant the pointer of each of them refer to the value the current intensity in the circuit at closing the key, so the pointer of each ammeter refer to

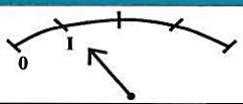
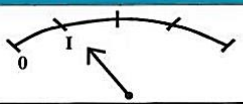
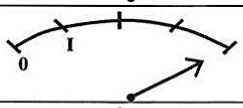
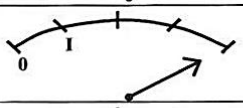
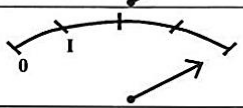
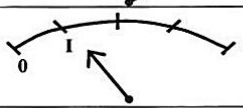
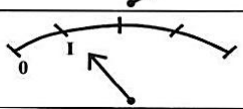
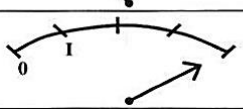
	Ammeter 1	Ammeter 2
(A)		
(B)		
(C)		
(D)		

Fig (2)

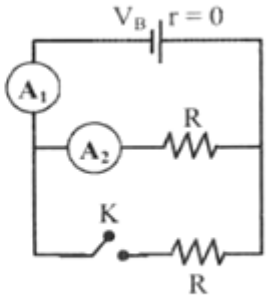
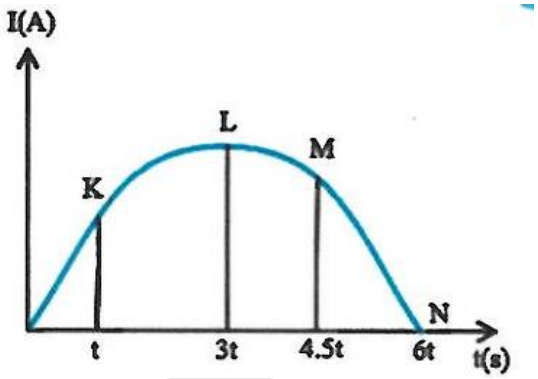


Fig (1)

4) In the opposite diagram the relation (I_A) between the current intensity from dynamo coil and time through half cycle At any point the current intensity is equal to the reading of the Hot wire ammeter which used to measure this current

(A) K
(B) L
(C) M.
(D) N



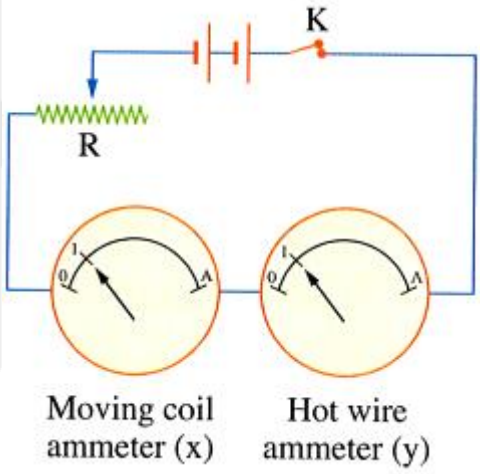
5) In the opposite electric circuit, an electric current of 1 A is passing and the pointers of both ammeters deflect by the same angle θ When the value of resistance R changes an electric current of intensity 2 A gets passing in the circuit, then the pointers of the two ammeters x and y deflect from the previous position **by** two angles that respectively will be

(A) θ & greater than θ

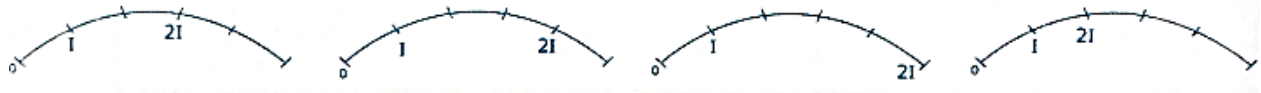
(B) θ & θ

(C) θ & less θ

(D) the answer is indeterminable

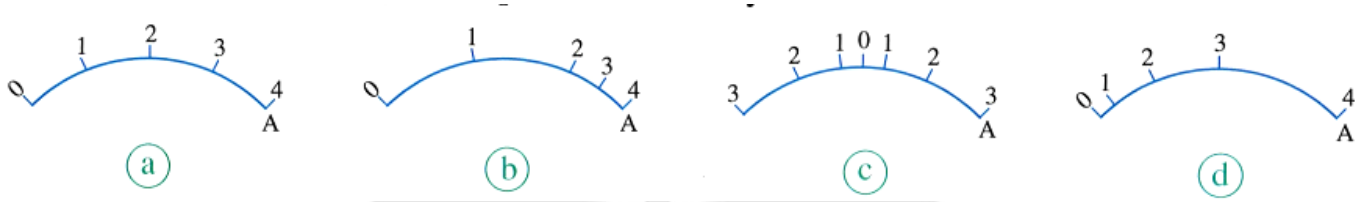


6) During the calibration of the hot wire ammeter scale, the opposite figure represented the position of the pointer of the hot wire ammeter when the effective value of A.C current equals (I). Which one of the following figures represents the correct position of the pointer of the hot wire ammeter when the value of effective current becomes (2I)?



(A) (B) (C) (D)

7) Which of the following figures represent correctly relation the scale of the hot wire ammeter

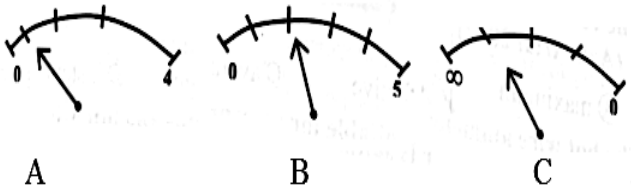


8) Experimental Exam2021

In the hot wire ammeter; the power generated in the iridium platinum alloy wire due to the flow of a.c is proportional directly to……

(A) $1/ V_{eff}$
(B) Θ and I_{eff}
(C) Θ and I_{max}
(D) Θ and V^2_{eff}

9) The following figures show different scales of different electric devices, they may be (ammeter, voltmeter or hot wire meter). So the devices will be……..



	H.W.A	Ohmmeter	Voltmeter
(A)	C	B	A
(B)	A	B	C
(C)	A	C	B
(D)	B	A	C

10) Ammeter (X) its pointer moves till it settles at a specific reading within a time of 5 sec when a DC of intensity (I) passes through it And another Ammeter (Y), its pointer moves till it settles at a specific reading within a time of 0.7 sec when a current of intensity (I) passes through it. Which of the following choices is correct?

	Ammeter (X)	Ammeter (Y)
(A)	Hot wire	Hot wire
(B)	Hot wire	Moving coil
(C)	Moving coil	Hot wire
(D)	Moving coil	Moving coil

11) If the current passes through a DC circuit is small (I= $3x10^{-3}$A), it can be measured accurately by.....

(A) The hot wire ammeter
(B) The moving coil galvanometer
(C) Both of them
(D) No one of them

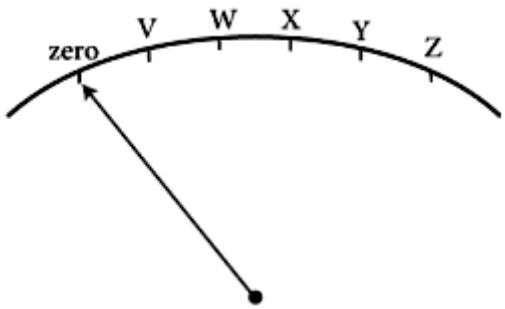
12) In the hot wire ammeter, if we fixed the wire of the ammeter on a plate that has an expansion coefficient greater than that of the wire, as the temperature increases the reading of pointer will be……..

(A) More than usual
(B) Less than usual
(C) Doesn't change
(D) There is no correct answer

13) Experimental Exam2023

The figure illustrates the scale of a hot wire ammeter where the spaces between the positions marked on the scale are equal. When a current of intensity (I) passes through the wire of the device, the pointer deflects to the position V. Which of the following choices represent the current intensity passing through the wire of the device when the pointer deflects to the position Y

(A) 2I
(B) 3I
(C) 4I
(D) 5I

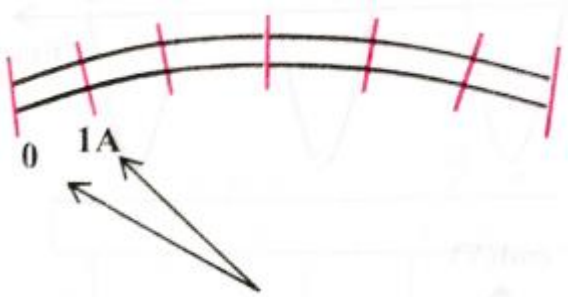


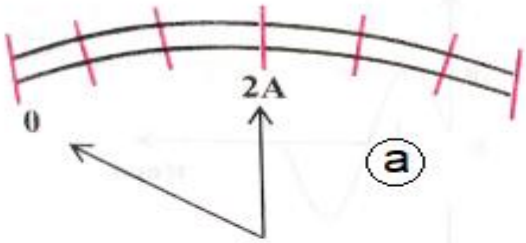
14) Exam2022 1st session

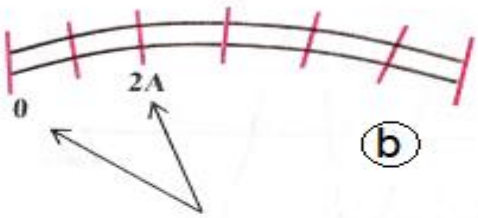
If the shunt resistor in the hot wire ammeter is replaced by another of smaller value, and keeping the effective value of the electric current flowing through the circuit constant, then

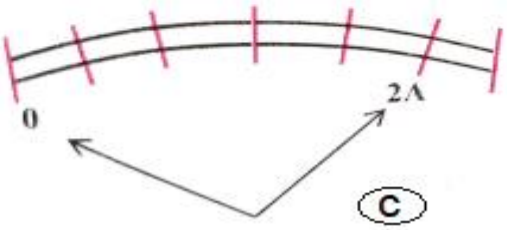
	Thermal energy generated in a wire	Total resistance of ammeter
(A)	Decreases	Increases
(B)	Decreases	Decreases
(C)	Increases	Decreases
(D)	Increases	Increases

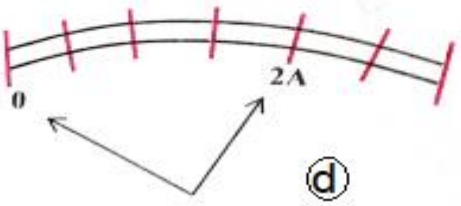
15) During the calibration of the hot wire ammeter scale, the opposite figure represented the position of the pointer of the hot wire ammeter when the effective value of A.C current equals (1A). Which one of the following figures represents the correct position of the pointer of the hot wire ammeter when the value of effective current becomes (2A)?











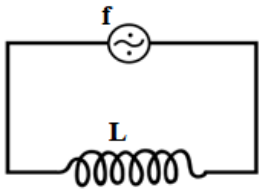
16) The scale of ammeter has hot wire

(A) They are close together at the beginning of the scale and far apart at the end.
(B) Divergent at the beginning of the scale and converging at the end.
(C) Equal
(D) Other than that

17) Among the operations in which the use of alternating current **is not** appropriate

(A) Lighting lamps
(B) Electrolysis
(C) Operating air conditioners
(D) all the above.

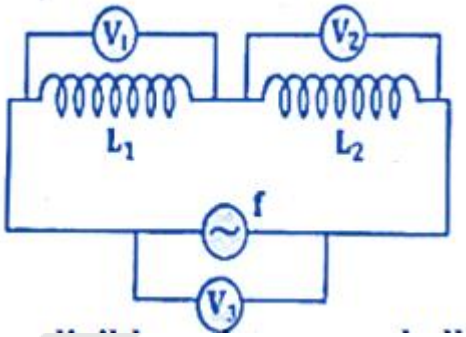
18) In the opposite figure, an inductor of self induction coefficient L is connected to an AC source of frequency f, so its inductive reactance becomes X_L. If the coil is cut into three identical parts and one of them is connected with the same electric source, then the self induction coefficient and the inductive reactance of the coil become……..



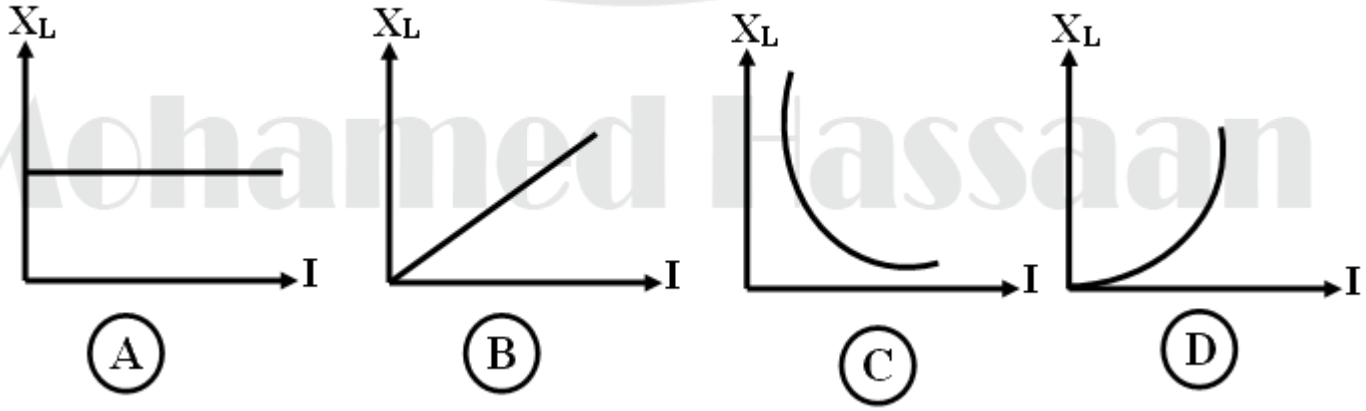
	Self induction coefficient of coil	**Inductive reactance becomes X_L**
A	L/3	X_L /3
B	3L	X_L /3
C	L/3	$3X_L$
D	3L	$3X_L$

19) The opposite figure which of the relations is correct .....

(A) $V_1 = V_2 + V_3$
(B) $V_2 = V_1 + V_3$
(C) $V_1 = V_2 - V_3$
(D) $V_3 = V_2 + V_1$



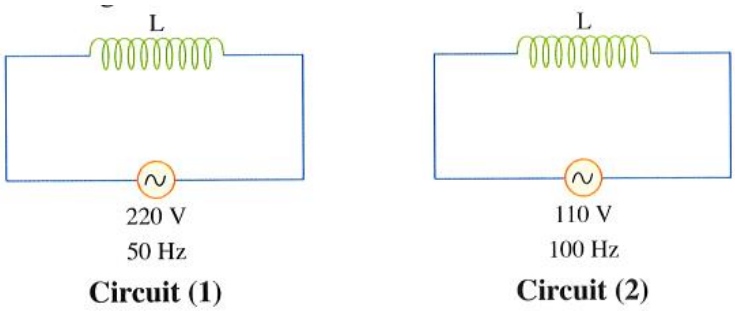
20) A circuit contains an inductor of zero resistance which is connected to an AC source of constant frequency and changeable emf, the graph which represents the relation between the inductive reactance of the coil (X_L) and the current intensity (I) which passes through the coil is



21) Final Exams (2 nd Session-22)

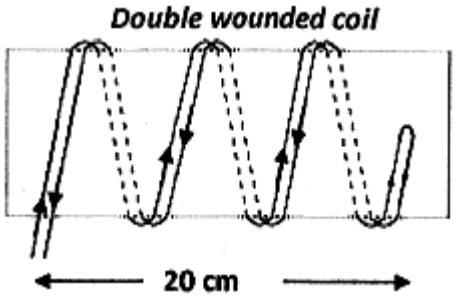
A self-inducting coil (L) with no ohmic resistance is combined into two alternating current circuits, as shown in the figure. The ratio between current in circuit (1)/ current in circuit (2) equals……..

(A) 1/1
(B) 2/1
(C) 4/1
(D) 1/2



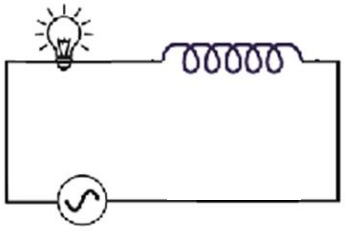
22) An insulated wire of cross-sectional area is 1 mm^2 is double wounded with 200 turns around a hollow cylindrical tube of external radius of 0.5m, as shown. If the terminals are connected to (12V - 50 Hz) supply, ($\rho_{wire} = 4.77 \times 10^{-8} \Omega.m$)

	Inductive reactance of the coil	Current passing through the coil is
A	0 Ω	0.4A
B	0.5 Ω	0.4A
C	0 Ω	0A
D	1 Ω	0.8A

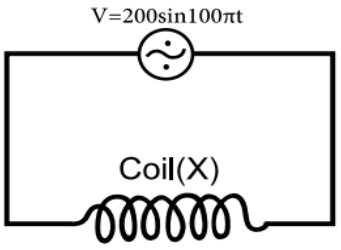


23) The frequency of the AC source is adjusted while its maximum voltage held constant. The light bulb has the brightest glowing at:

(A) High frequencies
(B) Low frequencies
(C) The brightness will be the same at all frequencies
(D) None of the above



24) The figure illustrates an AC source, whose instantaneous voltage is given by the equation. (V=200 sin 100 π t). the source is connected to an inductive coil (x) of self-inductance (L) and negligible ohmic resistance. given that the effective value of current passing in tne circuit is 2A, what modification is required to double the effective value of current?



(A)connecting another coil of (0.23H) parallel to the coil (x)

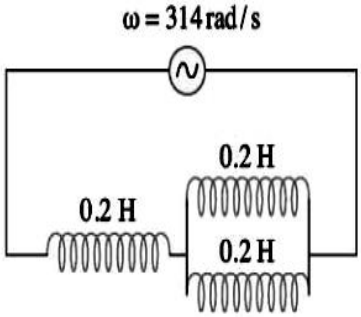
(B)connecting another coil of (0.32H) parallel to the coil (x)

(C)connecting another coil of (0.32H) in series to coil (x)

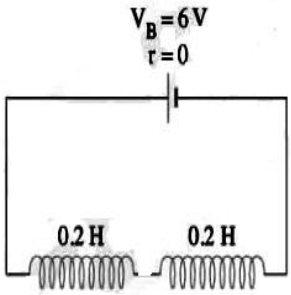
(D)connecting another coil of (0.23H) in series to coil (x)

25) (A) and (B) are two different electric circuits as shown: The inductive reactance for circuit A = ……While that for circuit B =……

(A) 94.2Ω , 0Ω
(B) 94.2Ω , 125.6Ω
(C) 62.8Ω , 0Ω
(D) 62.8Ω , 125.6Ω



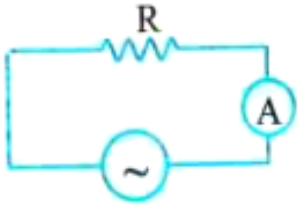
Circuit (A)



Circuit (B)

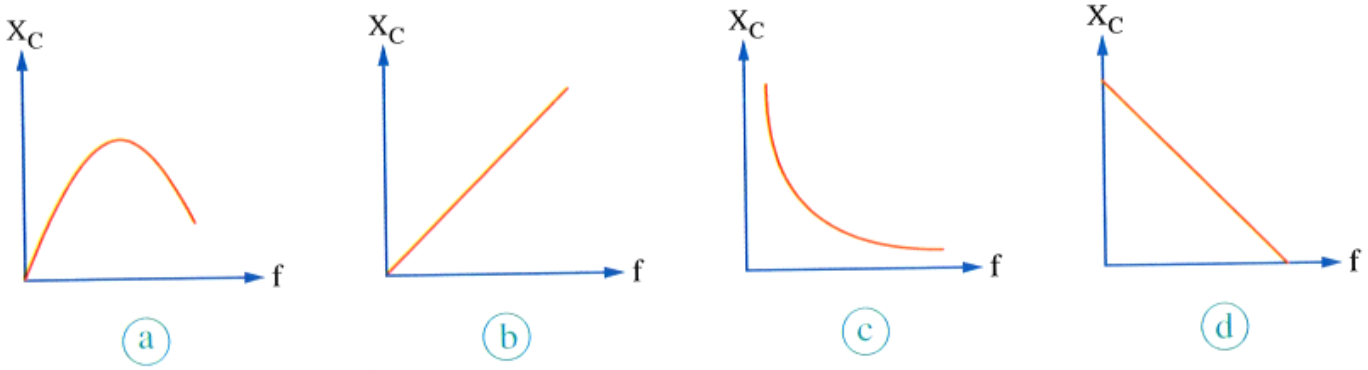
26) In the corresponding circuit: If the reading of the thermal ammeter is 4A the value of the resistance R will be equal to

(A) 4 Ω
(B) 6 Ω
(C) 10Ω
(D) 8 Ω

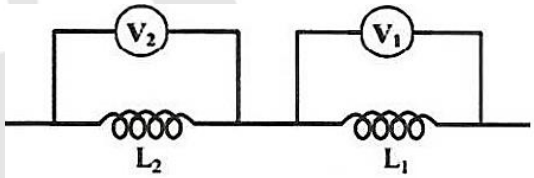


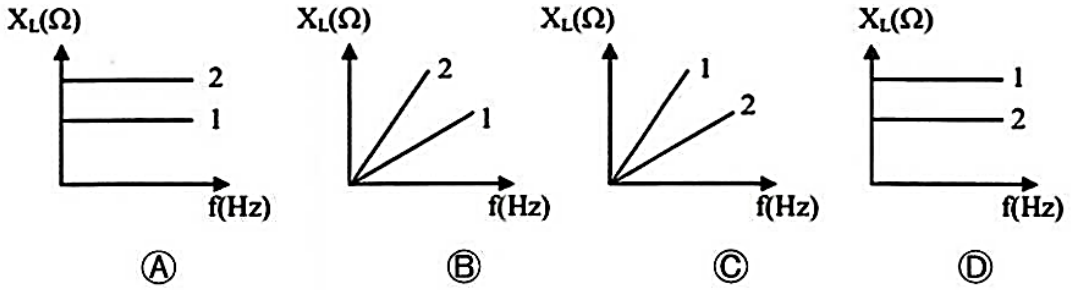
$V = 40\sqrt{2}\sin \omega t$

27) In a pure capacitor which graph represents the relation between X_C and the current frequency?



28) In the opposite figure if the reading of voltmeter $V_1 < V_2$ So the correct figure of relation between the inductive reactance of the two coil and frequency is



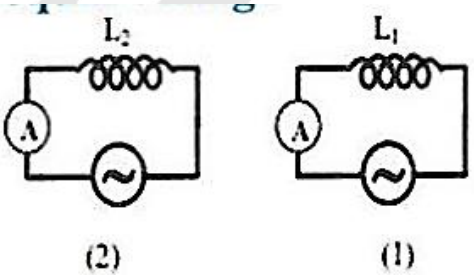


29) Two identical coils L_1, L_2 are connected to two equal voltage alternating sources and two hot wire ammeters then:

1- Inserting an iron core in figure (1)

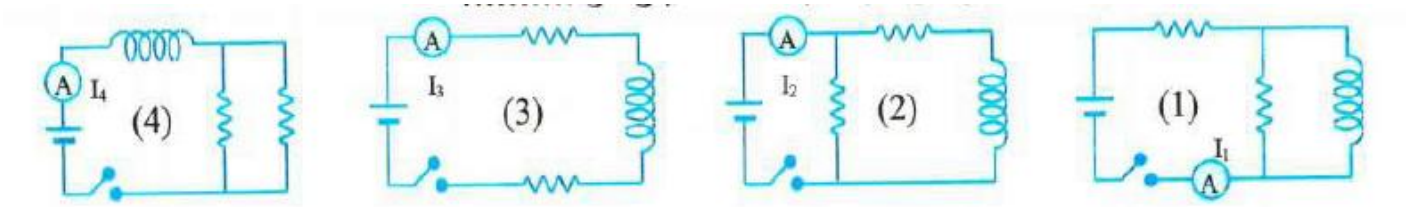
2- Increasing the distance between the turns in figure (2)

, so the reading of the ammeter in both cases will.....



	Case (1)	Case (2)
A	Increase	Decrease
B	Increase	Constant
C	Decrease	Increase
D	Decrease	Constant

30) In the following circuits: the batteries are identical, internal resistance is negligible, the resistances are equal, and the inductors are identical and negligible Resistance, the order of ammeter reading in terms of current intensity value is



(A) $(I_2 = I_4) < I_3 < I_1$
(B) $I_4 < I_3 < I_2 < I_1$
(C) $I_4 > I_1 > I_2 > I_3$
(D) $I_3 < I_1 < (I_2 = I_4)$.

Answer

Because the source is a direct current, there is no inductive reactance of the coil.

First figure: The coil cancels the resistance connected to it in parallel and it passes through With only one resistance, the equivalent resistance of the circuit is **R.**

$I_1 = V_B/R$ $I_1 = 1A$

The second figure is that the coil does not cancel any resistances, but the current is divided into the two resistors, so the equivalent resistance is **0.5R**

$I_2 = V_B/0.5R$ $I_2 = 2A$

The third figure: The two resistors are connected in series to form the equivalent resistance = **2R**

$I_3 = V_B/2R$ $I_3 = 0.5A$

Figure Four: The two resistors are connected in parallel to form the total resistance equivalent **0.5R**

$I_4 = V_B/0.5R$ $I_4 = 2A$

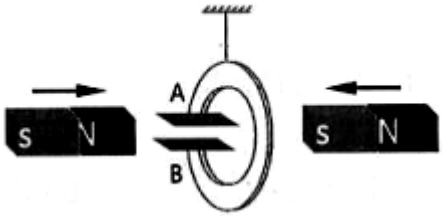
31) In the opposite figure: predict the polarity of the capacitor for plates A and B.

(A) Pole A is positive and Pole B is negative

(B) The poles are positive

(C) Pole A is negative and Pole B is positive

(D) Negative poles



32) Three different capacitors, the figure (I) represent relation between its capacity, but the figure (II) represent relation between its frequency, so the relation between its a capacitive reactance

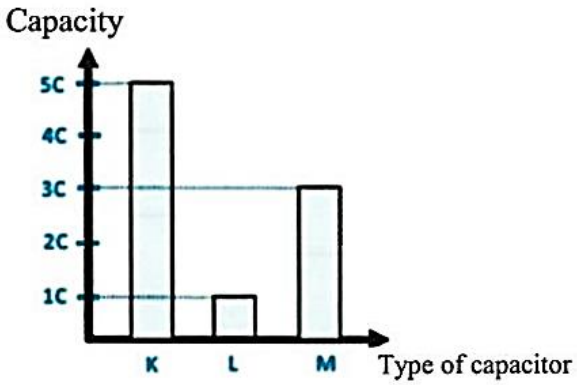


Fig (I)

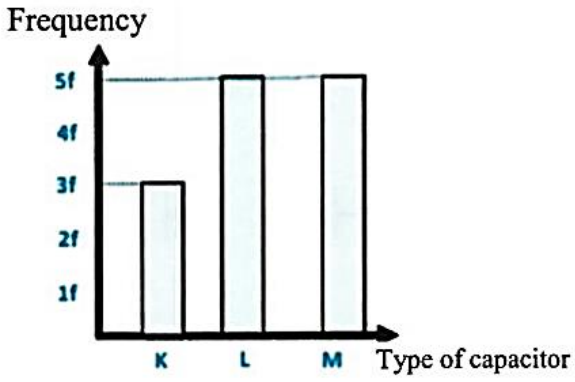
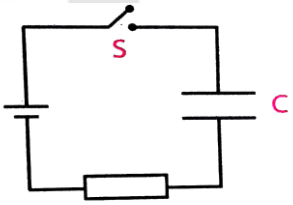


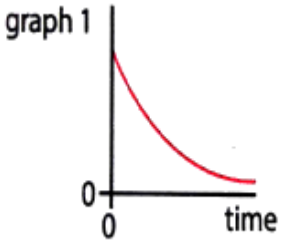
Fig (II)

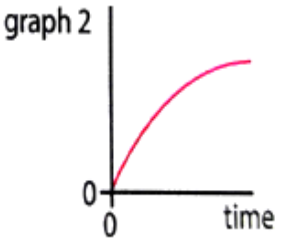
(A) $X_k=X_m>X_L$
(B) $X_L> X_k >X_m$
(C) $X_k> X_L>X_m$
(D) $X_L>Xk>=X_m$
(E) $X_m>X_L>X_k$

33) In the circuit shown the capacitor C charges when switch S is closed. Which line, in the table gives a correct pair of graphs showing how the charge on the capacitor and the current in the circuit change with time after S is closed?

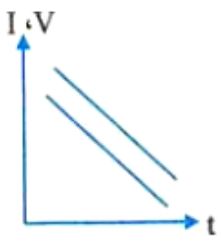


	Charge	P.D	Current
A	Graph 1	Graph 1	Graph 1
B	Graph 1	Graph 1	Graph 2
C	Graph 2	Graph 2	Graph 2
D	Graph 2	Graph 2	Graph 1

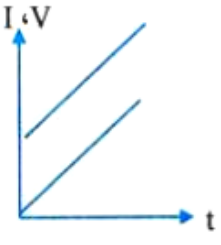




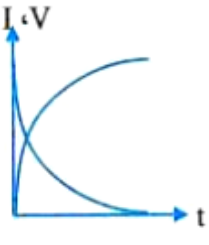
34) Which of the following figures expresses the relationship between the potential difference between the capacitor plates and the intensity of the current passing through the circuit during charging? Capacitor with the time required to charge the capacitor when connected to a battery



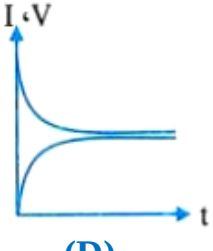
(A)



(B)

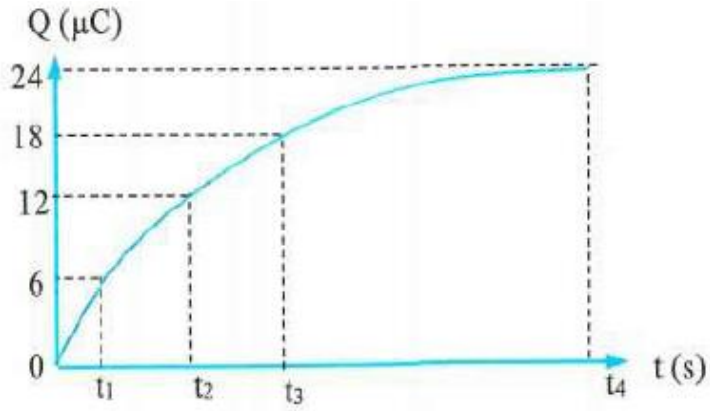


(C)



(D)

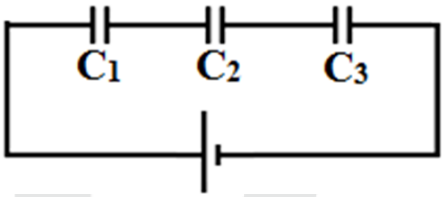
35) An electrical circuit consisting of a battery with an electromotive force (V_B) and a capacitor with a capacity of (2μF). The corresponding figure represents the graphical relationship between the amount of stored charge (Q) and the time (t) during the charging process until it is completed at time (t_4). Calculate the electromotive force. Battery electrical



(A) 16V
(B) 8V
(C) 12V
(D) 20V

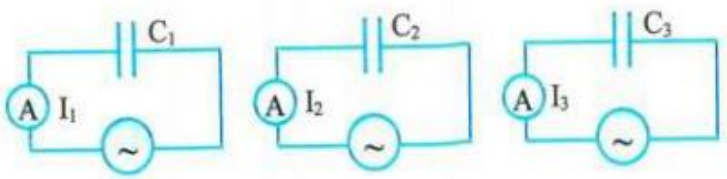
36) In the opposite circuit, if $C_1 > C_2 > C_3$, then …….

(A)	$V_1 = V_2 = V_3$	$Q_1 > Q_2 > Q_3$
(B)	$V_1 = V_2 = V_3$	$Q_1 < Q_2 < Q_3$
(C)	$V_1 > V_2 > V_3$	$Q_1 = Q_2 = Q_3$
(D)	$V_1 < V_2 < V_3$	$Q_1 = Q_2 = Q_3$

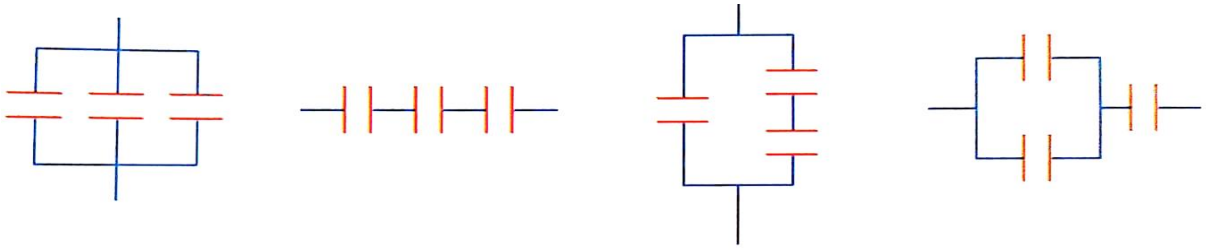


37) The corresponding figure: three capacitors $C_1 < C_2 < C_3$ each connected With an alternating current source and a thermal ammeter. If the voltage sources are the same, the relationship between the readings of the three ammeters is .....

(A) $I_1 < I_2 < I_3$
(B) $I_1 = I_2 = I_3$
(C) $I_3 < I_2 < I_1$
(D) It cannot be determined



38) Three identical capacitors, the capacity of each is C, are connected together in four different ways, so the correct order for these ways according to the total capacity of them is….

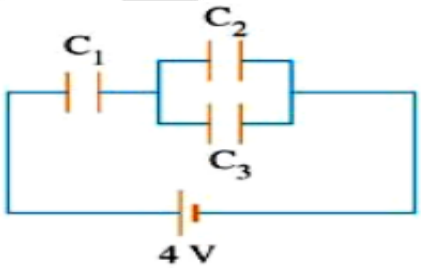


(1) (2) (3) (4)

	Total capacity of them	Total capacitive reactance of them
A	2 < 3 < 4 < 1	2 < 3 < 4 < 1
B	2 < 4 < 3 < 1	1 < 3 < 4 < 2
C	1 < 3 < 4 < 2	1 < 3 < 4 < 2
D	2 < 4 < 3 < 2	2 < 4 < 3 < 2

39) In the opposite figure, if the capacitance of each capacitor is 3μF and the emf of the battery is 4V, then the accumulated charges on one of the plates of each capacitor are

	Q_1	Q_2	Q_3
A	10μC	10μC	10μC
B	18μC	4μC	8μC
C	4μC	4μC	4μC
D	8μC	4μC	4μC



40) When a fixed-capacitance capacitor is connected to a moving-coil ammeter and a continuous source, the ammeter indicator

(A) It deviates to a certain value and remains constant.
(B) It deviates to a certain value and then returns to zero
(C) Doesn't deviate
(D) Other than that

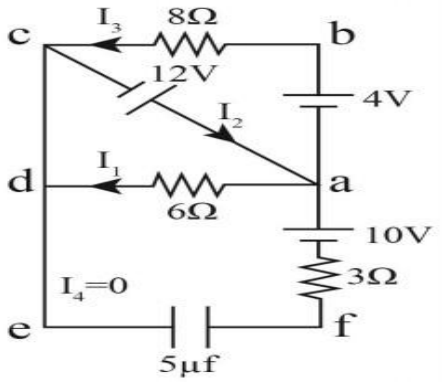
41) In the electric circuit shown in figure, find the charge on the capacitor when it charged (knowing that in this case the current passing in its branch equals zero).

(A) 1×10^{-5}C

(B) 5×10^{-5}C

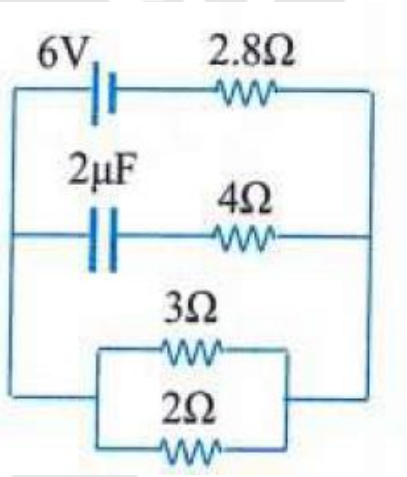
(C) 1×10^{-6}C

(D) 0 C



42) In the electric circuit shown in figure, find the charge on the capacitor when it charged And current intensity through 2Ω

	Value of the current intensity through 2Ω	The positive accumulated charge on the capacitor
A	1.25A	0.9μC
B	1.5A	0.9μC
C	1.8A	3.6 μC
D	0.9A	3.6 μC



43) An alternating current circuit contains only ohmic resistance. If the frequency of the current passing through the circuit increases, its resistance...

(A) It increases

(B) Decrease

(C) does not change.

(D) It changes sinusoidally

44) In the two electric circuits, if the capacitance of each capacitor is (C).
So, the ratio X_{C1}/X_{C2}

(A) 8/1

(B) 1/8

(C) 1/4

(D) 1/2

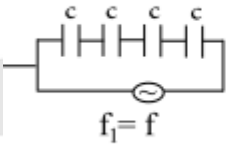


Figure (1)

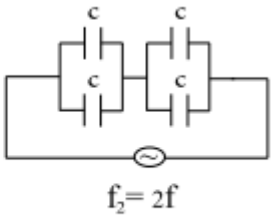


Figure (2)

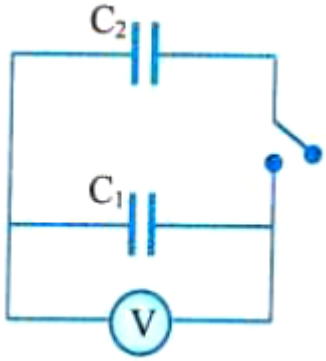
45) Final Exams (2 nd Session-22)

The opposite figure shows the connection of two capacitors in series, each of which has a capacitance (C). When another capacitor is connected in parallel between two points B, A its capacity is equal to half the capacity of one of the two capacitors, so the total capacitance of the three capacitors will be……

(A) C
(B) 2C
(C) C/2
(D) 3/2 C

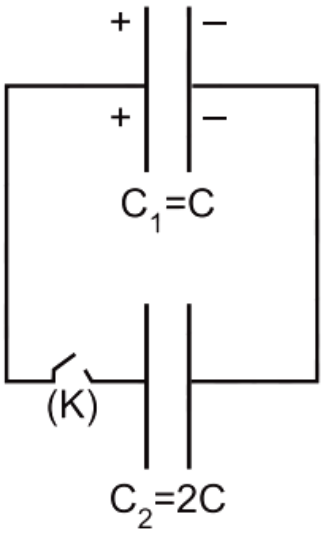
46) In the corresponding figure: a charged capacitor with a capacity of C_1=8μF) is connected to another uncharged capacitor with a capacity of (C_2=2μF). If the voltmeter reading before closing the switch is (20V), then the voltmeter reading will be after Close the key

(A) 8V
(B) 12V
(C) 20V
(D) 16V



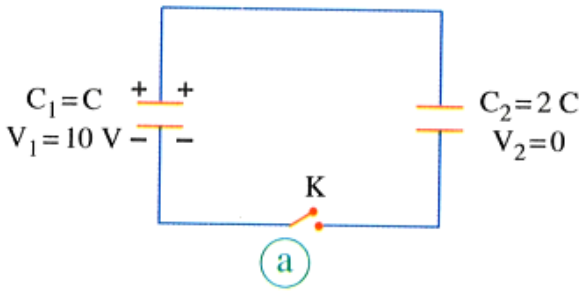
47) Exam2023 1st session

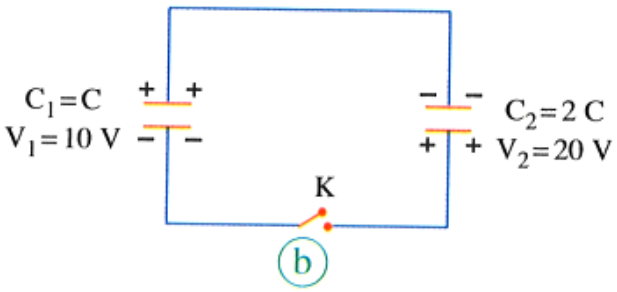
The figure represents two capacitors (1) and (2), the capacitor (1) is charged with a charge of 60 µc. and the capacitor (2) is uncharged. On closing the switch (k). **which** of the following choices represents the charge on the two capacitors (1) and (2)

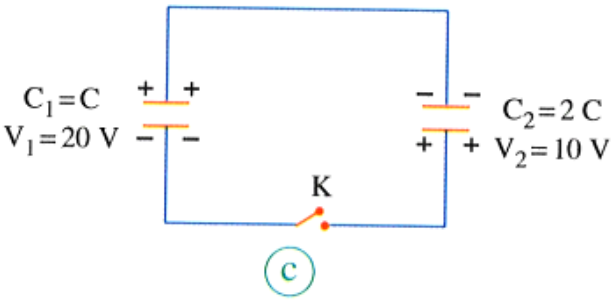


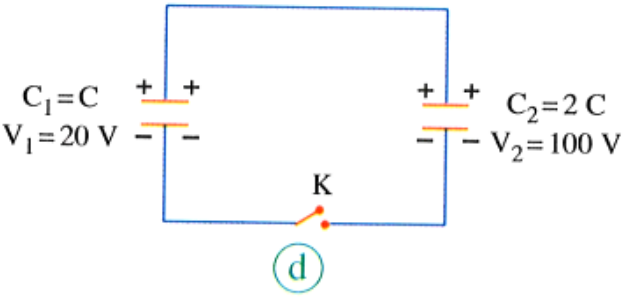
	The charge(Q_1)	The charge(Q_2)
A	40µC	20µC
B	20µC	40µC
C	30 µC	30 µC
D	Zero	60 µC

48) In which of the following circuits, when switch K is closed, the accumulated charges on capacitor C_1 increases?



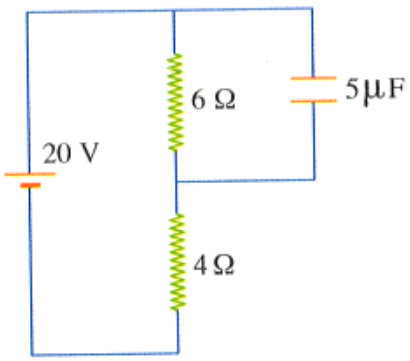






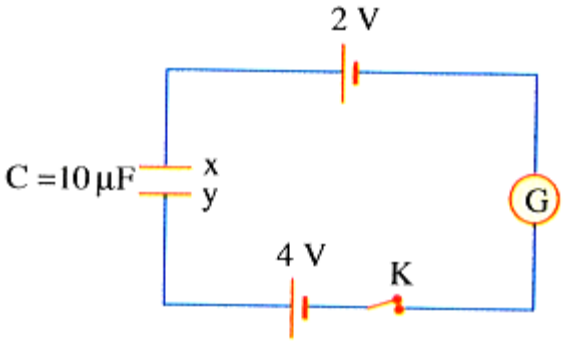
49) In The figure represents the accumulated positive charge on a capacitor

(A) 10μC
(B) 12μC
(C) 15μC
(D) 60μC



50) In the opposite electric circuit, when the pointer of the galvanometer settles at zero, then the electric charge that is accumulated on plate (x) of the capacitor is

(A) -20μC
(B) -40μC
(C) 20μC
(D) 40μC



51) In the opposite graph **Xc (Ω) vs f (Hz)**

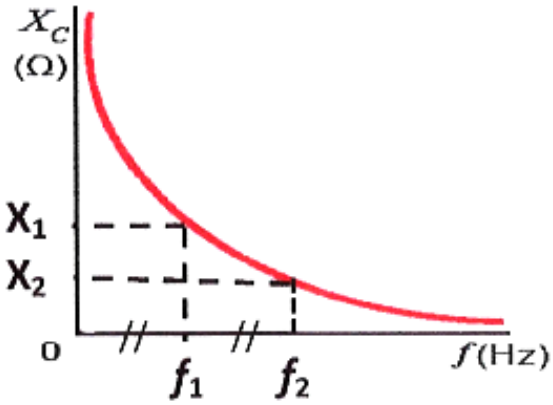
$\frac{X1}{X2}$ =……

(A) $\frac{C2}{C1}$

(B) $\frac{2C2}{C1}$

(C) $\frac{3C2}{C1}$

(D) $\frac{4C2}{C1}$



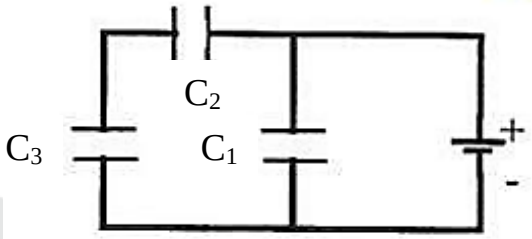
52) In the opposite circuit, if $C_1 = C_2 = C_3$, so

(A) $Q_1 = Q_2 = Q_3$

(B) $Q_1 < Q_2 < Q_3$

(C) $Q_1 = (Q_2 + Q_3)$

(D) $Q_1 < (Q_2 + Q_3)$



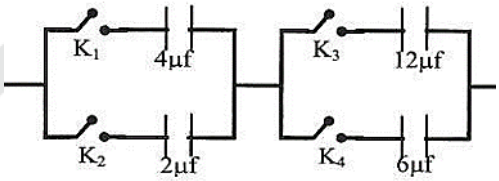
53) The opposite figure shows four capacitors and four key .....closed, the equivalent capacitance becomes 4μf

(A) K_2 , K_3 , K_4 only

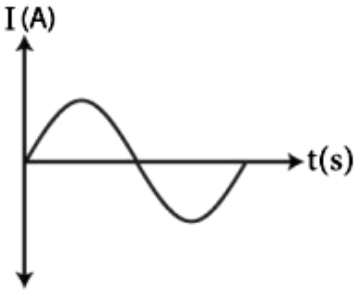
(B) K_1 K_2, K_4 only

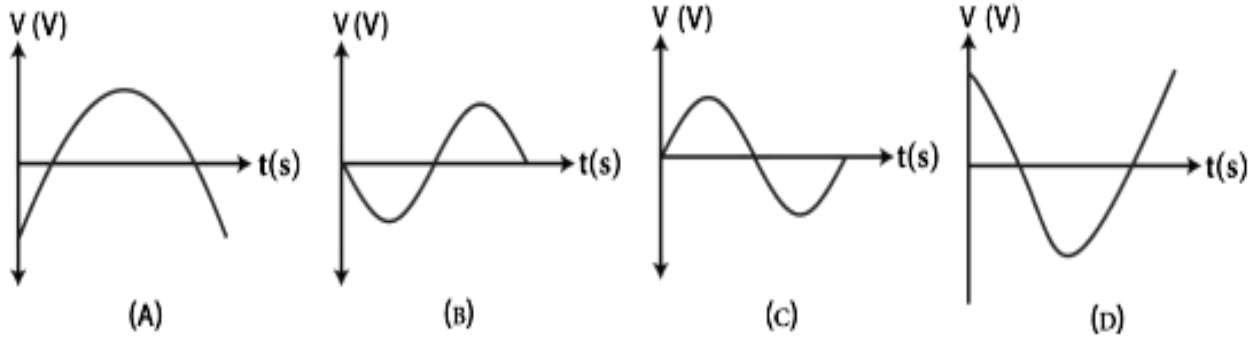
(C) when all keys are closed

(D) K_1, K_2, K_3 only.



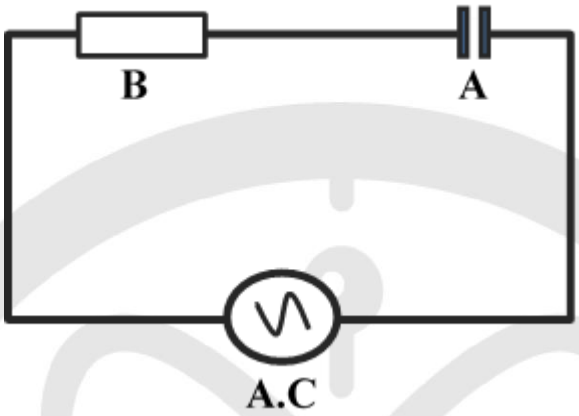
54) The graph illustrates the relation between the change in the current intensity (I) and the time (t) in an alternating current circuit contains a certain element Which of the following graphs represent the change of voltage across the element at same time? In following fig





	Resistance	Capacitor	Coil
A	C	A	D
B	A	B	C
C	A	C	D
D	A	D	A

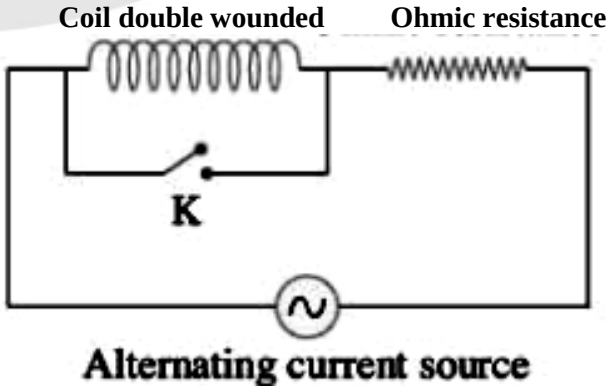
55) In the circuit shown the total potential difference equals ……. so the element (B) is



	$V_A + V_B$	$V = \sqrt{V_A^2 + V_B^2}$	$V_A - V_B$
A	Capacitor	Ohmic resistance	Induction coil Without ohmic resistanc
B	Capacitor	Ohmic resistance	Induction coil With ohmic resistance
C	Ohmic resistance	Induction coil Without ohmic resistance	Capacitor
D	Induction coil	capacitor	Ohmic resistance

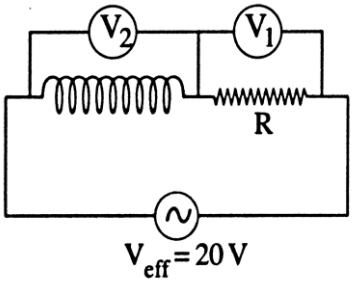
56) An AC circuit contains a non-inductive ohmic resistance and a coil of self-inductance (L) of negligible ohmic resistance so that the phase angle between the voltage and the current is (θ). When the key (K) is closed, so the phase angle…….

(A) Decreases
(B) doesn't change
(C) increases
(D) decreases but doesn't equal zero

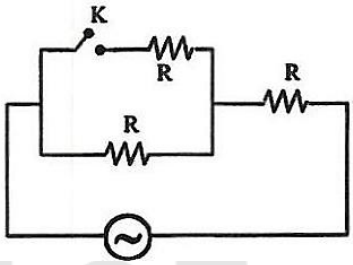


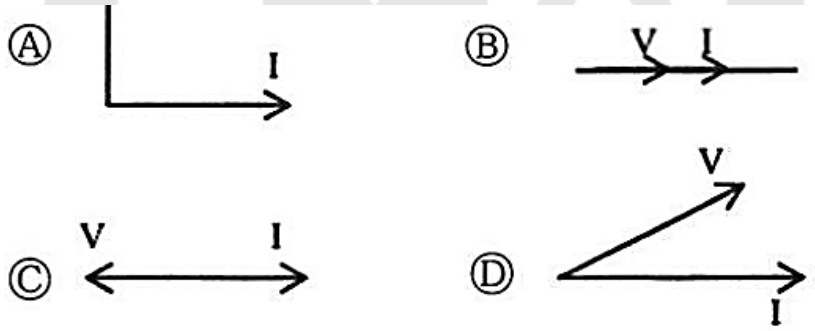
57) In the circuit illustrated in the opposite figure: If the reading of V_1 is 10 V, then the reading of V_2 is……..

(A) 15V
(B) 10V
(C) 14.14V
(D) 17.30V

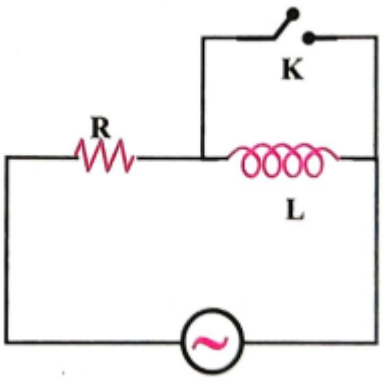


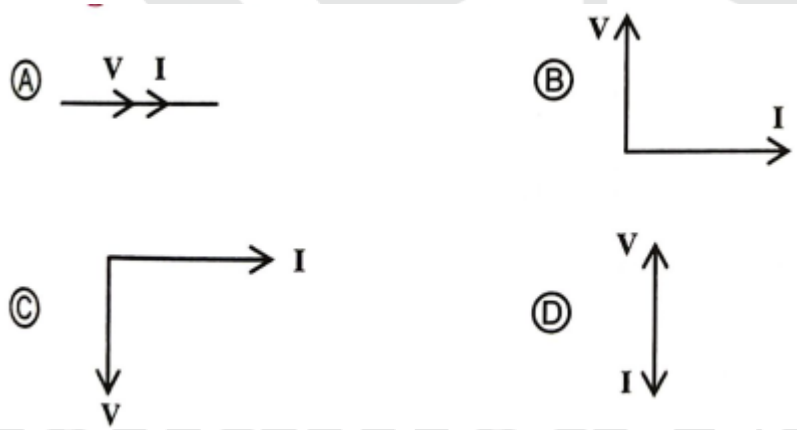
58) Alternating circuit as the K shown in the figure, at closed the key so the vector relation between the voltage and the current



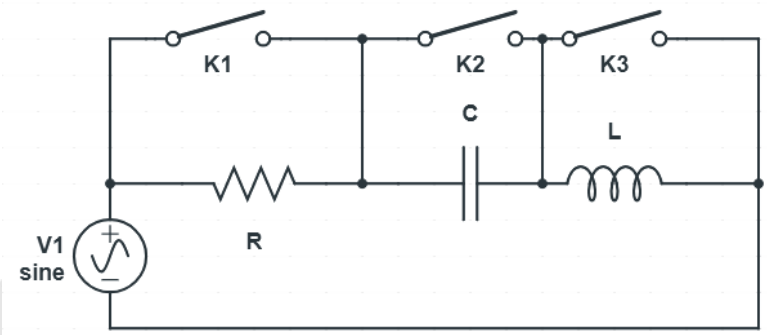


59) In the opposite figure if the switch (K) is closed, then the phase angle between the voltage and the current will.....

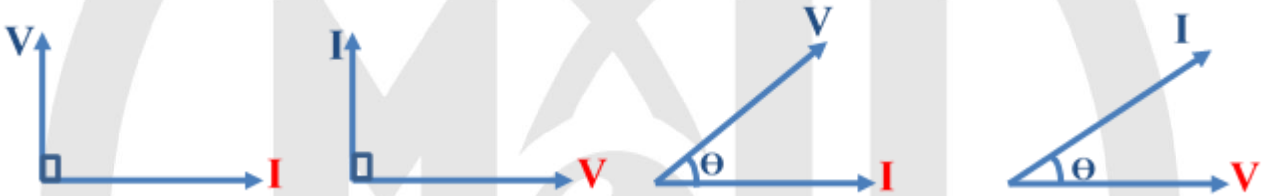




60) In the opposite figure if the $X_L > X_C$

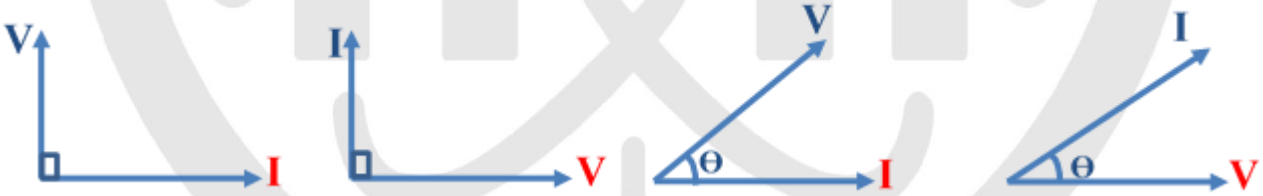


i. switch (K_1) is only closed, then the phase angle between the voltage and the current will.....



(A) **(B)** **(C)** **(D)**

ii. switch (K_2) is only closed, then the phase angle between the voltage and the current will.....

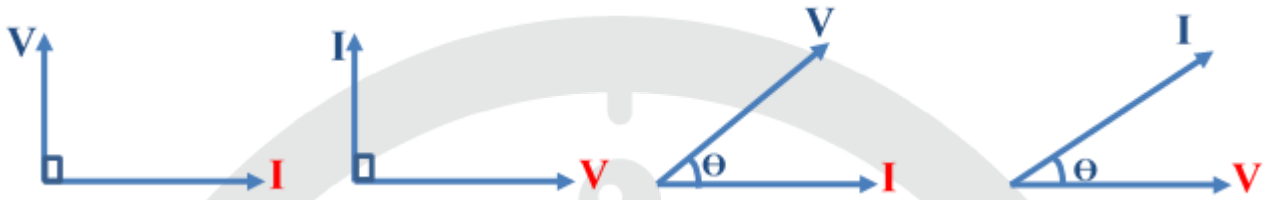


(A) **(B)** **(C)** **(D)**

iii. switch (K_3) is only closed, then the phase angle between the voltage and the current will.....

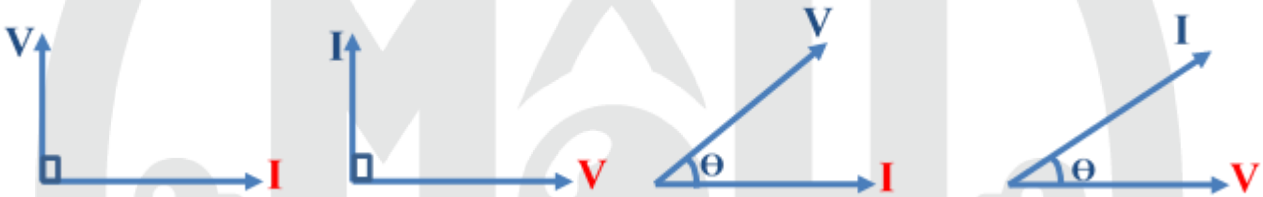
(A) **(B)** **(C)** **(D)**

iv. switch (K_1) and (K_2) closed, then the phase angle between the voltage and the current will.....



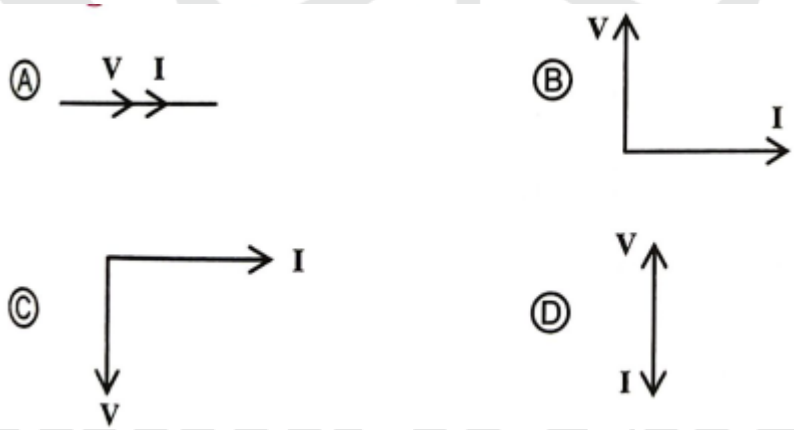
(A) **(B)** **(C)** **(D)**

v. switch (K_1) and (K_3) closed, then the phase angle between the voltage and the current will.....

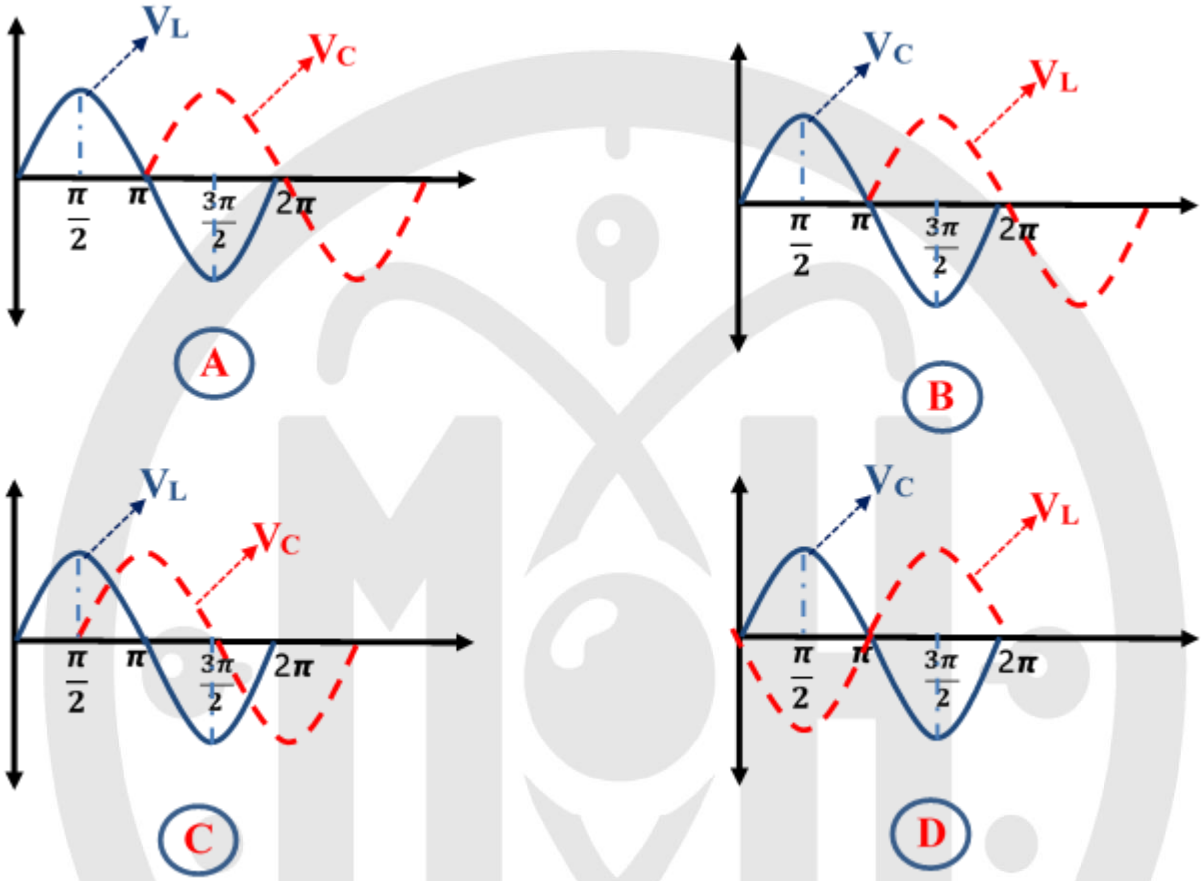


(A) **(B)** **(C)** **(D)**

vi. switch (K_2) and (K_3) closed, then the phase angle between the voltage and the current will.....



61) A series circuit consisting of a capacitor, and coil Zero ohmic resistance and an AC supply the voltage across each of them V_L and V_C reactively ($V_L > V_C$) so the V_L is…



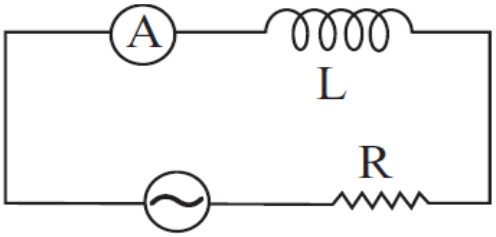
62) When a capacitor is connected in series to the given circuit, it is noticed that the reading of the hot wire ammeter is unchanged. In this case, the capacitive reactance of the capacitor is ……. the inductive reactance of the coil.

(A) half

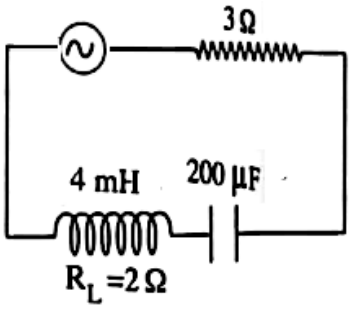
(B) equal to

(C) twice

(D) three times

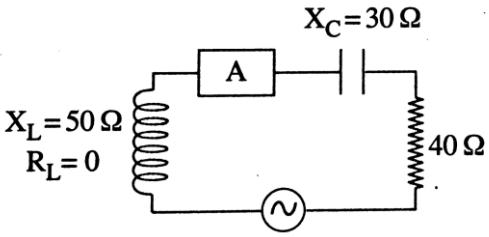


63) The opposite circuit is an AC circuit where the instantaneous value of its potential difference can be determined from the relation (V = 40 sinωt) and the value of ω=1000rad/s, then the maximum value of the current passing in the circuit equals…….



(A) 2.3A
(B) 3.3A
(C) 5.6A
(D) 7.8A

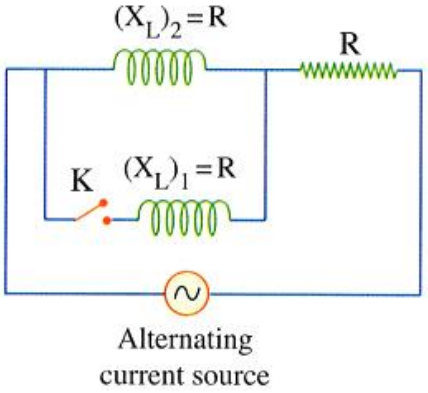
64) In the opposite electric circuit, if the total voltage lags the current by an angle of 45°, then the component A is……..



(A) an inductor of reactance 20Ω
(B) an inductor of reactance 80Ω
(C) a capacitor of reactance 20Ω
(D) a capacitor of reactance 60Ω

65) Final Exams (2nd Session-22)

In the figure, an alternating current circuit with ohmic resistance and two inductors neglecting the ohmic resistance, when the switch (K) was open, the phase angle between the total voltage and the current was (θ), if the switch (K) was closed, the phase angle between the total voltage and the electrical current……

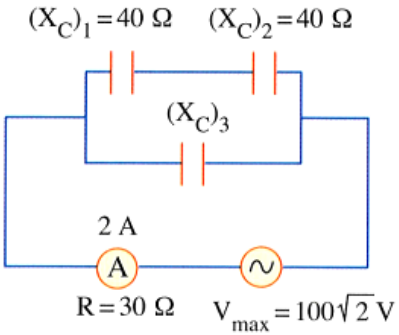


(A) Increases
(B) Decreases and not reach to zero
(C) Becomes zero
(D) Remains the same

66) Final Exams (2 nd Session-22)

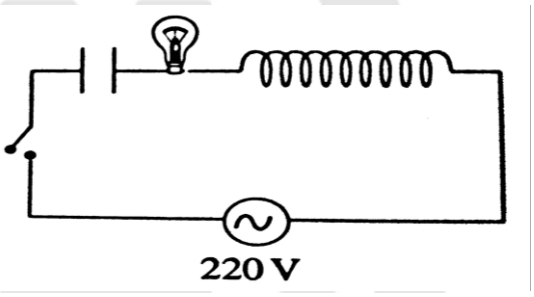
An alternating current source that produces a maximum e.m.f of $100\sqrt{2}$V connected with three capacitors and hot wire ammeter as in the figure, using the data shown, the value of the capacitive reactance (X_{c3}) is equal to…….Ω

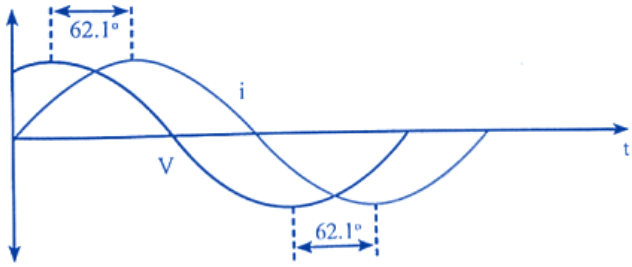
(A) 80
(B) 20
(C) 40
(D) 50



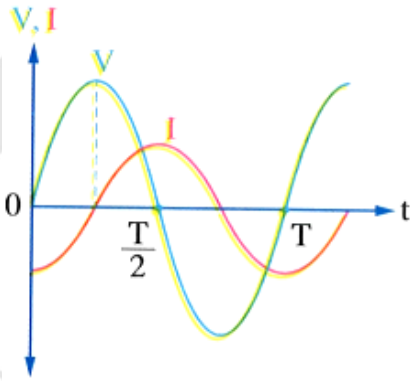
67) The opposite figure, an electric circuit that contains AC source of emf 220V, a capacitor of capacitive reactance 600Ω, a coil of inductive reactance 800Ω, an electric lamp of resistance R and a switch where all are connected in series, then the value of the current passes through it equals…….

(A) 0.97A
(B) 0.22A
(C) 0.36A
(D) 0.16A



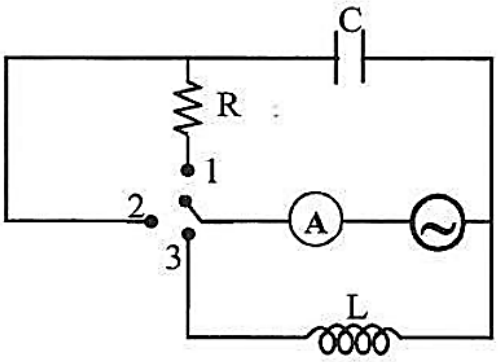


68) The corresponding graph represents the relationship between each of the potential difference (V) between the two ends of a pure element connected to an alternating source and the value of the current (I) passing through it and the time (t). Which of the following alternating current circuits is represented by the graph?

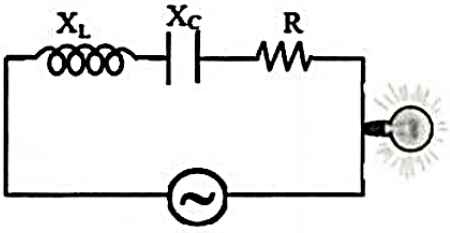


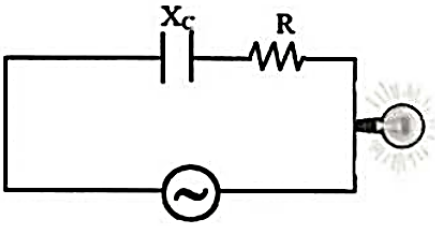
69) In the opposite electric circuit, when the key (1) is switched on , current (I_1) passes through the circuit, when the key (2) only is switched on , current(I_2) passes through the circuit and when the key (3) is switched on ,current(I_3) passes through the circuit .Given that $X_L=X_C=R$, so the relation between the three currents is.....

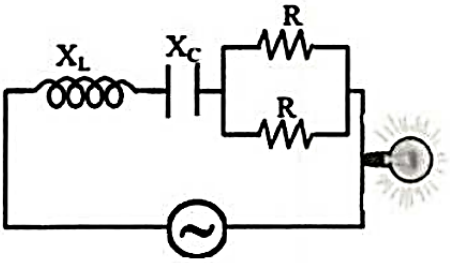
(A) $I_1=I_2=I_3$
(B) $I_1>I_2=I_3$
(C) $I_1<I_2=I_3$
(D) $I_2=I_1=I_3$
(E) $I_3>I_1=I_2$

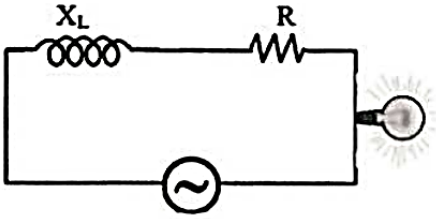


70) In front of you four circuit $X_L=X_C=R$ connected to an AC source as shown Which of them the lamp illumination is the greatest?

Ⓐ


Ⓑ


Ⓒ


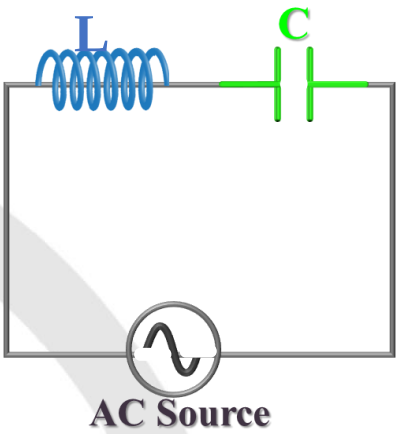
Ⓓ


71) From the opposite electric circuit induction coils of negligible ohmic resistance and capacitor connected to an alternating current source When replaced a.c source by d.c source the power consumed is…….

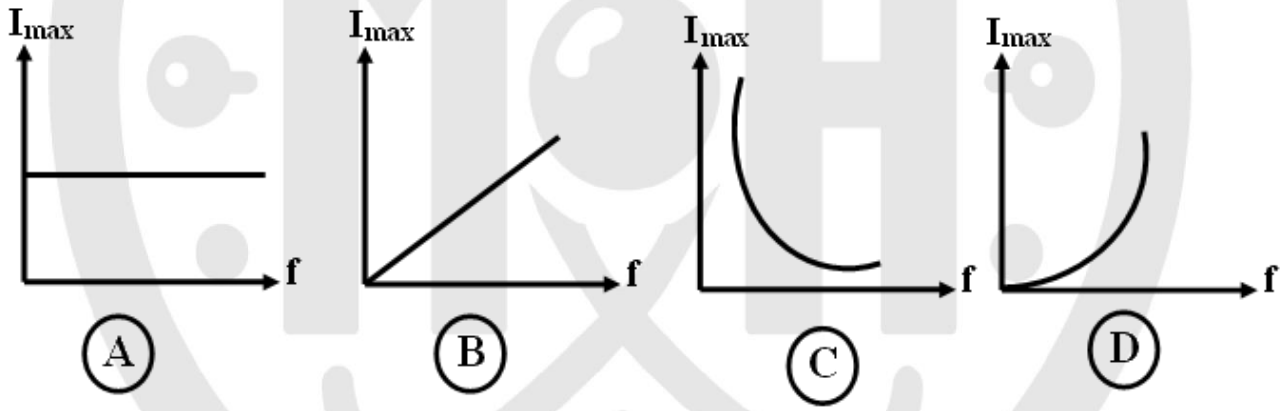
(A) Doesn't change

(B) Increases

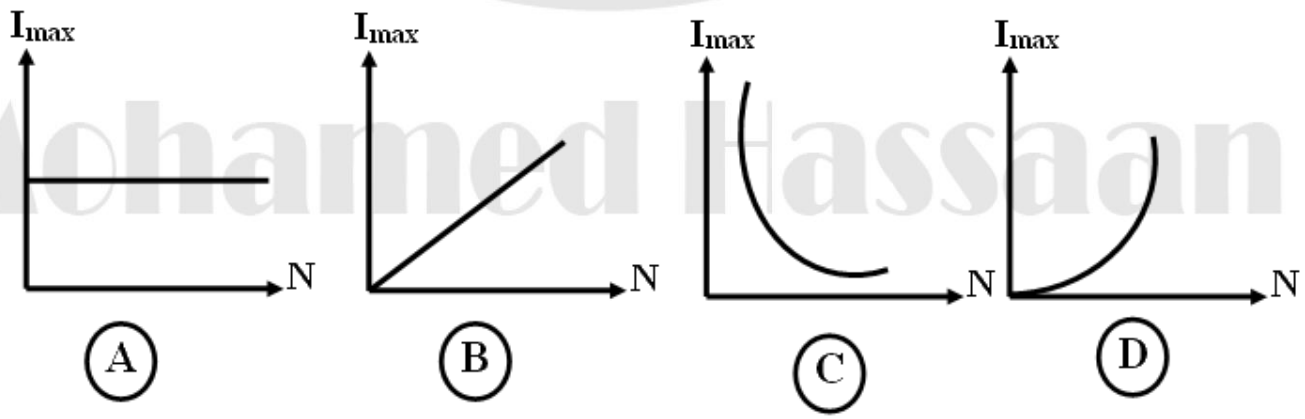
(C) Decreases but doesn't equal zero



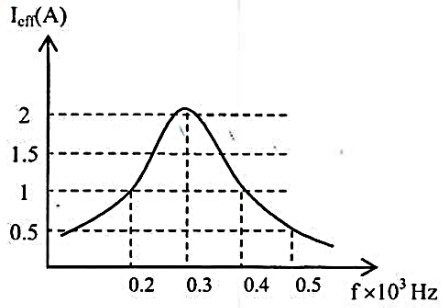
72) Which of the following graphs represents the relation between the maximum intensity of an AC current (I_{max}) that passes through a capacitor which is connected to a AC source of negligible internal resistance and the frequency (f)?

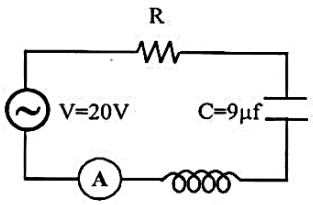


73) Which of the following graphs represents the relation between the maximum intensity of an AC current (I_{max}) that passes through an coil which is connected to a dynamo of negligible internal resistance and the number of turns (N)?



74)



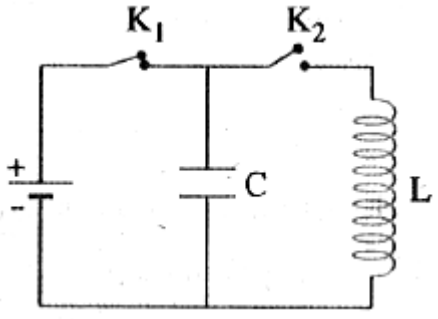


The graph represents the change of the effective current intensity by changing the source frequency .So the coil self - induction coefficient needed to get maximum current in the given circuit equals..... Henry

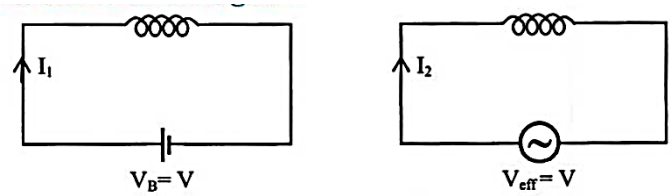
(A) 0.031
(B) 93.7
(C) 16.4
(D) 103.19

75) The electrical power consumed in an AC circuit containing an ohmic resistor, a pure inductor, and a capacitor is the largest When the inductive reactance of the coil is...
(A) Equal to the reactance of the capacitor.
(B) Smaller than the reactance of the capacitor
(C) Greater than the reactance of the capacitor
(D) Other than that

76) In the opposite oscillating circuit, when switch K_1 is opened and switch K_2 is closed for a period and for the assuming of neglecting the ohmic resistance of the coil and the connecting wires, which of the following occurs in the coil?
(A) A direct current passing through it
(B) An unidirectional current passing
(C) An alternating current passing
(D) No current passing



77) Induction coil has ohmic resistance. it is connected to a battery has emf of (V) a current of intensity (I_1) passes through the circuit, when the coil is connected to AC source of effective voltage (V) ,a current of intensity (I_2) passes through the circuit, as shown in the figure:



Circuit (I) circuit (II)

I) $I_1 > I_2$
II) $Z_1 > Z_2$
III) $I_1 = I_2$

Which of the previous relations is correct ?

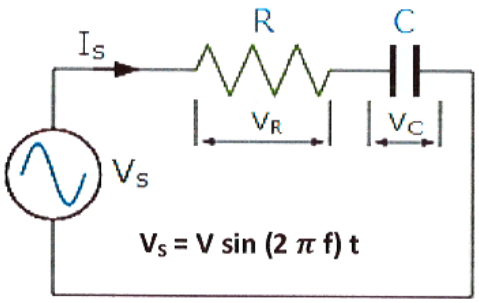
(A) I only.
(B) II only
(C) III only
(D) I, II only
(E) I, Ill only

78) **<u>RC circuit is powered by AC power supply,</u>**

If Vs= Vsin(2πf)t

a) Sketch the voltage (phase) diagram of; **Is**, **V_R**, **Vc** and **Vs**

b) The current drawn is in terms of, R, C and f is



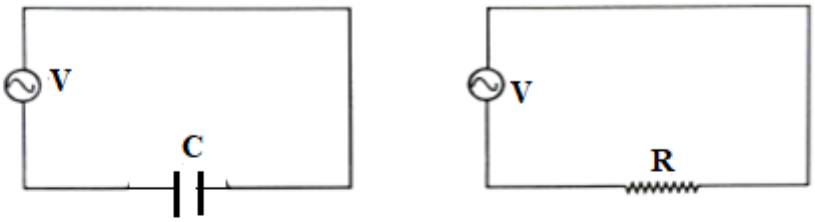
A. $Is = \frac{Vs}{\sqrt{R^2+(\frac{1}{2\pi fC})}}$

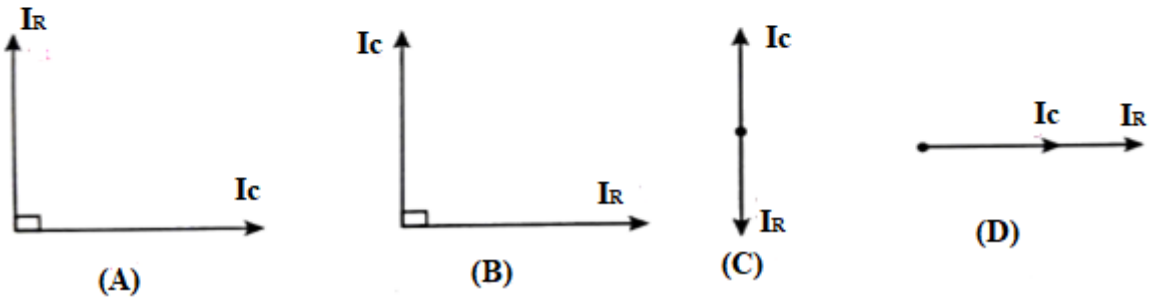
B. $Is = \frac{Vs}{\sqrt{R^2+(\frac{1}{2\pi fC})^2}}$

C. $Is = \frac{Vs}{\sqrt{(R+\frac{1}{2\pi fC})^2}}$

D. $Is = \frac{Vs}{\sqrt{R+(\frac{1}{2\pi fC})}}$

79) The figure illustrates two AC circuits, one contains an ohmic resistance (R) while the other contains an inductive capacitor (C) of negligible ohmic resistance. Assuming that the voltages of the two sources in the same phase, so the diagram below that represents the phase difference between the currents I_R and I_c is.....





80) In **AC** circuit if instantaneous voltage is determined from the relation;
$\mathbf{V_{inst} = 100 \sin \theta}$ and current is determined by $\mathbf{I_{inst} = 50 \sin (\theta + \frac{\pi}{3})\ mA}$

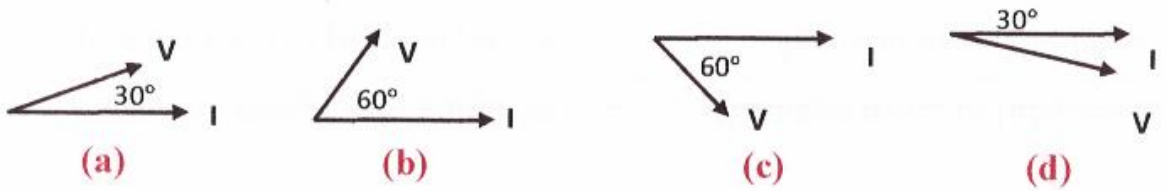
(If all phasors are rotating in the clock clockwise direction)
The right phase diagram is represented by

A. a

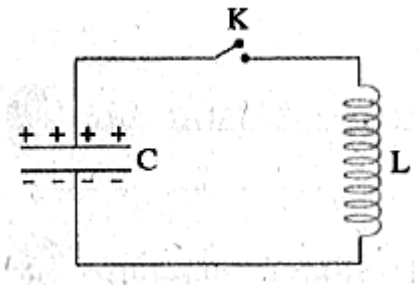
B. b

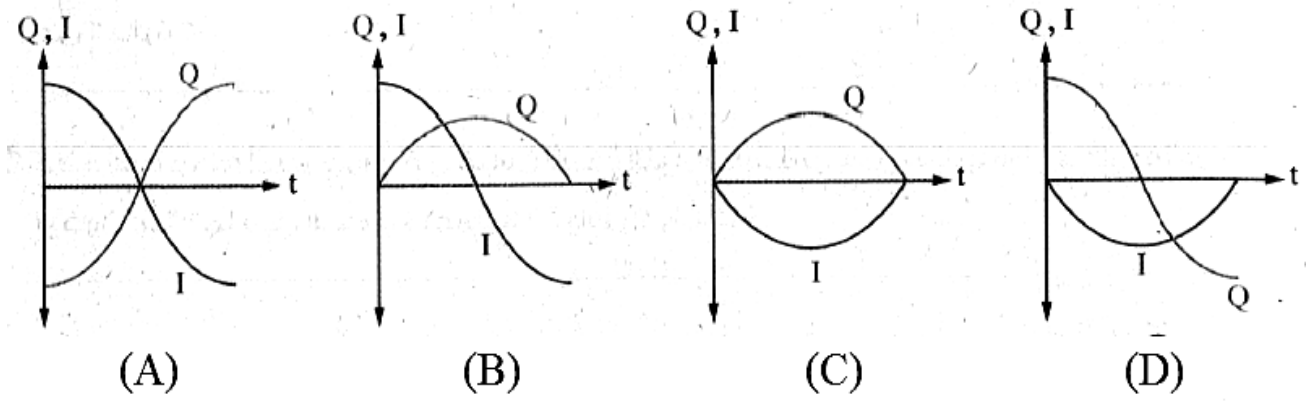
C. c

D. d



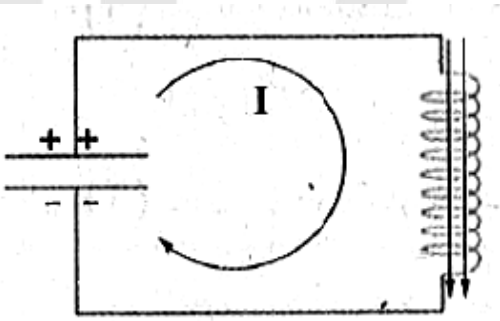
81) The figure shows an electric circuit with a charged capacitor C connected to a coil L via a switch K, which of the following graphs represent the change in both the amount of electric charge on the plates of the capacitor (Q) and the intensity of the current passing through the coil (I) with time (t) during half a cycle When the key K is closed?





82) The opposite figure represents the current direction in an oscillating circuit at a given moment, what happens to the value of the current (I) in the following moments and during a quarter of the periodic time of the current?

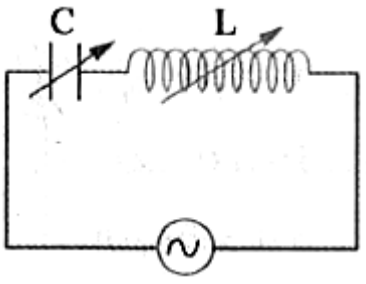
(A) Increases
(B) Increases then decreases
(C) Decreases
(D) Decreases then increases



83) Final Exams (2 nd Session-22)

The figure represents a resonant circuit consisting of a capacitor with variable capacitance and an inductance coil with an ohmic resistance connected in series. If capacitance of capacitor increasing to double and its wanted to circuit to stay of state of resonance. So the ratio between inductive reactance in the first case to its value in the second case (X_{L1}/X_{L2}) equals……..

(A) 1/2
(B) 1/4
(C) 4/1
(D) 2/1

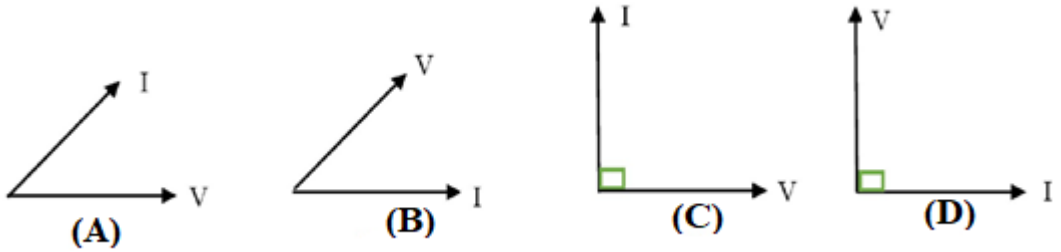


84) Experimental exam 2023

Resonant circuit of frequency 2 x 10^{14}Hz has a capacitor of capacitance (C) farad and a coil of self-induction (L) Henry, if the capacitance is increased to (9C) farad and self-induction of the coil decreases to (L/9) Henry, then the resonate frequency will……

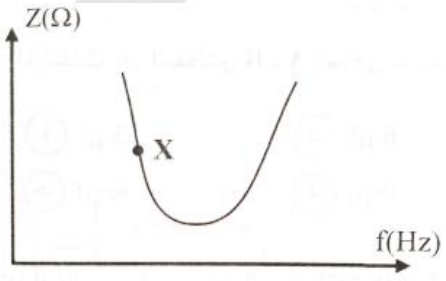
(A) increases three times
(B) remains constant
(C) increases 9 times
(D) decreases to third

85) Which diagram represents the vectors of the total voltage and the current in a circuit consisting of a capacitor, and coil Zero ohmic resistance ($X_L > X_C$) and an AC supply?



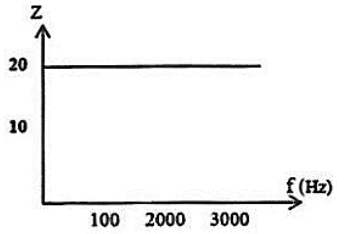
86) An Alternating current circuit contains inductive coil of negligible ohmic resistance, capacitor of variable capacitance and ohmic resistance in series. From the figure, at point X the ratio between $\frac{X_L}{X_c}$ is…

(A) Greater than one act as a coil property
(B) Less than one act as a capacitor property
(C) Greater than one act as a capacitor property
(D) Less than one act as a coil property

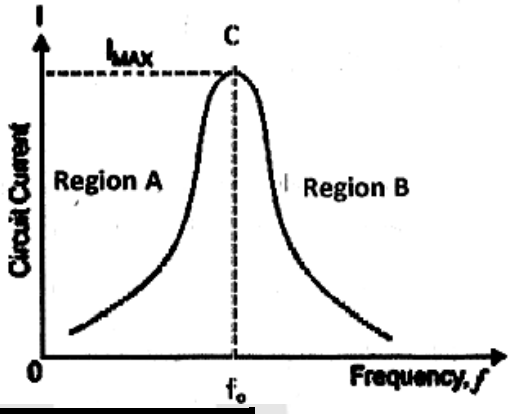


87) The opposite graph illustrates the change of the total impedance and the frequency in an alternating current circuit. Which of the" following elements connected to the circuit in series?

(A) a non-inductive ohmic resistance
(B) an impure inductive coil and a capacitor
(C) an impure inductive coil
(D) an pure inductive coil and a capacitor



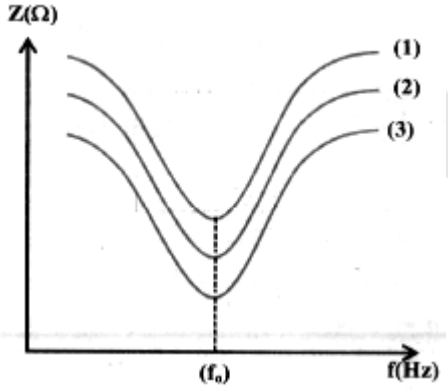
88) The graph represent the relation between the current intensity I (A) through RLC series circuit and the frequency f (Hz) In AC circuit;



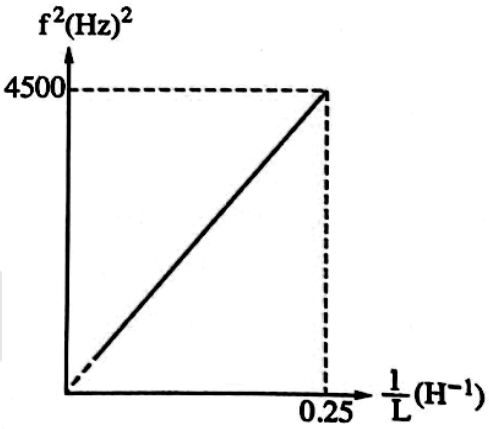
	The current through And frequency region A	The current through And frequency region C	The current through And frequency region B
A	Leading & Capacitive	In phase & Resistive	Lagging & Inductive
B	Leading& Inductive	In phase& Capacitive	In phase& Capacitive
C	In phase& Capacitive	Lagging& Resistive	Leading& Inductive
D	Leading& Inductive	In phase& Capacitive	In phase & Resistive

89) Three RLC circuits when drawing the relationship between the impedance and frequency (f) represents the form as by drawing. The relationship between the three currents passing through each of them at frequency (f_o) be……

(A) $I_1 = I_2 > I_3$
(B) $I_1 < I_2 < I_3$
(C) $I_2 > I_3 > I_1$
(D) $I_1 > I_2 > I_3$



90) A capacitor of constant capacitance is connected in series with an inductor of changeable self-inductance and an AC source of changeable frequency and the opposite graph represents the relation between the square of the resonance frequency $(f)^2$ of the circuit and the reciprocal of the inductance of the inductor (1/L), then the capacitance of the capacitor is……

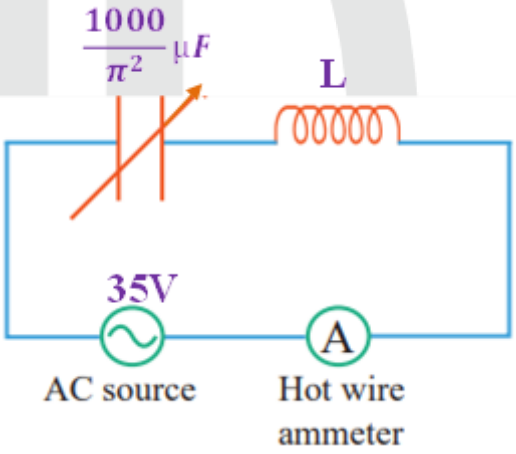


(A) 0.9×10^{-6} F
(B) 1.1×10^{-6} F
(C) 1.4×10^{-6} F
(D) 1.9×10^{-6} F

91) When studying the impedance of the electric circuit shown in the figure while changing the frequency of the AC source we obtained the shown graph, so:

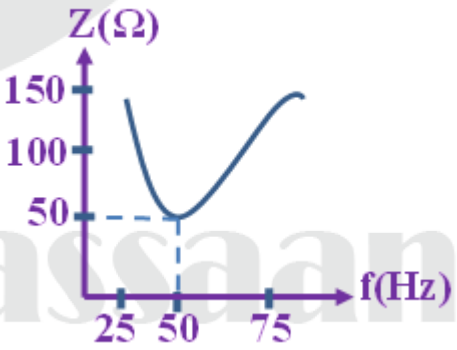
(i) The self inductance of the coil equals

(A) 0.1H
(B) 0.2H
(C) 2H
(D) 1H

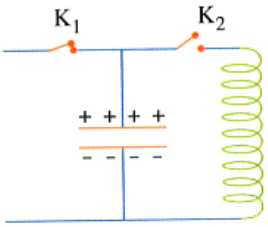


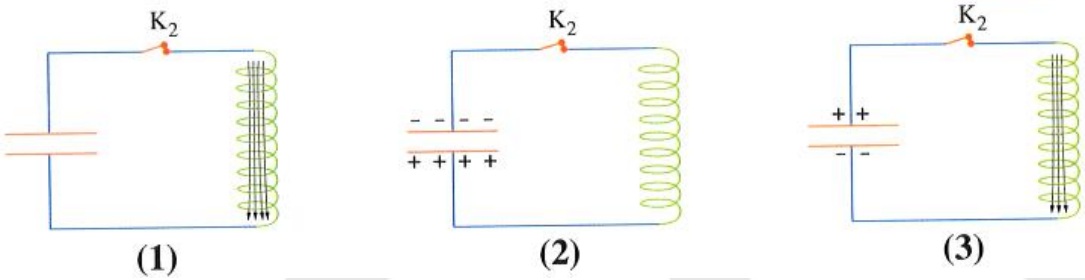
(ii) The potential differences between the terminals of each of the coil and the capacitor at position x respectively are

(A) 22V &22V
(B) 41.3V&22V
(C) 41.V&41.3V
(D) 22V&41.3V



92) The opposite figure represents an oscillating circuit with a charged capacitor, the following figures show three stages of the circuit after opening the switch K_1 and closing the switch K_2:



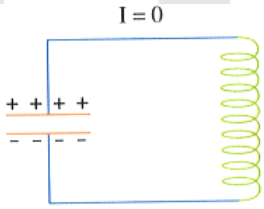


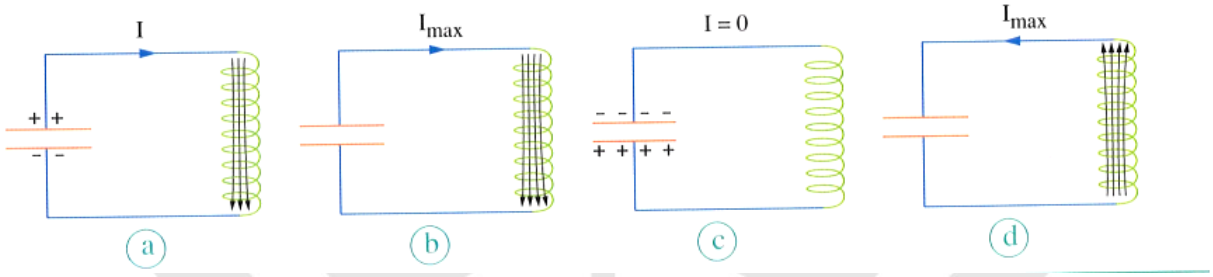
(1) (2) (3)

So the correct for the occurrence these stages is…..

(a) (1) ⟶ (2) ⟶ (3)
(b) (3) ⟶ (1) ⟶ (2)
(c) (2) ⟶ (1) ⟶ (3)
(d) (3) ⟶ (2) ⟶ (1)

93) The opposite figure represents an oscillating circuit at a certain instant, then which of the following figures represents this circuit, after $\frac{3}{4}$ cycle of a current cycle?

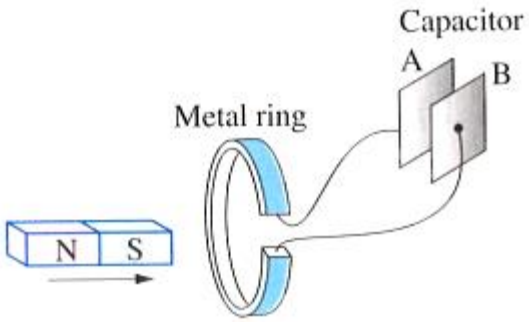




(a) (b) (c) (d)

94) **What** is the electric charge that forms on plate A of the capacitor as the magnet approaches the metal ring shown in the corresponding figure? And **why**?

Answer:



95) **[Egypt 1989]**

An AC series circuit consists of a condenser of reactance 80 Ω, a coil of inductance 0.28H, a resistance wire 12m long and cross-sectional area $7x10^{-4}m^2$. And the resistivity of its material is $35x10^{-5}\Omega.m$. and AC mains of frequency 50cycles/s and of effective e.m.f of 20 V find:

a) The maximum current in the circuit.

b) The p.d across the terminals of each of the condenser and the coil.

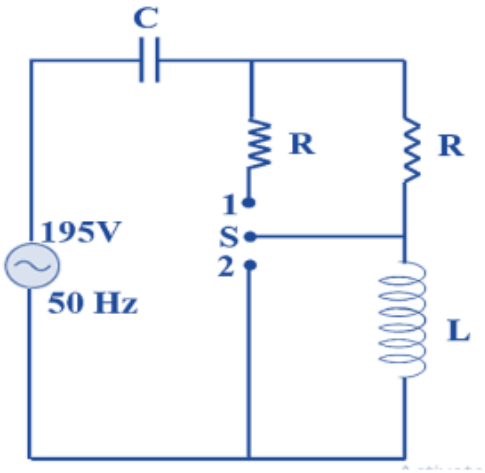
96) In the electric circuit shown in the figure, when the switch S is open in both direction, the electric current intensity becomes 0.015A, and when the switch is closed in the position (1) the electric current intensity becomes 0.025A, and when the switch is closed in the position (2) the electric current intensity becomes0.015A,

Calculate the value of

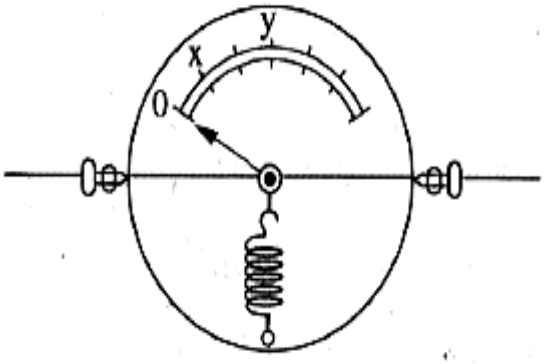
i. Self-induction coefficient

ii. Capacitance of capacitor

iii. Ohmic resistance



97) The opposite figure shows the composition of a hot wire ammeter and equal sections on its scale:

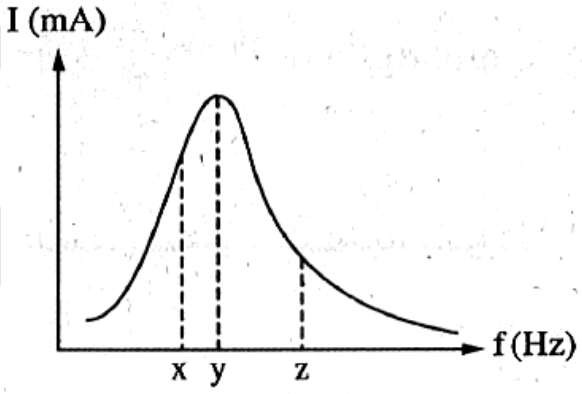


- **Why** is the hot wire ammeter used to measure the effective value of the current?
- When a current with an effective value of 4A passes through a platinum-iridium wire the pointer deflects to the sign (x). **Find** the effective value of the current which make pointer deflects to the sign (y).

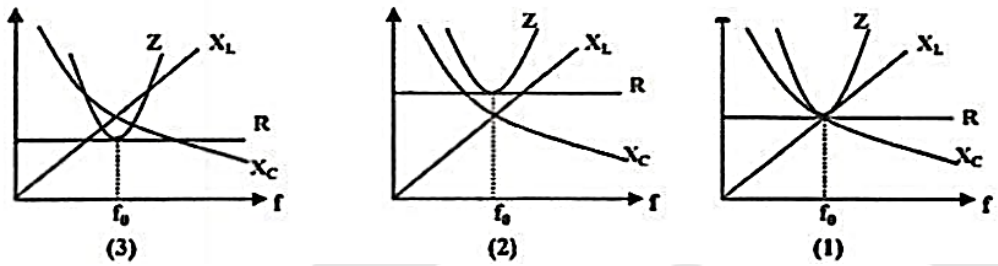
Answer:

98) The opposite graph represents the relationship between the value of the current (I) passing through an RLC circuit and the frequency of the current (f). **Explain** at which of the frequencies (x, y, z) shown in the graph is:

- The inductive reactance is less than the capacitive reactance.
- The phase angle between the total voltage and the current in the circuit is zero.



99) Mark (true) or (false) according to the following three forms:



a) Figure (1) at f_0, R= X_L ( )
b) Figure (2) at f_0, R= Z. ( )
c) Figure (3) at f_0,, Z > Xc ( )
d) In the three figures at fp the circuit is in resonance. ( )
e) Figure (2) at f_0, X_L < Z ( )
f) (f) Figure (1) at f_o, Z = Xc ( )
g) Figure (3) at f_0, R> Xc ( )

100) From the graph below:

It represents the relation between each of the ohmic resistance, inductive reactance and capacitive reactance with the frequency of the source in RLC circuit if knowing that the capacitance of the capacitor is 2μF, (π = 22/7). Calculate.

The self-induction coefficient of the coil. (0.051H)

If the voltage of the A.C. source equals 400V, find the highest current intensity passing through the circuit. (2A)

Answer: