American University of Beirut

Faculty of Engineering and Architecture

Department of Electrical and Computer Engineering

EECE200 – Introduction to Engineering– Fall 2010-2011

Homework 1 Solution

Problem 1 [30 points]

a. The amplitude of y1 is 1V [1]
The amplitude of y2 is 0.5V [1]
The amplitude of y3 is 0.33V [1]

b. For y1
T= 0.00209-0 = 0.00209 sec [1]
F= 1/T = 477.4648 Hz [1]
$\omega = 2\pi F = 3000$ rad/sec [1]

For y2
T= 0.002806-0.00155 = 0.001256 sec [1]
F= 1/T = 795.7747 Hz [1]
$\omega = 2\pi F = 5000$ rad/sec [1]

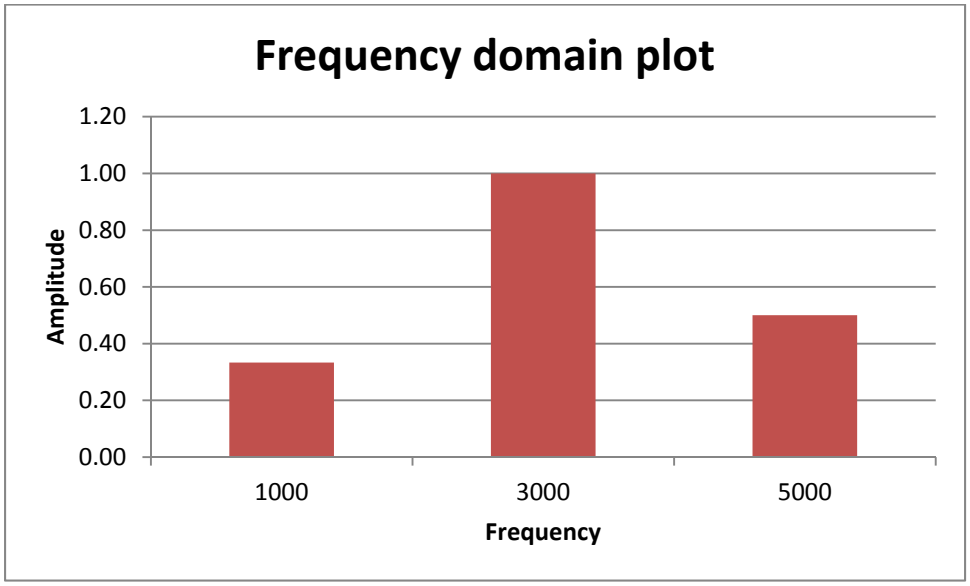
For Y3
T= 0.00628-0 = 0.00628 sec [1]
F= 1/T = 159.1549 Hz [1]
$\omega = 2\pi F = 1000$ rad/sec [1]

c. The second signal has the highest frequency (5000 Hz) [1]

d. For Y1
At T = 0.00052 sec Y1 =1 ; $1=1\sin(3000t+\varphi 1)$; $\sin(3000t+\varphi 1)=1$; $3000t+\varphi 1=\pi/2$ [1]
$\varphi 1=0$ rad/s [1]
$\varphi 1=0$ deg [1]
On the graph at T=0 sec the signal has a zero amplitude. Substituting in the equation verifies the calculated results [1]
For Y2
At T = 0 sec Y2 =0.5 ; $0.5=0.5\sin(5000t+\varphi 2)$; $\sin(5000t+\varphi 2)=1$; $5000t+\varphi 2=\pi/2$ [1]
$\varphi 1=\pi/2$ rad/s [1]
$\varphi 1=90$ deg [1]
On the graph at T=0.005 sec the signal has a 0.5 amplitude. Substituting in the equation verifies the calculated results [1]
For Y3
At T = 0.0015 sec Y3 =-0.3333 ; $-0.333=0.333\sin(1000t+\varphi 3)$; $\sin(1000t+\varphi 3)=-1$;
$1000t+\varphi 3=-\pi/2$ [1]
$\varphi 3=\pi$ rad/s [1]

φ3=180 deg [1]
On the graph at T=0 sec the signal has a zero amplitude. Substituting in the equation verifies the calculated results [1]

e. 1 point for each correct column (total 3) and one point for labeling each axis (total 2) [5 points].



Problem 2 [10 points]

a. Radio Monte Carlo [1]. Frequency is 1233 KHz [1]. Range of AM satins is 530 KHz to 1700KHz [1]
b. (108Mhz-88Mhz)/200KHz = 100 stations [3]
c. Yes the TV station bandwidth is bigger than the FM stations because they are transmitting audio as well as video which requires more data or bandwidth [4]

Problem 3 [25 points]

a. 4x4 = 16 pixels [2]
b. 2 bits are needed to represent the pixel because we have 4 levels of gray which are represented with 2 bits (2^2=4 levels) [1] for the number of bits and [1] for verification
Black: 00 [2]
Dark grey: 01 [2]
Light Grey: 10 [2]
White: 11 [2]

d.

0 2 3 0
3 0 2 3
1 3 3 3
1 3 3 1

[0.5] for each correct element in the matrix

e. 16 (elements)x2(bits for each element)x25 (frames per second)x60 (sec per minute)x5 (minutes)/8 (bits per byte)= 30000 bytes =0.03 megabytes [5]

Problem 4 [35 points]

a. $10110101.0101_2 = 1x2^7+0x2^6+1x2^5+1x2^4+0x2^3+1x2^2+0x2^1+1x2^0+0x2^{-1}+1x2^{-2}+0x2^{-3}+1x2^{-4} = 181.3125$ [9]

b. $548.23_{10} = 1000100100.00111010111$ [4] on the answer and [5] on the steps

548/2	274	0
274/2	137	0
137/2	68	1
68/2	34	0
34/2	17	0
17/2	8	1
8/2	4	0
4/2	2	0
2/2	1	0
1/2	0	1

0.23x2=0.46; 0.46x2=0.92; 0.92x2=1.84; 0.84x2=1.68; 0.68x2=1.36; 0.36x2=0.72; 0.72x2=1.44; 0.44x2=0.88; 0.88x2=1.76……..

c. $1546_8 = 1x8^3+5x8^2+4x8^1+6x8^0 = 870_{10} = 1101100110_2$ [2] for the answer and [2] for the steps

870/2	435	0
435/2	217	1
217/2	108	1
108/2	54	0
54/2	27	0
27/2	13	1
13/2	6	1
6/2	3	0
3/2	1	1
1/2	0	1

d. $100011100_2 = 11C_{HEX}$ [4]
$1100_2=C_{HEX}$
$0001_2=1_{HEX}$
$0001_2=1_{HEX}$

e. $118B_{16} = 1x16^3+1x16^2+8x16^1+11x16^0 = 4491$ [9]