

Key Topic 25: Transistors-1

- 3-25C1 What is the meaning of the term “alpha” with regard to bipolar transistors? The change of:
- A. Collector current with respect to base current.
 - B. Base current with respect to collector current.
 - C. Collector current with respect to gate current.
 - D. Collector current with respect to emitter current.
- 3-25C2 What are the three terminals of a bipolar transistor?
- A. Cathode, plate and grid.
 - B. Base, collector and emitter.
 - C. Gate, source and sink.
 - D. Input, output and ground.
- 3-25C3 What is the meaning of the term “beta” with regard to bipolar transistors? The change of:
- A. Base current with respect to emitter current.
 - B. Collector current with respect to emitter current.
 - C. Collector current with respect to base current.
 - D. Base current with respect to gate current.
- 3-25C4 What are the elements of a unijunction transistor?
- A. Base 1, base 2, and emitter.
 - B. Gate, cathode, and anode.
 - C. Gate, base 1, and base 2.
 - D. Gate, source, and sink.
- 3-25C5 The beta cutoff frequency of a bipolar transistor is the frequency at which:
- A. Base current gain has increased to 0.707 of maximum.
 - B. Emitter current gain has decreased to 0.707 of maximum.
 - C. Collector current gain has decreased to 0.707.
 - D. Gate current gain has decreased to 0.707.
- 3-25C6 What does it mean for a transistor to be fully saturated?
- A. The collector current is at its maximum value.
 - B. The collector current is at its minimum value.
 - C. The transistor’s Alpha is at its maximum value.
 - D. The transistor’s Beta is at its maximum value.

Answer Key: 3-25C1: D 3-25C2: B 3-25C3: C 3-25C4: A 3-25C5: B 3-25C6: A

Key Topic 26: Transistors-2

- 3-26C1 A common base amplifier has:
- A. More current gain than common emitter or common collector.
 - B. More voltage gain than common emitter or common collector.
 - C. More power gain than common emitter or common collector.
 - D. Highest input impedance of the three amplifier configurations.
- 3-26C2 What does it mean for a transistor to be cut off?
- A. There is no base current.
 - B. The transistor is at its Class A operating point.
 - C. There is no current between emitter and collector.
 - D. There is maximum current between emitter and collector.
- 3-26C3 An emitter-follower amplifier has:
- A. More voltage gain than common emitter or common base.
 - B. More power gain than common emitter or common base.
 - C. Lowest input impedance of the three amplifier configurations.
 - D. More current gain than common emitter or common base.
- 3-26C4 What conditions exists when a transistor is operating in saturation?
- A. The base-emitter junction and collector-base junction are both forward biased.
 - B. The base-emitter junction and collector-base junction are both reverse biased.
 - C. The base-emitter junction is reverse biased and the collector-base junction is forward biased.
 - D. The base-emitter junction is forward biased and the collector-base junction is reverse biased.
- 3-26C5 For current to flow in an NPN silicon transistor's emitter-collector junction, the base must be:
- A. At least 0.4 volts positive with respect to the emitter.
 - B. At a negative voltage with respect to the emitter.
 - C. At least 0.7 volts positive with respect to the emitter.
 - D. At least 0.7 volts negative with respect to the emitter.
- 3-26C6 When an NPN transistor is operating as a Class A amplifier, the base-emitter junction:
- A. And collector-base junction are both forward biased.
 - B. And collector-base junction are both reverse biased.
 - C. Is reverse biased and the collector-base junction is forward biased.
 - D. Is forward biased and the collector-base junction is reverse biased.

Answer Key: 3-26C1: B 3-26C2: C 3-26C3: D 3-26C4: A 3-26C5: C 3-26C6: D

Key Topic 27: Light Emitting Diodes

3-27C1 What type of bias is required for an LED to produce luminescence?

- A. Reverse bias.
- B. Forward bias.
- C. Logic 0 (Lo) bias.
- D. Logic 1 (Hi) bias.

3-27C2 What determines the visible color radiated by an LED junction?

- A. The color of a lens in an eyepiece.
- B. The amount of voltage across the device.
- C. The amount of current through the device.
- D. The materials used to construct the device.

3-27C3 What is the normal operating current of a light-emitting diode?

- A. 20 mA.
- B. 5 mA.
- C. 10 mA.
- D. 40 mA.

3-27C4 What would be the maximum current to safely illuminate a LED?

- A. 1 amp.
- B. 1 microamp.
- C. 500 milliamps.
- D. 20 mA.

3-27C5 An LED facing a photodiode in a light-tight enclosure is commonly known as a/an:

- A. Optoisolator.
- B. Seven segment LED.
- C. Optointerrupter.
- D. Infra-red (IR) detector.

3-27C6 What circuit component must be connected in series to protect an LED?

- A. Bypass capacitor to ground.
- B. Electrolytic capacitor.
- C. Series resistor.
- D. Shunt coil in series.

Answer Key: 3-27C1: B 3-27C2: D 3-27C3: A 3-27C4: D 3-27C5: A 3-27C6: C

Key Topic 28: Devices

- 3-28C1 What describes a diode junction that is forward biased?
- A. It is a high impedance.
 - B. It conducts very little current.
 - C. It is a low impedance.
 - D. It is an open circuit.
- 3-28C2 Why are special precautions necessary in handling FET and CMOS devices?
- A. They have fragile leads that may break off.
 - B. They are susceptible to damage from static charges.
 - C. They have micro-welded semiconductor junctions that are susceptible to breakage.
 - D. They are light sensitive.
- 3-28C3 What do the initials CMOS stand for?
- A. Common mode oscillating system.
 - B. Complementary mica-oxide silicon.
 - C. Complementary metal-oxide semiconductor.
 - D. Complementary metal-oxide substrate.
- 3-28C4 What is the piezoelectric effect?
- A. Mechanical vibration of a crystal by the application of a voltage.
 - B. Mechanical deformation of a crystal by the application of a magnetic field.
 - C. The generation of electrical energy by the application of light.
 - D. Reversed conduction states when a P-N junction is exposed to light.
- 3-28C5 An electrical relay is a:
- A. Current limiting device.
 - B. Device used for supplying 3 or more voltages to a circuit.
 - C. Component used mainly with HF audio amplifiers.
 - D. Remotely controlled switching device.
- 3-28C6 In which oscillator circuit would you find a quartz crystal?
- A. Hartley.
 - B. Pierce
 - C. Colpitts.
 - D. All of the above.

Answer Key: 3-28C1: C 3-28C2: B 3-28C3: C 3-28C4: A 3-28C5: D 3-28C6: B

Subelement D – Circuits: 4 Key Topics, 4 Exam Questions, 6 Drawings

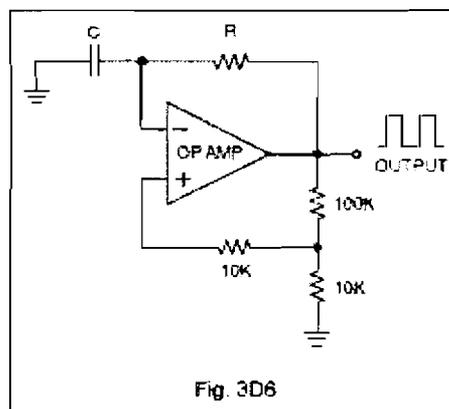
Key Topic 29: R-L-C Circuits

- 3-29D1 What is the approximate magnitude of the impedance of a parallel R-L-C circuit at resonance?
- A. Approximately equal to the circuit resistance.
 - B. Approximately equal to X_L .
 - C. Low, as compared to the circuit resistance.
 - D. Approximately equal to X_C .
- 3-29D2 What is the approximate magnitude of the impedance of a series R-L-C circuit at resonance?
- A. High, as compared to the circuit resistance.
 - B. Approximately equal to the circuit resistance.
 - C. Approximately equal to X_L .
 - D. Approximately equal to X_C .
- 3-29D3 How could voltage be greater across reactances in series than the applied voltage?
- A. Resistance.
 - B. Conductance.
 - C. Capacitance.
 - D. Resonance.
- 3-29D4 What is the characteristic of the current flow in a series R-L-C circuit at resonance?
- A. Maximum.
 - B. Minimum.
 - C. DC.
 - D. Zero.
- 3-29D5 What is the characteristic of the current flow within the parallel elements in a parallel R-L-C circuit at resonance?
- A. Minimum.
 - B. Maximum.
 - C. DC.
 - D. Zero.
- 3-29D6 What is the relationship between current through a resonant circuit and the voltage across the circuit?
- A. The current and voltage are 180 degrees out of phase.
 - B. The current leads the voltage by 90 degrees.
 - C. The voltage and current are in phase.
 - D. The voltage leads the current by 90 degrees.

Answer Key: 3-29D1: A 3-29D2: B 3-29D3: D 3-29D4: A 3-29D5: B 3-29D6: C

Key Topic 30: Op Amps

- 3-30D1 What is the main advantage of using an op-amp audio filter over a passive LC audio filter?
- A. Op-amps are largely immune to vibration and temperature change.
 - B. Most LC filter manufacturers have retooled to make op-amp filters.
 - C. Op-amps are readily available in a wide variety of operational voltages and frequency ranges.
 - D. Op-amps exhibit gain rather than insertion loss.
- 3-30D2 What are the characteristics of an inverting operational amplifier (op-amp) circuit?
- A. It has input and output signals in phase.
 - B. Input and output signals are 90 degrees out of phase.
 - C. It has input and output signals 180 degrees out of phase.
 - D. Input impedance is low while the output impedance is high.
- 3-30D3 Gain of a closed-loop op-amp circuit is determined by?
- A. The maximum operating frequency divided by the square root of the load impedance.
 - B. The op-amp's external feedback network.
 - C. Supply voltage and slew rate.
 - D. The op-amp's internal feedback network.
- 3-30D4 Where is the external feedback network connected to control the gain of a closed-loop op-amp circuit?
- A. Between the differential inputs.
 - B. From output to the non-inverting input.
 - C. From output to the inverting input.
 - D. Between the output and the differential inputs.
- 3-30D5 Which of the following op-amp circuits is operated open-loop?
- A. Non-inverting amp.
 - B. Inverting amp.
 - C. Active filter.
 - D. Comparator.
- 3-30D6 In the op-amp oscillator circuit shown in Figure 3D6, what would be the most noticeable effect if the capacitance of C were suddenly doubled?
- A. Frequency would be lower.
 - B. Frequency would be higher.
 - C. There would be no change. The inputs are reversed, therefore the circuit can not function.
 - D. None of the above.



Answer Key: 3-30D1: D 3-30D2: C 3-30D3: B 3-30D4: C 3-30D5: D 3-30D6: A

Key Topic 31: Phase Locked Loops (PLLs); Voltage Controlled Oscillators (VCOs); Mixers

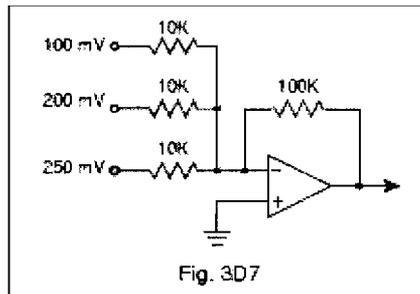
- 3-31D1 What frequency synthesizer circuit uses a phase comparator, look-up table, digital-to-analog converter, and a low-pass antialias filter?
- A. A direct digital synthesizer.
 - B. Phase-locked-loop synthesizer.
 - C. A diode-switching matrix synthesizer.
 - D. A hybrid synthesizer.
- 3-31D2 A circuit that compares the output of a voltage-controlled oscillator (VCO) to a frequency standard and produces an error voltage that is then used to adjust the capacitance of a varactor diode used to control frequency in that same VCO is called what?
- A. Doubly balanced mixer.
 - B. Phase-locked loop.
 - C. Differential voltage amplifier.
 - D. Variable frequency oscillator.
- 3-31D3 RF input to a mixer is 200 MHz and the local oscillator frequency is 150 MHz. What output would you expect to see at the IF output prior to any filtering?
- A. 50, 150, 200 and 350 MHz.
 - B. 50 MHz.
 - C. 350 MHz.
 - D. 50 and 350 MHz.
- 3-31D4 What spectral impurity components might be generated by a phase-locked-loop synthesizer?
- A. Spurs at discrete frequencies.
 - B. Random spurs which gradually drift up in frequency.
 - C. Broadband noise.
 - D. Digital conversion noise.
- 3-31D5 In a direct digital synthesizer, what are the unwanted components on its output?
- A. Broadband noise.
 - B. Spurs at discrete frequencies.
 - C. Digital conversion noise.
 - D. Nyquist limit noise pulses.
- 3-31D6 What is the definition of a phase-locked loop (PLL) circuit?
- A. A servo loop consisting of a ratio detector, reactance modulator, and voltage-controlled oscillator.
 - B. A circuit also known as a monostable multivibrator.
 - C. A circuit consisting of a precision push-pull amplifier with a differential input.
 - D. A servo loop consisting of a phase detector, a low-pass filter and voltage-controlled oscillator.

Answer Key: 3-31D1: A 3-31D2: B 3-31D3: A 3-31D4: C 3-31D5: B 3-31D6: D

Key Topic 32: Schematics

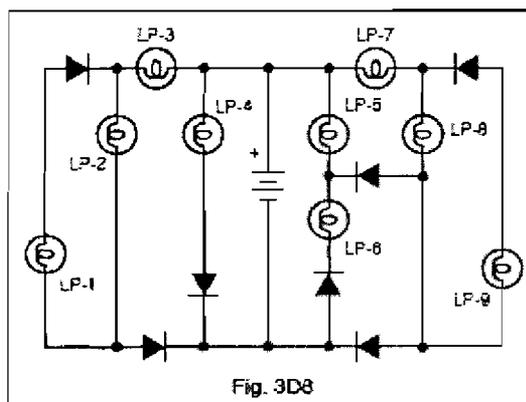
3-32D1 Given the combined DC input voltages, what would the output voltage be in the circuit shown in Figure 3D7?

- A. 150 mV
- B. 5.5 V
- C. -15 mV
- D. -5.5 V



3-32D2 Which lamps would be lit in the circuit shown in Figure 3D8?

- A. 2, 3, 4, 5 and 6.
- B. 5, 6, 8 and 9.
- C. 2, 3, 4, 7 and 8.
- D. 1, 3, 5, 7 and 8.

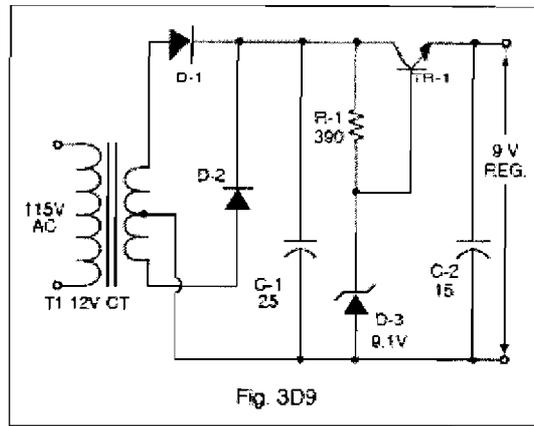


3-32D3 What will occur if an amplifier input signal coupling capacitor fails open?

- A. No amplification will occur, with DC within the circuit measuring normal.
- B. Improper biasing will occur within the amplifier stage.
- C. Oscillation and thermal runaway may occur.
- D. An AC hum will appear on the circuit output.

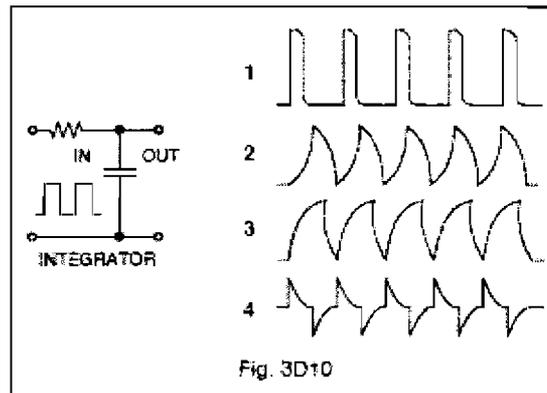
3-32D4 In Figure 3D9, determine if there is a problem with this regulated power supply and identify the problem.

- A. *R1 value is too low which would cause excessive base current and instantly destroy TR 1.*
- B. D1 and D2 are reversed. The power supply simply would not function.
- C. TR1 is shown as an NPN and must be changed to a PNP.
- D. There is no problem with the circuit.



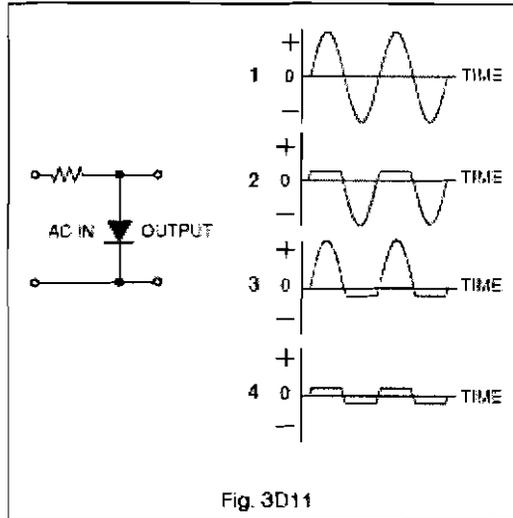
3-32D5 In Figure 3D10 with a square wave input what would be the output?

- A. 1
- B. 2
- C. 3
- D. 4



3-32D6 With a pure AC signal input to the circuit shown in Figure 3D11, what output wave form would you expect to see on an oscilloscope display?

- A. 1
- B. 2
- C. 3
- D. 4



Answer Key: 3-32D1: D 3-32D2: C 3-32D3: A 3-32D4: D 3-32D5: C 3-32D6: B

Subelement E – Digital Logic: 8 Key Topics, 8 Exam Questions, 3 Drawings

Key Topic 33: Types of Logic

- 3-33E1 What is the voltage range considered to be valid logic low input in a TTL device operating at 5 volts?
- A. 2.0 to 5.5 volts.
 - B. -2.0 to -5.5 volts.
 - C. Zero to 0.8 volts.
 - D. 5.2 to 34.8 volts.
- 3-33E2 What is the voltage range considered to be a valid logic high input in a TTL device operating at 5.0 volts?
- A. 2.0 to 5.5 volts.
 - B. 1.5 to 3.0 volts.
 - C. 1.0 to 1.5 volts.
 - D. 5.2 to 34.8 volts.
- 3-33E3 What is the common power supply voltage for TTL series integrated circuits?
- A. 12 volts.
 - B. 13.6 volts.
 - C. 1 volt.
 - D. 5 volts.
- 3-33E4 TTL inputs left open develop what logic state?
- A. A high-logic state.
 - B. A low-logic state.
 - C. Open inputs on a TTL device are ignored.
 - D. Random high- and low-logic states.
- 3-33E5 Which of the following instruments would be best for checking a TTL logic circuit?
- A. VOM.
 - B. DMM.
 - C. Continuity tester.
 - D. Logic probe.
- 3-33E6 What do the initials TTL stand for?
- A. Resistor-transistor logic.
 - B. Transistor-transistor logic.
 - C. Diode-transistor logic.
 - D. Emitter-coupled logic.

Answer Key: 3-33E1: C 3-33E2: A 3-33E3: D 3-33E4: A 3-33E5: D 3-33E6: B

Key Topic 34: Logic Gates

- 3-34E1 What is a characteristic of an AND gate?
- A. Produces a logic "0" at its output only if all inputs are logic "1".
 - B. Produces a logic "1" at its output only if all inputs are logic "1".
 - C. Produces a logic "1" at its output if only one input is a logic "1".
 - D. Produces a logic "1" at its output if all inputs are logic "0".
- 3-34E2 What is a characteristic of a NAND gate?
- A. Produces a logic "0" at its output only when all inputs are logic "0".
 - B. Produces a logic "1" at its output only when all inputs are logic "1".
 - C. Produces a logic "0" at its output if some but not all of its inputs are logic "1".
 - D. Produces a logic "0" at its output only when all inputs are logic "1".
- 3-34E3 What is a characteristic of an OR gate?
- A. Produces a logic "1" at its output if any input is logic "1".
 - B. Produces a logic "0" at its output if any input is logic "1".
 - C. Produces a logic "0" at its output if all inputs are logic "1".
 - D. Produces a logic "1" at its output if all inputs are logic "0".
- 3-34E4 What is a characteristic of a NOR gate?
- A. Produces a logic "0" at its output only if all inputs are logic "0".
 - B. Produces a logic "1" at its output only if all inputs are logic "1".
 - C. Produces a logic "0" at its output if any or all inputs are logic "1".
 - D. Produces a logic "1" at its output if some but not all of its inputs are logic "1".
- 3-34E5 What is a characteristic of a NOT gate?
- A. Does not allow data transmission when its input is high.
 - B. Produces a logic "0" at its output when the input is logic "1" and vice versa.
 - C. Allows data transmission only when its input is high.
 - D. Produces a logic "1" at its output when the input is logic "1" and vice versa.
- 3-34E6 Which of the following logic gates will provide an active high out when both inputs are active high?
- A. NAND.
 - B. NOR.
 - C. AND.
 - D. XOR.

Answer Key: 3-34E1: B 3-34E2: D 3-34E3: A 3-34E4: C 3-34E5: B 3-34E6: C

Key Topic 35: Logic Levels

3-35E1 In a negative-logic circuit, what level is used to represent a logic 0?

- A. Low level.
- B. Positive-transition level.
- C. Negative-transition level.
- D. High level.

3-35E2 For the logic input levels shown in Figure 3E12, what are the logic levels of test points A, B and C in this circuit? (Assume positive logic.)

- A. A is high, B is low and C is low.
- B. A is low, B is high and C is high.
- C. A is high, B is high and C is low.
- D. A is low, B is high and C is low.

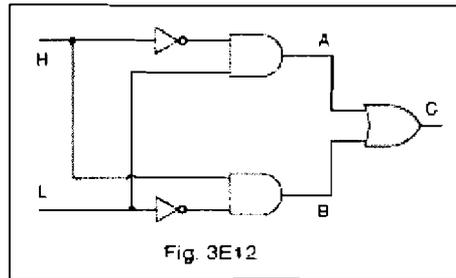


Fig. 3E12

3-35E3 For the logic input levels given in Figure 3E13, what are the logic levels of test points A, B and C in this circuit? (Assume positive logic.)

- A. A is low, B is low and C is high.
- B. A is low, B is high and C is low.
- C. A is high, B is high and C is high.
- D. A is high, B is low and C is low.

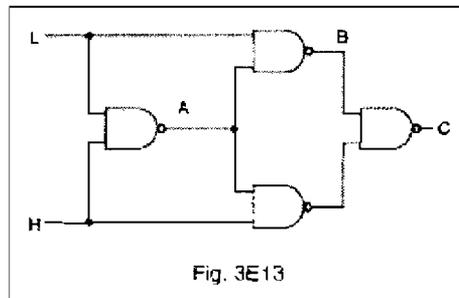


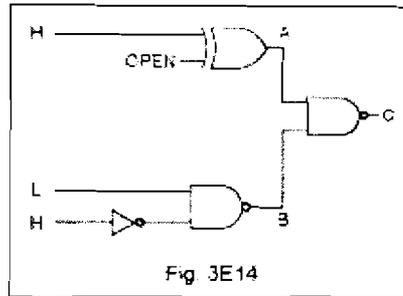
Fig. 3E13

3-35E4 In a positive-logic circuit, what level is used to represent a logic 1?

- A. High level
- B. Low level
- C. Positive-transition level
- D. Negative-transition level

3-35E5 Given the input levels shown in Figure 3E14 and assuming positive logic devices, what would the output be?

- A. A is low, B is high and C is high.
- B. A is high, B is high and C is low.
- C. A is low, B is low and C is high.
- D. None of the above are correct.



3-35E6 What is a truth table?

- A. A list of input combinations and their corresponding outputs that characterizes a digital device's function.
- B. A table of logic symbols that indicate the high logic states of an op-amp.
- C. A diagram showing logic states when the digital device's output is true.
- D. A table of logic symbols that indicates the low logic states of an op-amp.

Answer Key: 3-35E1: D 3-35E2: B 3-35E3: C 3-35E4: A 3-35E5: B 3-35E6: A

Key Topic 36: Flip-Flops

3-36E1 A flip-flop circuit is a binary logic element with how many stable states?

- A. 1
- B. 2
- C. 4
- D. 8

3-36E2 What is a flip-flop circuit? A binary sequential logic element with ___ stable states.

- A. 1
- B. 4
- C. 2
- D. 8

3-36E3 How many flip-flops are required to divide a signal frequency by 4?

- A. 1
- B. 4
- C. 8
- D. 2

3-36E4 How many bits of information can be stored in a single flip-flop circuit?

- A. 1
- B. 2
- C. 3
- D. 4

3-36E5 How many R-S flip-flops would be required to construct an 8 bit storage register?

- A. 2
- B. 4
- C. 8
- D. 16

3-36E6 An R-S flip-flop is capable of doing all of the following except:

- A. Accept data input into R-S inputs with CLK initiated.
- B. Accept data input into PRE and CLR inputs without CLK being initiated.
- C. Refuse to accept synchronous data if asynchronous data is being input at same time.
- D. Operate in toggle mode with R-S inputs held constant and CLK initiated.

Answer Key: 3-36E1: B 3-36E2: C 3-36E3: D 3-36E4: A 3-36E5: C 3-36E6: D

Key Topic 37: Multivibrators

- 3-37E1 The frequency of an AC signal can be divided electronically by what type of digital circuit?
- A. Free-running multivibrator.
 - B. Bistable multivibrator.
 - C. OR gate.
 - D. Astable multivibrator.
- 3-37E2 What is an astable multivibrator?
- A. A circuit that alternates between two stable states.
 - B. A circuit that alternates between a stable state and an unstable state.
 - C. A circuit set to block either a 0 pulse or a 1 pulse and pass the other.
 - D. A circuit that alternates between two unstable states.
- 3-37E3 What is a monostable multivibrator?
- A. A circuit that can be switched momentarily to the opposite binary state and then returns after a set time to its original state.
 - B. A "clock" circuit that produces a continuous square wave oscillating between 1 and 0.
 - C. A circuit designed to store one bit of data in either the 0 or the 1 configuration.
 - D. A circuit that maintains a constant output voltage, regardless of variations in the input voltage.
- 3-37E4 What is a bistable multivibrator circuit commonly named?
- A. AND gate.
 - B. OR gate.
 - C. Clock.
 - D. Flip-flop.
- 3-37E5 What is a bistable multivibrator circuit?
- A. Flip-flop.
 - B. AND gate.
 - C. OR gate.
 - D. Clock.
- 3-37E6 What wave form would appear on the voltage outputs at the collectors of an astable, multivibrator, common-emitter stage?
- A. Sine wave.
 - B. Sawtooth wave.
 - C. Square wave.
 - D. Half-wave pulses.

Answer Key: 3-37E1: B 3-37E2: D 3-37E3: A 3-37E4: D 3-37E5: A 3-37E6: C

Key Topic 38: Memory

3-38E1 What is the name of the semiconductor memory IC whose digital data can be written or read, and whose memory word address can be accessed randomly?

- A. ROM – Read-Only Memory.
- B. PROM – Programmable Read-Only Memory.
- C. RAM – Random-Access Memory.
- D. EPROM – Electrically Programmable Read-Only Memory.

3-38E2 What is the name of the semiconductor IC that has a fixed pattern of digital data stored in its memory matrix?

- A. RAM – Random-Access Memory.
- B. ROM – Read-Only Memory.
- C. Register.
- D. Latch.

3-38E3 What does the term “IO” mean within a microprocessor system?

- A. Integrated oscillator.
- B. Integer operation.
- C. Input-output.
- D. Internal operation.

3-38E4 What is the name for a microprocessor’s sequence of commands and instructions?

- A. Program.
- B. Sequence.
- C. Data string.
- D. Data execution.

3-38E5 How many individual memory cells would be contained in a memory IC that has 4 data bus input/output pins and 4 address pins for connection to the address bus?

- A. 8
- B. 16
- C. 32
- D. 64

3-38E6 What is the name of the random-accessed semiconductor memory IC that must be refreshed periodically to maintain reliable data storage in its memory matrix?

- A. ROM – Read-Only Memory.
- B. DRAM – Dynamic Random-Access Memory.
- C. PROM – Programmable Read-Only Memory.
- D. PRAM – Programmable Random-Access Memory.

Answer Key: 3-38E1: C 3-38E2: B 3-38E3: C 3-38E4: A 3-38E5: D 3-38E6: B

Key Topic 39: Microprocessors

3-39E1 *In a microprocessor-controlled two-way radio, a “watchdog” timer:*

- A. Verifies that the microprocessor is executing the program.
- B. Assures that the transmission is exactly on frequency.
- C. Prevents the transmitter from exceeding allowed power out.
- D. Connects to the system RADAR presentation.

3-39E2 What does the term “DAC” refer to in a microprocessor circuit?

- A. Dynamic access controller.
- B. Digital to analog converter.
- C. Digital access counter.
- D. Dial analog control.

3-39E3 Which of the following is not part of a MCU processor?

- A. RAM
- B. ROM
- C. I/O
- D. Voltage Regulator

3-39E4 What portion of a microprocessor circuit is the pulse generator?

- A. Clock
- B. RAM
- C. ROM
- D. PLL

3-39E5 In a microprocessor, what is the meaning of the term “ALU”?

- A. Automatic lock/unlock.
- B. Arithmetical logic unit.
- C. Auto latch undo.
- D. Answer local unit.

3-39E6 What circuit interconnects the microprocessor with the memory and input/output system?

- A. Control logic bus.
- B. PLL line.
- C. Data bus line.
- D. Directional coupler.

Answer Key: 3-39E1: A 3-39E2: B 3-39E3: D 3-39E4: A 3-39E5: B 3-39E6: C

Key Topic 40: Counters, Dividers, Converters

3-40E1 What is the purpose of a prescaler circuit?

- A. Converts the output of a JK flip-flop to that of an RS flip-flop.
- B. Multiplies an HF signal so a low-frequency counter can display the operating frequency.
- C. Prevents oscillation in a low frequency counter circuit.
- D. Divides an HF signal so that a low-frequency counter can display the operating frequency.

3-40E2 What does the term "BCD" mean?

- A. Binaural coded digit.
- B. Bit count decimal.
- C. Binary coded decimal.
- D. Broad course digit.

3-40E3 What is the function of a decade counter digital IC?

- A. Decode a decimal number for display on a seven-segment LED display.
- B. Produce one output pulse for every ten input pulses.
- C. Produce ten output pulses for every input pulse.
- D. Add two decimal numbers.

3-40E4 What integrated circuit device converts an analog signal to a digital signal?

- A. DAC
- B. DCC
- C. ADC
- D. CDC

3-40E5 What integrated circuit device converts digital signals to analog signals?

- A. ADC
- B. DCC
- C. CDC
- D. DAC

3-40E6 In binary numbers, how would you note the quantity TWO?

- A. 0010
- B. 0002
- C. 2000
- D. 0020

Answer Key: 3-40E1: D 3-40E2: C 3-40E3: B 3-40E4: C 3-40E5: D 3-40E6: A

Subelement F – Receivers: 10 Key Topics, 10 Exam Questions, 2 Drawings

Key Topic 41: Receiver Theory

- 3-41F1 What is the limiting condition for sensitivity in a communications receiver?
- A. The noise floor of the receiver.
 - B. The power supply output ripple.
 - C. The two-tone intermodulation distortion.
 - D. The input impedance to the detector.
- 3-41F2 What is the definition of the term “receiver desensitizing”?
- A. A burst of noise when the squelch is set too low.
 - B. A reduction in receiver sensitivity because of a strong signal on a nearby frequency.
 - C. A burst of noise when the squelch is set too high.
 - D. A reduction in receiver sensitivity when the AF gain control is turned down.
- 3-41F3 What is the term used to refer to a reduction in receiver sensitivity caused by unwanted high-level adjacent channel signals?
- A. Desensitizing.
 - B. Intermodulation distortion.
 - C. Quieting.
 - D. Overloading.
- 3-41F4 What is meant by the term noise figure of a communications receiver?
- A. The level of noise entering the receiver from the antenna.
 - B. The relative strength of a received signal 3 kHz removed from the carrier frequency.
 - C. The level of noise generated in the front end and succeeding stages of a receiver.
 - D. The ability of a receiver to reject unwanted signals at frequencies close to the desired one.
- 3-41F5 Which stage of a receiver primarily establishes its noise figure?
- A. The audio stage.
 - B. The RF stage.
 - C. The IF strip.
 - D. The local oscillator.
- 3-41F6 What is the term for the ratio between the largest tolerable receiver input signal and the minimum discernible signal?
- A. Intermodulation distortion.
 - B. Noise floor.
 - C. Noise figure.
 - D. Dynamic range.

Answer Key: 3-41F1: A 3-41F2: B 3-41F3: A 3-41F4: C 3-41F5: B 3-41F6: D

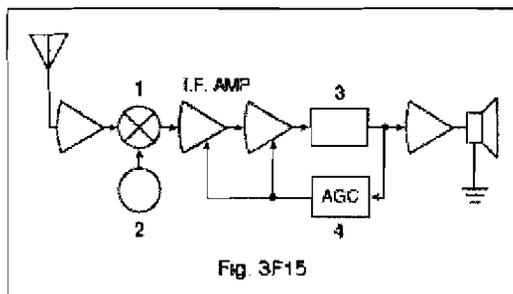
Key Topic 42: RF Amplifiers

- 3-42F1 How can selectivity be achieved in the front-end circuitry of a communications receiver?
- A. By using an audio filter.
 - B. By using an additional RF amplifier stage.
 - C. By using an additional IF amplifier stage.
 - D. By using a preselector.
- 3-42F2 What is the primary purpose of an RF amplifier in a receiver?
- A. To provide most of the receiver gain.
 - B. To vary the receiver image rejection by utilizing the AGC.
 - C. To improve the receiver's noise figure.
 - D. To develop the AGC voltage.
- 3-42F3 How much gain should be used in the RF amplifier stage of a receiver?
- A. Sufficient gain to allow weak signals to overcome noise generated in the first mixer stage.
 - B. As much gain as possible short of self oscillation.
 - C. Sufficient gain to keep weak signals below the noise of the first mixer stage.
 - D. It depends on the amplification factor of the first IF stage.
- 3-42F4 Too much gain in a VHF receiver front end could result in this:
- A. Local signals become weaker.
 - B. Difficult to match receiver impedances.
 - C. Dramatic increase in receiver current.
 - D. Susceptibility of intermodulation interference from nearby transmitters.
- 3-42F5 What is the advantage of a GaAsFET preamplifier in a modern VHF radio receiver?
- A. Increased selectivity and flat gain.
 - B. Low gain but high selectivity.
 - C. High gain and low noise floor.
 - D. High gain with high noise floor.
- 3-42F6 In what stage of a VHF receiver would a low noise amplifier be most advantageous?
- A. IF stage.
 - B. Front end RF stage.
 - C. Audio stage.
 - D. Power supply.

Answer Key: 3-42F1: D 3-42F2: C 3-42F3: A 3-42F4: D 3-42F5: C 3-42F6: B

Key Topic 43: Oscillators

- 3-43F1 Why is the Colpitts oscillator circuit commonly used in a VFO (variable frequency oscillator)?
- A. It can be phase locked.
 - B. It can be remotely tuned.
 - C. It is stable.
 - D. It has little or no effect on the crystal's stability.
- 3-43F2 What is the oscillator stage called in a frequency synthesizer?
- A. VCO.
 - B. Divider.
 - C. Phase detector.
 - D. Reference standard.
- 3-43F3 What are three major oscillator circuits found in radio equipment?
- A. Taft, Pierce, and negative feedback.
 - B. Colpitts, Hartley, and Taft.
 - C. Taft, Hartley, and Pierce.
 - D. Colpitts, Hartley, and Pierce.
- 3-43F4 Which type of oscillator circuit is commonly used in a VFO (variable frequency oscillator)?
- A. Colpitts.
 - B. Pierce.
 - C. Hartley.
 - D. Negative feedback.
- 3-43F5 What condition must exist for a circuit to oscillate? It must:
- A. Have a gain of less than 1.
 - B. Be neutralized.
 - C. Have sufficient negative feedback.
 - D. Have sufficient positive feedback.
- 3-43F6 In Figure 3F15, which block diagram symbol (labeled 1 through 4) is used to represent a local oscillator?
- A. 1
 - B. 2
 - C. 3
 - D. 4



Answer Key: 3-43F1: C 3-43F2: A 3-43F3: D 3-43F4: A 3-43F5: D 3-43F6: B

Key Topic 44: Mixers

3-44F1 What is the image frequency if the normal channel is 151.000 MHz, the IF is operating at 11.000 MHz, and the LO is at 140.000 MHz?

- A. 131.000 MHz.
- B. 129.000 MHz.
- C. 162.000 MHz.
- D. 150.000 MHz.

3-44F2 What is the mixing process in a radio receiver?

- A. The elimination of noise in a wideband receiver by phase comparison.
- B. The elimination of noise in a wideband receiver by phase differentiation.
- C. Distortion caused by auroral propagation.
- D. The combination of two signals to produce sum and difference frequencies.

3-44F3 In what radio stage is the image frequency normally rejected?

- A. RF.
- B. IF.
- C. LO.
- D. Detector.

3-44F4 What are the principal frequencies that appear at the output of a mixer circuit?

- A. Two and four times the original frequency.
- B. The sum, difference and square root of the input frequencies.
- C. The original frequencies and the sum and difference frequencies.
- D. 1.414 and 0.707 times the input frequency.

3-44F5 If a receiver mixes a 13.8 MHz VFO with a 14.255 MHz receive signal to produce a 455 kHz intermediate frequency signal, what type of interference will a 13.345 MHz signal produce in the receiver?

- A. Local oscillator interference.
- B. An image response.
- C. Mixer interference.
- D. Intermediate frequency interference.

3-44F6 What might occur in a receiver if excessive amounts of signal energy overdrive the mixer circuit?

- A. Automatic limiting occurs.
- B. Mixer blanking occurs.
- C. Spurious mixer products are generated.
- D. The mixer circuit becomes unstable and drifts.

Answer Key: 3-44F1: B 3-44F2: D 3-44F3: A 3-44F4: C 3-44F5: B 3-44F6: C

Key Topic 45: IF Amplifiers

- 3-45F1 What degree of selectivity is desirable in the IF circuitry of a wideband FM phone receiver?
- A. 1 kHz.
 - B. 2.4 kHz.
 - C. 4.2 kHz.
 - D. 15 kHz.
- 3-45F2 Which one of these filters can be used in micro-miniature electronic circuits?
- A. High power transmitter cavity.
 - B. Receiver SAW IF filter.
 - C. Floppy disk controller.
 - D. Internet DSL to telephone line filter.
- 3-45F3 A receiver selectivity of 2.4 KHz in the IF circuitry is optimum for what type of signals?
- A. CW.
 - B. Double-sideband AM voice.
 - C. SSB voice.
 - D. FSK RTTY.
- 3-45F4 A receiver selectivity of 10 KHz in the IF circuitry is optimum for what type of signals?
- A. Double-sideband AM.
 - B. SSB voice.
 - C. CW.
 - D. FSK RTTY.
- 3-45F5 What is an undesirable effect of using too wide a filter bandwidth in the IF section of a receiver?
- A. Output-offset overshoot.
 - B. Undesired signals will reach the audio stage.
 - C. Thermal-noise distortion.
 - D. Filter ringing.
- 3-45F6 How should the filter bandwidth of a receiver IF section compare with the bandwidth of a received signal?
- A. Slightly greater than the received-signal bandwidth.
 - B. Approximately half the received-signal bandwidth.
 - C. Approximately two times the received-signal bandwidth.
 - D. Approximately four times the received-signal bandwidth.

Answer Key: 3-45F1: D 3-45F2: B 3-45F3: C 3-45F4: A 3-45F5: B 3-45F6: A

Key Topic 46: Filters and IF Amplifiers

- 3-46F1 What is the primary purpose of the final IF amplifier stage in a receiver?
- A. Dynamic response.
 - B. Gain.
 - C. Noise figure performance.
 - D. Bypass undesired signals.
- 3-46F2 What factors should be considered when selecting an intermediate frequency?
- A. Cross-modulation distortion and interference.
 - B. Interference to other services.
 - C. Image rejection and selectivity.
 - D. Noise figure and distortion.
- 3-46F3 What is the primary purpose of the first IF amplifier stage in a receiver?
- A. Noise figure performance.
 - B. Tune out cross-modulation distortion.
 - C. Dynamic response.
 - D. Selectivity.
- 3-46F4 What parameter must be selected when designing an audio filter using an op-amp?
- A. Bandpass characteristics.
 - B. Desired current gain.
 - C. Temperature coefficient.
 - D. Output-offset overshoot.
- 3-46F5 What are the distinguishing features of a Chebyshev filter?
- A. It has a maximally flat response over its passband.
 - B. It only requires inductors.
 - C. It allows ripple in the passband.
 - D. A filter whose product of the series- and shunt-element impedances is a constant for all frequencies.
- 3-46F6 When would it be more desirable to use an m-derived filter over a constant-k filter?
- A. When the response must be maximally flat at one frequency.
 - B. When the number of components must be minimized.
 - C. When high power levels must be filtered.
 - D. When you need more attenuation at a certain frequency that is too close to the cut-off frequency for a constant-k filter.

Answer Key: 3-46F1: B 3-46F2: C 3-46F3: D 3-46F4: A 3-46F5: C 3-46F6: D