أسئلة سنوات سابقة

لمادة

Communication System

قال رسول الله صلى الله عليه وسلم: **(إنكم لن تسعوا الناس بأموالكم فليسعهم منكم بسط الوجه وحسن الخلق)** رواه مسلم

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Principles of Communication Systems (EE 450)

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Number

Second Examination　　Summer 2008

Q1. An VSB modulated signal is generated by passing an DSB-SC signal through an ideal BPF that passes the USB completely and a trace of the LSB (f_v). The frequency response of the used BPF is shown in Figure Q1. Let $H_I(f)$ and $H_Q(f)$ be the filters used to generate the in-phase and the quadrature component of the VSB modulated signal, respectively.

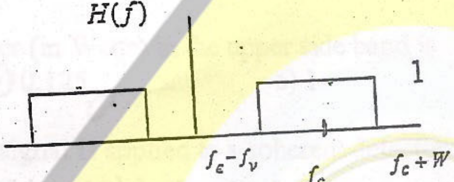

Figure Q1

1-1. $H_I(0)$ will be　[A]
a) 1　　b) 0　　c) 2　　d) 4　　e) 0.5

1-2. $H_Q(0)/j$ will be
a) 1　　b) 0　　c) 2　　d) 4　　e) 0.5

1-3. The carrier is added to the VSB modulated signal and the result is put through an envelope detector. The distortion at the output of the envelope detector due to the presence of the quadrature component can be reduced by
a) Increasing W　　b) Reducing W　　c) Increasing f_c　　d) Increasing f_v　　e) Decreasing f_c

Q2. Two speech signals (Each occupies the spectrum 0.3-3.3 kHz) are to be modulated using the same carrier without interfering with each other.

2-1. If the modulated signals must have minimum bandwidth, then the type of the modulated signals will be　Ans c
a) Both are USB-SSB　　b) Both are LSB-SSB　　c) One is LSB-SSB and the other is USB-SSB
d) Both are DSB-SC　　e) One is DSB-SC and the other is USB-SSB

2-2. The bandwidth of the modulated signals in 2-1 is
a) 3.3 kHz　　b) 9.9 kHz　　c) 0.3 kHz　　d) 13.2 kHz　　e) 6.6 kHz

2-3. If one of the signals is to be USB-SSB modulated signal with carrier frequency of 800 kHz and is applied to a coherent detector where its local oscillator has carrier frequency of 800.1kHz., then the demodulate signal will occupy the spectrum:
a) 0.3-3.3 kHz　　b) 0.1-3.3 kHz　　c) 0.4-3.4 kHz　　d) 0.2-3.2 kHz　　e) 0.3-3.4 kHz

Q3. The system shown in Figure Q3 is used to generate a WBFM signal.

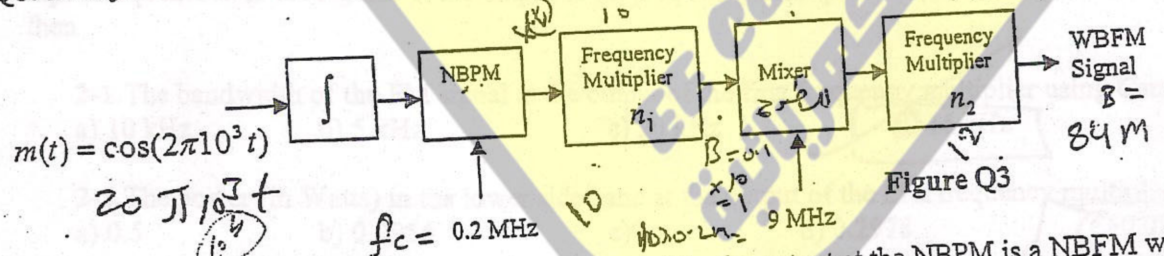

Figure Q3

The frequency multiplication ratios are $n_1 = 10$, $n_2 = 12$, the output at the NBPM is a NBFM with modulation index $\beta = 0.1$ and unity amplitude, and the BPF in the mixer is designed to select the difference between its input frequencies. If the signals at the output of the frequency multipliers and the mixer are unity amplitude, then

abw1:- $\beta = 0.1 \times 10 = 1$, $n f_c = 10 \times 0.2M = 2M$
mixer: 9M − 2M = 7M
2: $\beta = 1 \times 12 = 12$, $\Delta f = 12K$, $f_c = 7M \times 12 = 84MHz$

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…cond Examination — Spring 2008

Q1. The modulating signal $m(t)=\cos(2000\pi t)$ is used to modulate a carrier $c(t)=2\cos(800\pi*10^3t)$ in order to generate an upper side-band SSB modulated signal.

1-1. The spectrum of the modulated signal will have deltas at frequencies (in kHz)
a) 399 b) 801,800 c) 802, 800 d) 401 e) 398,402

1-2. The average power (in Watts) in the upper side band is
a) 0.25 b) 0.125 c) 1 d) 0.5

1-3. If the modulated signal is applied to a coherent detector where its local oscillator supplies the signal $c_r(t)=\cos(800.04\pi*10^3t)$, then the frequency components at the output of the detector is
a) 1 kHz b) 1020 Hz c) 20 Hz d) 40 Hz e) 980 Hz

1-4. The output of the coherent detector in part 1-3 can be seen as
a) $Km(t)$ b) LSB-SSB c) DSB-SC d) Full AM e) USB-SSB

1-5. The quadrature component of the modulated signal is
a) $\sin(2000\pi t)$ b) $\cos(2000\pi t)/2$ c) $\sin(2000\pi t)/2$ d) $\cos(2000\pi t)$ e) $|\cos(2000\pi t)|$

Q2. The system shown in Figure Q2 is used to generate a WBFM signal.

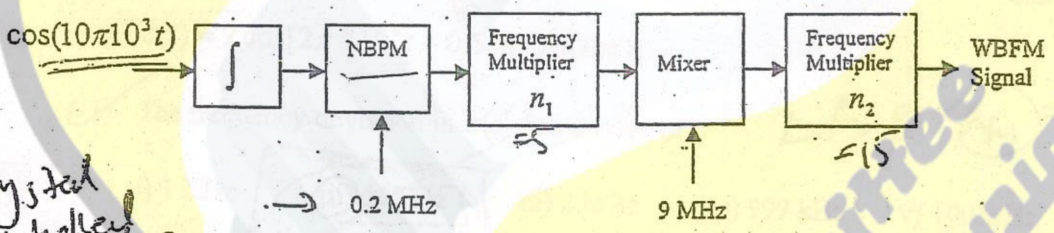

Figure Q2

The frequency multiplication ratios are $n_1=5$, $n_2=15$, the output at the NBPM is a NBFM with modulation index $\beta=0.1$ and unity amplitude, and the BPF in the mixer is designed to select the difference between its input frequencies. If the signals at the output of the frequency multipliers and the mixer are unity amplitude, then

2-1. The bandwidth of the FM signal at the output of the first frequency multiplier using Carson's rule is
a) 10 kHz b) 5 kHz c) 20 kHz d) 15 kHz e) 12.5 kHz

2-2. The power (in Watts) in the lower side band at the output of the first frequency multiplier is
a) 0.5 b) 0.0956 c) 0 d) 0.2978 e) 0.0298

2-3. The power (in Watts) in the side frequency 1005 kHz at the output of the first frequency multiplier is
a) 0.5 b) 0.9385 c) 0.0294 d) 0 e) 0.2423

Principles of Communication (EE 450)

Second Examination — Fall 2007/2008

Q1. An SSB modulated signal is given by $s(t) = m(t)\cos(2\pi f_c t) - \hat{m}(t)\sin(2\pi f_c t)$. The amplitude spectrum of the message signal is shown in Figure Q1.

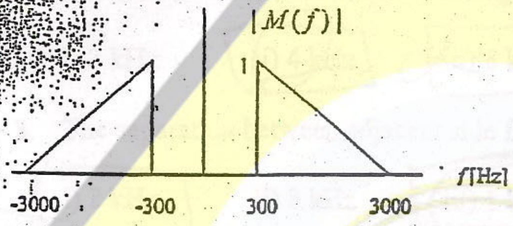

Figure Q1

a) Give one advantage and one disadvantage of using SSB modulation scheme. *(2 points)*

b) Draw a block diagram to generate $s(t)$ based on its in-phase and quadrature components. *(3 points)*

c) If $f_c = 500\,\text{kHz}$, draw the amplitude spectrum of the modulated signal ($|S(f)|$). *(3 points)*

d) The modulated signal, $s(t)$ is put through a coherent detector with its local oscillator generating the signal $\cos[2\pi(f_c + f_0)t]$. Derive an expression for the output of the coherent detector. *(3 points)*

e) How would modify $s(t)$ such that an envelope detector can be used recover the message signal $m(t)$ form the modulated signal $s(t)$? *(3 points)*

Q2. A sinusoidal message signal $m(t) = A_m \cos(2\pi f_m t)$ was used to generate the FM modulated signal

$$s(t) = 2\cos[2\pi * 10^6 t + 0.5\sin(2000\pi t)]$$

a) The frequency deviation in $s(t)$ has a value of

i) 1 KHz ii) 500 Hz iii) 2 MHz iv) 999 kHz v) 1001kHz

b) The transmission bandwidth using the 1% rule is

i) 2 kHz ii) 1 kHz iii) 8 kHz iv) 4 kHz v) 6 kHz

c) The power in the side bands frequencies within $s(t)$ is

i) 0.238 W ii) 1.762 W iii) 2 W iv) 1.56 W v) 1.062 W

$s(t)$ is put through a frequency multiplier with a multiplication ratio $n = 2$ and unity gain, then

1. The power in the carrier within the output of the frequency multiplier is

   i) 0.829 W ii) 1.762 W iii) 2 W iv) 0.765 W v) 1.171 W

2. The transmission bandwidth according to Carson's rule is

   i) 2 kHz ii) 4 kHz iii) 8 kHz iv) 1 kHz v) 5 kHz

3. The separation between adjacent side frequencies is

   i) 2 kHz ii) 8 kHz iii) 1 kHz iv) 4 kHz v) 5 kHz

e) If $s(t)$ is put through an ideal band pass filter with center frequency of 1 MHz and bandwidth of 3 kHz, then the signal at the output of filter will have a bandwidth of

i) 2 kHz ii) 8 kHz iii) 1 kHz iv) 3 kHz v) 4 kHz

f) The modulated signal $s(t)$ is put through a system with frequency response $H(f) = j2\pi f$ and then through an envelope detector to recover the message signal. If $A_m = 1$, which of the following frequency sensitivity k_f will not result in envelope distortion of the recovered signal:

i) 2×10^6 ii) 4×10^6 iii) 2×10^8 iv) 2×10^5 v) 2×10^9

TABLE A6.5 *Table of Bessel functions*[a]

	$J_n(x)$								
n\x	0.5	1	2	3	4	6	8	10	12
0	0.9385	0.7652	0.2239	−0.2601	−0.3971	0.1506	0.1717	−0.2459	0.0477
1	0.2423	0.4401	0.5767	0.3391	−0.0660	−0.2767	0.2346	0.0435	−0.2234
2	0.0306	0.1149	0.3528	0.4861	0.3641	−0.2429	−0.1130	0.2546	−0.0849
3	0.0026	0.0196	0.1289	0.3091	0.4302	0.1148	−0.2911	0.0584	0.1951
4	0.0002	0.0025	0.0340	0.1320	0.2811	0.3576	−0.1054	−0.2196	0.1825
5	—	0.0002	0.0070	0.0430	0.1321	0.3621	0.1858	−0.2341	−0.0735
6		—	0.0012	0.0114	0.0491	0.2458	0.3376	−0.0145	−0.2437
7			0.0002	0.0025	0.0152	0.1296	0.3206	0.2167	0.1703
8			—	0.0005	0.0040	0.0565	0.2235	0.3179	0.0451
9				0.0001	0.0009	0.0212	0.1263	0.2919	0.2304
10				—	0.0002	0.0070	0.0608	0.2075	0.3005
11					—	0.0020	0.0256	0.1231	0.2704
12						0.0005	0.0096	0.0634	0.1953
13						0.0001	0.0033	0.0290	0.1201
14						—	0.0010	0.0120	0.0650

[a] For more extensive tables of Bessel functions, see Watson (1966, pp. 666–697), and Abramowitz and Stegun (1965, pp. 358–406).