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

3rd year

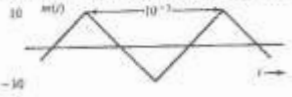
Date: 22 /5 /2016
Time allowed: 3 hours
final Exam
full mark :90
Instructor: Dr. Shamia Ghamry

Answer The Following Questions

Question1[20 marks]:

a- Draw the circuit diagram of rectifier detector. Explain with the aid of analysis, how it can be used to demodulate AM.

b- Sketch the AM signal for the periodic signal m(t) shown in the following figure if the modulation index is 0.8. Also find the power efficiency in this case.



c- ADSB-SC signal is given by $m(t)\cos(2\pi)10^6 t$. The carrier frequency of this signal is to be changed to 500 KHz. The only equipment available is one ring modulator, a bandpass filter centered at 500KHz, and one sine wave generator whose frequency can be varied from 50 t0 200 KHz. Show how you can obtain the desired signal $cm(t)\cos(2\pi\times500\times10^3 t)$. Determine the value of c.

Question2 [20 marks]:

a- Explain the process of direct generation of wide band F.M.

b- Estimate the power and band width of an angle modulated signal with carrier frequency $\omega_c = 2\pi\times10^3$ and the modulated signal is described by:

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

c- Design an Armstrong indirect FM modulator to generate an FM carrier with a carrier frequency of 96 MHz and $\nabla f = 20KHz$. A narrow band FM generator with $f_c = 200\ KHz$ and adjustable ∇f in the range of 9 to 10 Hz is available. There is an oscillator with adjustable frequency in the range of 9 to 10 MHz. there is a bandpass filter with any center frequency, and only frequency doublers are available.

Question3 [15 marks]:

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

b- Find $\phi_{USB}(t)$ and $\phi_{LSB}(t)$ for the modulating signal $m(t) = B\sin(2\pi Bt)$ with B=1000 and the carrier frequency $\omega_c = 10{,}000\pi$.

Question4 [15 marks]:

a- Explain the process of non- uniform quantization, illustrating why it is needed.

b- A signal $m(t) = 10\cos(2\pi \times 5000t)$ 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.

Question5 [20 marks]:

a- Draw a block diagram of a general SCADA system, specifying the function of each part

b- Write down short notes about;
Single board RTU, modular RTU and SCADA generations.

c- Name some devices that are used in power system automation indicating the function of each device.

Best Wishes

Dr. Shamia Ghamry