Kafr Elsheikh University
Faculty of Engineering
Department of Electrical Engineering
Subject: Data Communication Systems

3rd year electrical power engineering

Date: 20 /5 /2017
Time allowed: 3 hours
final Exam
full mark :90
Instructor: Dr. Shamia Ghamry

Answer the Following Questions

Question1[30 marks]:

a- Explain the process of DSBSC generation using non-linear modulator.

b- ADSB-SC signal is given by $m(t)\cos(2\pi)10^6 t$. Show how you can obtain the desired signal $cm(t)\cos(\pi \times 10^6 t)$. The only equipment available is one ring modulator, a tunable bandpass filter, and one sine wave generator whose frequency can be varied from 50 to 200 KHz. Determine the value of c.

c- A DSB-TC AM signal is produced by the signal: m(t)=3cos 500πt. The carrier signal is c(t)=10 cos $2\pi \times 10^6$ t

- Sketch the modulated signal in time domain.
- Determine and sketch the spectrum of the DSB-TC AM signal.
- Calculate the average power of the AM signal.

d- Explain, with the aid of sketches, how to generate SSBSC using phase shift method

Question2 [20 marks]:

a- An Armstrong indirect FM modulator is used to generate a wide band FM carrier with a carrier frequency of 98 MHz and $\nabla f = 75kHz$. A narrow band FM generator with frequency deviation of 10 Hz is used. The oscillator with adjustable frequency in the range of 10 to 11 MHz. the bandpass filter is centered at 10.9 MHz, the second frequency multiplier consists of five frequency doublers.

i- Draw a block diagram of this modulator

ii- Determine the carrier frequency of the narrow band FM generator and the order of the first multiplier.

b- Estimate the power and band width of an angle modulated signal with carrier frequency $\omega_c = 2\pi \times 10^5$ and the modulated signal is described by:

$$\phi_{EM}(t) = 10\cos(\omega_c t + 5\sin 500\pi t + 10\sin 2000t)$$

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c- Explain the process of wide band F.M. recovery based on phase locked loop (PLL).

Question3 [20 marks]:

a- Explain the process of " companding "in PCM , why it is needed.

b- A signal $m(t) = 10\cos(\pi \times 10^4 t) + 3\sin(2\pi \times 10^3 t)$ is sampled at a rate 30% higher than the Nyquist rate. The quantized samples are binary coded, the minimum band width of the channel required to transmit the encoded binary signal is 52 kHz. Find the quantization noise expected in the recovered signal.

c- A TDM system uses a PCM sampling frequency of 30 kHz to convert audio signals in the range 20 Hz – 12.5 kHz into digital form. A 14-bit code is used to define the sample levels. Several signals are sent along one carrier using TDM. The clock rate of each PCM channel is 1 MHz. Calculate the number of PCM channels can be combined using the TDM on the communication link.

Question4 [20 marks]:

a- (8,4) Hamming code is used to encode the following data sequence 11001010. Find the transmitted block. If the data bit 3 in position 6 sustains an error. Show that hamming code can detect and correct that error.

b- Write down short notes about:

i- SCADA system components

ii- Communication networks that can be used for data transmission in SCADA systems

Best Wishes

Dr. Shamia Ghamry