Amateur Extra – The Right Answers

Chapter Four – Electrical Principles

E5C11. What do the two numbers that are used to define a point on a graph using rectangular coordinates represent?

The coordinate values along the horizontal and vertical axes

E3A15. What is an electromagnetic wave?

A wave consisting of an electric field and a magnetic field oscillating at right angles to each other

E3A16. Which of the following best describes electromagnetic waves traveling in free space?

Changing electric and magnetic fields propagate the energy

E3A17. What is meant by circularly polarized electromagnetic waves?

Waves with a rotating electric field

E5D08. What type of energy is stored in an electromagnetic or electrostatic field?

Potential energy

E4B15. Which of the following can be used as a relative measurement of the Q for a series-tuned circuit?

The bandwidth of the circuit's frequency response

E5A01. What can cause the voltage across reactances in series to be larger than the voltage applied to them?

Resonance

E5A02. What is resonance in an electrical circuit?

The frequency at which the capacitive reactance equals the inductive reactance

E5A03. What is the magnitude of the impedance of a series RLC circuit at resonance?

Approximately equal to circuit resistance

E5A04. What is the magnitude of the impedance of a circuit with a resistor, an inductor and a capacitor all in parallel, at resonance?

Approximately equal to circuit resistance

E5A05. What is the magnitude of the current at the input of a series RLC circuit as the frequency goes through resonance?

Maximum

E5A06. What is the magnitude of the circulating current within the components of a parallel LC circuit at resonance?

It is at a maximum

E5A07. What is the magnitude of the current at the input of a parallel RLC circuit at resonance?

Minimum

E5A08. What is the phase relationship between the current through and the voltage across a series resonant circuit at resonance?

The voltage and current are in phase

E5A09. How is the Q of an RLC parallel resonant circuit calculated?

Resistance divided by the reactance of either the inductance or capacitance

E5A10. How is the Q of an RLC series resonant circuit calculated?

Reactance of either the inductance or capacitance divided by the resistance

E5A11. What is the half-power bandwidth of a parallel resonant circuit that has a resonant frequency of 7.1 MHz and a Q of 150?

47.3 kHz

E5A12. What is the half-power bandwidth of a parallel resonant circuit that has a resonant frequency of 3.7 MHz and a Q of 118?

31.4 kHz

E5A13. What is an effect of increasing Q in a resonant circuit?

Internal voltages and circulating currents increase

E5A14. What is the resonant frequency of a series RLC circuit if R is 22 ohms, L is 50 microhenries and C is 40 picofarads?

3.56 MHz

E5A15. Which of the following can increase Q for inductors and capacitors?

Lower losses

E5A16. What is the resonant frequency of a parallel RLC circuit if R is 33 ohms, L is 50 microhenriess and C is 10 picofarads?

7.12 MHz

E5A17. What is the result of increasing the Q of an impedance-matching circuit?

Matching bandwidth is decreased

E5B01. What is the term for the time required for the capacitor in an RC circuit to be charged to 63.2% of the applied voltage?

One time constant

E5B02. What is the term for the time it takes for a charged capacitor in an RC circuit to discharge to 36.8% of its initial voltage?

One time constant

E5B03. What happens to the phase angle of a reactance when it is converted to a susceptance?

The sign is reversed

E5B04. What is the time constant of a circuit having two 220-microfarad capacitors and two 1-megohm resistors, all in parallel?

220 seconds

E5B05. What happens to the magnitude of a reactance when it is converted to a susceptance?

The magnitude of the susceptance is the reciprocal of the magnitude of the reactance

E5B06. What is susceptance?

The inverse of reactance

E5B07. What is the phase angle between the voltage across and the current through a series RLC circuit if XC is 500 ohms, R is 1 kilohm, and XL is 250 ohms?

14.0 degrees with the voltage lagging the current

E5B08. What is the phase angle between the voltage across and the current through a series RLC circuit if XC is 100 ohms, R is 100 ohms, and XL is 75 ohms?

14 degrees with the voltage lagging the current

E5B09. What is the relationship between the current through a capacitor and the voltage across a capacitor?

Current leads voltage by 90 degrees

E5B10. What is the relationship between the current through an inductor and the voltage across an inductor?

Voltage leads current by 90 degrees

E5B11. What is the phase angle between the voltage across and the current through a series RLC circuit if XC is 25 ohms, R is 100 ohms, and XL is 50 ohms?

14 degrees with the voltage leading the current

E5B12. What is admittance?

The inverse of impedance

E5B13. What letter is commonly used to represent susceptance?

B

E5C01. Which of the following represents a capacitive reactance in rectangular notation?

-jX

E5C02. How are impedances described in polar coordinates?

By phase angle and amplitude

E5C03. Which of the following represents an inductive reactance in polar coordinates?

A positive phase angle

E5C04. Which of the following represents a capacitive reactance in polar coordinates?

A negative phase angle

E5C05. What is the name of the diagram used to show the phase relationship between impedances at a given frequency?

Phasor diagram

E5C06. What does the impedance 50 - j25 represent?

50 ohms resistance in series with 25 ohms capacitive reactance

E5C07. What is a vector?

A quantity with both magnitude and an angular component

E5C08. What coordinate system is often used to display the phase angle of a circuit containing resistance, inductive and/or capacitive reactance?

Polar coordinates

E5C09. When using rectangular coordinates to graph the impedance of a circuit, what does the horizontal axis represent?

Resistive component

E5C10. When using rectangular coordinates to graph the impedance of a circuit, what does the vertical axis represent?

Reactive component

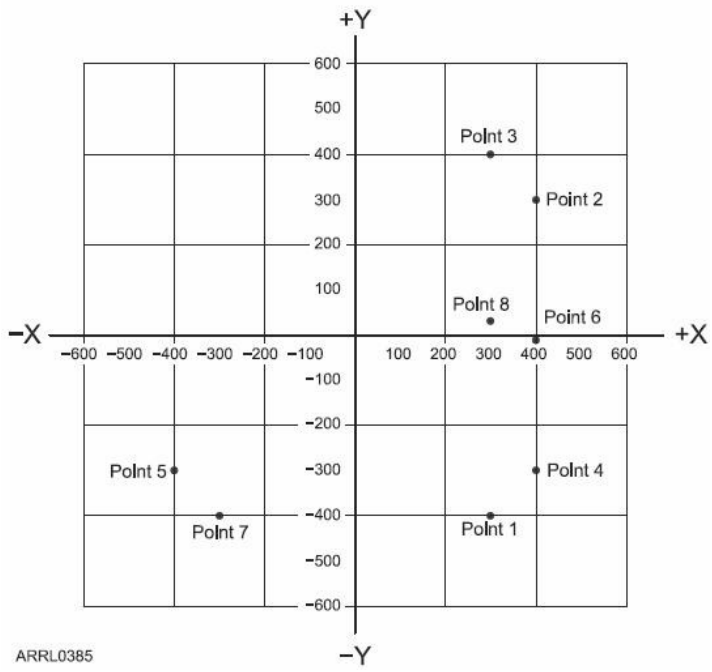
E5C12. If you plot the impedance of a circuit using the rectangular coordinate system and find the impedance point falls on the right side of the graph on the horizontal axis, what do you know about the circuit?

It is equivalent to a pure resistance

E5C13. What coordinate system is often used to display the resistive, inductive, and/or capacitive reactance components of an impedance?

Rectangular coordinates

Figure E5-2



E5C14. Which point on Figure E5-2 best represents that impedance of a series circuit consisting of a 400 ohm resistor and a 38 picofarad capacitor at 14 MHz?

Point 4

E5C15. Which point in Figure E5-2 best represents the impedance of a series circuit consisting of a 300 ohm resistor and an 18 microhenry inductor at 3.505 MHz?

Point 3

E5C16. Which point on Figure E5-2 best represents the impedance of a series circuit consisting of a 300 ohm resistor and a 19 picofarad capacitor at 21.200 MHz?

Point 1

E5C17. Which point on Figure E5-2 best represents the impedance of a series circuit consisting of a 300-ohm resistor, a 0.64-microhenry inductor and an 85-picofarad capacitor at 24.900 MHz?

Point 8

E5D01. What is the result of skin effect?

As frequency increases, RF current flows in a thinner layer of the conductor, closer to the surface

E5D02. Why is it important to keep lead lengths short for components used in circuits for VHF and above?

To avoid unwanted inductive reactance

E5D04. Why are short connections necessary at microwave frequencies?

To reduce phase shift along the connection

E5D05. Which parasitic characteristic increases with conductor length?

Inductance

E5D06. In what direction is the magnetic field oriented about a conductor in relation to the direction of electron flow?

In a direction determined by the left-hand rule

E5D07. What determines the strength of the magnetic field around a conductor?

The amount of current flowing through the conductor

E5D09. What happens to reactive power in an AC circuit that has both ideal inductors and ideal capacitors?

It is repeatedly exchanged between the associated magnetic and electric fields, but is not dissipated

E5D10. How can the true power be determined in an AC circuit where the voltage and current are out of phase?

By multiplying the apparent power times the power factor

E5D11. What is the power factor of an R-L circuit having a 60 degree phase angle between the voltage and the current?

0.5

E5D12. How many watts are consumed in a circuit having a power factor of 0.2 if the input is 100 VAC at 4 amperes?

80 watts

E5D13. How much power is consumed in a circuit consisting of a 100 ohm resistor in series with a 100 ohm inductive reactance drawing 1 ampere?

100 watts

E5D14. What is reactive power?

Wattless, nonproductive power

E5D15. What is the power factor of an R-L circuit having a 45 degree phase angle between the voltage and the current?

0.707

E5D16. What is the power factor of an R-L circuit having a 30 degree phase angle between the voltage and the current?

0.866

E5D17. How many watts are consumed in a circuit having a power factor of 0.6 if the input is 200 VAC at 5 amperes?

600 watts

E5D18. How many watts are consumed in a circuit having a power factor of 0.71 if the apparent power is 500 VA?

355 W

E6D01. How many turns will be required to produce a 5-microhenry inductor using a powdered-iron toroidal core that has an inductance index (A L) value of 40 microhenries/100 turns-squared?

35 turns

E6D04. Which materials are commonly used as a slug core in a variable inductor?

Ferrite and brass

E6D05. What is one reason for using ferrite cores rather than powdered-iron in an inductor?

Ferrite toroids generally require fewer turns to produce a given inductance value

E6D06. What core material property determines the inductance of a toroidal inductor?

Permeability

E6D07. What is the usable frequency range of inductors that use toroidal cores, assuming a correct selection of core material for the frequency being used?

From less than 20 Hz to approximately 300 MHz

E6D08. What is one reason for using powdered-iron cores rather than ferrite cores in an inductor?

Powdered-iron cores generally maintain their characteristics at higher currents

E6D09. What devices are commonly used as VHF and UHF parasitic suppressors at the input and output terminals of a transistor HF amplifier?

Ferrite beads

E6D10. What is a primary advantage of using a toroidal core instead of a solenoidal core in an inductor?

Toroidal cores confine most of the magnetic field within the core material

E6D11. How many turns will be required to produce a 1-mH inductor using a ferrite toroidal core that has an inductance index (A L) value of 523 millihenries/1000 turns-squared?

43 turns

E6D12. What is the definition of saturation in a ferrite core inductor?

The ability of the inductor's core to store magnetic energy is exceeded

E6D13. What is the primary cause of inductor self-resonance?

Inter-turn capacitance

E6D14. Which type of slug material decreases inductance when inserted into a coil?

Brass

E6D15. What is current in the primary winding of a transformer called if no load is attached to the secondary?

Magnetizing current

E6D17. Why should core saturation of a conventional impedance matching transformer be avoided?

Harmonics and distortion could result

E6E02. Which of the following device packages is a through-hole type?

DIP

E6E09. Which of the following component package types would be most suitable for use at frequencies above the HF range?

Surface-mount

E6E10. What is the packaging technique in which leadless components are soldered directly to circuit boards?

Surface mount

E6E11. What is a characteristic of DIP packaging used for integrated circuits?

A total of two rows of connecting pins placed on opposite sides of the package (Dual In-line Package)

E6E12. Why are high-power RF amplifier ICs and transistors sometimes mounted in ceramic packages?

Better dissipation of heat