K S ACADEMY, SALEM

PG TRB, POLY TRB, UG TRB & AP TRB - COACHING CENTRE FOR PHYSICS

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UG TRB PHYSICS

UNIT:9 - Alternating Current Slip Test

Mark:40 Time: 1Hr

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1. In a parallel circuit, we consider_____ instead of impedance.

a) Resistance

b) Capacitance

c) Inductance

d) Admittance

Answer: d)

Explanation: In a parallel circuit, we consider admittance instead of impedance, whereadmittance is the reciprocal of impedance.

2. The frequency for which a 5 μF capacitor has a reactance of $\frac{1}{1000} ohm$ is given by

a) $\frac{100}{\pi} MHz$

b) $\frac{1000}{\pi} Hz$

c) $\frac{1}{1000} Hz$

d) 1000 Hz

Answer: a)

Explanation:

$$X_C = \frac{1}{2\pi v C} \Rightarrow \frac{1}{1000} = \frac{1}{2\pi \times v \times 5 \times 10^{-6}}$$

$$\Rightarrow v = \frac{100}{\pi} MHz$$

3. A capacitor is a perfect insulator for
a) Alternating currents
b) Direct currents
c) Both ac and dc
d) None of these

Answer: b)

Explanation:

$X_C = \frac{1}{\omega C} = \frac{1}{2\pi v C}$; For dc $v = 0, \therefore X_C = \infty$

4. The quality factor of R-L-C circuit will increase if

a) R increases

b) R decreases

c) Impedance increases

d) Voltage increases

Answer: b) R decreases

5. Under which of the following condition the current in the inductor lags the voltage in a series RLC circuit

a) Above

b) Below

c) Equal to

d) Depends on the circuit

Answer: a)

Explanation: The current in the inductor lags the voltage in a series RLC circuit if a circuit is inductive dominant i.e. if XL > XC $\omega L > 1/\omega C \Rightarrow \omega > 1/\sqrt{LC} \Rightarrow \omega > \omega 0$. So, the current in the inductor lags the voltage in a series RLC circuit above the resonantfrequency.

6. Higher the Q of a series circuit, narrower its

a) Passband

b) Resonance curve

c) Bandwidth

d) All of these

Answer: d) All of these

7. Alternating current cannot be measured by dc ammeter because

a) ac cannot pass through dc ammeter
b) Average value of complete cycle is zero
c) ac is virtual
d) ac changes its direction

Answer b)

Explanation: In dc ammeter, a coil is free to rotate in the magnetic field of a fixed magnet. If an alternating current is passed through such a coil, the torque will reverse it's direction each time the current changes direction and the average value of the torque will be zero.

8. The root mean square value of the alternating current is equal to
a) Twice the peak value
b) Half the peak value
c) $\frac{1}{\sqrt{2}}$ times the peak value
d) Equal to the peak value

Answer: c)

9. In general in an alternating current circuit
a) The average value of current is zero
b) The average value of square of the current is zero
c) Average power dissipation is zero
d) The phase difference between voltage and current is zero

Answer: a)

10. The voltage of domestic ac is 230 volt. What does this represent

a) Mean voltage
b) Peak voltage
c) Root mean voltage
d) Root mean square voltage

Answer: d)

11. An alternating current is given by the equation $i = i_1 \cos \omega t + i_2 \sin \omega t$ The r.m.s. current is given by

a) $\frac{1}{\sqrt{2}}(i_1 + i_2)$

b) $\frac{1}{\sqrt{2}}(i_1 + i_2)^2$

c) $\frac{1}{\sqrt{2}}\left(i_i^2 + i_2^2\right)^{\frac{1}{2}}$

d) $\frac{1}{2}\left(i_i^2 + i_2^2\right)^{\frac{1}{2}}$

Answer: c) $i_{rms} = \sqrt{\frac{i_1^2 + i_1^2}{2}} = \frac{1}{\sqrt{2}}(i_1^2 + i_2^2)^{1/2}$

12. In an ac circuit, the r.m.s. value of current, I_{rms} is related to the peak current, I by the relation

a) $I_{rms} = \frac{1}{\pi} I_0$

b) $I_{rms} = \frac{1}{\sqrt{2}} I_0$

c) $I_{rms} = \sqrt{2} I_0$

d) $I_{rms} = \pi I_0$

Answer: b)

13. Choke coil works on the principle of

a) Transient current
b) Self induction
c) Mutual induction
d) Wattless current

Answer: b)

14. A choke coil has
a) High inductance and low resistance
b) Low inductance and high resistance
c) High inductance and high resistance
d) Low inductance and low resistance

Answer: a)

15. Choke coil is used to control
a) ac
b) dc
c) Both ac and dc
d) Neither ac nor dc
Answer: a)
Explanation: The choke coil can be used only in ac circuits, not in dc circuits, because for dc ($\omega = 0$) the inductive reactance of the coil is zero, only the resistance of the coil remains effective which too is almost zero.

16. Current in the circuit is wattless, if
a) Inductance in the circuit is zero
b) Resistance in the circuit is zero
c) Current is alternating
d) Resistance and inductance both are zero
Answer: b)
Explanation: Because power = i^2R, if $R = 0$, then $P = 0$

17. A choke coil is preferred to a rheostat in ac circuit as
a) It consumes almost zero power
b) It increases current
c) It increases power
d) It increases voltage

Answer: a)
Explanation: A choke coil contains high inductance but negligible resistance, due to which power loss becomes appreciably small.

18. The average power dissipated in a pure inductor of inductance L when an ac current is passing through it, is

a) $\frac{1}{2}Li^2$

b) $\frac{1}{4}Li^2$

c) $2Li^2$

d) zero

Answer: d)

19. For a purely resistive circuit the following statement is in correct

a) Work done is zero

b) Power consumed is zero

c) Heat produced is zero

d) Power factor is unity

Answer: d) Power factor is unity

20. In an ac circuit containing inductance only, the current

a) Leads the e.m.f. by 90°

b) Lags behind the e.m.f. by 90°

c) Sometimes leads and sometime lags behind the e.m.f.

d) Is in phase with the e.m.f.

Answer: b)

21. For high frequency, a capacitor offers

a) More reactance

b) Less reactance

c) Zero reactance

d) Infinite reactance

Answer: b)

$$X_C = \frac{1}{\omega C} = \frac{1}{2\pi\nu C} \Rightarrow X_C \propto \frac{1}{\nu}$$

22. Radio frequency choke uses core of

a) Air

b) Iron

c) Air and iron

d) None of these

Answer: a)

23. The admittance of a system is 10 ohm^{-1}, calculate its impedance.

a) 10 ohm

b) 0.1 ohm

c) 1 ohm

d) 1.1 ohm

Answer: b)

Explanation: $Z = 1/Y = 1/10 \rightarrow Z = 0.1\ ohm.$

24. The power factor at resonance in R-L-C parallel circuit is

a) Zero

b) 0.5 lagging

c) 0.8 leading

d) Unity

Answer: d) Unity

25. The power factor of good choke coil is

a) Nearly zero

b) Exactly zero

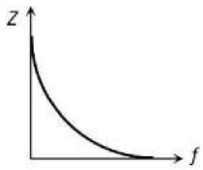
c) Nearly one

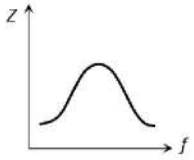
d) Exactly one

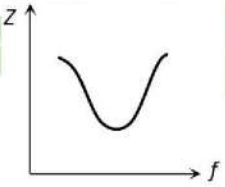
Answer: a)

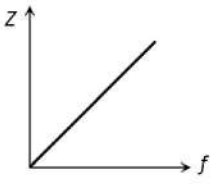
Explanation: $\cos\phi = \frac{R}{Z}$. In choke coil $\phi = 90°$ so $\cos\phi \approx 0$

26. Which one of the following curves represents the variation of impedance (Z) with frequency f in series LCR circuit

a) 

b) 

c) 

d) 

Answer: c)

Explanation:

$$Z = \sqrt{R^2 + \left(2\pi fL - \frac{1}{2\pi fC}\right)^2}$$

From above equation at $f = 0, z = \infty$

When $f = \frac{1}{2\pi\sqrt{LC}}$ (resonant frequency) $\Rightarrow Z = R$

For $f > \frac{1}{2\pi\sqrt{LC}} \Rightarrow Z$ starts increasing

$i.e.$, for frequency $0 - f_r, Z$ decreases and for f_r to ∞, Z increases

This is justified by graph c

27. In a circuit, the current lags behind the voltage by a phase difference of $\pi/2$, the circuit will contain which of the following?

a) Only R

b) Only C

c) R and C

d) Only L

Answer: b)

Explanation: When a circuit contains inductance only, then the current lags behind the voltage by the phase difference of $\frac{\pi}{2}$ or 90°. While in a purely capacitive circuit, the current leads the voltage by a phase angle of $\frac{\pi}{2}$ or 90°. In a purely resistive circuit current is in phase with the applied voltage.

28. In a circuit, the value of the alternating current is measured by hot wire ammeter as
10 $ampere$. Its peak value will be

a) 10 A

b) 20 A

c) 14.14 A

d) 7.07 A

Answer: c)

29. Hot wire ammeter reads rms value of current. Hence its peak value $= i_{rms} \times \sqrt{2} = 14.14\ amp$ Power dissipated in an LCR series circuit connected to an a.c. source of emf E is

a) $\frac{E^2 R}{\left[R^2+\left(\omega L-\frac{1}{\omega C}\right)^2\right]}$

b) $\frac{E^2\sqrt{R^2+\left(L\omega-\frac{1}{C\omega}\right)^2}}{R}$

c) $\frac{\left[R^2+\left(\omega L-\frac{1}{\omega C}\right)^2\right]}{R}$

d) $\frac{E^2R}{\sqrt{R^2+\left(L\omega-\frac{1}{C\omega}\right)^2}}$

Answer: a)

Explanation:

$$P = E_{rms}\, i_{rms} \cos\phi = \frac{E^2R}{Z^2} = \frac{E^2R}{\left[R^2+\left(\omega L-\frac{1}{\omega C}\right)^2\right]}$$

30. A resistor of R=6Ω, an inductor of L = 1 H and a capacitor of C=17.36 μF are connected in series with an AC source. The Q – factor is

a) 3.72

b) 40

c) 2.37

d) 80

Answer: b)

Explanation:

$$Q - \text{factor} = \frac{1}{R}\sqrt{\frac{L}{C}} = \frac{1}{6}\sqrt{\frac{1}{17.36\times10^{-6}}} = 40$$

31. In a series RLC circuit, the phase difference between the current in the capacitor and the current in the resistor is

a) 0°

b) 90°

c) 180°

d) 360°

Answer: a)

Explanation: In a series RLC circuit, the phase difference between the current in the capacitorand the current in the resistor is 0° because same current flows in the capacitor as well as the resistor.

32. The natural frequency (ω_0) of oscillations in L - C circuit is given by

a) $\frac{1}{2\pi}\frac{1}{\sqrt{LC}}$

b) $\frac{1}{2\pi}\sqrt{LC}$

c) $\frac{1}{\sqrt{LC}}$

d) $\sqrt{LC}$

Answer: a)

Explanation:

Natural frequency is nothing but resonant frequency.

In this case $X_L = X_C$

$$\Rightarrow \quad \omega_0 L = \frac{1}{\omega_0 C}$$

$$\Rightarrow \quad \omega_0^2 = \frac{1}{LC}$$

$$\Rightarrow \quad \omega_0 = \frac{1}{\sqrt{LC}}$$

$$\Rightarrow \quad 2\pi f = \frac{1}{\sqrt{LC}}$$

$$\Rightarrow \quad f = \frac{1}{2\pi\sqrt{LC}}$$

33. A resistor 30 Ω, inductor of reactance 10 Ω and capacitor of reactance 10 Ω are connected in series to an AC voltage source $e = 300\sqrt{2}\sin(\omega t)$. The current in the circuit is

a) $10\sqrt{2}$ A

b) 10 A

c) $30\sqrt{11}$ A

d) $\frac{30}{\sqrt{11}}$ A

Answer: b)

Explanation:

$e = 300\sqrt{2}\sin\omega t$

$$I_0 = \frac{e_0}{Z} = \frac{300\sqrt{2}}{\sqrt{(30)^2 + (10-10)^2}}$$

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

$$= \frac{300\sqrt{2}}{30} = 10\sqrt{2}\ \text{A}$$

$\therefore$ Current $I = \frac{I_0}{\sqrt{2}} = 10$ A

34. Q-factor of a parallel resonant circuit is

A) $2\pi \times \frac{f_r}{\text{bandwidth}}$

b) $2\pi \times \frac{\text{maximum stored energy}}{\text{energy dissipated per cycle}}$

c) $\frac{1}{2\pi} \times \frac{\text{maximum stored energy}}{\text{energy dissipated per cycle}}$

d) $\frac{1}{2\pi} \times \frac{f_r}{\text{bandwidth}}$

Answer: b)

Explanation:

$$\text{Q} - \text{factor} = 2\pi \times \frac{\text{maximum stored energy}}{\text{energy dissipated per cycle}}$$

35. A lamp consumes only 50% of peak power in an a.c. circuit. What is the phase difference between the applied voltage and the circuit current

a) $\frac{\pi}{6}$

b) $\frac{\pi}{3}$

c) $\frac{\pi}{4}$

d) $\frac{\pi}{2}$

Answer: b)

$$P = \frac{1}{2}V_0 i_0 \cos\phi \Rightarrow P = P_{Peak}.\cos\phi$$

36. In an LCR series resonant circuit which one of the following cannot be the expression for the Q-factor

a) $\frac{\omega L}{R}$

b) $\frac{1}{\omega CR}$

c) $\sqrt{\frac{L}{C}}\frac{1}{R}$

d) $\frac{R}{LC}$

Answer: d)

37. In a purely resistive, the average power Pav is _____ the peak power P_{max}

a) Double

b) One-half of

c) One-fourth

d) Equal to

Answer: b) One-half of

38. The peak value of an alternating current is 5 A and its frequency is 60 Hz. Its rms value is

a) 5.507A

b) 3.536 A

c) 6.07 A

d) 2.536 A

Answer: a)

Explanation:

$$i_{rms} = \frac{i_0}{\sqrt{2}} = \frac{5}{\sqrt{2}} = 3.536\ \text{A}$$

39. In a pure resistive circuit

a) Current lags behind the voltage by 90°

b) Current leads the voltage by 90°

c) Current can lead or lag the voltage by 90°

d) Current is in phase with the voltage

Answer: d) Current is in phase with the voltage

40. A resistance of Ω and an inductance of $\frac{1}{\pi}$ henry is connected in series to a ac voltage of 20 volts and 200 Hz frequency. The phase angle between the voltage and current is

a) $\tan^{-1}\frac{4}{3}$

b) $\tan^{-1}\frac{3}{4}$

c) $\tan^{-1}\frac{3}{2}$

d) $\tan^{-1}\frac{2}{5}$

Answer: a)

Explanation:

Phase angle, $\tan \emptyset = \frac{\omega L}{R} = \frac{2\pi \times 200}{300} \times \frac{1}{\pi} = \frac{4}{3}$, $\emptyset = \tan^{-1}\frac{4}{3}$

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