QUIZ – ANSWER KEY

QUIZ NO: 106

TOPIC: ELECTRICAL ENGINEERING

DATE: 06/09/2022

1. A sine wave has a frequency of 50 Hz. Its angular frequency is _____radian/second ?

   [A] 100 π

   [B] 50 π

   [C] 25 π

   [D] 5 π

   Answer: A

   Explanation:-

   The relation between angular velocity and frequency is given as

   ω = 2πf rad/sec

   ω = 2xπx50

   = 100π

2. The reactance offered by a capacitor to alternating current of frequency 50 Hz is 20 Ω.

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If frequency is increased to 100 Hz, reactance becomes_____ohms ?

[A] 5

[B] 11

[C] 10

[D] 15

Answer: C

Explanation:-
Capacitive reactance

$Xc = 1/2\pi f$

Therefore $X_{C1}/X_{C2} = 2\pi f_2/2\pi f_1$

$= 20/X_{C2} = 100/50$

$= X_{C2} = 10$

3. If two sinusoids of the same frequency but of different amplitudes and phase angles are subtracted, the resultant is ?

[A] A sinusoid of the same frequency

[B] A sinusoid of half the original frequency

[C] A sinusoid of double the frequency

[D] Not a sinusoid

Answer: A

Explanation:-

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- Adding two sinusoids of the same frequency but with possibly different amplitudes and phases, produces another sinusoid at that frequency.
- When alternating waveforms have the same frequency but different phase, they are said to be "Out of phase".

The equation of A.C sin wave is given as:

$V_{st} = Asin(\omega \times t)$

$V_{st} = Asin(2\pi ft)$

Where Vs is the A.C signal voltage with the peak amplitude of "A" volts

Let us take an example

Suppose we add the two sinusoidal with amplitude of A and B but having the same frequencies the equation can be written as

$Vt = V_{1t} + V_{2t}$

$= Asin(\omega \times t) + Bsin(\omega \times t)$

$= (A + B) sin(\omega \times t)$

Hence the amplitude is added up but the frequency remains same.
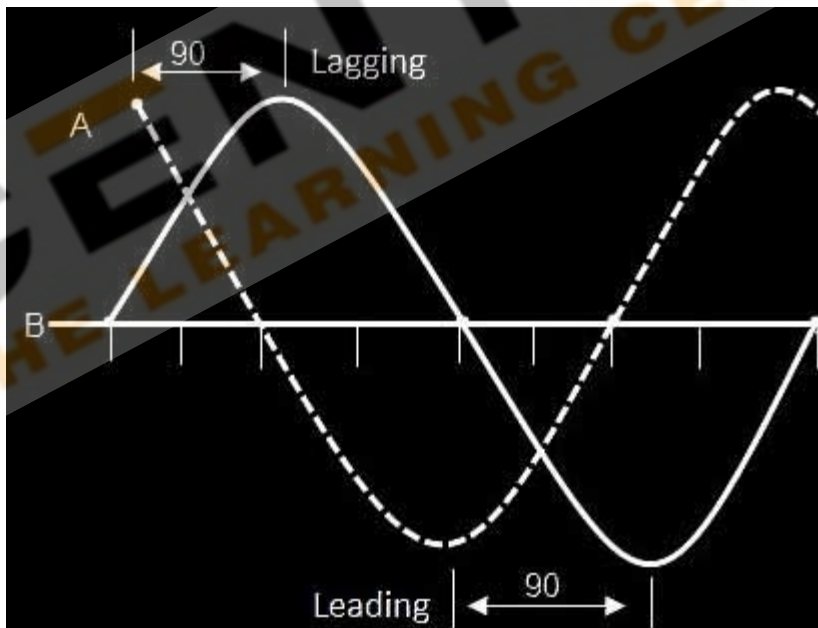
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4. If two sine waves of the same frequency have a phase difference of π radians, then ?

   [A] Both will reach their minimum values at the same instant

   [B] Both will reach their maximum values at the same instant

   [C] When one wave reaches its maximum value, the other will reach its minimum value

   [D] None of the above

   Answer: C

   Explanation:-

   If the phase difference is 180 degrees (π radians), then the two sine waves are said to be in **antiphase or Phase opposition** i.e if one wave reaches its maximum value, then other will reach its minimum value.

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5. A current of 4 Amp through a coil of 1000 turns produces a magnetic flux of 400 lines. The self-inductance of the coil is ?

      [A] 0.1 mH

      [B] 100 mH

      [C] 1 mH

      [D] 0.001 mH

Answer: C

Explanation:-

Self-Inductance is given as

L = NΦ/I

$$L = \frac{N\phi}{I} = \frac{1000 \times 400 \times 10^{-8}}{4} = 1 \times 10^{-3} \text{ H} = \textbf{1 mH}$$

6. The r.m.s. value of alternating current is given by steady (D.C.) current which when flowing through a given circuit for a given time produces ?

      [A] The more heat than produced by A.C. when flowing through the same circuit

      [B] The same heat as produced by A.C. when flowing through the same circuit

      [C] The less heat than produced by A.C. flowing through the same circuit

      [D] None of the above

Answer: B

Explanation:-

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The term "RMS" stands for "Root-Mean-Squared". Most books define this as the "amount of AC power that produces the same heating effect as an equivalent DC power".

7. The square waveform of current has following relation between r.m.s. value and average value ?

    [A] R.M.S value is equal to average value

    [B] R.M.S value of current is greater than average value

    [C] R.M.S value of current is less than average value

    [D] None of the above

Answer: A

Explanation:-

The R.M.S value of Square wave is given as

$$V_{rms} = \sqrt{\frac{1}{\frac{\pi}{2}} \int_{0}^{\frac{\pi}{2}} V^2 pk. \, d\theta}$$

$$= \sqrt{\frac{2}{\pi} V^2 pk. \, \theta \Big|_{0}^{\frac{\pi}{2}}}$$

$$= \sqrt{\frac{2}{\pi} V^2 pk. \left[\frac{\pi}{2} - 0 \right]}$$

$$= \sqrt{V^2 pk} = Vpk$$

The Average value of square wave is given as

$$Vavg = \frac{1}{\frac{\pi}{2}} \int_{0}^{\frac{\pi}{2}} Vpk.\, d\theta$$

$$Vavg = \frac{2}{\pi} [Vpk.\, \theta]_{2}^{0}$$

$$Vavg = \frac{2}{\pi} Vpk. \left[\frac{\pi}{2} - 0\right]$$

$$Vavg = Vpk$$

Hence in case of square wave, the R.M.S voltage and Average Voltage is equal to peak voltage

8. Time constant of an inductive circuit ?

   [A] Increases with increase of inductance and decrease of resistance
   [B] Increases with the increase of inductance and the increase of resistance
   [C] Increases with decrease of inductance and decrease of resistance
   [D] Increases with decrease of inductance and increase of resistance

   Answer: A

   Explanation:-

   - The ratio L/R is called as the time constant of the inductive circuit and gives the time in the seconds required for the circuit to rise to 63.2% of its maximum value.

   - Hence the time constant of the inductive circuit is directly proportional to the inductance and inversely proportional to the resistance.

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9. Power factor of an inductive circuit is usually improved by connecting capacitor to it in ?

    [A] Parallel

    [B] Series

    [C] Either 1 or 2

    [D] None of the above

Answer: A

Explanation:-

In the industry, inductive loads draw a lagging current which in turn increases the amount of reactive power. In this case, the KVA rating of the transformer and the size of the conductor should be increased to carry out the additional reactive power. Generally. Capacitors are connected in parallel with the load to improve the low power factor by increasing the power factor value. Capacitor draws leading current and partially or completely neutralizes the lagging reactive power of the load.

For further detail check the explanation of question number 26.

10. The mutual inductance between two unity coupled coil of 9H and 4H is ?

    [A] 50 H

    [B] 13 H

    [C] 2.2 H

    [D] 6 H

Answer: D

Explanation:-

Mutual inductance between two coils is

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$M = \sqrt{L_1 L_2}$

$M = \sqrt{9 \times 4}$

$M = 6$