OBJECTIVE - I

1. A capacitor acts as an infinite resistance for
(A*) DC (B) AC (C) DC as well as AC (D) neither AC nor DC

Sol. **A**

$X_C \frac{1}{\omega C} = \frac{1}{O \times C} = \infty \quad \left\{ \text{in } \underset{\omega=0}{DC} \right\}$

2. An AC source producing emf x = x_0[cos(100 p s $^{-1}$)t + cos(500 p s $^{-1}$)t] is connected in series with a capacitor and a resistor. The steady-state current in the circuit is found to be
i = i_1 cos[(100 p s $^{-1}$)t + j_1]+i_2 cos[(500 p s $^{-1}$)t+ j_1]

(A) $i_1 > i_2$ (B) $i_1 = i_2$ (C*) $i_1 < i_2$
(D) i_1

Sol. **C**
Q = CÎ = $Î_0$C [cos (100p s^{-1})t + cos (500 p s^{-1})t]

$$i = \frac{d\theta}{dt} = (\epsilon_0\ c) \times 100\,\pi\left[\sin\left(100\pi s^{-1}\right)t\right] + (\epsilon_0\ C) \times 500\,\pi\left[\sin\left(500\,\pi s^{-1}\right)t\right]$$

$$= 100\ \pi \epsilon_0\ C\ \cos\left[\left(100\pi s^{-1}\right)t + \phi_1\right] + 500\ \pi \epsilon_0\ C\ \cos\left[\left(500\pi s^{-1}\right)t + \phi_2\right]$$

$i_1 = 100\,\pi\,\epsilon_0\ C$ & $i_2 = 500\,\pi\,\epsilon_0\ C$
$i_2 > i_1$

3. The peak voltage in a 200 V AC source is

(A) 220 V (B) about 160 V (C*) about 310 V (D) 440 V

Sol. **C**
$V_{rms} = 220$ v
$V_P = \sqrt{2}\ V_{rms} = 220 \times 1.414 = 311$ volt

4. An AC source is rated 220 V, 50 Hz. The average voltage is calculated in a time interval of 0.01 s. It
(A) must be zero (B*) may be zero (C) is never zero (D) is (220/Ö2)V

,

Sol. **B**
(I)
V = V_0 sinwt
w = 2pf = 2 × 3.14 × 50 = 314 Þ wt = 3.14 = p

$$V_{avg} = \frac{\int_0^{0.01} vdt}{\int_0^{0.01} dt} = v_0\left(\frac{1\cos\omega t}{\omega}\right)_0^{0.01}$$

$$= \frac{V_0}{\omega \times 0.01}\left(1 - \cos\omega(0.1)\right)$$

$$= \frac{V_0}{314 \times 0.01}\left(1 - \cos(314 \times 0.01)\right)$$

$$= \frac{V_0}{3.14}\left(1 - \cos(314)\right)$$

$$= \frac{V_0}{3.14}\left(1 - \cos \pi\right)$$

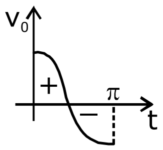
$$= \frac{2V_0}{\pi} = 140.127 \text{ volt}$$

(II)

may be zero

if $v = v_0 \cos wt$

$$v_{avg} = \frac{\int v d\rho}{\int dt} = 0$$



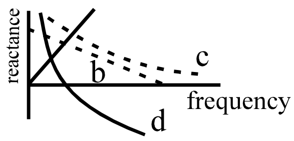
5. The magnetic field energy in an inductor changes from maximum value to minimum value in 5.0 ms when connected to an AC source. The frequency of the source is

(A) 20 Hz (B*) 50 Hz (C) 200 Hz (D) 500 Hz

Sol. **B**

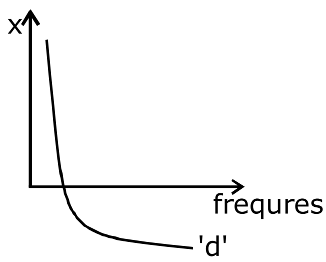
Frequency of the source is remain constant = $50H_2$

6. Which of the following plots may represnet the reactance of a series LC combination ?



(D*)

Sol. **D**



$X = X_L - X_c = wL - \dfrac{1}{wc} = 2\pi fL - \dfrac{1}{2\pi fc}$

7. A series AC circuit has resistance of 4 W and a reactance of 3 W. the impedence of the circuit is

(A*) 5 W (B) 7 W (C) 12/7 W (D) 7/12 W

Sol. **A**

$Z = \sqrt{R^2 + x^2}$

R = 4W

X = 3W

$Z = \sqrt{4^2 + 3^2} = 5\Omega$

8. Transformers are used

(A) in DC circuits only (B*) in AC circuits only

(C) in both DC and AC circuits (D) neither in DC nor in AC circuits

Sol. **B**

Transformers are used in AC circuits only.

9. An alternating current is given by

$i = i_1 \cos wt + i_2 \sin wt$. The rms current is given by

(A) $\frac{i_1 + i_2}{\sqrt{2}}$ (B) $\frac{|i_1 + i_2|}{\sqrt{2}}$ (C*) $\sqrt{\frac{i_1^2 + i_1^2}{2}}$ (D) $\sqrt{\frac{i_1^2 + i_1^2}{\sqrt{2}}}$

Sol. **C**

$i = i_1 \cos \omega t + i = i_2 \sin \omega t$

$$I_{rms} = \frac{\int_0^T I^2 dt}{\int_0^T dt}$$

if $I = coswf$

Þ $I_{rms}^2 = \frac{I_0^2}{2}$

$i = i_1 \, coswt + i_2 \, sinwt$

than $i_{rms}^2 = \frac{i_1^2}{2} + \frac{i_2^2}{2}$

$$i_{rms} = \sqrt{\frac{I_1^2 + i_2^2}{2}}$$

10. An alternating current having peak value 14 A is used to heat a metal wire. To produce the same heating effect, a constant current i can be used where is -

\

(A) 14 A (B) about 20 A (C) 7 A (D*) about 10 A

Sol. **D**

I_P= 14 Amp

$$I_{rms} = \frac{IP}{\sqrt{2}} = \frac{14}{\sqrt{2}} = 9.9 \quad 10 \text{ Amp.}$$

11. A constant current of 2.8 A exists in a resistor. The rms current is

(A*) 2.8 A (B) about 2 A (C) 1.4 A (D) undefined for a direct current

Sol. **A**

A constant current exists in a resistor is rms current it is equal to 2.8 Amp.

OBJECTIVE - II

1. An inductor, a resistor and a capacitor are joined in series with AC source. As the frequency of the source is slightly increased from a very low value, the reactance
(A*) of the inductor increase
(B) of the resistor increase
(C) of the capacitor increases
(D) of the circuit increases

Sol. **A**
$X_L = wL$

$X_C = \frac{1}{\omega c}$ $\quad$ $t = \frac{\omega}{2\pi}$

If frequency increases, w is increases that causes 'X_L' Reaction of inductor increases & 'X_c' Reactance of capacitor decreses.

2. The reactance of a circuits is zero. It is possible that the circuit contains
(A*) an inductor and a capacitor
(B) an inductor but no capacitor
(C) a capacitor but no inductor
(D*) neither an inductor nor a capacitor

Sol. **A**
X = 0 (Given)

$X = X_L + X_C \quad = \quad \omega L - \frac{1}{w_C} = 0$

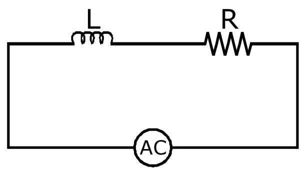
It is possible that the circuit contains an inductor and a capacitor.

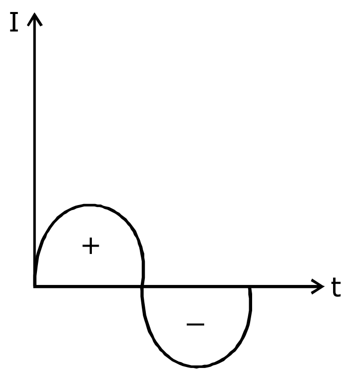
3. In an AC series circuit, the instantaneous current is zero when the instantaneous voltage is maximum. Connected to the source may be a
(A*) pure inductor
(B*) pure capacitor
(C) pure resistor
(D*) combination of an inductor and capacitor

Sol. **ABD**
Instantaneous current is zero when the intantaneous voltage is maximum.
mean Resistance = 0

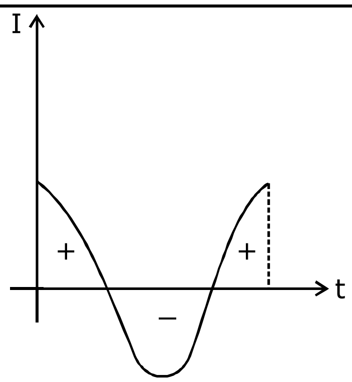
4. An inductor-coil having some resistance is connected to an AC source. Which of the following quantities have zero average value over cycle ?
(A*) current
(B*) induced emf in the inductor
(C) Joule heat
(D) magnetic energy stored in the inductor

Sol. **AB**
$I = I_0 \sin wt$





average value of current over a cycle = 0
$V = v_0 \cos wt = v_0 \sin (wt + p/2)$



average value of induced emf in inductor over a cycle = 0

5. The AC voltage across a resistance can be measured using
(A) a potentiometer (B*) a hot-wire voltmeter
(C) a moving-coil galvarometer (D) a moving-magnet galvarometer

Sol. **B**
The AC voltae across a resistance can be measured using a hot-wore voltmeter.

6. To convert machanical energy into electrical energy, one can use
(A*) DC dynamo (B*) AC dynamo (C) motor (D) transformer

Sol. **AB**
DC dynamo or AC dynamo use to convert mechanical Energy into electrical energy.

7. An AC source rated 100 V (rms) supplies a current of 10 A (rms) to a circuit. The average power delivered by the source
(A) must be 1000 W (B*) may be 1000 W
(C) may be greater than 1000 W (D*) may be less than 1000 W

Sol. **BD**
Average power $P_{av} = V_{rms} I_{rms} \cos f$
$= 100 \times 10 \cos f$
$P_{av} = 1000 \cos f$
$\therefore \cos\phi$ lies "o to 1" $\Rightarrow 0 \le P_{av} \le 1000$