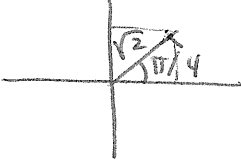


ECE 366 HW 1

Fall 2008

Solutions

(1) B.2 a, d, f

$$a) 1+j = \sqrt{2} e^{j\pi/4}$$


$$\begin{aligned}
 d) e^{j\pi/4} + 2e^{-j\pi/4} &= \cos(\pi/4) + j\sin(\pi/4) + 2\cos(-\pi/4) + j2\sin(-\pi/4) \\
 &= \frac{\sqrt{2}}{2} + j\frac{\sqrt{2}}{2} + \sqrt{2} - j\sqrt{2} \\
 &= \frac{3\sqrt{2}}{2} - j\frac{\sqrt{2}}{2} //
 \end{aligned}$$

$$f) \frac{(1+j)}{-4+j3} \cdot \frac{-4-j3}{-4-j3} = \frac{-4-4j-j3+3}{16+9} = \frac{-1-j7}{25} //$$

B.3 b, c, e

$$b) \frac{1}{e^j} = e^{-j} = \cos(-1) + j\sin(-1) = \cos(1) - j\sin(1)$$

$$c) (1+j)(-4+j3) = -4-4j+j3-3 = -7-j$$

$$e) e^j + 1 = \cos(1) + j\sin(1) + 1 = \cos(1) + 1 + j\sin(1)$$

② B.7 $w_1 = 3 + j4$ $w_2 = 2e^{j\pi/4}$

a) $5e^{j \tan^{-1}(4/3)} = 5e^{j0.9273}$

b) $w_2 = 2e^{j\pi/4} = 2\cos(\pi/4) + j2\sin(\pi/4)$
 $\sqrt{2} + j\sqrt{2} //$

c) $|w_1|^2 = 25$ $|w_2|^2 = 4$

d) $w_1 + w_2 = 3 + j4 + \sqrt{2} + j\sqrt{2} = 4.4142 + j5.4142 //$

e) $w_1 - w_2 = 3 + j4 - \sqrt{2} - j\sqrt{2}$
 $= 1.5858 + j2.5858$
 $= 3.0333 e^{j1.0207}$

f) $w_1 w_2 = 5e^{j0.9273} \cdot 2e^{j\pi/4} = 10e^{j(1.7127)}$
 $= 10\cos(1.7127) + j10\sin(1.7127)$
 $= -1.4143 + j9.8995 //$

g) $\frac{w_1}{w_2} = \frac{5e^{j0.9273}}{2e^{j\pi/4}} = 2.5e^{j0.1419} //$

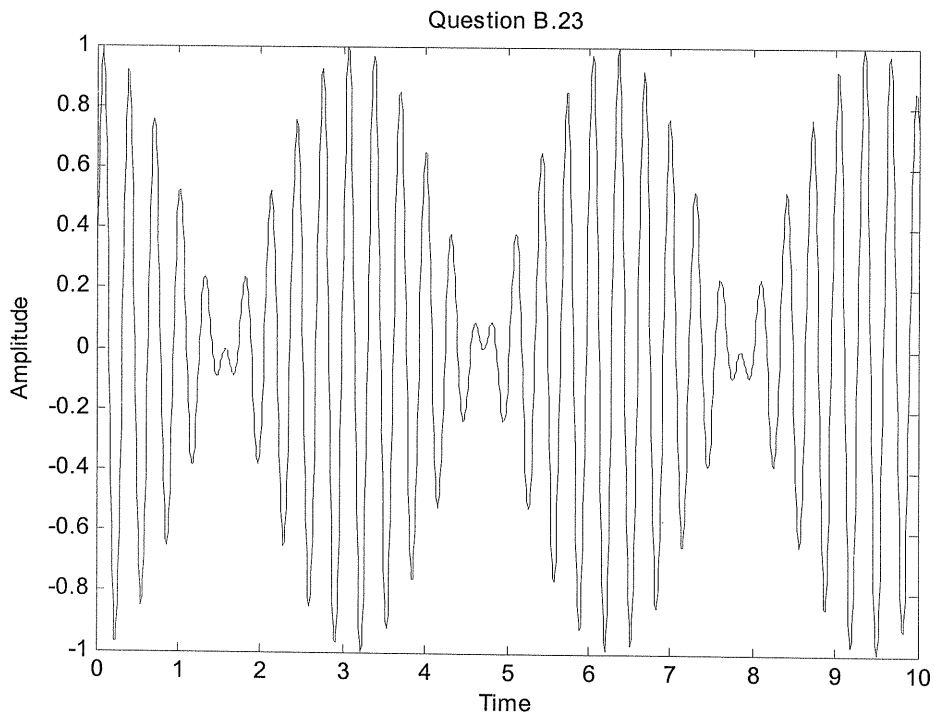
③ B.23 see attached plot.

④ B.24 see attached plot.

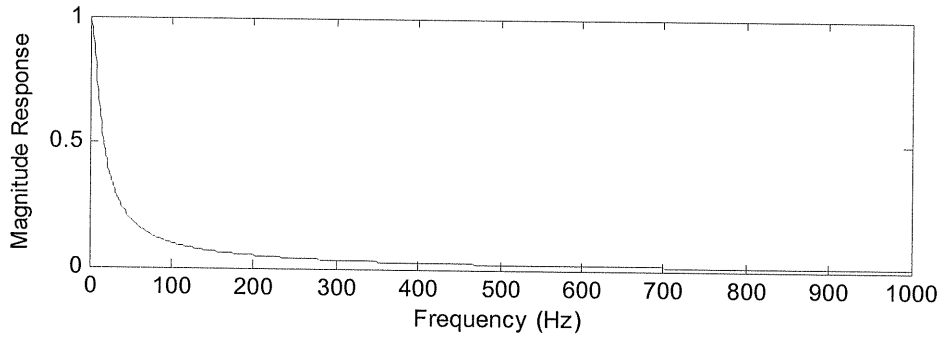
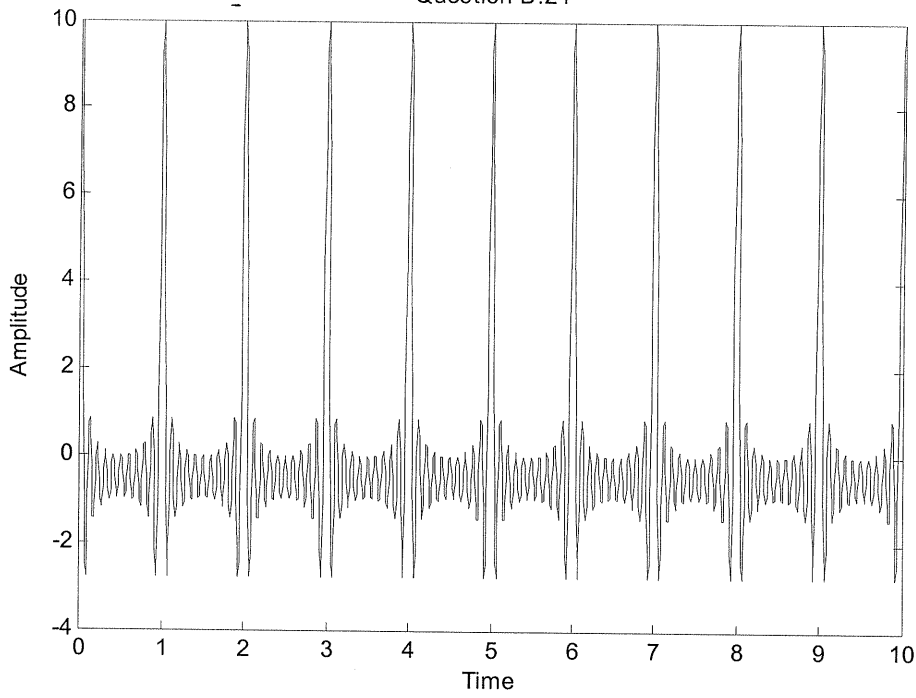
```

%hw 1 question 3 B.23
t=0:0.01:10;
x=cos(t).*sin(20*t);
plot(t,x);
xlabel('Time');
ylabel('Amplitude');
title('Question B.23');
%hw 1 question B.24
t=0:0.01:10;
x=zeros(size(t));
for k=1:10;
    x=x+cos(2*pi*k*t);
end
figure
plot(t,x);
xlabel('Time');
ylabel('Amplitude');
title('Question B.24');
%hw 1 question 5;
f=0:1000;
R=16000;
C=1e-06;
H=1./(1+j*2*pi*f*R*C);
figure
subplot(211)
plot(f,abs(H));
xlabel('Frequency (Hz)');
ylabel('Magnitude Response');
subplot(212);
plot(f,angle(H));
xlabel('Frequency (Hz)');
ylabel('Phase Response');

```



Question B.24



lowpass
filter.

