Chapter 1

What is the process of Data transmission:

* Data transmission occurs between transmitter and receiver over some transmission medium(guided and unguided)

What is the main difference between Analog signal and Digital signal?

* Analog signal intensity varies smoothly with no breaks. Digital signal intensity maintains a constant level and then suddenly changes to another level

How can a composite periodic signal be decomposed into its individual frequencies?

* Use frourier analysis
* In general, Frourier Transform can be used to transform the signals (both) from the time domain to the frequency domain

What is the 3 main features of a signal?

* Amplitude, frequency and phase

Briefly explain the Spectrum and Bandwidth and their difference:

* Spectrum is the range between the frequencies of maximum and minimum. Bandwidth is the absolute value of the diffetence between the highest frequencies and lowest frequencies. The spectrum is a range and bandwidth is a value.

What’s the frequency domain difference between periodic signal and nonperiodic signal?

* The periodic signal is discret and nonperiodic signal is continuous.

Please list the 4 devices to change signal types:

* Telephone change a t a. Modem change D t A. Codec change A t D. Data transceiver change D t D.

What is Transmission Impairments? Please list the types and explain them briefly.

* Transmission impairment means signal received may differ from signal transmitted causing the bit errors for digital and degradation of signal quality. First, Attennuation which means a loss of energy and Amplifier is often used to compensate for this loss. Distortion which means the signal changes its from or shape. Noise is the unwanted signals added between transmitter and receiver and is the major limiting factor in communications system performance. The main types of noise are thermal noise, intermodulation noise, cross talk and impulse noise.

What is the definition of Channel capacity? And what is the main factors influencing channel capacity?

* Channel capacity is the maximum data rate at which data canbe transmitted over a given communications channel under given conditions. Noise, bandwidth and signal level

How to draw spectrum?

The calculation of SNR(Signal-to-Noise Ratio)

The calculation of Error Rate

The calculation of DB

Chapter 2

Why the morse code is unsuitable for computer communications?

* Extra time required between transmission of characters

Baudot Code is one of the first character codes developed with machines

Unicode can offer 2^32 characters or symbols which numbering goes from U-00000000 to U-FFFFFFFF

Please list the Data Transmission and Modes:  
 - Parallel and Serial Mode. The Serial mode can be divided into asynchronous, synchronous and isochronous.

Please list the 3 types of data flow and their features:  
 - Simplex: Signals transmitted in one direction

* Half duplex: Both stations transmit, but only one at a time
* Full Duplex: Simultaneous transmission in both transmission paths.

The calculation of synchronous transmission and asynchronous transmission.

Chapter 3

What is the difference between characteristics and quality determined by medium and signal?

* Guided media medium is more important. Unguided media- bandwidth produced by the antenna is more important. And Key concerns are data rate and distance.

Please list the four key factors when determining Data Rate and Distance:

* Bandwidth, transmission impairments, interference and number of receivers

Please list the 2 main types of twisted pairs and make comparison:

* Unshielded Twisted Pair and Shielded Twisted Pair. The STP has metal braid or sheathing that reduces interference and provides bettwe performance at higher data rates. But it is harder to handle because of its thick and heavy.
* UTP use RJ-45

Please give a brief definition of Insertion Loss:

* Insertion Loss is the loss of signal power resulting from the insertion of a device in a transmission line or optical fiber.

Please give a brief definition of NEXT:

* Coupling of signal from one pair of conductors to another.

Please list the benefits of optical fiber:

* Greater capacity, smaller size and lighter weight, lower attenuation, electromagnetic isolation, greater repeater spacing

Please list 3 types of Optical fiber transmission modes:

* Step-index multimode, Graded-index multimode and Single mode.

Wireless Transmission Waves

* Radio wave, Microwave and Infrared

Please introduce Antennas briefly:

* Antenna is an electrical conductors used to radiate or collect electromagnetic energy

Please introduce Radiation pattern and isotropic antenna briefly:

* Radiation pattern is a graphical representation of the radiation properties of an antenna. An isotropic antenna is a point in space that radiates power.

List types of microwave and their applications:

* Terrestrial Microwave and its most common type is a parabolic dish with an antenna focusing a narrow beam onto a receiving antenna. It’s used for long haul telecommunications, short point-to-point links between buildings and cellular systems. Satellite Microwave is a communication satellite is in effect a microwave relay station and used to link two or more ground stations. It’s Applications include private business networks, television distribution and global positioning

Please list 3 types of propagation:

* Ground Wave, Sky Wave and Line of Sight.

Chapter 4

Please list the encoding of Digital signals and Analog signals:

* Line coding is used for Digital signals to Digital signals. It includes NRZ, NRZ-I, NRZ- L, Manchester, differential Manchester, AMI, P, 2B1Q
* Digital – Analog: ASK, PSK, FSK, QAM, QPSK
* Analog – Digital: DM, PCM
* Analog – Analog: AM, FM, PM

Please list the line coding terminologies:

* Unipolar, polar, data rate, duration or length of a bit, modulation rate

What need to know of interpreting signals and the factors affecting signal interpretation:

* Timing of bits and signal levels. SNR, data rate, bandwidth and encoding scheme influence the signal interpretation.

What is NRZ used for:

* Used for magnetic recording and not often used for signal transmission

What is the main use of Digital – Analog signal techniques?

* Public telephone system

If each signal element represents more than one bit, better to use QPSK

Draw the 8PSK and 16QAM

Draw the Delta Modulation

Please list the 3 components of PCM:

* Sampling, Quantizing and Encoding

DM has simplicity compared to PCM but has worse SNR

Please explain the modulation and demodulation:

* The conversion of digital signals to analog signals suitable for transmission is called modulation. The conversion of modulated analog signal to digital signals is called demodulation. A device that performs modulation and demodulation is called a modem

Chapter 5

Why using multiplexing?

* To make efficient use of high-speed telecommunications lines and minimizing circuit costs

Please introduce the Multiplexer and Demutiplexer briefly:

* A MUX selects one of several analog or digital input signals and forwards the selected input into a single line. A DEMUX takes a single input signals and selects one of many data-output-lines which is connected to the single input

Why we use STDM and how does it operate?

* STDM allocates time slots dynamically based on demand so time slots won’t be wasted. A statistical multiplexer decides how many time slots to allocate in the next second is based on the amount of datasent by a given device in the last second.

How does umtiplexer know which data goes to which port?

* Typically, a STDM multiplexer sends not only the data, but also an address, which indicates the destination port.

The TDM graph

The Guard Band calculation

Chapter 6

Drawing a ARQ process

Calculation on CRC

* FCS generation
* Error Checking

Hamming code of FEC(Forward Error Correction)

* Hamming Distance
* Calculation on Hamming Code: D4, D3, D2, P3, D1, P2, P1

Parity Check

Chapter 7

Each layer in the stack performs a subset of functions. Relies on next lower layer to perform primitive functions. Changes in one layer should not require changes on other layers

OSI model:

* Each layer relies on the next lower layer to perform more primitive functions. Each layer provides services to the next higher layer
* PDU in different layers: Application layer for message, record, file, envelope. Transport layer for block and segment. Network layer for packet and datagram. Data Link layer for frame, cell and slot. Physical layer for frame and envelope.

Comparison of the OSI and TCP/IP Protocol Architectures: Presentation and Session layer are not included in TCP/IP Suite since their function are included in other layers in TCP/IP

Chapter 8

Circuit-Switching Technology is efficient for analog transmission of voice signals and inefficient for digital transmission.

Packet Switching

* Packets contains user data and control info. Use data may be part of a larger message. Control information includes routing (addressing) packets are received, stored briefly and passed on to the next node
* Line efficiency and data rate conversion are the advantages

Chapter 9

Local Area Networks

* Usually owned by the organization that is using the network to interconnect equipment and the key elements are: topology, transmission medium, wiring layout and medium access control
* Tree is a generalization of bus
* Ring topology is a closed loop of repeaters joined by point-to-point links. Medium access control(MAC) determines when a station can insert frame.
* Repeater is a simple and cheap layer 1 device that regenerate the signal and forward the incoming frame.
* Star Topology’s significant feature is that it has a central node that each station connects to. And another important feature is only one station can transmit at a time
* Ring is good for long distance transmission and star is good for short distance transmission
* Usually we need to consider 3 factors of topology: reliability-medium, performance- access control, - expandability- wiring layout
* Bridge is a layer 2 device that connects similar LANs with identical physical and link layer protocols and we use bridge for four reasons: reliability, performance, security and geography
* Router is a faster and more sophisticated 3-layer switch that forwards and routes packets based on logical address, it can select the shortest path, and if one path has problems, it will use another path.

IEEE 802.11ac and 802.11ax

* Ax is the developed version of ac, which support 2.4GHZ/5GHZ, 1024QAM