Kafr Elsheikh University
Department of Electrical Engineering
Electrical Power and Machines Engineering program
Subject: Data Communication Systems(ECE3232)
full mark :90 **Date:26/5/2019**

Faculty of Engineering
Time allowed: 3 hours
3rd year
final exam
Instructor: Dr. Sherief Hashima

This Exam measures the ILOs [a2, a4, b1, b8, c1 and c3]

Answer the following questions as you can

Question1[20 marks]: *[measures ILOs a2, b1, and c1]*

a- Draw the main components of digital communication system then list different types of communication systems. [a.1.1 (4 marks)]

b- Identify the type for each of the following communication systems: [C.1.1 (4 marks)]
1- Internet 2- TV broadcasting 3- Intercom with push to talk bar 4- mobile phone

c- A radio channel has a bandwidth of 10 kHz and a signal-to-noise ratio of 15 dB and 0 what is the channel capacity in the two cases? [C.1.2 (4 marks)]

d- Find the noise power produced by a resistor at a temperature of 60oc in a bandwidth of 6MHZ in
1- watts 2- dBm [C.1.2 (4 marks)]

e- Explain the operation of envelop detector circuit in AM demodulation [a.2.1 (4 marks)]

Question2 [20 marks]: *[measures ILOs a4, c1 and c3]*

a- Define modulation, mention its pros and cons, what is meant by 100% modulation, over modulation, under modulation? [c.2.1 (6 marks)]

b- Explain, with the aid of sketches, how to generate SSBSC. Also mention how you can demodulate this type of signal? [a.4.1 (6 marks)]

c- An AM signal is generated by modulating the carrier f_c= 800 kHz by the signal m(t)=sin2000πt+5 cos4000πt The generated AM signal is u(t)=100[1+m(t)] cos $2\pi f_c t$ is fed to a 50 Ω load.

1- Determine and sketch the spectrum of the AM signal [C.3.1 (4 marks)]

2- Determine the average power in the carrier and in the side bands

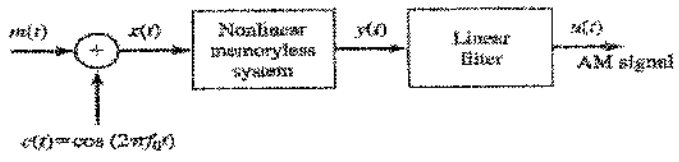
3- What is the modulation index? 4- what is the peak power delivered to the load?

d- The system shown in the figure below is used to generate an AM signal. The modulating signal m(t) has zero mean and its maximum value A_m=max[m(t)]. The nonlinear device has input-output characteristics y(t)= a x(t)+b x^2(t) [C.1.3 (4 marks)]

1- Express y(t) in terms of modulating signal m(t) and the carrier c(t)=cos 2πfct

2- What is the modulation index?

3- Specify the filter characteristics that yield an AM signal at its output



Question3 [15 marks]: [Includes ILOs of a1 and c3]

a- How you can modulate narrow band PM signal then determine its bandwidth and power [a4.1: 5 marks]

b- Determine how you can generate FM signal using phase modulator and how you can generate PM signal using frequency modulator [b 4.1: 5 marks]

c- The message signal m(t)=10 sinc(400t) frequency modulates the carrier c(t)=100cos $2\pi f_c t$. The modulation index is 6.

1- write an expression ffor the modulated signal u(t)?
2- what is the maximum frequency deviation of the modulated signal?
3- What is the power content off the modulated signal?
4- Find the bandwidth of the modulated signal.

[C 3.1 :5 marks]

Question4 [15 marks]: [Includes ILOs of a2 a1 and b8]

a- Define the digital hierarchy used by telephone companies and list its different levels. Mention the overhead (number of extra bits) in each service. [a 2.1 and a 2.2 :5 marks]

b- Compare between multilevel TDM, multiple slot TDM, and pulse-stuffed TDM. [5 marks]

c- Ten sources, six with a bit rate of 200 kbps and four with a bit rate of 400 kbps are to be combined using multilevel TDM with no synchronizing bits. Answer the following questions about the final stage of the multiplexing: [b 1.2 and b8.2 :5 marks]

1. What is the size of a frame in bits? 2. What is the frame rate?
3. What is the duration of a frame? 4. What is the data rate?

Question5 [20 marks]: [Includes ILOs of a2 and b1]

a- Aided with sketches, compare between Direct Sequence Spread spectrum (DSS) and frequency hopping spread spectrum (FHSS). [a 2.5 :5 marks]

b- A discrete source emits one of five symbols once every 2 milliseconds. The first three symbols probabilities are ½, ¼, 1/8 the last two symbols have equal probability. Find the source entropy and source information rate. [b 1.2 :5 marks]

c- An FHSS system uses a 4-bit PN sequence. If the bit rate of the PN is 64 bits per second. [b 1.2 :5 marks]

1- What is the total number of possible hops?
2- What is the time needed to finish a complete cycle of PN?

Best Wishes **Committee of Correctors and Testers**

Dr.Sherief Hashima