

EERI423 Flash Cards

Chapter 1

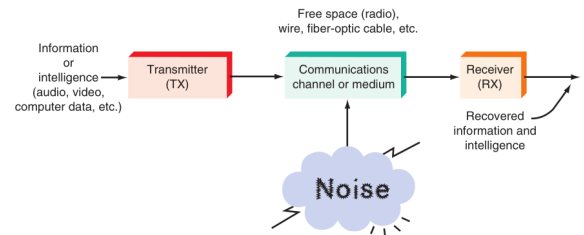
1) In what century did electronic communication begin?

1) 19th (1800s)

2) Name the four main elements of a communication system, and draw a diagram that shows their relationship.

2)

- Transmitter (TX)
- Receiver (RX)
- Communications Channel or medium
- Noise



3) List five types of media used for communication, and state which three are the most commonly used.

3)

- Electrical conductors
- Optical media
- Free space
- Water (Less common, used in sonar)
- The earth itself (Less common)
- AC power lines (Less common)

4) Name the device used to convert an information signal to a signal compatible with the medium over which it is being transmitted.

4) Modulator

5) What piece of equipment acquires a signal from a communication medium and recovers the original information signal?

5) Demodulator

6) What is a transceiver?

6) A comm device capable of transmitting and receiving

7) What are two ways in which a communication medium can affect a signal?

7) Attenuation and noise

8) What is another name for communication medium?

8) A communication channel

9) What is the name given to undesirable interference that is added to a signal being transmitted?

9) Noise

10) Name three common sources of interference.

10)

- Solar Flares
- Other signals with the same freq
- NEED ONE MORE

- 11) What is the name given to the original information or intelligence signals that are transmitted directly via a communication medium?
 - 12) Name the two forms in which intelligence signals can exist
 - 13) What is the name given to one-way communication? Give three examples.
 - 14) What is the name given to simultaneous two-way communication? Give three examples
 - 15) What is the term used to describe two-way communication in which each party takes turns transmitting? Give three examples.
 - 16) What type of electronic signals are continuously varying voice and video signals?
 - 17) What are on/off intelligence signals called?
 - 18) How are voice and video signals transmitted digitally?
 - 19) What terms are often used to refer to original voice, video, or data signals?
 - 20) What technique must sometimes be used to make an information signal compatible with the medium over which it is being transmitted?
 - 21) What is the process of recovering an original signal called?
 - 22) What is a broadband signal?
 - 23) Name the process used to transmit two or more base-band signals simultaneously over a common medium
 - 24) Name the technique used to extract multiple intelligence signals that have been transmitted simultaneously over a single communication channel
 - 25) What is the name given to signals that travel through free space for long distances
 - 26) What does a radio wave consist of?
- 11) Baseband transmission
 - 12) Analog and digital
 - 13) Simplex communication:
 - Radio Broadcasting
 - TV Broadcasting
 - Remote control
 - 14) Full Duplex communication:
 - Telephone
 - VOIP
 - 15) Half Duplex communication:
 - Ham Radio
 - Military radio
 - CB radio
 - 16) Analog
 - 17) Digital intelligence signals
 - 18) By using an A/D converter
 - 19) Original intelligence signal
 - 20) Modulation
 - 21) Demodulation
 - 22) A signal modulated with a higher frequency
 - 23) Multiplexing
 - 24) Demultiplexing
 - 25) Radio Waves
 - 26) A carrier and intelligence signal

- 27) Calculate the wavelength of signals with frequencies of 1.5 kHz, 18 MHz, and 22 GHz in miles, feet, and centimeters, respectively
- 28) Why are audio signals not transmitted directly by electromagnetic waves?
- 29) What is the human hearing frequency range?
- 30) What is the approximate frequency range of the human voice?
- 31) Do radio transmissions occur in the VLF and LF ranges?
- 32) What is the frequency range of AM radio broadcast stations?
- 33) What is the name given to radio signals in the high-frequency range?
- 34) In what segment of the spectrum do TV channels 2 to 13, and FM broadcasting, appear?
- 35) List five major uses of the UHF band.
- 36) What are frequencies above 1 GHz called?
- 37) What are the frequencies just above the EHF range called?
- 38) What is a micrometer, and what is it used to measure?
- 39) Name the three segments of the optical frequency spectrum.
- 40) What is a common source of infrared signals?
- 41) What is the approximate spectrum range of infrared signals?
- 42) Define the term angstrom and explain how it is used.
- 43) What is the wavelength range of visible light?
- 44) Which two channels or media do light signals use for electronic communication?
- 45) Name two methods of transmitting visual data over a telephone network.
- 46) What is the name given to the signaling of individuals at remote locations by radio?
- 27) $\lambda = \frac{1}{f} * c$ Where c is the speed of light
- 28) The frequencies cannot be transmitted efficiently
- 29) 20 to 20kHz
- 30) 300 to 3kHz
- 31) Yes, used for submarines
- 32) 535 to 1605 kHz
- 33) short waves
- 34) Very high frequencies (VHF's)
- 35)
- Mobile radio
 - Marine and aeronautical comms
 - UHF TV channels 14 through 51
 - Land mobile comms
 - military communication
- 36) Microwaves
- 37) Millimeter waves
- 38)
- 39) $1 * 10^{-6}m$. Used to measure infrared wavelengths
- 40) LED's and lasers
- 41) 700-1000nm
- 42) $\text{\AA} = 10^{-10}m$
- 43) 400-800nm
- 44) Fibre optics
- 45) Fax
- 46) Cellular radio

47) What term is used to describe the process of making measurements at a distance?

48) List four ways radio is used in the telephone system.

49) What principle is used in radar?

50) What is underwater radar called? Give two examples.

51) What is the name of a popular radio communication hobby?

52) What device enables computers to exchange digital data over the telephone network?

53) What do you call the systems of interconnections of PCs and other computers in offices or buildings?

54) What is a generic synonym for radio?

55) Name the three main types of technical positions available in the communication field.

56) What is the main job of an engineer?

57) What is the primary degree for an engineer?

58) What are the four main segments of the communication industry? Explain briefly the function of each.

59) Why are standards important?

60) What types of characteristics do communication standards define?

47) telemetry

48)

- Cordless Telephones
- Cell phones
- Satellite phones
- VOIP over wifi

49) Doppler effect

50) Sonar

51) Ham Radio

52) A modem

53) LAN

54) Wireless

55) Engineer, Technician and sales

56) Engineers design communication equipment and systems

57) B.S.E.E

58)

- Manufacture
- Sales
- Services
- End Users

59) To ensure compatibility between systems

60) modulation methods, frequency of operation, multiplexing methods, word length and bit formats, data transmission speeds, line coding methods, and cable and connector types

Chapter 2

1) What happens to capacitive reactance as the frequency of operation increases?

2) As frequency decreases, how does the reactance of a coil vary?

1) An increase in Frequency decreases X_c , remember, A capacitor is an open circuit in DC conditions

2) A decrease in Frequency will decrease X_L , remember that an inductor is an short circuit under DC conditions

- 3) What is skin effect, and how does it affect the Q of a coil?
- 4) What happens to a wire when a ferrite bead is placed around it?
- 5) What is the name given to the widely used coil form that is shaped like a doughnut?
- 6) Describe the current and impedance in a series RLC circuit at resonance.
- 7) Describe the current and impedance in a parallel RLC circuit at resonance.
- 8) State in your own words the relationship between Q and the bandwidth of a tuned circuit.
- 9) What kind of filter is used to select a single signal frequency from many signals?
- 10) What kind of filter would you use to get rid of an annoying 120-Hz hum?
- 11) What does selectivity mean?
- 12) State the Fourier theory in your own words.
- 13) Define the terms time domain and frequency domain.
- 14) Write the first four odd harmonics of 800 Hz.
 - 2400Hz
 - 4000Hz
 - 5600Hz
- 15) What waveform is made up of even harmonics only?
- 16) What waveform is made up of odd harmonics only?
- 17) Why is a nonsinusoidal signal distorted when it passes through a filter?
- 3) The fact that electrons flow on or near the surface of a conductor. At high frequency this decreases the cross sectional area of the resistor, increasing resistance.
- 4) It creates an inductor
- 5) Toroid
- 6) At resonance, X_C and X_L are equal and the total reactance is a minimum
- 7) At resonance, X_C and X_L are equal and the total reactance is a maximum
- 8) The bandwidth of a circuit is inversely proportional to the circuit Q. The higher the Q, the smaller the bandwidth. Low Q values produce wide bandwidths or less selectivity.
- 9) Band pass filter
- 10) Band reject or notch filter
- 11) A lower bandwidth makes a circuit more selective
- 12) Any wave can be described as the sum of a series of sine waves
- 13) The time domain compares amplitude and time. The frequency domain describes the amplitudes of the sinusoidal signals added to make a given signal. It can therefore be said to compare frequency and amplitude
- 14)
 - 2400Hz
 - 4000Hz
 - 5600Hz
- 15) Square Wave
- 16) Half sine wave
- 17) Because some harmonics are filtered out

Chapter 3

- 1) What mathematical operation does an amplitude modulator perform?
- 2) What type of response curve must a device that produces amplitude modulation have?
- 3) Describe the two basic ways in which amplitude modulator circuits generate AM.
- 4) What type of semiconductor device gives a near-perfect square-law response?
- 5) Which four signals and frequencies appear at the output of a low-level diode modulator?
- 6) Which type of diode would make the best (most sensitive) AM demodulator?
- 7) Why does an analog multiplier make a good AM modulator?
- 8) What kind of amplifier must be used to boost the power of a low-level AM signal?
- 9) To what stage of a transmitter does the modulator connect in a high-level AM transmitter?
- 10) What is the simplest and most common technique for demodulating an AM signal?
- 11) What is the most critical component value in a diode detector circuit? Explain.
- 12) What is the basic component in a synchronous detector? What operates this component?
- 13) What signals does a balanced modulator generate? Eliminate?
- 14) What type of balanced modulator uses transformers and diodes?
- 15) What is the most commonly used filter in a filter-type SSB generator?
- 1) Multiplication
- 2) Square law response curve
- 3) One type of AM circuit varies the gain of the amplifier or the attenuation of the voltage divider according to the modulating signal plus 1. Another applies the product of the carrier and modulating signals to a nonlinear component or circuit. A parallel tuned circuit resonant at the carrier frequency, with a bandwidth wide enough to filter out the modulating signal as well as the second and higher harmonics of the carrier, can be used to produce an AM wave.
- 4) diode
- 5) carrier, modulating, upper, and lower sidebands
- 6) a germanium diode is used because its voltage threshold is lower than that of a silicon diode and permits reception of weaker signals.
- 7) Because it uses differential amplifiers, it outputs the true product of the sine waves
- 8) differential amplifier
- 9) The final amplifier stage
- 10) diode detector
- 11) The Resonant frequency
- 12) A generated signal from a clock
- 13) generates a DSB signal, suppressing the carrier and leaving only the sum and difference frequencies at the output; the output of the modulator can be further processed by filters or phase-shifting circuitry to eliminate one of the sidebands, resulting in an SSB signal
- 14)
- 15)

- 16)What is the most difficult part of producing SSB for voice signals by using the phasing methods? 16)
- 17)Which type of balanced modulator gives the greatest carrier suppression? 17)
- 18)What is the name of the circuit used to demodulate an SSB signal? 18)
- 19)What signal must be present in an SSB demodulator besides the signal to be detected? 19) the carrier oscillator frequency

Chapter 5

- 1)What is the general name given to both FM and PM? 1) Angle Modulation
- 2)State the effect on the amplitude of the carrier during FM or PM. 2)
- 3)What are the name and mathematical expressions for the amount that the carrier varies from its unmodulated center frequency during modulation? 3) FM is proportional only to the amplitude of the modulating signal regardless of its frequency. In FM, the frequency of the modulating signal determines how many times per second the carrier frequency deviates above and below its nominal center frequency. PM, the amount of phase shift of a constant frequency carrier is varied in accordance with a modulating signal, and the carrier frequency deviation is proportional to both the modulating frequency and the amplitude.
- 4)State how the frequency of a carrier varies in an FM system when the modulating signal amplitude and frequency change. 4) As the modulating signal amplitude increases, the carrier frequency increases. If the amplitude of the modulating signal decreases, the carrier frequency decreases. The reverse relationship can also be implemented. A decreasing modulating signal increases the carrier frequency above its center value, whereas an increasing modulating signal decreases the carrier frequency below its center value. As the modulating signal amplitude varies, the carrier frequency varies above and below its normal center, or resting, frequency with no modulation.

5) State how the frequency of a carrier varies in a PM system when the modulating signal amplitude and frequency change.

6) When does maximum frequency deviation occur in an FM signal? A PM signal?

7) State the conditions that must exist for a phase modulator to produce FM

8) What do you call FM produced by PM techniques?

9) State the nature of the output of a phase modulator during the time when the modulating signal voltage is constant.

10) What is the name given to the process of frequency modulation of a carrier by binary data?

11) What is the name given to the process of phase modulation of a carrier by binary data?

12) How must the nature of the modulating signal be modified to produce FM by PM techniques?

13) What is the difference between the modulation index and the deviation ratio?

14) Define narrowband FM. What criterion is used to indicate NBFM?

15) What is the name of the mathematical equation used to solve for the number and amplitude of sidebands in an FM signal?

16) What is the meaning of a negative sign on the sideband value in Fig. 5-8?

17) Name two ways that noise affects an FM signal

5) As the modulating signal goes positive, the amount of phase lag, and thus the delay of the carrier output, increases with the amplitude of the modulating signal. The result at the output is the same as that if the constant frequency carrier signal had been stretched out or had its frequency lowered. When the modulating signal goes negative, the phase shift becomes leading. This causes the carrier sine wave to be effectively speeded up, or compressed. The result is the same as if the carrier frequency has been increased

6) For FM maximum frequency deviation occurs at the maximum amplitude of the modulating signal. For PM the maximum frequency deviation is when the modulating signal is changing most quickly, for a sine wave modulating signal, that time is when the modulating wave changes from plus to minus or from minus to plus.

7) deviation produced by frequency variations in the modulating signal must be compensated for.

8) Indirect FM

9) Amplitude is constant as always, frequency is carrier frequency and the phase difference is constant, according to the constant voltage

10) FSK

11) PSK

12) deviation produced by frequency variations in the modulating signal must be compensated for.

13)

14) the FM signal occupies no more spectrum space than an AM signal.

15) Bessel functions

16) a Phase shift of 180°

17)

18)How is the noise on an FM signal minimized at the receiver?

19)What is the primary advantage of FM over AM?

20)List two additional advantages of FM over AM.

21)What is the nature of the noise that usually accompanies a radio signal?

22)In what ways is an FM transmitter more efficient than a low-level AM transmitter? Explain.

23)What is the main disadvantage of FM over AM? State two ways in which this disadvantage can be overcome.

24)What type of power amplifier is used to amplify FM signals? Low-level AM signals?

25)What is the name of the receiver circuit that eliminates noise?

26)What is the capture effect and what causes it?

27)What is the nature of the modulating signals that are most negatively affected by noise on an FM signal?

28)Describe the process of preemphasis. How does it improve communication performance in the presence of noise? Where is it performed, at the transmitter or receiver?

18) limiter circuits that deliberately restrict the amplitude of the received signal. Any amplitude variations occurring on the FM signal are effectively clipped off. This does not affect the information content of the FM signal, since it is contained solely within the frequency variations of the carrier. Because of the clipping action of the limiter circuits, noise is almost completely eliminated. Even if the peaks of the FM signal itself are clipped or flattened and the resulting signal is distorted, no information is lost.

19) its superior immunity to noise

20) Capture Effect interfering signals on the same frequency are effectively rejected; If one signal is more than twice the amplitude of the other, the stronger signal captures the channel, totally eliminating the weaker signal. Transmitter Efficiency FM signals have a constant amplitude, and it is therefore not necessary to use linear amplifiers to increase their power level.

21)

22) An FM transmitter is more efficient because the signals are already generated at a low level signal once combined with a series of highly efficient amplifiers the signal become more efficient than any lowlevel AM transmitter

23) Excessive Spectrum Use and Circuit Complexity

24)

25)

26) capture effect is the effect caused by two or more FM signals occurring simultaneously on the same frequency. The stronger signal captures the channel, eliminating the weaker channel.

27)

28)

- 29)What is the basic circuit used to produce pre-emphasis? 29)
- 30)Describe the process of deemphasis. Where is it performed, at the transmitter or receiver? 30)
- 31)What type of circuit is used to accomplish deemphasis? 31)
- 32)What is the cutoff frequency of preemphasis and deem- phasis circuits? 32)
- 33)List four major applications for FM 33) FM radio, Cellular Telephone, FM Stereo Multiplex Sound, VCR

Chapter 7

- 1)Name the four primary benei ts of using digital tech- niques in communication. Which of these is probably the most important? 1)
- 2)What is data conversion? Name two basic types. 2)
- 3)What is the name given to the process of mea- suring the value of an analog signal at some point in time? 3)
- 4)What is the name given to the process of as- signing a specii c binary number to an instantane- ous value on an analog signal? 4)
- 5)What is another name commonly used for A/D conversion? 5)
- 6)Describe the nature of the signals and informa- tion obtained when an analog signal is converted to digital form 6)
- 7)Describe the nature of the output waveform obtained from a D/A converter 7)
- 8)Name the four major components in a D/A converter. 8)
- 9)Define aliasing and explain its effect in an A/D converter. 9)
- 10)What types of circuits are commonly used to translate the current output from a D/A con- verter to a voltage output? 10)
- 11)Name three types of A/D converters, and state which is the most widely used 11)
- 12)What A/D converter circuit sequentially turns the bits of the output on one at a time in sequence from MSB to LSB in seeking a voltage level equal to the input volt- age level 12)

- 13)What is the fastest type of A/D converter? Briel y de- scribe the method of conversion used 13)
- 14)Define oversampling and undersampling. 14)
- 15)What circuit is normally used to perform serial-to- parallel and parallel-to-serial data conversion? What is the abbreviation for this process? 15)
- 16)What circuit performs the sampling operation prior to A/D conversion, and why is it so important? 16)
- 17)Where are sigma-delta converters used? Why? 17)
- 18)Undersampling produces an aliasing effect that is equivalent to what analog signal process? 18)
- 19)What is the name given to the process of compressing the dynamic range of an analog signal at the transmitter and expanding it later at the receiver? 19)
- 20)What is the general mathematical shape of a compand- ing curve? 20)
- 21)Name the three basic types of pulse modulation. Which type is not binary? 21)
- 22)Name the DAC that produces a voltage output 22)
- 23)What type of DAC is used for very high-speed conversions? 23)
- 24)True or false? ADC outputs or DAC inputs may be either parallel or serial. 24)
- 25)What type of ADC is faster than a successive-approximations converter but slower than a l ash converter? 25)
- 26)Which type of ADC gives the best resolution? 26)
- 27)Why are capacitor D/A converters preferred over R-2R D/A converters? 27)
- 28)What does oversampling mean? What converter uses this technique? Why is it used? 28)
- 29)How is aliasing prevented? 29)
- 30)Name two common noncommunication applications for PWM 30)
- 31)Describe briel y the techniques known as digital signal processing (DSP). 31)
- 32)What types of circuits perform DSP? 32)

- 33) Briefly describe the basic mathematical process used in the implementation of DSP 33)
- 34) Give the names for the basic architecture of non-DSP microprocessors and for the architecture normally used in DSP microprocessors. Briefly describe the difference between the two. 34)
- 35) Name five common processing operations that take place with DSP. What is probably the most commonly implemented DSP application? 35)
- 36) Briefly describe the nature of the output of a DSP processor that performs the discrete Fourier transform or the fast Fourier transform 36)
- 37) Name the two types of filters implemented with DSP and explain how they differ. 37)
- 38) What useful function is performed by an FFT computation? 38)

Chapter 8

- 1) What circuits are typically part of every radio transmitter? 1) Oscillators, amplifiers, frequency multipliers, and impedance matching networks.
- 2) Which type of transmitter does not use class C amplifiers? 2) Single Sideband (SSB) transmitter
- 3) For how many degrees of an input sine wave does a class B amplifier conduct? 3) 180
- 4) What is the name given to the bias for a class C amplifier produced by an input RC network? 4) Signal Bias
- 5) Why are crystal oscillators used instead of LC oscillators to set transmitter frequency? 5) The only oscillator capable of meeting the precision and stability demanded by the FCC is a crystal oscillator.
- 6) What is the most common way to vary the output frequency of a crystal oscillator? 6) frequency of vibration is determined primarily by the thickness of the crystal.
- 7) How is the output frequency of a frequency of a PLL synthesizer changed? 7) by varying the frequency division ratio.
- 8) What are prescalers, and why are they used in VHF and UHF synthesizers? 8) A prescaler is a high-frequency divider circuit, usually in IC form, that is connected between the VCO output and the input to the programmable frequency divider used in the feedback loop of a PLL. It is used because programmable frequency dividers are usually not capable of operating at the higher VCO frequency.
- 9) What is the purpose of the loop filter in a PLL? 9) The loop filter smoothes the output of the phase detector into a varying direct current to control the VCO frequency.

10) What circuit in a direct digital synthesizer (DDS) actually generates the output waveform?

11) In a DDS, what is stored in ROM

12) How is the output for frequency of a DDS changed?

13) What is the most efficient class of RF power amplifier?

14) What is the approximate maximum power of typical transistor RF power amplifiers?

15) Define power-added efficiency.

16) What is the main advantage and disadvantage of switching amplifiers?

17) What is the difference between a class D and a class E amplifier?

18) Explain how an envelope tracking power amplifier works

19) Explain how a feedforward power amplifier reduces distortion

20) In a predistortion power amplifier, what is the feedback signal?

21) Maximum power transfer occurs when what relationship exists between generator impedance Z_i and load impedance Z_L ?

22) What is a toroid and how is it used? What components are made from it?

23) What are the advantages of a toroid RF inductor?

24) In addition to impedance matching, what other important function do LC networks perform?

10) Digital-to-analog converter (DAC) and low pass filter (LPF)

11) The ROM stores binary values representing sine wave values at equal degree spacings.

12) Change the binary value in the phase increment counter.

13) Class D or E.

14) For individual transistors, 500 W or so; for multiple transistors, several thousand watts.

15) Parasitics are very-high-frequency oscillations unrelated to the operating frequency that can occur in RF amplifiers because of stray inductances and capacitances. They are normally eliminated by connecting a small value of resistor or parallel RL circuit in series with the base or collector leads in the problem amplifier. A ferrite bead on the appropriate lead can also solve the problem

16) High efficiency, low heat generation, and simple circuits.

17) Both are switching-type amplifiers, but class D uses two transistors and dual power supplies, whereas the class E amplifier uses a single supply and transistor.

18)

19) A feedforward power amplifier generates the amplified signal with and without distortion and subtracts out the distortion (harmonics) before being sent to the output

20) The feedback is a sample of the amplified output signal with distortion.

21) When they equal

22) A toroid is a donut-shaped magnetic core used to make inductors, transformers, and baluns.

23) Toroids do not radiate their magnetic field like other coils. Most of the magnetic field is confined to the core. The high permeability of the core permits higher-value inductors to be made with fewer turns of wire than in an air core coil.

24)

25)What is the name given to a single winding trans- former?

26)What is the name given to an RF transformer with a 1 : 1 turns ratio connected so that it provides a 1 : 4 or 4 : 1 impedance matching? Give a common application

27)Why are untuned RF transformers used in power amplifiers?

28)How is impedance matching handled in a broadband linear RF amplifier?

29)What are the common impedance-matching ratios of transmission line transformers used as baluns?

30)Why are π and T networks preferred over L networks?

25) Autotransformer.

26) Balun. A common application is to convert balanced outputs to unbalanced (grounded) loads or unbalanced outputs to balanced (ungrounded) loads.

27) So that the amplifier will amplify signals over a wide frequency range

28)

29) 1:1, 1:4, 1:9, 1:16, 1:25.

30) Higher Q or Q selected for a specific bandwidth. Improved selectivity and minimized harmonics