SUBELEMENT T1 – FCC Rules, descriptions, and definitions for the Amateur Radio Service, operator and station license responsibilities - [6 Exam Questions - 6 Groups]

2018-2022

T1B - Authorized frequencies: frequency allocations; ITU; emission modes; restricted sub-bands; spectrum sharing; transmissions near band edges; contacting the International Space Station; power output.

T1B03 [97.301(a)]: Which frequency is within the 6 meter amateur band?

300 million meters per second / ? meters per cycle = ? million cycles per second (million hertz)

300 / 6 meters (per cycle) = 50 MHz

(6 meter band is 50.0 – 54.0 MHz)

52.525 MHz - - - - - - - - - - - - (page 7-9)

T1B04 [97.301(a)]: Which amateur band are you using when your station is transmitting on 146.52 MHz?

300 million meters per second / ? million cycles per second (million hertz) = ? meters per cycle

300 / 146.52 (MHz) = 2.04 meters (per cycle)

(2 meter band is 144.0 – 148.0 MHz)

2 meter band - - - - - - - - - - - - (page 7-9)

SUBELEMENT T5 – Electrical principles: math for electronics; electronic principles; Ohm's Law
[4 Exam Questions - 4 Groups]
2018-2022

T5A - Electrical principles, units, and terms: current and voltage; conductors and insulators; alternating and direct current; series and parallel circuits.

T5A01: Electrical current is measured in which of the following units?

Amperes - - - - - - - - - - - - (page 3-1)

T5A02: Electrical power is measured in which of the following units?

Watts - - - - - - - - - - - - - (page 3-7)

T5A03: What is the name for the flow of electrons in an electric circuit?

Current - - - - - - - - - - - - (page 3-1)

T5A04: What is the name for a current that flows only in one direction?

Direct current - - - - - - - - - - - - (page 3-2)

T5A05: What is the electrical term for the electromotive force (EMF) that causes electron flow?

Voltage - - - - - - - - - - - - (page 3-1)

T5A06: How much voltage does a mobile transceiver usually require?

About 12 volts - - - - - - - - - - - - (page 5-16)

T5A07: Which of the following is a good electrical conductor?

Copper - - - - - - - - - - - - (page 3-5)

T5A08: Which of the following is a good electrical insulator?

Glass - - - - - - - - - - - - - (page 3-5)

T5A09: What is the name for a current that reverses direction on a regular basis?

Alternating current - - - - - - - - - - - - (page 3-2)

T5A10: Which term describes the rate at which electrical energy is used?

Power - - - - - - - - - - - - - (page 3-7)

SUBELEMENT T5 – Electrical principles: math for electronics; electronic principles; Ohm's Law
[4 Exam Questions - 4 Groups]
2018-2022

T5A11: What is the basic unit of electromotive force?

The volt - - - - - - - - - - - - (page 3-2)

T5A12: What describes the number of times per second that an alternating current makes a complete cycle?

Frequency - - - - - - - - - - - - (page 2-3)

T5A13: In which type of circuit is current the same through all components?

Series - - - - - - - - - - - - - (page 3-2)

T5A14: In which type of circuit is voltage the same across all components?

Parallel - - - - - - - - - - - - - (page 3-2)

T5B - Math for electronics: conversion of electrical units; decibels; the metric system

T5B01: How many milliamperes is 1.5 amperes?

amperes X 1000 = milliamperes

1.5 amperes X 1000 = 1,500 milliampers

1,500 milliamperes - - - - - - - - - - - - (page 2-2)

T5B02: What is another way to specify a radio signal frequency of 1,500,000 hertz?

hertz ÷ 1000 = kiloHertz

1,500,000 hertz ÷ 1000 = 1,500.000 kilohertz

1500 kHz - - - - - - - - - - - - (page 2-2)

T5B03: How many volts are equal to one kilovolt?

kilovolt X 1000 = volts

1.000 kilovolt X 1000 = 1,000.000 volts

One thousand volts - - - - - - - - - - - - (page 2-2)

T5B04: How many volts are equal to one microvolt?

microvolt ÷ 1,000,000 = volts

1. microvolt ÷ 1,000,000 = 0.0000001 volts

One one-millionth of a volt - - - - - - - - - - - - (page 2-2)

SUBELEMENT T5 – Electrical principles: math for electronics; electronic principles; Ohm's Law
[4 Exam Questions - 4 Groups]
2018-2022

T5B05: Which of the following is equivalent to 500 milliwatts?

milliwatts ÷ 1000 = watts

500. milliwatts ÷ 1000 = 0.500 watts

0.5 watts - - - - - - - - - - - - (page 2-2)

T5B06: If an ammeter calibrated in amperes is used to measure a 3000-milliampere current, what reading would it show?

milliamperes ÷ 1000 = amperes

3,000. milliamperes ÷ 1000 = 3.000 amperes

3 amperes - - - - - - - - - - - - (page 2-2)

T5B07: If a frequency readout calibrated in megahertz shows a reading of 3.525 MHz, what would it show if it were calibrated in kilohertz?

megahertz X 1000 = kilohertz

3.525 megahertz X 1000 = 3,525.000 kilohertz

3525 kHz - - - - - - - - - - - - (page 2-2)

T5B08: How many microfarads are 1,000,000 picofarads?

picofarads ÷ 1,000,000 = microfarads

1,000,000. picofarads ÷ 1,000,000 = 1.000000 microfarads

1 microfarad - - - - - - - - - - - - (page 2-2)

T5B09: What is the approximate amount of change, measured in decibels (dB), of a power increase from 5 watts to 10 watts?

Power DB = 10 * LOG (Change)

Change = (to watts / from watts) = (10 watts / 5 watts) = 2

Power DB = 10 * LOG (2) = 10 * 0.3010299957 = 3.010299957

(Rule: If power doubles or halves, it changes by ± 3 dB)

3 dB - - - - - - - - - - - - (page 4-8)

T5B10: What is the approximate amount of change, measured in decibels (dB), of a power decrease from 12 watts to 3 watts?

Power DB = 10 * LOG (Change)

Change = (to watts / from watts) = (3 watts / 12 watts) = 0.25

Power DB = 10 * LOG (0.25) = 10 * -0.6020599913 = -6.020599913

(Rule: If power quadruples or fourths, it changes by ± 6 dB)

-6 dB - - - - - - - - - - - - - (page 4-8)

T5B11: What is the amount of change, measured in decibels (dB), of a power increase from 20 watts to 200 watts?

Power DB = 10 * LOG (Change)

Change = (to watts / from watts) = (200 watts / 20 watts) = 10

Power DB = 10 * LOG (10) = 10 * 1 = 10

(Rule: If power increase by tens or reduces by tenths, it changes by ± 10 dB)

10 dB - - - - - - - - - - - - - (page 4-8)

T5B12: Which of the following frequencies is equal to 28,400 kHz?

kilohertz ÷ 1000 = megahertz

28,400. kilohertz ÷ 1000 = 28.400 megahertz

28.400 MHz - - - - - - - - - - - - - (page 2-2)

T5B13: If a frequency display shows a reading of 2425 MHz, what frequency is that in GHz?

Megahertz ÷ 1000 = gigahertz

2,425. megahertz ÷ 1000 = 2.425 gigahertz

2.425 GHz - - - - - - - - - - - - - (page 2-2)

T5C - Electronic principles: capacitance; inductance; current flow in circuits; alternating current; definition of RF; definition of polarity; DC power calculations; impedance

T5C01: What is the ability to store energy in an electric field called?

Capacitance - - - - - - - - - - - - - (page 3-9)

T5C02: What is the basic unit of capacitance?

The farad - - - - - - - - - - - - - (page 3-9)

T5C03: What is the ability to store energy in a magnetic field called?

Inductance - - - - - - - - - - - - (page 3-9)

T5C04: What is the basic unit of inductance?

The henry - - - - - - - - - - - - (page 3-9)

T5C05: What is the unit of frequency?

Hertz - - - - - - - - - - - - (page 2-3)

T5C06: What does the abbreviation "RF" refer to?

Radio frequency signals of all types - - - - - - - - (page 2-4)

T5C07: A radio wave is made up of what type of energy?

Electromagnetic - - - - - - - - - - - - (page 4-6)

T5C08: What is the formula used to calculate electrical power in a DC circuit?

$$\frac{P}{E \mid I}$$

$P = E * I$
$E = P \div I$
$I = P \div E$

$$P = E * I$$

Power (P) equals voltage (E) multiplied by current (I) - - - - - - (page 3-7)

T5C09: How much power is being used in a circuit when the applied voltage is 13.8 volts DC and the current is 10 amperes?

$$\frac{P}{E \mid I}$$

$P = E * I$

$$P = E * I = 13.8 \text{ volts} * 10.0 \text{ amperes} = 138.00 \text{ watts}$$

138 watts - - - - - - - - - - - - (page 3-7)

T5C10: How much power is being used in a circuit when the applied voltage is 12 volts DC and the current is 2.5 amperes?

$$\frac{P}{E \mid I}$$

$P = E * I$

$$P = E * I = 12.0 \text{ volts} * 2.5 \text{ amperes} = 30.0 \text{ watts}$$

30 watts - - - - - - - - - - - - (page 3-7)

SUBELEMENT T5 – Electrical principles: math for electronics; electronic principles; Ohm's Law
[4 Exam Questions - 4 Groups]
2018-2022

T5C11: How many amperes are flowing in a circuit when the applied voltage is 12 volts DC and the load is 120 watts?

$$\frac{P}{E \mid I} \qquad I = P \div E$$

$$I = P \div E = 120 \text{ watts} \div 12 \text{ volts} = 10 \text{ amperes}$$

10 amperes - - - - - - - - - - - - (page 3-7)

T5C12: What is impedance?

A measure of the opposition to AC current flow in a circuit - - - - - (page 3-10)

T5C13: What are the units of impedance?

Ohms - - - - - - - - - - - - - (page 3-10)

T5C14: What is the proper abbreviation for megahertz?

MHz - - - - - - - - - - - - - (page 2-3)

T5D – Ohm's Law: formulas and usage; components in series and parallel

T5D01: What formula is used to calculate current in a circuit?

$$\frac{E}{I \mid R} \qquad \begin{array}{l} E = I * R \\ I = E \div R \\ R = E \div I \end{array}$$

$$I = E \div R$$

Current (I) equals voltage (E) divided by resistance (R) (page 3-5)

T5D02: What formula is used to calculate voltage in a circuit?

$$\frac{E}{I \mid R} \qquad \begin{array}{l} E = I * R \\ I = E \div R \\ R = E \div I \end{array}$$

$$E = I * R$$

Voltage (E) equals current (I) multiplied by resistance (R) (page 3-5)

T5D03: What formula is used to calculate resistance in a circuit?

$$\frac{E}{I \mid R} \qquad \begin{array}{l} E = I * R \\ I = E \div R \\ R = E \div I \end{array}$$

$$R = E \div I$$

Resistance (R) equals voltage (E) divided by current (I) (page 3-5)

SUBELEMENT T5 – Electrical principles: math for electronics; electronic principles; Ohm's Law
[4 Exam Questions - 4 Groups]
2018-2022

T5D04: What is the resistance of a circuit in which a current of 3 amperes flows through a resistor connected to 90 volts?

$$\frac{E}{I \mid R} \qquad \begin{aligned} E &= I * R \\ I &= E \div R \\ R &= E \div I \end{aligned}$$

$$R = E \div I = 90 \text{ volts} \div 3 \text{ amperes} = 30 \text{ ohms}$$

30 ohms - - - - - - - - - - - - (page 3-6)

T5D05: What is the resistance in a circuit for which the applied voltage is 12 volts and the current flow is 1.5 amperes?

$$\frac{E}{I \mid R} \qquad \begin{aligned} E &= I * R \\ I &= E \div R \\ R &= E \div I \end{aligned}$$

$$R = E \div I = 12 \text{ volts} \div 1.5 \text{ amperes} = 8 \text{ ohms}$$

8 ohms - - - - - - - - - - - - (page 3-6)

T5D06: What is the resistance of a circuit that draws 4 amperes from a 12-volt source?

$$\frac{E}{I \mid R} \qquad \begin{aligned} E &= I * R \\ I &= E \div R \\ R &= E \div I \end{aligned}$$

$$R = E \div I = 12 \text{ volts} \div 4 \text{ amperes} = 3 \text{ ohms}$$

3 ohms - - - - - - - - - - - - (page 3-6)

T5D07: What is the current in a circuit with an applied voltage of 120 volts and a resistance of 80 ohms?

$$\frac{E}{I \mid R} \qquad \begin{aligned} E &= I * R \\ I &= E \div R \\ R &= E \div I \end{aligned}$$

$$I = E \div R = 120 \text{ volts} \div 80 \text{ ohms} = 1.5 \text{ amperes}$$

1.5 amperes - - - - - - - - - - - - (page 3-6)

T5D08: What is the current flowing through a 100-ohm resistor connected across 200 volts?

$$\frac{E}{I \mid R} \qquad \begin{aligned} E &= I * R \\ I &= E \div R \\ R &= E \div I \end{aligned}$$

$$I = E \div R = 200 \text{ volts} \div 100 \text{ ohm} = 2 \text{ amperes}$$

2 amperes - - - - - - - - - - - - (page 3-6)

T5D09: What is the current through a 24-ohm resistor connected across 240 volts?

$$\frac{E}{I \mid R} \qquad \begin{aligned} E &= I * R \\ I &= E \div R \\ R &= E \div I \end{aligned}$$

$$I = E \div R = 240 \text{ volts} \div 24 \text{ ohms} = 10 \text{ amperes}$$

10 amperes - - - - - - - - - - - - (page 3-6)

T5D10: What is the voltage across a 2-ohm resistor if a current of 0.5 amperes flows through it?

$$\frac{E}{I \mid R} \qquad \begin{aligned} E &= I * R \\ I &= E \div R \\ R &= E \div I \end{aligned}$$

$$E = I * R = 0.5 \text{ amperes} * 2 \text{ ohms} = 1 \text{ volt}$$

1 volt - - - - - - - - - - - - (page 3-6)

T5D11: What is the voltage across a 10-ohm resistor if a current of 1 ampere flows through it?

$$\frac{E}{I \mid R} \qquad \begin{aligned} E &= I * R \\ I &= E \div R \\ R &= E \div I \end{aligned}$$

$$E = I * R = 1 \text{ ampere} * 10 \text{ ohms} = 10 \text{ volts}$$

10 volts - - - - - - - - - - - - (page 3-7)

T5D12: What is the voltage across a 10-ohm resistor if a current of 2 amperes flows through it?

$$\frac{E}{I \mid R} \qquad \begin{aligned} E &= I * R \\ I &= E \div R \\ R &= E \div I \end{aligned}$$

$$E = I * R = 10 \text{ ohms} * 2 \text{ amperes} = 20 \text{ volts}$$

20 volts - - - - - - - - - - - - (page 3-7)

T5D13: What happens to current at the junction of two components in series?

It is unchanged - - - - - - - - - - - - (page 3-2)

T5D14: What happens to current at the junction of two components in parallel?

It divides between them dependent on the value of the components - - - - (page 3-2)

T5D15: What is the voltage across each of two components in series with a voltage source?

It is determined by the type and value of the components - - - - - (page 3-2)

T5D16: What is the voltage across each of two components in parallel with a voltage source?

The same voltage as the source - - - - - - - - - - (page 3-3)

SUBELEMENT T6 – Electrical components; circuit diagrams; component functions
[4 Exam Questions - 4 Groups]
2018-2022

T6A - Electrical components: fixed and variable resistors; capacitors and inductors; fuses; switches; batteries

T6A01: What electrical component is used to oppose the flow of current in a DC circuit?

Resistor - - - - - - - - - - - - (page 3-9)

T6A02: What type of component is often used as an adjustable volume control?

Potentiometer - - - - - - - - - - - - (page 3-9)

T6A03: What electrical parameter is controlled by a potentiometer?

Resistance - - - - - - - - - - - - (page 3-9)

T6A04: What electrical component stores energy in an electric field?

Capacitor - - - - - - - - - - - - (page 3-9)

T6A05: What type of electrical component consists of two or more conductive surfaces separated by an insulator?

Capacitor - - - - - - - - - - - - (page 3-9)

T6A06: What type of electrical component stores energy in a magnetic field?

Inductor - - - - - - - - - - - - (page 3-9)

T6A07: What electrical component is usually composed of a coil of wire?

Inductor - - - - - - - - - - - - (page 3-9)

T6A08: What electrical component is used to connect or disconnect electrical circuits?

Switch - - - - - - - - - - - - (page 3-13)

T6A09: What electrical component is used to protect other circuit components from current overloads?

Fuse - - - - - - - - - - - - (page 3-12)

T6A10: Which of the following battery types is rechargeable?

Nickel-metal hydride
Lithium-ion
Lead-acid gel-cell

All of these choices are correct - - - - - - - - - (page 5-17)

T6A11: Which of the following battery types is not rechargeable?

Carbon-zinc - - - - - - - - - - - - (page 5-17)

T6B – Semiconductors: basic principles and applications of solid state devices; diodes and transistors

T6B01: What class of electronic components uses a voltage or current signal to control current flow?

Transistors - - - - - - - - - - - - (page 3-12)

T6B02: What electronic component allows current to flow in only one direction?

Diode - - - - - - - - - - - - (page 3-12)

T6B03: Which of these components can be used as an electronic switch or amplifier?

Transistor - - - - - - - - - - - - (page 3-12)

T6B04: Which of the following components can consist of three layers of semiconductor material?

Transistor - - - - - - - - - - - - (page 3-12)

T6B05: Which of the following electronic components can amplify signals?

Transistor - - - - - - - - - - - - (page 3-12)

T6B06: How is the cathode lead of a semiconductor diode often marked on the package?

With a stripe - - - - - - - - - - - - (page 3-12)

T6B07: What does the abbreviation LED stand for?

Light Emitting Diode - - - - - - - - - - (page 3-12)

T6B08: What does the abbreviation FET stand for?

Field Effect Transistor - - - - - - - - - - (page 3-12)

T6B09: What are the names of the two electrodes of a diode?

Anode and cathode - - - - - - - - - - - (page 3-12)

T6B10: Which of the following could be the primary gain-producing component in an RF power amplifier?

Transistor - - - - - - - - - - - - (page 3-12)

T6B11: What is the term that describes a device's ability to amplify a signal?

Gain - - - - - - - - - - - - - (page 3-12)

T6C - Circuit diagrams; schematic symbols

T6C01: What is the name of an electrical wiring diagram that uses standard component symbols?

Schematic symbols - - - - - - - - - - - (page 3-14)

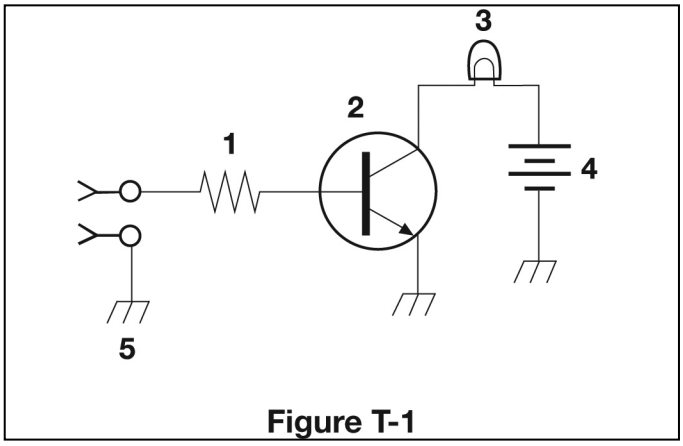

Figure T-1

T6C02: What is component 1 in figure T1?

Resistor - - - - - - - - - - - - (page 3-16)

T6C03: What is component 2 in figure T1?

Transistor - - - - - - - - - - - - (page 3-16)

T6C04: What is component 3 in figure T1?

Lamp - - - - - - - - - - - - - (page 3-16)

T6C05: What is component 4 in figure T1?

Battery - - - - - - - - - - - - - (page 3-16)

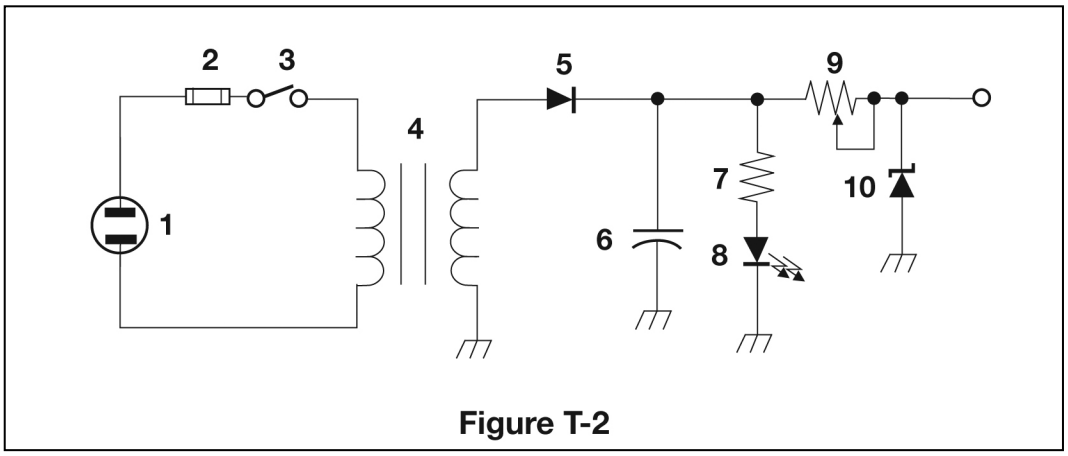

Figure T-2

T6C06: What is component 6 in figure T2?

Capacitor - - - - - - - - - - - - (page 3-16)

T6C07: What is component 8 in figure T2?

Light emitting diode - - - - - - - - - - - (page 3-16)

T6C08: What is component 9 in figure T2?

Variable resistor - - - - - - - - - - - (page 3-16)

T6C09: What is component 4 in figure T2?

Transformer - - - - - - - - - - - - (page 3-16)

SUBELEMENT T6 – Electrical components; circuit diagrams; component functions
[4 Exam Questions - 4 Groups]
2018-2022

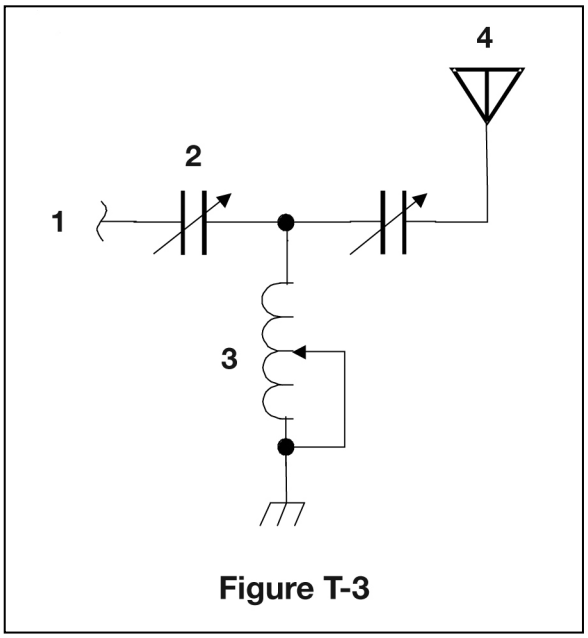

Figure T-3

T6C10: What is component 3 in figure T3?

Variable inductor - - - - - - - - - - - (page 3-16)

T6C11: What is component 4 in figure T3?

Antenna - - - - - - - - - - - - (page 3-16)

T6C12: What do the symbols on an electrical schematic represent?

Electrical components - - - - - - - - - - (page 3-14)

T6C13: Which of the following is accurately represented in electrical schematics?

The way components are interconnected - - - - - - - - (page 3-14)

SUBELEMENT T6 – Electrical components; circuit diagrams; component functions
[4 Exam Questions - 4 Groups]
2018-2022

T6D - Component functions: rectification; switches; indicators; power supply components; resonant circuit; shielding; power transformers; integrated circuits.

T6D01: Which of the following devices or circuits changes an alternating current into a varying direct current signal?

Rectifier - - - - - - - - - - - - (page 3-12)

T6D02: What is a relay?

An electrically-controlled switch - - - - - - - - - (page 3-13)

T6D03: What type of switch is represented by component 3 in figure T2?

Single-pole single-throw - - - - - - - - - - (page 3-14)

T6D04: Which of the following displays an electrical quantity as a numeric value?

Meter - - - - - - - - - - - - - (page 3-14)

T6D05: What type of circuit controls the amount of voltage from a power supply?

Regulator - - - - - - - - - - - - (page 5-16)

T6D06: What component is commonly used to change 120V AC house current to a lower AC voltage for other uses?

Transformer - - - - - - - - - - - - (page 3-9)

T6D07: Which of the following is commonly used as a visual indicator?

LED - - - - - - - - - - - - - (page 3-12)

T6D08: Which of the following is combined with an inductor to make a tuned circuit?

Capacitor - - - - - - - - - - - - (page 3-10)

T6D09: What is the name of a device that combines several semiconductors and other components into one package?

Integrated circuit - - - - - - - - - - - (page 3-12)

T6D10: What is the function of component 2 in Figure T1?

Control the flow of current - - - - - - - - - (page 3-12)

T6D11: What is a simple resonant or tuned circuit?

An inductor and a capacitor connected in series or parallel to form a filter - - - (page 3-10)

T6D12: Which of the following is a common reason to use shielded wire?

To prevent coupling of unwanted signals to or from the wire - - - - - (page 9-9)