Minia University | **Data transmission**
Faculty of Engineering | **January, 2020**
Comp. & Sys. Dept., 3rd year | **Code: EES 315**
Total Marks (105 Marks) | **Time: 3 hrs .**

الامتحان فى ورقة من وجهين

Assume any missing data

Question No.(1) (20 marks)

a. Define each of the following terms:

Digital signal, channel capacity, propagation delay, half-duplex, modulation rate

b. Suppose that a digitized TV picture is to be transmitted from a source that uses a matrix of picture elements (pixels), where each pixel can take on one of 32 intensity values. Assuming that 30 pictures are sent per second,

i. **Find the data rate R (bps) of the transmitted signal.**
ii. **Assume that the TV picture is to be transmitted over a channel with 4.5-MHz bandwidth and a 35-dB signal-to-noise ratio. Find the capacity of the channel (bps).**

Question No.(2) (20 marks)

a. Briefly, discuss the guided transmission media used in communication systems showing the transmission characteristics and applications of each one.

b. A microwave transmitter has an output of 0.1 W at 2 GHz. This transmitter is used in a microwave communication system where the transmitting and receiving antennas are parabolas, each 1.2 m in diameter. Assuming that the transmitting antenna is located at a height of 75 m and the receiving antenna is located 24 km from the transmitting antenna over a free space path

i. **What is the gain of each antenna in decibels?**
ii. **What is the effective radiated power of the transmitted signal?**
iii. **Calculate the signal power received by the receiving antenna in dB units.**
iv. **If the adjustment factor is taken as 4/3, what should be the height of the receiving antenna to achieve line-of-sight (LOS)?**
v. **Find the free space loss in dB/Km over the link between the two antennas.**

Question No.(3) (20 marks)

a. Answer the following:

i. **Why digital transmission is better than analog transmission.**
ii. **List and briefly define important factors that can be used in evaluating or comparing the various digital-to-digital encoding techniques.**
iii. **What is the signal form and signaling type in each of the following waveforms:**

- AM signal - FM signal - PSK signal - PCM signal - Manchester encoded signal

b. A digital signaling system is required to operate at 9600 bps,

i. **If a signal element encodes a 4-bit word, what is the minimum required bandwidth of the channel?**
ii. **If the signal is transmitted using FSK at carrier frequency of 250 KHz, what will be the difference frequency that can achieve the minimum bandwidth calculated in (i)?**
iii. **Calculate the frequency of each signal element of the FSK signal.**

Question No.(4) (20 marks)

a. Define the flow control and discuss two different forms of flow control showing the advantages and disadvantages of each one.

b. Two neighboring nodes (A and B) use a sliding-window protocol with a 3-bit sequence number. As the ARQ mechanism, go-back-N is used with a window size of 4. Assuming A is transmitting and B is receiving, show the window positions for the following succession of events:

i. **Before A sends any frames**
ii. **After A sends frames 0, 1, 2 and receives acknowledgment from B for 0 and 1**
iii. **After A sends frames 3, 4, and 5 and B acknowledges 4 and the ACK is received by A.**

Question No.(5) (25 marks)

a. What are the strategies on which the design of the ADSL is based?

b. Design a TDM PCM system that will accommodate four 300-bps, synchronous, digital inputs and one analog input with a bandwidth of 500 Hz. Assume that the analog samples will be encoded into 4-bit PCM words.

c. Ten 4-KHz voice signals are sampled at the minimum sampling rate and encoded using 8-bit encoder to be multiplexed in byte-interleaving fashion using TDM.

i. **What is the scanning speed required to multiplex the ten voice signals?**
ii. **If a one bit is used at the beginning of each frame for synchronization, determine the data rate of the resulted TDM signal?**
iii. **What is the time duration consumed by each voice channel inside the TDM frame?**
iv. **If a sequence of 30 bits is used for synchronization adjustment, determine the maximum possible time period required for the framing search mode to reset the synchronization**

========== End of Questions==========

With My Best Wishes,
Dr. Emad Tammam
January, 2020