ARRL The national association for AMATEUR RADIO®

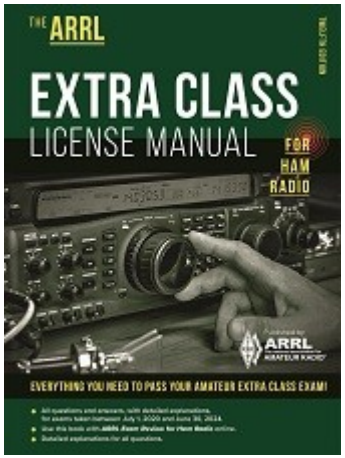
The ARRL Extra Class License Course

All You Need to Pass Your Extra Class Exam

LEVEL 3: Extra

For use with *The ARRL Extra Class License Manual*, 12th Edition

Extra License Manual and other resources



http://www.arrl.org/shop/Licensing-Education-and-Training/

How does a linear electronic voltage regulator work?

A. It has a ramp voltage as its output

B. It eliminates the need for a pass transistor

C. The control element duty cycle is proportional to the line or load conditions

D. The conduction of a control element is varied to maintain a constant output voltage

E7D01 ECLM Page (6 - 41)

How does a linear electronic voltage regulator work?

A. It has a ramp voltage as its output

B. It eliminates the need for a pass transistor

C. The control element duty cycle is proportional to the line or load conditions

D. The conduction of a control element is varied to maintain a constant output voltage

(D) E7D01 ECLM Page (6 - 41)

What is a characteristic of a switching electronic voltage regulator?

A. The resistance of a control element is varied in direct proportion to the line voltage or load current

B. It is generally less efficient than a linear regulator

C. The controlled device's duty cycle is changed to produce a constant average output voltage

D. It gives a ramp voltage at its output

E7D02 ECLM Page (6 - 43)

What is a characteristic of a switching electronic voltage regulator?

A. The resistance of a control element is varied in direct proportion to the line voltage or load current

B. It is generally less efficient than a linear regulator

C. The controlled device's duty cycle is changed to produce a constant average output voltage

D. It gives a ramp voltage at its output

(C) E7D02 ECLM Page (6 - 43)

What device is typically used as a stable voltage reference in a linear voltage regulator?

A. A Zener diode

B. A tunnel diode

C. An SCR

D. A varactor diode

E7D03 ECLM Page (6 - 42)

What device is typically used as a stable voltage reference in a linear voltage regulator?

A. A Zener diode

B. A tunnel diode

C. An SCR

D. A varactor diode

(A) E7D03 ECLM Page (6 - 42)

Which of the following types of linear voltage regulator usually make the most efficient use of the primary power source?

A. A series current source

B. A series regulator

C. A shunt regulator

D. A shunt current source

E7D04 ECLM Page (6 - 42)

Which of the following types of linear voltage regulator usually make the most efficient use of the primary power source?

A. A series current source

B. A series regulator

C. A shunt regulator

D. A shunt current source

(B) E7D04 ECLM Page (6 - 42)

Which of the following types of linear voltage regulator places a constant load on the unregulated voltage source?

A. A constant current source

B. A series regulator

C. A shunt current source

D. A shunt regulator

E7D05 ECLM Page (6 - 41)

Which of the following types of linear voltage regulator places a constant load on the unregulated voltage source?

A. A constant current source

B. A series regulator

C. A shunt current source

D. A shunt regulator

(D) E7D05 ECLM Page (6 - 41)

What is the purpose of Q1 in the circuit shown in Figure E7-2?

A. It provides negative feedback to improve regulation

B. It provides a constant load for the voltage source

C. It controls the current supplied to the load

D. It provides D1 with current

E7D06 ECLM Page (6 - 42)

What is the purpose of Q1 in the circuit shown in Figure E7-2?

A. It provides negative feedback to improve regulation

B. It provides a constant load for the voltage source

C. It controls the current supplied to the load

D. It provides D1 with current

(C) E7D06 ECLM Page (6 - 42)

What is the purpose of C2 in the circuit shown in Figure E7-2?

A. It bypasses rectifier output ripple around D1

B. It is a brute force filter for the output

C. To self-resonate at the hum frequency

D. To provide fixed DC bias for Q1

E7D07 ECLM Page (6 - 42)

What is the purpose of C2 in the circuit shown in Figure E7-2?

A. It bypasses rectifier output ripple around D1

B. It is a brute force filter for the output

C. To self-resonate at the hum frequency

D. To provide fixed DC bias for Q1

(A) E7D07 ECLM Page (6 - 42)

What type of circuit is shown in Figure E7-2?

A. Switching voltage regulator

B. Grounded emitter amplifier

C. Linear voltage regulator

D. Monostable multivibrator

E7D08 ECLM Page (6 - 42)

What type of circuit is shown in Figure E7-2?

A. Switching voltage regulator

B. Grounded emitter amplifier

C. Linear voltage regulator

D. Monostable multivibrator

(C) E7D08 ECLM Page (6 - 42)

What is the main reason to use a charge controller with a solar power system?

A. Prevention of battery undercharge

B. Control of electrolyte levels during battery discharge

C. Prevention of battery damage due to overcharge

D. Matching of day and night charge rates

E7D09 ECLM Page (6 - 42)

What is the main reason to use a charge controller with a solar power system?

A. Prevention of battery undercharge

B. Control of electrolyte levels during battery discharge

C. Prevention of battery damage due to overcharge

D. Matching of day and night charge rates

(C) E7D09 ECLM Page (6 - 42)

What is the primary reason that a high-frequency switching type high-voltage power supply can be both less expensive and lighter in weight than a conventional power supply?

A. The inverter design does not require any output filtering

B. It uses a diode bridge rectifier for increased output

C. The high frequency inverter design uses much smaller transformers and filter components for an equivalent power output

D. It uses a large power factor compensation capacitor to recover power from the unused portion of the AC cycle

E7D10 ECLM Page (6 - 43)

What is the primary reason that a high-frequency switching type high-voltage power supply can be both less expensive and lighter in weight than a conventional power supply?

A. The inverter design does not require any output filtering

B. It uses a diode bridge rectifier for increased output

C. The high frequency inverter design uses much smaller transformers and filter components for an equivalent power output

D. It uses a large power factor compensation capacitor to recover power from the unused portion of the AC cycle

(C) E7D10 ECLM Page (6 - 43)

What is the function of the pass transistor in a linear voltage regulator circuit?

A. Permits a wide range of output voltage settings

B. Provides a stable input impedance over a wide range of source voltage

C. Maintains nearly constant output impedance over a wide range of load current

D. Maintains nearly constant output voltage over a wide range of load current

E7D11 ECLM Page (6 - 42)

What is the function of the pass transistor in a linear voltage regulator circuit?

A. Permits a wide range of output voltage settings

B. Provides a stable input impedance over a wide range of source voltage

C. Maintains nearly constant output impedance over a wide range of load current

D. Maintains nearly constant output voltage over a wide range of load current

(D) E7D11 ECLM Page (6 - 42)

What is the dropout voltage of an analog voltage regulator?

A. Minimum input voltage for rated power dissipation

B. Maximum output voltage drops when the input voltage is varied over its specified range

C. Minimum input-to-output voltage required to maintain regulation

D. Maximum that the output voltage may decrease at rated load

E7D12 ECLM Page (6 - 42)

What is the dropout voltage of an analog voltage regulator?

A. Minimum input voltage for rated power dissipation

B. Maximum output voltage drops when the input voltage is varied over its specified range

C. Minimum input-to-output voltage required to maintain regulation

D. Maximum that the output voltage may decrease at rated load

(C) E7D12 ECLM Page (6 - 42)

What is the equation for calculating power dissipated by a series linear voltage regulator?

A. Input voltage multiplied by input current

B. Input voltage divided by output current

C. Voltage difference from input to output multiplied by output current

D. Output voltage multiplied by output current

E7D13 ECLM Page (6 - 42)

What is the equation for calculating power dissipated by a series linear voltage regulator?

A. Input voltage multiplied by input current

B. Input voltage divided by output current

C. Voltage difference from input to output multiplied by output current

D. Output voltage multiplied by output current

(C) E7D13 ECLM Page (6 - 42)

What is the purpose of connecting equal-value resistors across power supply filter capacitors connected in series?

A. Equalize the voltage across each capacitor

B. Discharge the capacitors when voltage is removed

C. Provide a minimum load on the supply

D. All these choices are correct

E7D14 ECLM Page (6 - 43)

What is the purpose of connecting equal-value resistors across power supply filter capacitors connected in series?

A. Equalize the voltage across each capacitor

B. Discharge the capacitors when voltage is removed

C. Provide a minimum load on the supply

D. All these choices are correct

(D) E7D14 ECLM Page (6 - 43)

What is the purpose of a "step-start" circuit in a high-voltage power supply?

A. To provide a dual-voltage output for reduced power applications

B. To compensate for variations of the incoming line voltage

C. To allow for remote control of the power supply

D. To allow the filter capacitors to charge gradually

E7D15 ECLM Page (6 - 43)

What is the purpose of a "step-start" circuit in a high-voltage power supply?

A. To provide a dual-voltage output for reduced power applications

B. To compensate for variations of the incoming line voltage

C. To allow for remote control of the power supply

D. To allow the filter capacitors to charge gradually

(D) E7D15 ECLM Page (6 - 43)

Which of the following can be used to generate FM phone emissions?

A. A balanced modulator on the audio amplifier

B. A reactance modulator on the oscillator

C. A reactance modulator on the final amplifier

D. A balanced modulator on the oscillator

E7E01 ECLM Page (6 - 23)

Which of the following can be used to generate FM phone emissions?

A. A balanced modulator on the audio amplifier

B. A reactance modulator on the oscillator

C. A reactance modulator on the final amplifier

D. A balanced modulator on the oscillator

(B) E7E01 ECLM Page (6 - 23)

What is the function of a reactance modulator?

A. To produce PM signals by using an electrically variable resistance

B. To produce AM signals by using an electrically variable inductance or capacitance

C. To produce AM signals by using an electrically variable resistance

D. To produce PM or FM signals by using an electrically variable inductance or capacitance

E7E02 ECLM Page (6 - 22)

What is the function of a reactance modulator?

A. To produce PM signals by using an electrically variable resistance

B. To produce AM signals by using an electrically variable inductance or capacitance

C. To produce AM signals by using an electrically variable resistance

D. To produce PM or FM signals by using an electrically variable inductance or capacitance

(D) E7E02 ECLM Page (6 - 22)

What is a frequency discriminator stage in a FM receiver?

A. An FM generator circuit

B. A circuit for filtering two closely adjacent signals

C. An automatic band-switching circuit

D. A circuit for detecting FM signals

E7E03 ECLM Page (6 - 24)

What is a frequency discriminator stage in a FM receiver?

A. An FM generator circuit

B. A circuit for filtering two closely adjacent signals

C. An automatic band-switching circuit

D. A circuit for detecting FM signals

(D) E7E03 ECLM Page (6 - 24)

What is one way a single-sideband phone signal can be generated?

A. By using a balanced modulator followed by a filter

B. By using a reactance modulator followed by a mixer

C. By using a loop modulator followed by a mixer

D. By driving a product detector with a DSB signal

E7E04 ECLM Page (6 - 21)

What is one way a single-sideband phone signal can be generated?

A. By using a balanced modulator followed by a filter

B. By using a reactance modulator followed by a mixer

C. By using a loop modulator followed by a mixer

D. By driving a product detector with a DSB signal

(A) E7E04 ECLM Page (6 - 21)

What circuit is added to an FM transmitter to boost the higher audio frequencies?

A. A de-emphasis network

B. A heterodyne suppressor

C. A heterodyne enhancer

D. A pre-emphasis network

E7E05 ECLM Page (6 - 23)

What circuit is added to an FM transmitter to boost the higher audio frequencies?

A. A de-emphasis network

B. A heterodyne suppressor

C. A heterodyne enhancer

D. A pre-emphasis network

(D) E7E05 ECLM Page (6 - 23)

Why is de-emphasis commonly used in FM communications receivers?

A. For compatibility with transmitters using phase modulation

B. To reduce impulse noise reception

C. For higher efficiency

D. To remove third-order distortion products

E7E06 ECLM Page (6 - 23)

Why is de-emphasis commonly used in FM communications receivers?

A. For compatibility with transmitters using phase modulation

B. To reduce impulse noise reception

C. For higher efficiency

D. To remove third-order distortion products

(A) E7E06 ECLM Page (6 - 23)

What is meant by the term "baseband" in radio communications?

A. The lowest frequency band that the transmitter or receiver covers

B. The frequency range occupied by a message signal prior to modulation

C. The unmodulated bandwidth of the transmitted signal

D. The basic oscillator frequency in an FM transmitter that is multiplied to increase the deviation and carrier frequency

E7E07 ECLM Page (6 - 20)

What is meant by the term "baseband" in radio communications?

A. The lowest frequency band that the transmitter or receiver covers

B. The frequency range occupied by a message signal prior to modulation

C. The unmodulated bandwidth of the transmitted signal

D. The basic oscillator frequency in an FM transmitter that is multiplied to increase the deviation and carrier frequency

(B) E7E07 ECLM Page (6 - 20)

What are the principal frequencies that appear at the output of a mixer circuit?

A. Two and four times the original frequency

B. The square root of the product of input frequencies

C. The two input frequencies along with their sum and difference frequencies

D. 1.414 and 0.707 times the input frequency

E7E08 ECLM Page (6 - 20)

What are the principal frequencies that appear at the output of a mixer circuit?

A. Two and four times the original frequency

B. The square root of the product of input frequencies

C. The two input frequencies along with their sum and difference frequencies

D. 1.414 and 0.707 times the input frequency

(C) E7E08 ECLM Page (6 - 20)

What occurs when an excessive amount of signal energy reaches a mixer circuit?

A. Spurious mixer products are generated

B. Mixer blanking occurs

C. Automatic limiting occurs

D. A beat frequency is generated

E7E09 ECLM Page (6 - 20)

What occurs when an excessive amount of signal energy reaches a mixer circuit?

A. Spurious mixer products are generated

B. Mixer blanking occurs

C. Automatic limiting occurs

D. A beat frequency is generated

(A) E7E09 ECLM Page (6 - 20)

How does a diode envelope detector function?

A. By rectification and filtering of RF signals

B. By breakdown of the Zener voltage

C. By mixing signals with noise in the transition region of the diode

D. By sensing the change of reactance in the diode with respect to frequency

E7E10 ECLM Page (6 - 23)

How does a diode envelope detector function?

A. By rectification and filtering of RF signals

B. By breakdown of the Zener voltage

C. By mixing signals with noise in the transition region of the diode

D. By sensing the change of reactance in the diode with respect to frequency

(A) E7E10 ECLM Page (6 - 23)

Which type of detector circuit is used for demodulating SSB signals?

A. Discriminator

B. Phase detector

C. Product detector

D. Phase comparator

E7E11 ECLM Page (6 - 24)

Which type of detector circuit is used for demodulating SSB signals?

A. Discriminator

B. Phase detector

C. Product detector

D. Phase comparator

(C) E7E11 ECLM Page (6 - 24)

What is meant by direct digital conversion as applied to software defined radios?

A. Software is converted from source code to object code during operation of the receiver

B. Incoming RF is converted to a control voltage for a voltage controlled oscillator

C. Incoming RF is digitized by an analog-to-digital converter without being mixed with a local oscillator signal

D. A switching mixer is used to generate I and Q signals directly from the RF input

E7F01 ECLM Page (6 - 29)

What is meant by direct digital conversion as applied to software defined radios?

A. Software is converted from source code to object code during operation of the receiver

B. Incoming RF is converted to a control voltage for a voltage controlled oscillator

C. Incoming RF is digitized by an analog-to-digital converter without being mixed with a local oscillator signal

D. A switching mixer is used to generate I and Q signals directly from the RF input

(C) E7F01 ECLM Page (6 - 29)

What kind of digital signal processing audio filter is used to remove unwanted noise from a received SSB signal?

A. An adaptive filter

B. A crystal-lattice filter

C. A Hilbert-transform filter

D. A phase-inverting filter

E7F02 ECLM Page (6 - 36)

What kind of digital signal processing audio filter is used to remove unwanted noise from a received SSB signal?

A. An adaptive filter

B. A crystal-lattice filter

C. A Hilbert-transform filter

D. A phase-inverting filter

(A) E7F02 ECLM Page (6 - 36)

What type of digital signal processing filter is used to generate an SSB signal?

A. An adaptive filter

B. A notch filter

C. A Hilbert-transform filter

D. An elliptical filter

E7F03 ECLM Page (6 - 32)

What type of digital signal processing filter is used to generate an SSB signal?

A. An adaptive filter

B. A notch filter

C. A Hilbert-transform filter

D. An elliptical filter

(C) E7F03 ECLM Page (6 - 32)

What is a common method of generating an SSB signal using digital signal processing?

A. Mixing products are converted to voltages and subtracted by adder circuits

B. A frequency synthesizer removes the unwanted sidebands

C. Varying quartz crystal characteristics emulated in digital form

D. Signals are combined in quadrature phase relationship

E7F04 ECLM Page (6 - 32)

What is a common method of generating an SSB signal using digital signal processing?

A. Mixing products are converted to voltages and subtracted by adder circuits

B. A frequency synthesizer removes the unwanted sidebands

C. Varying quartz crystal characteristics emulated in digital form

D. Signals are combined in quadrature phase relationship

(D) E7F04 ECLM Page (6 - 32)

How frequently must an analog signal be sampled by an analog-to-digital converter so that the signal can be accurately reproduced?

A. At least half the rate of the highest frequency component of the signal

B. At least twice the rate of the highest frequency component of the signal

C. At the same rate as the highest frequency component of the signal

D. At four times the rate of the highest frequency component of the signal

E7F05 ECLM Page (6 - 26)

How frequently must an analog signal be sampled by an analog-to-digital converter so that the signal can be accurately reproduced?

A. At least half the rate of the highest frequency component of the signal

B. At least twice the rate of the highest frequency component of the signal

C. At the same rate as the highest frequency component of the signal

D. At four times the rate of the highest frequency component of the signal

(B) E7F05 ECLM Page (6 - 26)

What is the minimum number of bits required for an analog-to-digital converter to sample a signal with a range of 1 volt at a resolution of 1 millivolt?

A. 4 bits

B. 6 bits

C. 8 bits

D. 10 bits

E7F06 ECLM Page (6 - 28)

What is the minimum number of bits required for an analog-to-digital converter to sample a signal with a range of 1 volt at a resolution of 1 millivolt?

A. 4 bits

B. 6 bits

C. 8 bits

D. 10 bits

(D) E7F06 ECLM Page (6 - 28)

What function is performed by a Fast Fourier Transform?

A. Converting analog signals to digital form

B. Converting digital signals to analog form

C. Converting digital signals from the time domain to the frequency domain

D. Converting 8-bit data to 16-bit data

E7F07 ECLM Page (6 - 28)

What function is performed by a Fast Fourier Transform?

A. Converting analog signals to digital form

B. Converting digital signals to analog form

C. Converting digital signals from the time domain to the frequency domain

D. Converting 8-bit data to 16-bit data

(C) E7F07 ECLM Page (6 - 28)

What is the function of decimation?

A. Converting data to binary code decimal form

B. Reducing the effective sample rate by removing samples

C. Attenuating the signal

D. Removing unnecessary significant digits

E7F08 ECLM Page (6 - 28)

What is the function of decimation?

A. Converting data to binary code decimal form

B. Reducing the effective sample rate by removing samples

C. Attenuating the signal

D. Removing unnecessary significant digits

(B) E7F08 ECLM Page (6 - 28)

Why is an anti-aliasing digital filter required in a digital decimator?

A. It removes high frequency signal components that would otherwise be reproduced as lower frequency components

B. It peaks the response of the decimator, improving bandwidth

C. It removes low frequency signal components to eliminate the need for DC restoration

D. It notches out the sampling frequency to avoid sampling errors

E7F09 ECLM Page (6 - 28)

Why is an anti-aliasing digital filter required in a digital decimator?

A. It removes high frequency signal components that would otherwise be reproduced as lower frequency components

B. It peaks the response of the decimator, improving bandwidth

C. It removes low frequency signal components to eliminate the need for DC restoration

D. It notches out the sampling frequency to avoid sampling errors

(A) E7F09 ECLM Page (6 - 28)

What aspect of receiver analog-to-digital conversion determines the maximum receive bandwidth of a Direct Digital Conversion SDR?

A. Sample rate

B. Sample width in bits

C. Sample clock phase noise

D. Processor latency

E7F10 ECLM Page (6 - 30)

What aspect of receiver analog-to-digital conversion determines the maximum receive bandwidth of a Direct Digital Conversion SDR?

A. Sample rate

B. Sample width in bits

C. Sample clock phase noise

D. Processor latency

(A) E7F10 ECLM Page (6 - 30)

What sets the minimum detectable signal level for a direct-sampling SDR receiver in the absence of atmospheric or thermal noise?

A. Sample clock phase noise

B. Reference voltage level and sample width in bits

C. Data storage transfer rate

D. Missing codes and jitter

E7F11 ECLM Page (6 - 28)

What sets the minimum detectable signal level for a direct-sampling SDR receiver in the absence of atmospheric or thermal noise?

A. Sample clock phase noise

B. Reference voltage level and sample width in bits

C. Data storage transfer rate

D. Missing codes and jitter

(B) E7F11 ECLM Page (6 - 28)

Which of the following is an advantage of a Finite Impulse Response (FIR) filter vs an Infinite Impulse Response (IIR) digital filter?

A. FIR filters can delay all frequency components of the signal by the same amount

B. FIR filters are easier to implement for a given set of passband rolloff requirements

C. FIR filters can respond faster to impulses

D. All these choices are correct

E7F12 ECLM Page (6 - 38)

Which of the following is an advantage of a Finite Impulse Response (FIR) filter vs an Infinite Impulse Response (IIR) digital filter?

A. FIR filters can delay all frequency components of the signal by the same amount

B. FIR filters are easier to implement for a given set of passband rolloff requirements

C. FIR filters can respond faster to impulses

D. All these choices are correct

(A) E7F12 ECLM Page (6 - 38)

What is the function of taps in a digital signal processing filter?

A. To reduce excess signal pressure levels

B. Provide access for debugging software

C. Select the point at which baseband signals are generated

D. Provide incremental signal delays for filter algorithms

E7F13 ECLM Page (6 - 37)

What is the function of taps in a digital signal processing filter?

A. To reduce excess signal pressure levels

B. Provide access for debugging software

C. Select the point at which baseband signals are generated

D. Provide incremental signal delays for filter algorithms

(D) E7F13 ECLM Page (6 - 37)

Which of the following would allow a digital signal processing filter to create a sharper filter response?

A. Higher data rate

B. More taps

C. Complex phasor representations

D. Double-precision math routines

E7F14 ECLM Page (6 - 37)

Which of the following would allow a digital signal processing filter to create a sharper filter response?

A. Higher data rate

B. More taps

C. Complex phasor representations

D. Double-precision math routines

(B) E7F14 ECLM Page (6 - 37)