Canadian Amateur Radio Advanced Exam

This document contains the entire **Advanced** Canadian Amateur Radio Exam Question Bank with only the **CORRECT** answer listed. This is the best way to study for the exam.

NOTE: An update to the Advanced Exam question bank is slated for 2026/2027.

This Document contains the questions & answers from the Pre-2026/2027 Updated Version!

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Section 001 - Advanced Theory

A-001-001-001 What is the meaning of the term “time constant” in an RL circuit ? **The time required for the current in the circuit to build up to 63.2% of the maximum value**

A-001-001-002 What is the term for the time required for the capacitor in an RC circuit to be charged to 63.2% of the supply voltage? **One time constant**

A-001-001-003 What is the term for the time required for the current in an RL circuit to build up to 63.2% of the maximum value? **One time constant**

A-001-001-004 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 value of stored charge? **One time constant**

A-001-001-005 What is meant by “back EMF”? **A voltage that opposes the applied EMF**

A-001-001-006 After two time constants, the capacitor in an RC circuit is charged to what percentage of the supply voltage? **86.5%**

A-001-001-007 After two time constants, the capacitor in an RC circuit is discharged to what percentage of the starting voltage? **13.5%**

A-001-001-008 What is the time constant of a circuit having a 100 microfarad capacitor in series with a 470 kilohm resistor? **47 seconds**

A-001-001-009 What is the time constant of a circuit having a 470 microfarad capacitor in series with a 470 kilohm resistor? **221 seconds**

A-001-001-010 What is the time constant of a circuit having a 220 microfarad capacitor in series with a 470 kilohm resistor? **103 seconds**

A-001-002-001 What is the result of skin effect? **As frequency increases, RF current flows in a thinner layer of the conductor, closer to the surface**

A-001-002-002 What effect causes most of an RF current to flow along the surface of a conductor? **Skin effect**

A-001-002-003 Where does almost all RF current flow in a conductor? **Along the surface of the conductor**

A-001-002-004 Why does most of an RF current flow within a very thin layer under the conductor’s surface? **Because of skin effect**

A-001-002-005 Why is the resistance of a conductor different for RF currents than for direct currents? **Because of skin effect**

A-001-002-006 What unit measures the ability of a capacitor to store electrical charge? **Farad**

A-001-002-007 A wire has a current passing through it. Surrounding this wire there is: **an electromagnetic field**

A-001-002-008 In what direction is the magnetic field oriented about a conductor in relation to the direction of electron flow? **In the direction determined by the left-hand rule**

A-001-002-009 What is the term for energy that is stored in an electromagnetic or electrostatic field? **Potential energy**

A-001-002-010 Between the charged plates of a capacitor there is: **an electrostatic field**

A-001-002-011 Energy is stored within an inductor that is carrying a current. The amount of energy depends on this current, but it also depends on a property of the inductor. This property has the following unit: **henry**

A-001-003-001 What is the resonant frequency of a series RLC circuit if R is 47 ohms, L is 50 microhenrys and C is 40 picofarads? **3.56 MHz**

A-001-003-002 What is the resonant frequency of a series RLC circuit, if R is 47 ohms, L is 40 microhenrys and C is 200 picofarads? **1.78 MHz**

A-001-003-003 What is the resonant frequency of a series RLC circuit, if R is 47 ohms, L is 50 microhenrys and C is 10 picofarads? **7.12 MHz**

A-001-003-004 What is the resonant frequency of a series RLC circuit, if R is 47 ohms, L is 25 microhenrys and C is 10 picofarads? **10.1 MHz**

A-001-003-005 What is the resonant frequency of a series RLC circuit, if R is 47 ohms, L is 3 microhenrys and C is 40 picofarads? **14.5 MHz**

A-001-003-006 What is the resonant frequency of a series RLC circuit, if R is 47 ohms, L is 4 microhenrys and C is 20 picofarads? **17.8 MHz**

A-001-003-007 What is the resonant frequency of a series RLC circuit, if R is 47 ohms, L is 8 microhenrys and C is 7 picofarads? **21.3 MHz**

A-001-003-008 What is the resonant frequency of a series RLC circuit, if R is 47 ohms, L is 3 microhenrys and C is 15 picofarads? **23.7 MHz**

A-001-003-009 What is the resonant frequency of a series RLC circuit, if R is 47 ohms, L is 4 microhenrys and C is 8 picofarads? **28.1 MHz**

A-001-003-010 What is the resonant frequency of a series RLC circuit, if R is 47 ohms, L is 1 microhenry and C is 9 picofarads? **53.1 MHz**

A-001-003-011 What is the value of capacitance (C) in a series R-L-C circuit, if the circuit resonant frequency is 14.25 MHz and L is 2.84 microhenrys? **44 picofarads**

A-001-004-001 What is the resonant frequency of a parallel RLC circuit if R is 4.7 kilohms, L is 1 microhenry and C is 10 picofarads? **50.3 MHz**

A-001-004-002 What is the resonant frequency of a parallel RLC circuit if R is 4.7 kilohms, L is 2 microhenrys and C is 15 picofarads? **29.1 MHz**

A-001-004-003 What is the resonant frequency of a parallel RLC circuit if R is 4.7 kilohms, L is 5 microhenrys and C is 9 picofarads? **23.7 MHz**

A-001-004-004 What is the resonant frequency of a parallel RLC circuit if R is 4.7 kilohms, L is 2 microhenrys and C is 30 picofarads? **20.5 MHz**

A-001-004-005 What is the resonant frequency of a parallel RLC circuit if R is 4.7 kilohms, L is 15 microhenrys and C is 5 picofarads? **18.4 MHz**

A-001-004-006 What is the resonant frequency of a parallel RLC circuit if R is 4.7 kilohms, L is 3 microhenrys and C is 40 picofarads? **14.5 MHz**

A-001-004-007 What is the resonant frequency of a parallel RLC circuit if R is 4.7 kilohms, L is 40 microhenrys and C is 6 picofarads? **10.3 MHz**

A-001-004-008 What is the resonant frequency of a parallel RLC circuit if R is 4.7 kilohms, L is 10 microhenrys and C is 50 picofarads? **7.12 MHz**

A-001-004-009 What is the resonant frequency of a parallel RLC circuit if R is 4.7 kilohms, L is 200 microhenrys and C is 10 picofarads? **3.56 MHz**

A-001-004-010 What is the resonant frequency of a parallel RLC circuit if R is 4.7 kilohms, L is 90 microhenrys and C is 100 picofarads? **1.68 MHz**

A-001-004-011 What is the value of inductance (L) in a parallel RLC circuit, if the resonant frequency is 14.25 MHz and C is 44 picofarads? **2.8 microhenrys**

A-001-005-001 What is the Q of a parallel RLC circuit, if it is resonant at 14.128 MHz, L is 2.7 microhenrys and R is 18 kilohms? **75.1**

A-001-005-002 What is the Q of a parallel RLC circuit, if it is resonant at 14.128 MHz, L is 4.7 microhenrys and R is 18 kilohms? **43.1**

A-001-005-003 What is the Q of a parallel RLC circuit, if it is resonant at 4.468 MHz, L is 47 microhenrys and R is 180 ohms? **0.136**

A-001-005-004 What is the Q of a parallel RLC circuit, if it is resonant at 14.225 MHz, L is 3.5 microhenrys and R is 10 kilohms? **31.9**

A-001-005-005 What is the Q of a parallel RLC circuit, if it is resonant at 7.125 MHz, L is 8.2 microhenrys and R is 1 kilohm? **2.73**

A-001-005-006 What is the Q of a parallel RLC circuit, if it is resonant at 7.125 MHz, L is 10.1 microhenrys and R is 100 ohms? **0.221**

A-001-005-007 What is the Q of a parallel RLC circuit, if it is resonant at 7.125 MHz, L is 12.6 microhenrys and R is 22 kilohms? **39**

A-001-005-008 What is the Q of a parallel RLC circuit, if it is resonant at 3.625 MHz, L is 3 microhenrys and R is 2.2 kilohms? **32.2**

A-001-005-009 What is the Q of a parallel RLC circuit, if it is resonant at 3.625 MHz, L is 42 microhenrys and R is 220 ohms? **0.23**

A-001-005-010 What is the Q of a parallel RLC circuit, if it is resonant at 3.625 MHz, L is 43 microhenrys and R is 1.8 kilohms? **1.84**

A-001-005-011 Why is a resistor often included in a parallel resonant circuit ? **To decrease the Q and increase the bandwidth**

Section 002 - Advanced Components and Circuits

A-002-001-001 What two elements widely used in semiconductor devices exhibit both metallic and non-metallic characteristics? **Silicon and germanium**

A-002-001-002 In what application is gallium-arsenide used as a semiconductor material in preference to germanium or silicon? **At microwave frequencies**

A-002-001-003 What type of semiconductor material contains fewer free electrons than pure germanium or silicon crystals? **P-type**

A-002-001-004 What type of semiconductor material contains more free electrons than pure germanium or silicon crystals? **N-type**

A-002-001-005 What are the majority charge carriers in P-type semiconductor material? **Holes**

A-002-001-006 What are the majority charge carriers in N-type semiconductor material? **Free electrons**

A-002-001-007 Silicon, in its pure form, is: **an insulator**

A-002-001-008 An element which is sometimes an insulator and sometimes a conductor is called a: **semiconductor**

A-002-001-009 Which of the following materials is used to make a semiconductor? **Silicon**

A-002-001-010 Substances such as silicon in a pure state are usually good: **insulators**

A-002-001-011 A semiconductor is said to be doped when it has added to it small quantities of: **impurities**

A-002-002-001 What is the principal characteristic of a Zener diode? **A constant voltage under conditions of varying current**

A-002-002-002 What type of semiconductor diode varies its internal capacitance as the voltage applied to its terminals varies? **Varactor**

A-002-002-003 What is a common use for the hot-carrier (Schottky) diode? **As VHF and UHF mixers and detectors**

A-002-002-004 What limits the maximum forward current in a junction diode? **Junction temperature**

A-002-002-005 What are the major ratings for junction diodes? **Maximum forward current and peak inverse voltage (PIV)**

A-002-002-006 Structurally, what are the two main categories of semiconductor diodes? **Junction and point contact**

A-002-002-007 What is a common use for point contact diodes? **As an RF detector**

A-002-002-008 What is one common use for PIN diodes? **As an RF switch**

A-002-002-009 A Zener diode is a device used to: **regulate voltage**

A-002-002-010 If a Zener diode rated at 10 V and 50 watts was operated at maximum dissipation rating, it would conduct ____ amperes: **5**

A-002-002-011 The power-handling capability of most Zener diodes is rated at 25 degrees C or approximately room temperature. If the temperature is increased, the power handling capability is: **less**

A-002-003-001 What is the alpha of a bipolar transistor? **The change of collector current with respect to emitter current**

A-002-003-002 What is the beta of a bipolar transistor? **The change of collector current with respect to base current**

A-002-003-003 Which component conducts electricity from a negative emitter to a positive collector when its base voltage is made positive? **An NPN transistor**

A-002-003-004 What is the alpha of a bipolar transistor in common base configuration? **Forward current gain**

A-002-003-005 In a bipolar transistor, the change of collector current with respect to base current is called: **beta**

A-002-003-006 The alpha of a bipolar transistor is specified for what configuration? **Common base**

A-002-003-007 The beta of a bipolar transistor is specified for what configurations? **Common emitter or common collector**

A-002-003-008 Which component conducts electricity from a positive emitter to a negative collector when its base is made negative? **A PNP transistor**

A-002-003-009 Alpha of a bipolar transistor is equal to: **beta / (1 + beta)**

A-002-003-010 The current gain of a bipolar transistor in common emitter or common collector compared to common base configuration is: **high to very high**

A-002-003-011 Beta of a bipolar transistor is equal to: **alpha / (1 - alpha)**

A-002-004-001 What is an enhancement-mode FET? **An FET without a channel no current occurs with zero gate voltage**

A-002-004-002 What is a depletion-mode FET? **An FET that has a channel with no gate voltage applied a current flows with zero gate voltage**

A-002-004-003 Why do many MOSFET devices have built-in gate protective Zener diodes? **The gate-protective Zener diode prevents the gate insulation from being punctured by small static charges or excessive voltages**

A-002-004-004 Why are special precautions necessary in handling FET and CMOS devices? **They are susceptible to damage from static charges**

A-002-004-005 How does the input impedance of a field-effect transistor (FET) compare with that of a bipolar transistor? **An FET has high input impedance a bipolar transistor has low input impedance**

A-002-004-006 What are the three terminals of a junction field-effect transistor (JFET)? **Gate, drain, source**

A-002-004-007 What are the two basic types of junction field-effect transistors (JFET)? **N-channel and P-channel**

A-002-004-008 Electron conduction in an n-channel depletion type MOSFET is associated with: **n-channel depletion**

A-002-004-009 Electron conduction in an n-channel enhancement MOSFET is associated with: **n-channel enhancement**

A-002-004-010 Hole conduction in a p-channel depletion type MOSFET is associated with: **p-channel depletion**

A-002-004-011 Hole conduction in a p-channel enhancement type MOSFET is associated with: **p-channel enhancement**

A-002-005-001 What are the three terminals of a silicon controlled rectifier (SCR)? **Anode, cathode and gate**

A-002-005-002 What are the two stable operating conditions of a silicon controlled rectifier (SCR)? **Conducting and non-conducting**

A-002-005-003 When a silicon controlled rectifier (SCR) is triggered, to what other semiconductor diode are its electrical characteristics similar (as measured between its cathode and anode)? **The junction diode**

A-002-005-004 Under what operating condition does a silicon controlled rectifier (SCR) exhibit electrical characteristics similar to a forward-biased silicon rectifier? **When it is gated "on"**

A-002-005-005 The silicon controlled rectifier (SCR) is what type of device? **PNPN**

A-002-005-006 The control element in the silicon controlled rectifier (SCR) is called the: **gate**

A-002-005-007 The silicon controlled rectifier (SCR) is a member of which family? **Thyristors**

A-002-005-008 In amateur radio equipment, which is the major application for the silicon controlled rectifier (SCR)? **Power supply overvoltage "crowbar" circuit**

A-002-005-009 Which of the following devices has anode, cathode, and gate? **The silicon controlled rectifier (SCR)**

A-002-005-010 When it is gated "on", the silicon controlled rectifier (SCR) exhibits electrical characteristics similar to a: **forward-biased silicon rectifier**

A-002-005-011 Which of the following is a PNPN device? **Silicon controlled rectifier (SCR)**

A-002-006-001 For what portion of a signal cycle does a Class A amplifier operate? **The entire cycle**

A-002-006-002 Which class of amplifier has the highest linearity and least distortion? **Class A**

A-002-006-003 For what portion of a cycle does a Class AB amplifier operate? **More than 180 degrees but less than 360 degrees**

A-002-006-004 For what portion of a cycle does a Class B amplifier operate? **180 degrees**

A-002-006-005 For what portion of a signal cycle does a Class C amplifier operate? **Less than 180 degrees**

A-002-006-006 Which of the following classes of amplifier provides the highest efficiency? **Class C**

A-002-006-007 Which of the following classes of amplifier would provide the highest efficiency in the output stage of a CW, RTTY or FM transmitter? **Class C**

A-002-006-008 Which class of amplifier provides the least efficiency? **Class A**

A-002-006-009 Which class of amplifier has the poorest linearity and the most distortion? **Class C**

A-002-006-010 Which class of amplifier operates over the full cycle? **Class A**

A-002-006-011 Which class of amplifier operates over less than 180 degrees of the cycle? **Class C**

A-002-007-001 What determines the input impedance of a FET common-source amplifier? **The input impedance is essentially determined by the gate biasing network**

A-002-007-002 What determines the output impedance of a FET common-source amplifier? **The output impedance is essentially determined by the drain resistor**

A-002-007-003 What are the advantages of a Darlington pair audio amplifier? **High gain, high input impedance and low output impedance**

A-002-007-004 In the common base amplifier, when the input and output signals are compared: **the signals are in phase**

A-002-007-005 In the common base amplifier, the input impedance, when compared to the output impedance is: **very low**

A-002-007-006 In the common emitter amplifier, when the input and output signals are compared: **the signals are 180 degrees out of phase**

A-002-007-007 In the common collector amplifier, when the input and output signals are compared: **the signals are in phase**

A-002-007-008 The FET amplifier source follower circuit is another name for: **common drain circuit**

A-002-007-009 The FET amplifier common source circuit is similar to which of the following bipolar transistor amplifier circuits? **Common emitter**

A-002-007-010 The FET amplifier common drain circuit is similar to which of the following bipolar transistor amplifier circuits? **Common collector**

A-002-007-011 The FET amplifier common gate circuit is similar to which of the following bipolar transistor amplifier circuits? **Common base**

A-002-008-001 What is an operational amplifier (op-amp)? **A high-gain, direct-coupled differential amplifier whose characteristics are determined by components mounted externally**

A-002-008-002 What would be the characteristics of the ideal op-amp? **Infinite input impedance, zero output impedance, infinite gain, and flat frequency response**

A-002-008-003 What determines the gain of a closed-loop op-amp circuit? **The external feedback network**

A-002-008-004 What is meant by the term op-amp offset voltage? **The potential between the amplifier input terminals of the op-amp in a closed-loop condition**

A-002-008-005 What is the input impedance of a theoretically ideal op-amp? **Very high**

A-002-008-006 What is the output impedance of a theoretically ideal op-amp? **Very low**

A-002-008-007 What are the advantages of using an op-amp instead of LC elements in an audio filter? **Op-amps exhibit gain rather than insertion loss**

A-002-008-008 What are the principal uses of an op-amp RC active filter in amateur circuitry? **Op-amp circuits are used as audio filters for receivers**

A-002-008-009 What is an inverting op-amp circuit? **An operational amplifier circuit connected such that the input and output signals are 180 degrees out of phase**

A-002-008-010 What is a non-inverting op-amp circuit? **An operational amplifier circuit connected such that the input and output signals are in phase**

A-002-008-011 What term is most appropriate for a high gain, direct-coupled differential amplifier whose characteristics are determined by components mounted externally? **Operational amplifier**

A-002-009-001 What is the mixing process? **The combination of two signals to produce sum and difference frequencies**

A-002-009-002 What are the principal frequencies that appear at the output of a mixer circuit? **The original frequencies and the sum and difference frequencies**

A-002-009-003 What occurs when an excessive amount of signal energy reaches the mixer circuit? **Spurious signals are generated**

A-002-009-004 In a frequency multiplier circuit, the input signal is coupled to the base of a transistor through a capacitor. A radio frequency choke is connected between the base of the transistor and ground. The capacitor is: **a DC blocking capacitor**

A-002-009-005 A frequency multiplier circuit must be operated in: **class C**

A-002-009-006 In a frequency multiplier circuit, an inductance (L1) and a variable capacitor (C2) are connected in series between VCC+ and ground. The collector of a transistor is connected to a tap on L1. The purpose of the variable capacitor is to: **tune L1 to the desired harmonic**

A-002-009-007 In a frequency multiplier circuit, an inductance (L1) and a variable capacitor (C2) are connected in series between VCC+ and ground. The collector of a transistor is connected to a tap on L1. A fixed capacitor (C3) is connected between the VCC+ side of L1 and ground. The purpose of C3 is to: **provide an RF ground at the VCC connection point of L1**

A-002-009-008 In a frequency multiplier circuit, an inductance (L1) and a variable capacitor (C2) are connected in series between VCC+ and ground. The collector of a transistor is connected to a tap on L1. C2 in conjunction with L1 operate as a: **frequency multiplier**

A-002-009-009 In a circuit where the components are tuned to resonate at a higher frequency than applied, the circuit is most likely a: **a frequency multiplier**

A-002-009-010 In a frequency multiplier circuit, an inductance (L1) and a variable capacitor (C2) are connected in series between VCC+ and ground. The collector of a transistor is connected to a tap on L1. A fixed capacitor (C3) is connected between the VCC+ side of L1 and ground. C3 is a: **RF by-pass capacitor**

A-002-009-011 What stage in a transmitter would change a 5.3-MHz input signal to 14.3 MHz? **A mixer**

A-002-010-001 What is a NAND gate? **A circuit that produces a logic "0" at its output only when all inputs are logic "1"**

A-002-010-002 What is an OR gate? **A circuit that produces a logic "1" at its output if any input is logic "1"**

A-002-010-003 What is a NOR gate? **A circuit that produces a logic "0" at its output if any or all inputs are logic "1"**

A-002-010-004 What is a NOT gate (also known as an INVERTER)? **A circuit that produces a logic "0" at its output when the input is logic "1"**

A-002-010-005 What is an EXCLUSIVE OR gate? **A circuit that produces a logic "1" at its output when only one of the inputs is logic "1"**

A-002-010-006 What is an EXCLUSIVE NOR gate? **A circuit that produces a logic "1" at its output when all of the inputs are logic "1"**

A-002-010-007 What is an AND gate? **A circuit that produces a logic "1" at its output only if all its inputs are logic "1"**

A-002-010-008 What is a flip-flop circuit? **A binary sequential logic element with two stable states**

A-002-010-009 What is a bistable multivibrator? **A flip-flop**

A-002-010-010 What type of digital logic is also known as a latch? **A flip-flop**

A-002-010-011 In a multivibrator circuit, when one transistor conducts, the other is: **cut off**

A-002-011-001 What is a crystal lattice filter? **A filter with narrow bandwidth and steep skirts made using quartz crystals**

A-002-011-002 What factor determines the bandwidth and response shape of a crystal lattice filter? **The relative frequencies of the individual crystals**

A-002-011-003 For single-sideband phone emissions, what would be the bandwidth of a good crystal lattice filter? **2.4 kHz**

A-002-011-004 The main advantage of a crystal oscillator over a tuned LC oscillator is: **much greater frequency stability**

A-002-011-005 A quartz crystal filter is superior to an LC filter for narrow bandpass applications because of the: **crystal's high Q**

A-002-011-006 Piezoelectricity is generated by: **deforming certain crystals**

A-002-011-007 Electrically, what does a crystal look like? **A very high Q tuned circuit**

A-002-011-008 Crystals are sometimes used in a circuit which has an output close to an integral multiple of the crystal frequency. This circuit is called: **an overtone oscillator**

A-002-011-009 Which of the following properties does not apply to a crystal when used in an oscillator circuit? **High power output**

A-002-011-010 Crystal oscillators, filters and microphones depend upon which principle? **Piezoelectric effect**

A-002-011-011 Crystals are not applicable to which of the following? **Active filters**

A-002-012-001 What are the three general groupings of filters? **High-pass, low-pass and band-pass**

A-002-012-002 What are the distinguishing features of a Butterworth filter? **It has a maximally flat response over its pass-band**

A-002-012-003 Which filter type is described as having ripple in the passband and a sharp cutoff? **A Chebyshev filter**

A-002-012-004 What are the distinguishing features of a Chebyshev filter? **It allows ripple in the passband in return for steeper skirts**

A-002-012-005 Resonant cavities are used by amateurs as a: **narrow bandpass filter at VHF and higher frequencies**

A-002-012-006 On VHF and above, 1/4 wavelength coaxial cavities are used to give protection from high-level signals. For a frequency of approximately 50 MHz, the diameter of such a device would be about 10 cm (4 in). What would be its approximate length? **1.5 metres (5 ft)**

A-002-012-007 A device which helps with receiver overload and spurious responses at VHF, UHF and above may be installed in the receiver front end. It is called a: **helical resonator**

A-002-012-008 Where you require bandwidth at VHF and higher frequencies about equal to a television channel, a good choice of filter is the: **none of the other answers**

A-002-012-009 What is the primary advantage of the Butterworth filter over the Chebyshev filter? **It has maximally flat response over its passband**

A-002-012-010 What is the primary advantage of the Chebyshev filter over the Butterworth filter? **It allows ripple in the passband in return for steeper skirts**

A-002-012-011 Which of the following filter types is not suitable for use at audio and low radio frequencies? **Cavity**

Section 003 - Measurements

A-003-001-001 What is the easiest amplitude dimension to measure by viewing a pure sine wave on an oscilloscope? **Peak-to-peak voltage**

A-003-001-002 What is the RMS value of a 340 volt peak-to-peak pure sine wave? **120 volts**

A-003-001-003 What is the equivalent to the RMS value of an AC voltage? **The AC voltage causing the same heating of a given resistor as a DC voltage of the same value**

A-003-001-004 If the peak value of a 100 Hz sinusoidal waveform is 20 volts, the RMS value is: **14.14 volts**

A-003-001-005 In applying Ohm's law to AC circuits, current and voltage values are: **peak values times 0.707**

A-003-001-006 The effective value of a sine wave of voltage or current is: **70.7% of the maximum value**

A-003-001-007 AC voltmeter scales are usually calibrated to read: **RMS voltage**

A-003-001-008 An AC voltmeter is calibrated to read the: **effective value**

A-003-001-009 Which AC voltage value will produce the same amount of heat as a DC voltage, when applied to the same resistance? **The RMS value**

A-003-001-010 What is the peak-to-peak voltage of a sine wave that has an RMS voltage of 120 volts? **339.5 volts**

A-003-001-011 A sine wave of 17 volts peak is equivalent to how many volts RMS? **12 volts**

A-003-002-001 The power supplied to the antenna transmission line by a transmitter during an RF cycle at the highest crest of the modulation envelope is known as: **peak-envelope power**

A-003-002-002 To compute one of the following, multiply the peak-envelope voltage by 0.707 to obtain the RMS value, square the result and divide by the load resistance. Which is the correct answer? **PEP**

A-003-002-003 Peak-Envelope Power (PEP) for SSB transmission is: **Peak-Envelope Voltage (PEV) multiplied by 0.707, squared and divided by the load resistance**

A-003-002-004 The formula to be used to calculate the power output of a transmitter into a resistor load using a voltmeter is: **P = (E exponent 2) /R**

A-003-002-005 How is the output Peak-Envelope Power of a transmitter calculated if an oscilloscope is used to measure the Peak-Envelope Voltage across a dummy

resistive load (where PEP = Peak-Envelope Power, PEV = Peak-Envelope Voltage, Vp = peak-voltage, RL = load resistance)? **PEP = [(0.707 PEV)(0.707 PEV)] / RL**

A-003-002-006 What is the output PEP from a transmitter if an oscilloscope measures 200 volts peak-to-peak across a 50-ohm dummy load connected to the transmitter output? **100 watts**

A-003-002-007 What is the output PEP from a transmitter if an oscilloscope measures 500 volts peak-to-peak across a 50-ohm dummy load connected to the transmitter output? **625 watts**

A-003-002-008 What is the output PEP of an unmodulated carrier transmitter if a wattmeter connected to the transmitter output indicates an average reading of 1060 watts? **1060 watts**

A-003-002-009 What is the output PEP from a transmitter, if an oscilloscope measures 400 volts peak-to-peak across a 50 ohm dummy load connected to the transmitter output? **400 watts**

A-003-002-010 What is the output PEP from a transmitter, if an oscilloscope measures 800 volts peak-to-peak across a 50 ohm dummy load connected to the transmitter output? **1600 watts**

A-003-002-011 An oscilloscope measures 500 volts peak-to-peak across a 50 ohm dummy load connected to the transmitter output during unmodulated carrier conditions. What would an average-reading power meter indicate under the same transmitter conditions? **625 watts**

A-003-003-001 What is a dip meter? **A variable frequency oscillator with metered feedback current**

A-003-003-002 What does a dip meter do? **It gives an indication of the resonant frequency of a circuit**

A-003-003-003 What two ways could a dip meter be used in an amateur station? **To measure resonant frequencies of antenna traps and to measure a tuned circuit resonant frequency**

A-003-003-004 A dip meter supplies the radio frequency energy which enables you to check: **the resonant frequency of a circuit**

A-003-003-005 A dip meter may not be used directly to: **measure the value of capacitance or inductance**

A-003-003-006 The dial calibration on the output attenuator of a signal generator: **reads accurately only when the attenuator is properly terminated**

A-003-003-007 What is a signal generator? **A high-stability oscillator which can produce a wide range of frequencies and amplitudes**

A-003-003-008 A dip meter: **should be loosely coupled to the circuit under test**

A-003-003-009 Which two instruments are needed to measure FM receiver sensitivity for a 12 dB SINAD ratio (signal + noise + distortion over noise + distortion)? **Calibrated RF signal generator with FM tone modulation and total harmonic distortion (THD) analyzer**

A-003-003-010 The dip meter is most directly applicable to: **parallel tuned circuits**

A-003-003-011 Which of the following is not a factor affecting the frequency accuracy of a dip meter? **Transmitter power output**

A-003-004-001 What does a frequency counter do? **It makes frequency measurements**

A-003-004-002 What factors limit the accuracy, frequency response and stability of a frequency counter? **Time base accuracy, speed of the logic, and time base stability**

A-003-004-003 How can the accuracy of a frequency counter be improved? **By increasing the accuracy of the time base**

A-003-004-004 If a frequency counter with a time base accuracy of +/- 0.1 PPM (parts per million) reads 146 520 000 Hz, what is the most that the actual frequency being measured could differ from that reading? **14.652 Hz**

A-003-004-005 If a frequency counter, with a time base accuracy of 10 PPM (parts per million) reads 146 520 000 Hz, what is the most the actual frequency being measured could differ from that reading? **1465.2 Hz**

A-003-004-006 The clock in a frequency counter normally uses a: **crystal oscillator**

A-003-004-007 The frequency accuracy of a frequency counter is determined by: **the characteristics of the internal time-base generator**

A-003-004-008 Which device relies on a stable low-frequency oscillator, with harmonic output, to facilitate the frequency calibration of receiver dial settings? **Frequency-marker generator**

A-003-004-009 What is the traditional way of verifying the accuracy of a crystal calibrator? **Zero-beat the crystal oscillator against a standard frequency station such as WWV**

A-003-004-010 Out of the following oscillators, one is NOT, by itself, considered a high-stability reference: **voltage-controlled crystal oscillator (VCXO)**

A-003-004-011 You want to calibrate your station frequency reference to the WWV signal on your receiver. The resulting beat tone must be: **of a frequency as low as possible and with a period as long as possible**

A-003-005-001 If a 100 Hz signal is fed to the horizontal input of an oscilloscope and a 150 Hz signal is fed to the vertical input, what type of pattern should be

displayed on the screen? **A looping pattern with 3 horizontal loops, and 2 vertical loops**

A-003-005-002 What factors limit the accuracy, frequency response and stability of an oscilloscope? **Accuracy of the time base and the linearity and bandwidth of the deflection amplifiers**

A-003-005-003 How can the frequency response of an oscilloscope be improved? **By increasing the horizontal sweep rate and the vertical amplifier frequency response**

A-003-005-004 You can use an oscilloscope to display the input and output of a circuit at the same time by: **utilizing a dual trace oscilloscope**

A-003-005-005 An oscilloscope cannot be used to: **determine FM carrier deviation directly**

A-003-005-006 The bandwidth of an oscilloscope is: **the highest frequency signal the scope can display**

A-003-005-007 When using Lissajous figures to determine phase differences, an indication of zero or 180 degrees is represented on the screen of an oscilloscope by: **a diagonal straight line**

A-003-005-008 A 100-kHz signal is applied to the horizontal channel of an oscilloscope. A signal of unknown frequency is applied to the vertical channel. The resultant wave form has 5 loops displayed vertically and 2 loops horizontally. The unknown frequency is: **40 kHz**

A-003-005-009 An oscilloscope probe must be compensated: **every time the probe is used with a different oscilloscope**

A-003-005-010 What is the best instrument to use to check the signal quality of a CW or single-sideband phone transmitter? **An oscilloscope**

A-003-005-011 What is the best signal source to connect to the vertical input of an oscilloscope for checking the quality of a transmitted signal? **The RF output of the transmitter through a sampling device**

A-003-006-001 A meter has a full-scale deflection of 40 microamperes and an internal resistance of 96 ohms. You want it to read 0 to 1 mA. The value of the shunt to be used is: **4 ohms**

A-003-006-002 A moving-coil milliammeter having a full-scale deflection of 1 mA and an internal resistance of 0.5 ohms is to be converted to a voltmeter of 20 volts full-scale deflection. It would be necessary to insert a: **series resistance of 19 999.5 ohms**

A-003-006-003 A voltmeter having a range of 150 volts and an internal resistance of 150 000 ohms is to be extended to read 750 volts. The required multiplier resistor would have a value of: **600 000 ohms**

A-003-006-004 The sensitivity of an ammeter is an expression of: **the amount of current causing full-scale deflection**

A-003-006-005 Voltmeter sensitivity is usually expressed in ohms per volt. This means that a voltmeter with a sensitivity of 20 kilohms per volt would be a: **50 microampere meter**

A-003-006-006 The sensitivity of a voltmeter, whose resistance is 150 000 ohms on the 150-volt range, is: **1000 ohms per volt**

A-003-006-007 The range of a DC ammeter can easily be extended by: **connecting an external resistance in parallel with the internal resistance**

A-003-006-008 What happens inside a multimeter when you switch it from a lower to a higher voltage range? **Resistance is added in series with the meter**

A-003-006-009 How can the range of an ammeter be increased? **By adding resistance in parallel with the meter**

A-003-006-010 Where should an RF wattmeter be connected for the most accurate readings of transmitter output power? **At the transmitter output connector**

A-003-006-011 At what line impedance do most RF wattmeters usually operate? **50 ohms**

Section 004 - Power Supplies

A-004-001-001 For the same transformer secondary voltage, which rectifier has the highest average output voltage? **Bridge**

A-004-001-002 In a half-wave power supply with a capacitor input filter and a load drawing little or no current, the peak inverse voltage (PIV) across the diode can reach _____ times the RMS voltage. **2.8**

A-004-001-003 In a full-wave centre-tap power supply, regardless of load conditions, the peak inverse voltage (PIV) will be _____ times the RMS voltage: **2.8**

A-004-001-004 A full-wave bridge rectifier circuit makes use of both halves of the AC cycle, but unlike the full-wave centre-tap rectifier circuit it does not require: **a centre-tapped secondary on the transformer**

A-004-001-005 For a given transformer the maximum output voltage available from a full-wave bridge rectifier circuit will be: **double that of the full-wave centre-tap rectifier**

A-004-001-006 The ripple frequency produced by a full-wave power supply connected to a normal household circuit is: **120 Hz**

A-004-001-007 The ripple frequency produced by a half-wave power supply connected to a normal household circuit is: **60 Hz**

A-004-001-008 Full-wave voltage doublers: **use both halves of an AC wave**

A-004-001-009 What are the two major ratings that must not be exceeded for silicon-diode rectifiers used in power-supply circuits? **Peak inverse voltage average forward current**

A-004-001-010 In a high voltage power supply, why should a resistor and capacitor be wired in parallel with the power-supply rectifier diodes? **To equalize voltage drops and guard against transient voltage spikes**

A-004-001-011 What is the output waveform of an unfiltered full-wave rectifier connected to a resistive load? **A series of pulses at twice the frequency of the AC input**

A-004-002-001 Filter chokes are rated according to: **inductance and current-handling capacity**

A-004-002-002 Which of the following circuits gives the best regulation, under similar load conditions? **A full-wave rectifier with a choke input filter**

A-004-002-003 The advantage of the capacitor input filter over the choke input filter is: **a higher terminal voltage output**

A-004-002-004 With a normal load, the choke input filter will give the: **best regulated output**

A-004-002-005 There are two types of filters in general use in a power supply. They are called: **choke input and capacitor input**

A-004-002-006 The main function of the bleeder resistor in a power supply is to provide a discharge path for the capacitor in the power supply. But it may also be used for a secondary function, which is to: **improve voltage regulation**

A-004-002-007 In a power supply, series chokes will: **readily pass the DC but will impede the flow of the AC component**

A-004-002-008 When using a choke input filter, a minimum current should be drawn all the time when the device is switched on. This can be accomplished by: **including a suitable bleeder resistance**

A-004-002-009 In the design of a power supply, the designer must be careful of resonance effects because the ripple voltage could build up to a high value. The components that must be carefully selected are: **first choke and first capacitor**

A-004-002-010 Excessive rectifier peak current and abnormally high peak inverse voltages can be caused in a power supply by the filter forming a: **series resonant circuit with the first choke and first capacitor**

A-004-002-011 In a properly designed choke input filter power supply, the no-load voltage across the filter capacitor will be about nine-tenths of the AC RMS voltage yet it is advisable to use capacitors rated at the peak transformer voltage. Why is

this large safety margin suggested? **Under no-load conditions and a burned-out bleeder, voltages could reach the peak transformer voltage**

A-004-003-001 What is one characteristic of a linear electronic voltage regulator? **The conduction of a control element is varied in direct proportion to the line voltage or load current**

A-004-003-002 What is one characteristic of a switching voltage regulator? **The control device is switched on and off, with the duty cycle proportional to the line or load conditions**

A-004-003-003 What device is typically used as a stable reference voltage in a linear voltage regulator? **A Zener diode**

A-004-003-004 What type of linear regulator is used in applications requiring efficient utilization of the primary power source? **A series regulator**

A-004-003-005 What type of linear voltage regulator is used in applications requiring a constant load on the unregulated voltage source? **A shunt regulator**

A-004-003-006 How is remote sensing accomplished in a linear voltage regulator? **A feedback connection to an error amplifier is made directly to the load**

A-004-003-007 What is a three-terminal regulator? **A regulator containing a voltage reference, error amplifier, sensing resistors and transistors, and a pass element**

A-004-003-008 In addition to an input voltage range what are the important characteristics of a three-terminal regulator? **Output voltage and maximum output current**

A-004-003-009 What type of voltage regulator contains a voltage reference, error amplifier, sensing resistors and transistors, and a pass element in one package? **A three-terminal regulator**

A-004-003-010 When extremely low ripple is required, or when the voltage supplied to the load must remain constant under conditions of large fluctuations of current and line voltage, a closed-loop amplifier is used to regulate the power supply. There are two main categories of electronic regulators. They are: **linear and switching**

A-004-003-011 A modern type of regulator, which features a reference, high-gain amplifier, temperature-compensated voltage sensing resistors and transistors as well as a pass element is commonly referred to as a: **three-terminal regulator**

A-004-004-001 In a series-regulated power supply, the power dissipation of the pass transistor is: **directly proportional to the load current and the input/output voltage differential**

A-004-004-002 In any regulated power supply, the output is cleanest and the regulation is best: **at the point where the sampling network or error amplifier is connected**

A-004-004-003 When discussing a power supply the_____ resistance is equal to the output voltage divided by the total current drawn, including the current drawn by the bleeder resistor: **load**

A-004-004-004 The regulation of long-term changes in the load resistance of a power supply is called: **static regulation**

A-004-004-005 The regulation of short-term changes in the load resistance of a power supply is called: **dynamic regulation**

A-004-004-006 The dynamic regulation of a power supply is improved by increasing the value of: **the output capacitor**

A-004-004-007 The output capacitor, in a power supply filter used to provide power for an SSB or CW transmitter, will give better dynamic regulation if: **the output capacitance is increased**

A-004-004-008 In a regulated power supply, four diodes connected together in a BRIDGE act as: **a rectifier**

A-004-004-009 In a regulated power supply, components that conduct alternating current at the input before the transformer and direct current before the output are: **fuses**

A-004-004-010 In a regulated power supply, the output of the electrolytic filter capacitor is connected to the: **voltage regulator**

A-004-004-011 In a regulated power supply, a diode connected across the input and output terminals of a regulator is used to: **protect the regulator from reverse voltages**

Section 005 - Transmitters, Modulation and Processing

A-005-001-001 How is the positive feedback coupled to the input in a Hartley oscillator? **Through a tapped coil**

A-005-001-002 How is positive feedback coupled to the input in a Colpitts oscillator? **Through a capacitive divider**

A-005-001-003 How is positive feedback coupled to the input in a Pierce oscillator? **Through capacitive coupling**

A-005-001-004 Why is the Colpitts oscillator circuit commonly used in a VFO? **It is stable**

A-005-001-005 Why must a very stable reference oscillator be used as part of a phase-locked loop (PLL) frequency synthesizer? **Any phase variations in the reference oscillator signal will produce phase noise in the synthesizer output**

A-005-001-006 Positive feedback from a capacitive divider indicates the oscillator type is: **Colpitts**

A-005-001-007 In an RF oscillator circuit designed for high stability, the positive feedback is drawn from two capacitors connected in series. These two capacitors would most likely be: **silver mica**

A-005-001-008 In an oscillator circuit where positive feedback is obtained through a single capacitor in series with the crystal, the type of oscillator is: **Pierce**

A-005-001-009 A circuit depending on positive feedback for its operation would be a: **variable-frequency oscillator**

A-005-001-010 An apparatus with an oscillator and a class C amplifier would be: **a two-stage CW transmitter**

A-005-001-011 In an oscillator where positive feedback is provided through a capacitor in series with a crystal, that type of oscillator is a: **Pierce**

A-005-002-001 The output tuning controls on a transmitter power amplifier with an adjustable PI network: **allow efficient transfer of power to the antenna**

A-005-002-002 The purpose of using a centre-tap return connection on the secondary of transmitting tube's filament transformer is to: **prevent modulation of the emitted wave by the alternating current filament supply**

A-005-002-003 In a grounded grid amplifier using a triode vacuum tube, the input signal is applied to: **the cathode**

A-005-002-004 In a grounded grid amplifier using a triode vacuum tube, the plate is connected to the pi-network through a: **blocking capacitor**

A-005-002-005 In a grounded grid amplifier using a triode vacuum tube, the plate is connected to a radio frequency choke. The other end of the radio frequency choke connects to the: **B+ (high voltage)**

A-005-002-006 In a grounded grid amplifier using a triode vacuum tube, the cathode is connected to a radio frequency choke. The other end of the radio frequency choke connects to the: **B- (bias)**

A-005-002-007 In a grounded grid amplifier using a triode vacuum tube, the secondary winding of a transformer is connected directly to the vacuum tube. This transformer provides: **filament voltage**

A-005-002-008 In a grounded grid amplifier using a triode vacuum tube, what would be the approximate B+ voltage required for an output of 400 watts at 400 mA with approximately 50 percent efficiency? **2000 volts**

A-005-002-009 In a grounded grid amplifier using a triode vacuum tube, each side of the filament is connected to a capacitor whose other end is connected to ground. These are: **by-pass capacitors**

A-005-002-010 After you have opened a VHF power amplifier to make internal tuning adjustments, what should you do before you turn the amplifier on? **Be certain all amplifier shielding is fastened in place**

A-005-002-011 Harmonics produced in an early stage of a transmitter may be reduced in a later stage by: **tuned circuit coupling between stages**

A-005-003-001 In a simple 2 stage CW transmitter circuit, the oscillator stage and the class C amplifier stage are inductively coupled by a RF transformer. Another role of the RF transformer is to: **be part of a tuned circuit**

A-005-003-002 In a simple 2 stage CW transmitter, current to the collector of the transistor in the class C amplifier stage flows through a radio frequency choke (RFC) and a tapped inductor. The RFC, on the tapped inductor side, is also connected to grounded capacitors. The purpose of the RFC and capacitors is to: **form a low-pass filter**

A-005-003-003 In a simple 2 stage CW transmitter, the transistor in the second stage would act as: **a power amplifier**

A-005-003-004 An advantage of keying the buffer stage in a transmitter is that: **changes in oscillator frequency are less likely**

A-005-003-005 As a power amplifier is tuned, what reading on its grid current meter indicates the best neutralization? **A minimum change in grid current as the output circuit is changed**

A-005-003-006 What does a neutralizing circuit do in an RF amplifier? **It cancels the effects of positive feedback**

A-005-003-007 What is the reason for neutralizing the final amplifier stage of a transmitter? **To eliminate parasitic oscillations**

A-005-003-008 Parasitic oscillations are usually generated due to: **accidental resonant frequencies in the power amplifier**

A-005-003-009 Parasitic oscillations would tend to occur mostly in: **RF power output stages**

A-005-003-010 Why is neutralization necessary for some vacuum-tube amplifiers? **To cancel oscillation caused by the effects of interelectrode capacitance**

A-005-003-011 Parasitic oscillations in an RF power amplifier may be caused by: **lack of neutralization**

A-005-004-001 What type of signal does a balanced modulator produce? **Double sideband, suppressed carrier**

A-005-004-002 How can a single-sideband phone signal be produced? **By using a balanced modulator followed by a filter**

A-005-004-003 Carrier suppression in a single-sideband transmitter takes place in: **the balanced modulator stage**

A-005-004-004 Transmission with SSB, as compared to conventional AM transmission, results in: **6 dB gain in the transmitter and 3 dB gain in the receiver**

A-005-004-005 The peak power output of a single-sideband transmitter, when being tested by a two-tone generator is: **twice the RF power output of any of the tones**

A-005-004-006 What kind of input signal is used to test the amplitude linearity of a single-sideband phone transmitter while viewing the output on an oscilloscope? **Two audio-frequency sine waves**

A-005-004-007 When testing the amplitude linearity of a single-sideband transmitter what audio tones are fed into the microphone input and on what kind of kind of instrument is the output observed? **Two non-harmonically related tones are fed in, and the output is observed on an oscilloscope**

A-005-004-008 What audio frequencies are used in a two-tone test of the linearity of a single-sideband phone transmitter? **Any two audio tones may be used, but they must be within the transmitter audio passband, and should not be harmonically related**

A-005-004-009 What measurement can be made of a single-sideband phone transmitter's amplifier by performing a two-tone test using an oscilloscope? **Its linearity**

A-005-004-010 How much is the carrier suppressed below peak output power in a single-sideband phone transmission? **At least 40 dB**

A-005-004-011 What is meant by "flat topping" in a single-sideband phone transmission? **Signal distortion caused by excessive drive**

A-005-005-001 In an FM phone signal having a maximum frequency deviation of 3000 Hz either side of the carrier frequency, what is the modulation index, when the modulating frequency is 1000 Hz? **3**

A-005-005-002 What is the modulation index of an FM phone transmitter producing an instantaneous carrier deviation of 6 kHz when modulated with a 2 kHz modulating frequency? **3**

A-005-005-003 What is the deviation ratio of an FM phone transmitter having a maximum frequency swing of plus or minus 5 kHz and accepting a maximum modulation rate of 3 kHz? **1.66**

A-005-005-004 What is the deviation ratio of an FM phone transmitter having a maximum frequency swing of plus or minus 7.5 kHz and accepting a maximum modulation rate of 3.5 kHz? **2.14**

A-005-005-005 When the transmitter is not modulated, or the amplitude of the modulating signal is zero, the frequency of the carrier is called its: **centre frequency**

A-005-005-006 In an FM transmitter system, the amount of deviation from the centre frequency is determined solely by the: **amplitude of the modulating frequency**

A-005-005-007 Any FM wave with single-tone modulation has: **an infinite number of sideband frequencies**

A-005-005-008 Some types of deviation meters work on the principle of: **a carrier null and multiplying the modulation frequency by the modulation index**

A-005-005-009 When using some deviation meters, it is important to know: **modulating frequency and the modulation index**

A-005-005-010 What is the significant bandwidth of an FM-phone transmission having a +/- 5-kHz deviation and a 3-kHz modulating frequency? **16 kHz**

A-005-005-011 What is the frequency deviation for a 12.21-MHz reactance-modulated oscillator in a +/- 5-kHz deviation, 146.52-MHz FM-phone transmitter? **+/- 416.7 Hz**

A-005-006-001 If the signals of two repeater transmitters mix together in one or both of their final amplifiers and unwanted signals at the sum and difference frequencies of the original signals are generated and radiated, what is this called? **Intermodulation interference**

A-005-006-002 How does intermodulation interference between two repeater transmitters usually occur? **When they are in close proximity and the signals mix in one or both of their final amplifiers**

A-005-006-003 How can intermodulation interference between two repeater transmitters in close proximity often be reduced or eliminated? **By installing a terminated circulator or ferrite isolator in the transmission line to the transmitter and duplexer**

A-005-006-004 If a receiver tuned to 146.70 MHz receives an intermodulation product signal whenever a nearby transmitter transmits on 146.52, what are the two most likely frequencies for the other interfering signal? **146.34 MHz and 146.61 MHz**

A-005-006-005 What type of circuit varies the tuning of an amplifier tank circuit to produce FM signals? **A phase modulator**

A-005-006-006 What audio shaping network is added at an FM transmitter to attenuate the lower audio frequencies? **A pre-emphasis network**

A-005-006-007 Which type of filter would be best to use in a 2-metre repeater duplexer? **A cavity filter**

A-005-006-008 The characteristic difference between a phase modulator and a frequency modulator is: **pre-emphasis**

A-005-006-009 In most modern FM transmitters, to produce a better sound, a compressor and a clipper are placed: **between the audio amplifier and the modulator**

A-005-006-010 Three important parameters to be verified in an FM transmitter are: **power, frequency deviation and frequency stability**

A-005-006-011 Intermodulation interference products are not typically associated with which of the following: **intermediate frequency stage**

A-005-007-001 Maintaining the peak RF output of a SSB transmitter at a relatively constant level requires a circuit called the: **automatic level control (ALC)**

A-005-007-002 Speech compression associated with SSB transmission implies: **full amplification of low level signals and reducing or eliminating amplification of high level signals**

A-005-007-003 Which of the following functions is not included in a typical digital signal processor? **Aliasing amplifier**

A-005-007-004 How many bits are required to provide 256 discrete levels, or a ratio of 256:1? **8 bits**

A-005-007-005 Adding one bit to the word length, is equivalent to adding ____ dB to the dynamic range of the digitizer: **6 dB**

A-005-007-006 What do you call the circuit which employs an analog to digital converter, a mathematical transform, a digital to analog converter and a low pass filter? **Digital signal processor**

A-005-007-007 Which principle is not associated with analog signal processing? **Frequency division**

A-005-007-008 Which of the following is not a method used for peak limiting, in a signal processor? **Frequency clipping**

A-005-007-009 What is the undesirable result of AF clipping in a speech processor? **Increased harmonic distortion**

A-005-007-010 Which description is not correct? You are planning to build a speech processor for your transceiver. Compared to AF clipping, RF clipping: **is easier to implement**

A-005-007-011 Automatic Level Control (ALC) is another name for: **RF compression**

A-005-008-001 What digital code consists of elements having unequal length? **Varicode**

A-005-008-002 Open Systems Interconnection (OSI) model standardizes communications functions as layers within a data communications system. Amateur digital radio systems often follow the OSI model in structure. What is the base layer of the OSI model involving the interconnection of a packet radio TNC to a computer terminal? **The physical layer**

A-005-008-003 What is the purpose of a Cyclic Redundancy Check (CRC)? **Error detection**

A-005-008-004 What is one advantage of using ASCII rather than Baudot code? **It includes both upper and lower case text characters in the code**

A-005-008-005 What type of error control system is used in AMTOR ARQ (Mode A)? **The receiving station automatically requests repeats when needed**

A-005-008-006 What error-correction system is used in AMTOR FEC (Mode B)? **Each character is sent twice**

A-005-008-007 APRS (Automatic Packet Reporting System) does NOT support which one of these functions? **Automatic link establishment**

A-005-008-008 Which algorithm may be used to create a Cyclic Redundancy Check (CRC)? **Hash function**

A-005-008-009 The designator AX.25 is associated with which amateur radio mode? **packet**

A-005-008-010 How many information bits are included in the Baudot code? **5**

A-005-008-011 How many information bits are included in the ISO-8859 extension to the ASCII code? **8**

A-005-009-001 What term describes a wide-band communications system in which the RF carrier varies according to some predetermined sequence? **Spread spectrum communication**

A-005-009-002 What is the term used to describe a spread spectrum communications system where the centre frequency of a conventional carrier is changed many times per second in accordance with a pseudorandom list of channels? **Frequency hopping**

A-005-009-003 What term is used to describe a spread spectrum communications system in which a very fast binary bit stream is used to shift the phase of an RF carrier? **Direct sequence**

A-005-009-004 Frequency hopping is used with which type of transmission? **Spread spectrum**

A-005-009-005 Direct sequence is used with which type of transmission? **Spread spectrum**

A-005-009-006 Which type of signal is used to produce a predetermined alteration in the carrier for spread spectrum communication? **Pseudo-random sequence**

A-005-009-007 Why is it difficult to monitor a spread spectrum transmission? **Your receiver must be frequency-synchronized to the transmitter**

A-005-009-008 What is frequency hopping spread spectrum? **The carrier frequency is changed in accordance with a pseudo-random list of channels**

A-005-009-009 What is direct-sequence spread spectrum? **The carrier is phase-shifted by a fast binary bit stream**

A-005-009-010 Why are received spread-spectrum signals so resistant to interference? **Signals not using the spectrum-spreading algorithm are suppressed in the receiver**

A-005-009-011 How does the spread-spectrum technique of frequency hopping work? **The frequency of an RF carrier is changed very rapidly according to a particular pseudo-random sequence**

Section 006 - Receivers

A-006-001-001 What are the advantages of the frequency conversion process in a superheterodyne receiver? **Increased selectivity and optimal tuned circuit design**

A-006-001-002 What factors should be considered when selecting an intermediate frequency? **Image rejection and responses to unwanted signals**

A-006-001-003 One of the greatest advantages of the double-conversion over the single-conversion receiver is that it: **greater reduction of image interference for a given front end selectivity**

A-006-001-004 In a communications receiver, a crystal filter would be located in the: **IF circuits**

A-006-001-005 A multiple conversion superheterodyne receiver is more susceptible to spurious responses than a single-conversion receiver because of the: **additional oscillators and mixing frequencies involved in the design**

A-006-001-006 In a dual-conversion superheterodyne receiver what are the respective aims of the first and second conversion: **image rejection and selectivity**

A-006-001-007 Which stage of a receiver has its input and output circuits tuned to the received frequency? **The RF amplifier**

A-006-001-008 Which stage of a superheterodyne receiver lies between a tuneable stage and a fixed tuned stage? **Mixer**

A-006-001-009 A single conversion receiver with a 9 MHz IF has a local oscillator operating at 16 MHz. The frequency it is tuned to is: **7 MHz**

A-006-001-010 A double conversion receiver designed for SSB reception has a beat frequency oscillator and: **two IF stages and two local oscillators**

A-006-001-011 The advantage of a double conversion receiver over a single conversion receiver is that it: **suffers less from image interference for a given front end sensitivity**

A-006-002-001 The mixer stage of a superheterodyne receiver is used to: **change the frequency of the incoming signal to that of the IF**

A-006-002-002 A superheterodyne receiver designed for SSB reception must have a beat-frequency oscillator (BFO) because: **the suppressed carrier must be replaced for detection**

A-006-002-003 The first mixer in the receiver mixes the incoming signal with the local oscillator to produce: **an intermediate frequency**

A-006-002-004 If the incoming signal to the mixer is 3 600 kHz and the first IF is 9 MHz, at which one of the following frequencies would the local oscillator (LO) operate? **5 400 kHz**

A-006-002-005 The BFO is off-set slightly (500 - 1 500 Hz) from the incoming signal to the detector. This is required: **to beat with the incoming signal**

A-006-002-006 It is very important that the oscillators contained in a superheterodyne receiver are: **stable and spectrally pure**

A-006-002-007 In a superheterodyne receiver, a stage before the IF amplifier has a variable capacitor in parallel with a trimmer capacitor and an inductance. The variable capacitor is for: **tuning of the local oscillator (LO)**

A-006-002-008 In a superheterodyne receiver without an RF amplifier, the input to the mixer stage has a variable capacitor in parallel with an inductance. The variable capacitor is for: **tuning the receiver preselector to the reception frequency**

A-006-002-009 What receiver stage combines a 14.25-MHz input signal with a 13.795-MHz oscillator signal to produce a 455-kHz intermediate frequency (IF) signal? **Mixer**

A-006-002-010 Which two stages in a superheterodyne receiver have input tuned circuits tuned to the same frequency? **RF and first mixer**

A-006-002-011 The mixer stage of a superheterodyne receiver: **produces an intermediate frequency**

A-006-003-001 What is meant by the noise floor of a receiver? **The weakest signal that can be detected above the receiver internal noise**

A-006-003-002 Which of the following is a purpose of the first IF amplifier stage in a receiver? **To improve selectivity and gain**

A-006-003-003 How much gain should be used in the RF amplifier stage of a receiver? **Sufficient gain to allow weak signals to overcome noise generated in the first mixer stage**

A-006-003-004 What is the primary purpose of an RF amplifier in a receiver? **To improve the receiver noise figure**

A-006-003-005 How is receiver sensitivity often expressed for UHF FM receivers? **RF level for 12 dB SINAD**

A-006-003-006 What is the term used for the decibel difference (or ratio) between the largest tolerable receiver input signal (without causing audible distortion products) and the minimum discernible signal (sensitivity)? **Dynamic range**

A-006-003-007 The lower the receiver noise figure becomes, the greater will be the receiver's _____: **sensitivity**

A-006-003-008 The noise generated in a receiver of good design originates in the: **RF amplifier and mixer**

A-006-003-009 Why are very low noise figures relatively unimportant for a high frequency receiver? **External HF noise, man-made and natural, are higher than the internal noise generated by the receiver**

A-006-003-010 The term which relates specifically to the amplitude levels of multiple signals that can be accommodated during reception is called: **dynamic range**

A-006-003-011 Normally, front-end selectivity is provided by the resonant networks both before and after the RF stage in a superheterodyne receiver. This whole section of the receiver is often referred to as the: **preselector**

A-006-004-001 What audio shaping network is added at an FM receiver to restore proportionally attenuated lower audio frequencies? **A de-emphasis network**

A-006-004-002 What does a product detector do? **It mixes an incoming signal with a locally generated carrier**

A-006-004-003 Distortion in a receiver that only affects strong signals usually indicates a defect in or mis-adjustment of the: **automatic gain control (AGC)**

A-006-004-004 In a superheterodyne receiver with automatic gain control (AGC), as the strength of the signal increases, the AGC: **reduces the receiver gain**

A-006-004-005 The amplified IF signal is applied to the _____ stage in a superheterodyne receiver: **detector**

A-006-004-006 The low-level output of a detector is: **applied to the AF amplifier**

A-006-004-007 The overall output of an AM/CW/SSB receiver can be adjusted by means of manual controls on the receiver or by use of a circuit known as: **automatic gain control**

A-006-004-008 AGC voltage is applied to the: **RF and IF amplifiers**

A-006-004-009 AGC is derived in a receiver from one of two circuits. Depending on the method used, it is called: **IF derived or audio derived**

A-006-004-010 Which two variables primarily determine the behaviour of an automatic gain control (AGC) loop? **Threshold and decay time**

A-006-004-011 What circuit combines signals from an IF amplifier stage and a beat-frequency oscillator (BFO), to produce an audio signal? **A product detector circuit**

A-006-005-001 What part of a superheterodyne receiver determines the image rejection ratio of the receiver? **RF amplifier pre-selector**

A-006-005-002 What is the term for the reduction in receiver sensitivity caused by a strong signal near the received frequency? **Desensitization**

A-006-005-003 What causes receiver desensitization? **Strong near frequency signals**

A-006-005-004 What is one way receiver desensitization can be reduced? **Use a cavity filter**

A-006-005-005 What causes intermodulation in an electronic circuit? **Nonlinear circuits or devices**

A-006-005-006 Which of the following is an important reason for using a VHF intermediate frequency in an HF receiver? **To move the image response far away from the filter passband**

A-006-005-007 Intermodulation interference is produced by: **the mixing of two or more signals in the front-end of a superheterodyne receiver**

A-006-005-008 Which of the following is NOT a direct cause of instability in a receiver? **Dial display accuracy**

A-006-005-009 Poor frequency stability in a receiver usually originates in the: **local oscillator and power supply**

A-006-005-010 Poor dynamic range of a receiver can cause many problems when a strong signal appears within or near the front-end bandpass. Which of the following is NOT caused as a direct result? **Feedback**

A-006-005-011 Which of these measurements is a good indicator of VHF receiver performance in an environment of strong out-of-band signals? **Two-tone Third-Order IMD Dynamic Range, 10 MHz spacing**

Section 007 - Feedlines - Matching and Antenna Systems

A-007-001-001 For an antenna tuner of the “Transformer” type, which of the following statements is FALSE? **The circuit is known as a Pi-type antenna tuner**

A-007-001-002 For an antenna tuner of the “Series” type, which of the following statements is false? **The circuit is known as a Pi-type antenna tuner**

A-007-001-003 For an antenna tuner of the “L” type, which of the following statements is false? **The circuit is suitable for matching to a vertical ground plane antenna**

A-007-001-004 For an antenna tuner of the “Pi” type, which of the following statements is false? **The circuit is a series-type antenna tuner**

A-007-001-005 What is a pi-network? **A network consisting of one inductor and two capacitors or two inductors and one capacitor**

A-007-001-006 Which type of network offers the greatest transformation ratio? **Pi-network**

A-007-001-007 Why is an L-network of limited utility in impedance matching? **It matches only a small impedance range**

A-007-001-008 How does a network transform one impedance to another? **It cancels the reactive part of an impedance and changes the resistive part**

A-007-001-009 What advantage does a pi-L network have over a pi-network for impedance matching between a vacuum tube linear amplifier and a multiband antenna? **Greater harmonic suppression**

A-007-001-010 Which type of network provides the greatest harmonic suppression? **Pi-L network**

A-007-001-011 A Smith Chart is useful: **because it simplifies mathematical operations**

A-007-002-001 What kind of impedance does a quarter wavelength transmission line present to the source when the line is shorted at the far end? **A very high impedance**

A-007-002-002 What kind of impedance does a quarter wavelength transmission line present to the source if the line is open at the far end? **A very low impedance**

A-007-002-003 What kind of impedance does a half wavelength transmission line present to the source when the line is open at the far end? **A very high impedance**

A-007-002-004 What kind of impedance does a half wavelength transmission line present to the source when the line is shorted at the far end? **A very low impedance**

A-007-002-005 What is the velocity factor of a transmission line? **The velocity of the wave on the transmission line divided by the velocity of light**

A-007-002-006 What is the term for the ratio of the actual velocity at which a signal travels through a transmission line to the speed of light in a vacuum? **Velocity factor**

A-007-002-007 What is a typical velocity factor for coaxial cable with polyethylene dielectric? **0.66**

A-007-002-008 What determines the velocity factor in a transmission line? **Dielectrics in the line**

A-007-002-009 Why is the physical length of a coaxial cable shorter than its electrical length? **RF energy moves slower along the coaxial cable than in air**

A-007-002-010 The reciprocal of the square root of the dielectric constant of the material used to separate the conductors in a transmission line gives the _____ of the line: **velocity factor**

A-007-002-011 The velocity factor of a transmission line is the: **ratio of the velocity of propagation in the transmission line to the velocity of propagation in free space**

A-007-003-001 What term describes a method used to match a high-impedance transmission line to a lower impedance antenna by connecting the line to the driven element in two places, spaced a fraction of a wavelength on each side of the driven element centre? **The T match**

A-007-003-002 What term describes an unbalanced feed system in which the driven element of an antenna is fed both at the centre and a fraction of a wavelength to one side of centre? **The gamma match**

A-007-003-003 What term describes a method of antenna impedance matching that uses a short section of transmission line connected to the antenna transmission line near the antenna and perpendicular to the transmission line? **The stub match**

A-007-003-004 Assuming a velocity factor of 0.66 what would be the physical length of a typical coaxial stub that is electrically one quarter wavelength long at 14.1 MHz? **3.51 metres (11.5 feet)**

A-007-003-005 The driven element of a Yagi antenna is connected to a coaxial transmission line. The coax braid is connected to the centre of the driven element and the centre conductor is connected to a variable capacitor in series with an adjustable mechanical arrangement on one side of the driven element. The type of matching is: **gamma match**

A-007-003-006 A quarter-wave stub, for use at 15 MHz, is made from a coaxial cable having a velocity factor of 0.8. Its physical length will be: **4 m (13.1 ft)**

A-007-003-007 The matching of a driven element with a single adjustable mechanical and capacitive arrangement is descriptive of: **a "gamma" match**

A-007-003-008 A Yagi antenna uses a gamma match. The coaxial braid connects to: **the centre of the driven element**

A-007-003-009 A Yagi antenna uses a gamma match. The centre of the driven element connects to: **the coaxial line braid**

A-007-003-010 A Yagi antenna uses a gamma match. The adjustable gamma rod connects to: **the variable capacitor**

A-007-003-011 A Yagi antenna uses a gamma match. The variable capacitor connects to the: **adjustable gamma rod**

A-007-004-001 In a half-wave dipole, the distribution of _____ is highest at each end. **voltage**

A-007-004-002 In a half-wave dipole, the distribution of _____ is lowest at each end. **current**

A-007-004-003 The feed point in a centre-fed half-wave antenna is at the point of: **maximum current**

A-007-004-004 In a half-wave dipole, the lowest distribution of _____ occurs at the middle. **voltage**

A-007-004-005 In a half-wave dipole, the highest distribution of _____ occurs at the middle. **current**

A-007-004-006 A half-wave dipole antenna is normally fed at the point where: **the current is maximum**

A-007-004-007 At the ends of a half-wave dipole: **voltage is high and current is low**

A-007-004-008 The impedance of a half-wave antenna at its centre is low, because at this point: **voltage is low and current is high**

A-007-004-009 In a half-wave dipole, where does minimum voltage occur? **The centre**

A-007-004-010 In a half-wave dipole, where does the minimum current occur? **At both ends**

A-007-004-011 In a half-wave dipole, where does the minimum impedance occur? **At the centre**

A-007-005-001 What is meant by circularly polarized electromagnetic waves? **Waves with a rotating electric field**

A-007-005-002 What type of polarization is produced by crossed dipoles fed 90 degrees out of phase? **Circular polarization**

A-007-005-003 Which of these antennas does not produce circular polarization? **Loaded helical-wound antenna**

A-007-005-004 On VHF/UHF frequencies, Doppler shift becomes of consequence on which type of communication? **Contact via satellite**

A-007-005-005 For VHF and UHF signals over a fixed path, what extra loss can be expected when linearly-polarized antennas are crossed-polarized (90 degrees)? **20 dB or more**

A-007-005-006 Which of the following is NOT a valid parabolic dish illumination arrangement? **Newtonian**

A-007-005-007 A parabolic antenna is very efficient because: **all the received energy is focused to a point where the pick-up antenna is located**

A-007-005-008 A helical-beam antenna with right-hand polarization will best receive signals with: **right-hand polarization**

A-007-005-009 One antenna which will respond simultaneously to vertically- and horizontally-polarized signals is the: **helical-beam antenna**

A-007-005-010 In amateur work, what is the surface error upper limit you should try not to exceed on a parabolic reflector? **0.1 lambda**

A-007-005-011 You want to convert a surplus parabolic dish for amateur radio use, the gain of this antenna depends on: **the diameter of the antenna in wavelengths**

A-007-006-001 A transmitter has an output of 100 watts. The cable and connectors have a composite loss of 3 dB, and the antenna has a gain of 6 dBd. What is the Effective Radiated Power? **200 watts**

A-007-006-002 As standing wave ratio rises, so does the loss in the transmission line. This is caused by: **dielectric and conductor heat losses**

A-007-006-003 What is the Effective Radiated Power of an amateur transmitter, if the transmitter output power is 200 watts, the transmission line loss is 5 watts, and the antenna power gain is 3 dBd? **390 watts**

A-007-006-004 Effective Radiated Power means the: **transmitter output power, minus line losses, plus antenna gain relative to a dipole**

A-007-006-005 A transmitter has an output power of 200 watts. The coaxial and connector losses are 3 dB in total, and the antenna gain is 9 dBd. What is the approximate Effective Radiated Power of this system? **800 watts**

A-007-006-006 A transmitter has a power output of 100 watts. There is a loss of 1.30 dB in the transmission line, a loss of 0.2 dB through the antenna tuner, and a gain of 4.50 dBd in the antenna. The Effective Radiated Power (ERP) is: **200 watts**

A-007-006-007 If the overall gain of an amateur station is increased by 3 dB the ERP (Effective Radiated Power) will: **double**

A-007-006-008 A transmitter has a power output of 125 watts. There is a loss of 0.8 dB in the transmission line, 0.2 dB in the antenna tuner, and a gain of 10 dBd in the antenna. The Effective Radiated Power (ERP) is: **1000**

A-007-006-009 If a 3 dBd gain antenna is replaced with a 9 dBd gain antenna, with no other changes, the Effective Radiated Power (ERP) will increase by: **4**

A-007-006-010 A transmitter has an output of 2000 watts PEP. The transmission line, connectors and antenna tuner have a composite loss of 1 dB, and the gain from the stacked Yagi antenna is 10 dBd. What is the Effective Radiated Power (ERP) in watts PEP? **16 000**

A-007-006-011 A transmitter has an output of 1000 watts PEP. The coaxial cable, connectors and antenna tuner have a composite loss of 1 dB, and the antenna gain is 10 dBd. What is the Effective Radiated Power (ERP) in watts PEP? **8000**

A-007-007-001 For a 3-element Yagi antenna with horizontally mounted elements, how does the main lobe takeoff angle vary with height above flat ground? **It decreases with increasing height**

A-007-007-002 Most simple horizontally polarized antennas do not exhibit significant directivity unless they are: **a half wavelength or more above the ground**

A-007-007-003 The plane from which ground reflections can be considered to take place, or the effective ground plane for an antenna is: **several centimeters to as much as 2 meters below ground, depending upon soil conditions**

A-007-007-004 Why is a ground-mounted vertical quarter-wave antenna in reasonably open surroundings better for long distance contacts than a half-wave dipole at a quarter wavelength above ground? **The vertical radiation angle is lower**

A-007-007-005 When a half-wave dipole antenna is installed one-half wavelength above ground, the: **vertical or upward radiation is effectively cancelled**

A-007-007-006 How does antenna height affect the horizontal (azimuthal) radiation pattern of a horizontal dipole HF antenna? **If the antenna is less than one-half wavelength high, reflected radio waves from the ground significantly distort the pattern**

A-007-007-007 For long distance propagation, the vertical radiation angle of the energy from the antenna should be: **less than 30 degrees**

A-007-007-008 Greater distance can be covered with multiple-hop transmissions by decreasing the: **vertical radiation angle of the antenna**

A-007-007-009 The impedance at the centre of a dipole antenna more than 3 wavelengths above ground would be nearest to: **75 ohms**

A-007-007-010 Why can a horizontal antenna closer to ground be advantageous for close range communications on lower HF bands? **The ground tends to act as a reflector**

A-007-007-011 Which antenna system and operating frequency are most suitable for Near Vertical Incidence (NVIS) communications? **A horizontal antenna less than 1/4 wavelength above ground and a frequency below the current critical frequency**

A-007-008-001 What is meant by the radiation resistance of an antenna? **The equivalent resistance that would dissipate the same amount of power as that radiated from an antenna**

A-007-008-002 Why would one need to know the radiation resistance of an antenna? **To match impedances for maximum power transfer**

A-007-008-003 What factors determine the radiation resistance of an antenna? **Antenna location with respect to nearby objects and the conductors length/diameter ratio**

A-007-008-004 What is the term for the ratio of the radiation resistance of an antenna to the total resistance of the system? **Antenna efficiency**

A-007-008-005 What is included in the total resistance of an antenna system? **Radiation resistance plus ohmic resistance**

A-007-008-006 How can the approximate beamwidth of a beam antenna be determined? **Note the two points where the signal strength is down 3 dB from the maximum signal point and compute the angular difference**

A-007-008-007 How is antenna percent efficiency calculated? **(radiation resistance / total resistance) x 100**

A-007-008-008 What is the term used for an equivalent resistance which would dissipate the same amount of energy as that radiated from an antenna? **Radiation resistance**

A-007-008-009 Antenna beamwidth is the angular distance between: **the points on the major lobe at the half-power points**

A-007-008-010 If the ohmic resistance of a half-wave dipole is 2 ohms, and the radiation resistance is 72 ohms, what is the antenna efficiency? **97.3%**

A-007-008-011 If the ohmic resistance of a miniloop antenna is 2 milliohms and the radiation resistance is 50 milliohms, what is the antenna efficiency? **96.15%**

A-007-009-001 Waveguide is typically used: **at frequencies above 3000 MHz**

A-007-009-002 Which of the following is not correct? Waveguide is an efficient transmission medium because it features: **low hysteresis loss**

A-007-009-003 Which of the following is an advantage of waveguide as a transmission line? **Low loss**

A-007-009-004 For rectangular waveguide to transfer energy, the cross-section should be at least: **one-half wavelength**

A-007-009-005 Which of the following statements about waveguide IS NOT correct? **Waveguide has high loss at high frequencies, but low loss below cutoff frequency**

A-007-009-006 Which of the following is a major advantage of waveguide over coaxial cable for use at microwave frequencies? **Very low losses**

A-007-009-007 What is printed circuit transmission line called? **Microstripline**

A-007-009-008 Compared with coaxial cable, microstripline: **has poorer shielding**

A-007-009-009 A section of waveguide: **operates like a high-pass filter**

A-007-009-010 Stripline is a: **printed circuit transmission line**

A-007-009-011 What precautions should you take before beginning repairs on a microwave feed horn or waveguide? **Be sure the transmitter is turned off and the power source is disconnected**