An Najah University – Faculty of engineering
Industrial Eng. Department
System and Signals

10/20

Instructor: Jamal Khrousheh

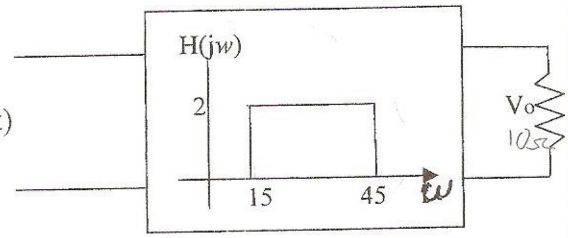
1^{st} hr exa
9/10/200

Question #1(7 marks)

For system shown, knowing that

$$vi(t) = 2 + \sum_{n=1}^{5} \frac{2}{n+1}\cos(10nt) + \sum_{n=1}^{5} \frac{2}{n}\sin(10nt)$$

And $$H(jw) = \frac{Vo(jw)}{Vin(jw)}$$



- Draw the spectrum of out put (magnitude and phase)
- What is the output power dissipated on the load

for $v_i(t) \Rightarrow C_n = \frac{a + jb}{2}$ $\quad e^{-jnw_0 t}$ ($w_0 = 10$)

$\boxed{|C_n| = \sqrt{(n+1)^2 + (\frac{1}{n})^2}}$

$a_n = \frac{2}{n+1}$

$\angle C_n = \angle \tan^{-1} \frac{\frac{1}{n}}{n+1}$

$b_n = \frac{2}{n}$

$\boxed{\angle C_n = \angle \tan^{-1} \frac{1}{n(n+1)}}$

$C_n = \frac{2(n+1) + j(\frac{2}{n})}{2}$

$C_n = n+1 + \frac{j}{n}$

$\therefore V_o = |V_{in}|\,|H(jw)| \angle \theta_{V_{in}} + \theta_{H(jw)}$

$v_i(t) = \sum_{n=-\infty}^{\infty} C_n e^{-jnw_0 t}$

$\boxed{V_i(t) = \sum_{n=1}^{5} \frac{n^2+n+j}{n} e^{-j10nt}}$

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for $h(t) \Rightarrow H(jw) = 2[\mu(w-15) - \mu(w-45)] e^{-jw30} ((\pi\delta(t) + \frac{1}{t}) + \pi\delta(t) - \frac{1}{t}$

$H(t) = (\pi\delta(t) + \frac{1}{t}) + (\pi\delta(t) - \frac{1}{t}$

$P_{10\Omega} = \frac{C_0^2 + \sum_{n=1}^{n=5} 2|C_n|^2}{10}$

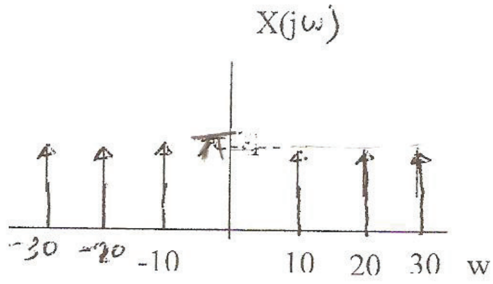
Pont

$\cos(n w_0 t)$
$\pi\delta(w+nw_0) - \pi\delta(w-w_0)$

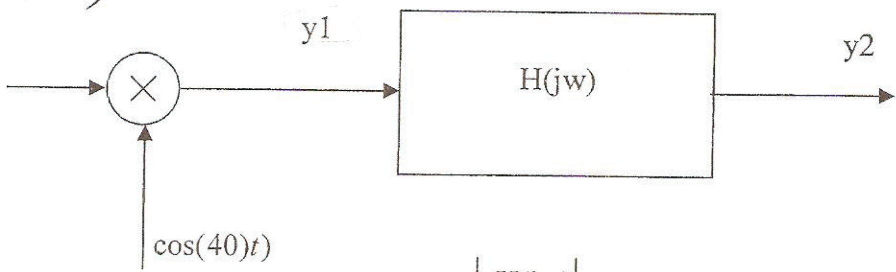
Question #2 (7marks)

The Fourier transform for signal x(t) is given by
For system represented by the following block diagram

1- sketch Fourier transform for signal y1(t) and y2(t)
2- ~~Sketch Y2(jw)~~
3- Write the function of y2(t)



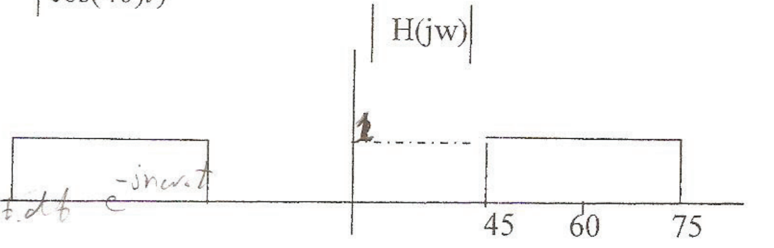
where $Y_1(t) = X(t)\cos(40t)$



$x(jw) = \pi\delta(w+nw_0) + \pi\delta(w-nw_0)$

$X(jw) = \pi\delta(w+10n) + \pi\delta(w-10n)$

$X(t) = \cos(10n)t$



$Y_1(t) = \cos(10n)t * \cos(40t)$

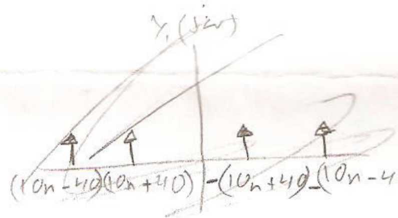
$Y_1(t) = \frac{1}{2}[\cos(10n+40)t + \cos(10n-40)t]$

$Y_1(jw) = \frac{1}{2}\int_{-\infty}^{\infty} \cos(10n+40)t\,dt + \int_{-\infty}^{\infty}\cos(10n-40)t\,dt \quad e^{-jnw_0 t}$

$= \frac{1}{2}\left[\frac{\sin(10n+40)t}{10n+40} + \frac{\sin(10n-40)t}{10n-40}\right]$

$\frac{1}{(jw)+jw}$

$Y_1(jw) = \int_{-\infty}^{\infty} \frac{1}{2}[\cos(10n+40)t + \cos(10n-40)t]\, e^{-j10nt}\,dt$



~~$H(jw) = \mu(jw-45) - \mu(jw-75)$~~

$Y_1(jw) = \pi\delta(w+(10n+40)) + \pi\delta(w-(10n+40)) + \pi\delta(w+(10n-40)) + \pi\delta(w-(10n+40))$

$Y_2(jw) = Y_1(jw) * H(jw)$

But $H(jw) = \mu(jw-45) - \mu(jw-75)$

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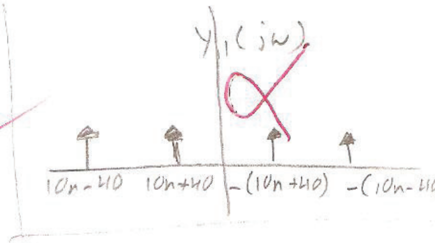
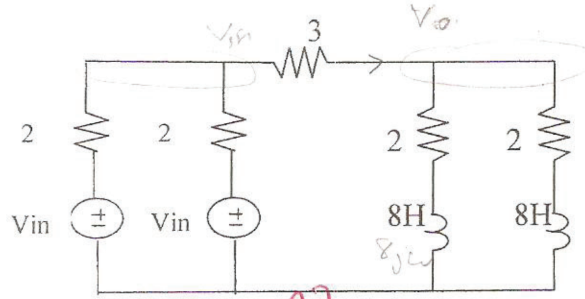


Question # 3 (6 marks)

For circuit shown, knowing that all initial values are zero

Find : 1- transfer function related Vo to Vin

2-Vo(t) if Vin(t) = u(t-1)



$$H(j\omega) = \frac{V_o}{V_{in}}$$

$$2 * \frac{V_{in}}{2} + \frac{V_{in} - V_o}{3} + V$$

$V_o = ??$

$$\cancel{2} * \frac{V_{in}}{\cancel{2}} + \frac{V_{in} - V_o}{3} + 2\frac{V_o}{2 + j8\omega} = 0$$

$$V_{in} + \frac{V_{in} - V_o}{3} + \frac{V_o}{1 + j4\omega} = 0$$

$$\frac{V_o}{1 + j4\omega} = 0.33 V_o - 1.33 V_{in}$$

$$\frac{V_o}{1 + j4\omega} - 0.33 V_o = -1.33 V_{in}$$

$$V_o \left(\frac{1}{1 + j4\omega} - \frac{1}{3}\right) = -1.33 V_{in}$$

$$V_o = \frac{3 + j12\omega}{3 - 1 - j4\omega}(-1.33 V_{in})$$

$$V_o = \frac{3 + j12\omega}{2 - j4\omega}\left(-\frac{4}{3} V_{in}\right)$$

$$\boxed{V_o = \frac{-12 - j48\omega}{6 - j12\omega} V_{in}}$$

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$$H(j\omega) = \frac{\frac{-12 - j48\omega}{6 - j12\omega} \cancel{V_{in}}}{\cancel{V_{in}}}$$

$$\boxed{H(j\omega) = \frac{-2 - j8\omega}{1 - j2\omega}}$$

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$$V_o(t) = \frac{-2 - j8\omega}{1 - j2\omega} * u(t-1)$$

$$= \frac{-2 - j8\omega}{1 - j2\omega}\left(e^{-j\omega}(\pi\delta(\omega)\right.$$

$$= \frac{-2 - j8\omega}{1 - j2\omega}\left(\left(\pi\delta(\omega) + \cancel{\frac{1}{j\omega}}\right) e^{-j\omega}\right.$$

$$= \left(\pi\delta(\omega)\frac{-2}{1} + \frac{-2 - j8\omega}{j\omega(1 - j2\omega)}\right)$$

$$\frac{-2 - j8\omega}{j\omega(1 - j2\omega)} = \frac{A}{j\omega} + \cancel{\frac{B}{1 - j2\omega}}$$

$$-2 - j8\omega = A(1 - j2\omega) + B(j\omega)$$

when $j\omega = 0$ $\quad\boxed{A = -2}$

when $j\omega = \frac{1}{2}$ $\quad\boxed{B = -12}$

$$= \left(\pi\delta(\omega) - 2 + \frac{-2}{j\omega} \frac{-12}{1 - j2\omega}\right) e^{-j\omega}$$

$$= \left(-2\left(\pi\delta(\omega) + \frac{1}{j\omega}\right) - \frac{6}{0.5 - j\omega}\right) e^{-j\omega}$$

$$V_o(t) = \left(-2u(t) - e^{-0.5t}u(t)\right) e$$

$$\boxed{V_o(t) = -2u(t-1) - e^{-0.5t}u(t-1)}$$

To show on the screen print it

mov DL, AL
[illegible] ; mov AH, 06   ≡ func #2
INT 21

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Q2

draw (mag. & phase) for the output

$$C_n = \frac{a_n - j b_n}{2}$$

for input (sym.)

$C_0 = 2$

$$\Rightarrow C_1 = \frac{\frac{2}{1+1} - j\frac{2}{1}}{2} = 0.5 - j1 = \sqrt{(0.5)^2+(-1)^2}\ \angle \tan^{-1}\frac{-1}{0.5}$$

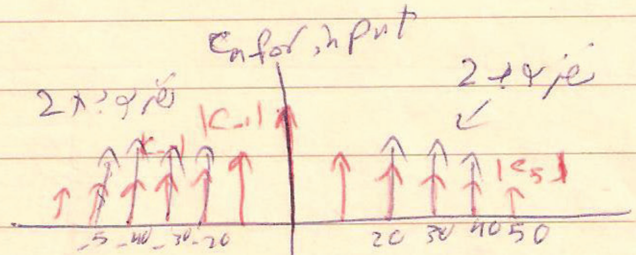
$$C_{-1} = C_1^* = 0.5 + j1 = (\quad)\ \angle \tan^{-1}\frac{1}{0.5}$$

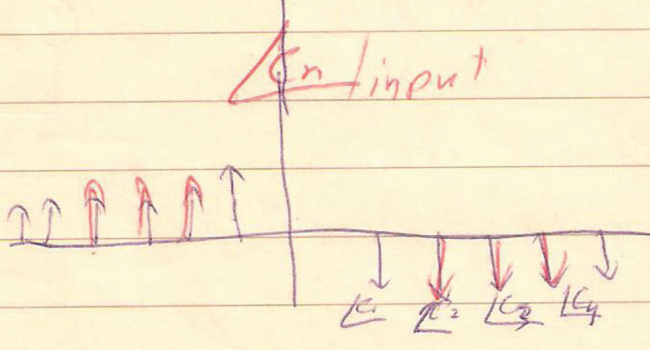
C_2

C_{-2}

⋮

C_{-5}





Input

$$V \Rightarrow P_{output} = \frac{2|C_{2out}|^2 + 2|C_{3out}|^2 + 2|C_{4out}|^2}{R}$$

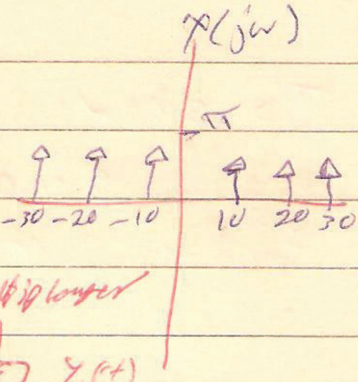
f.sh interegration.p
t.sh dist.p

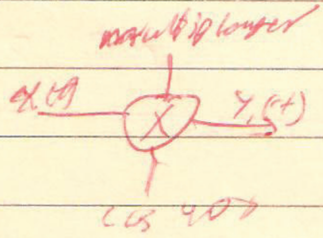
Q2

$y_1(t) = x(t)\cos 40t$

spect. ...

40 ...

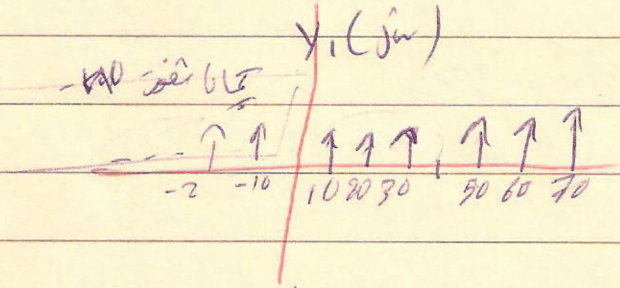


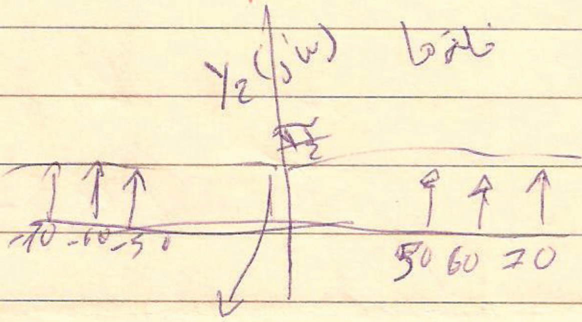


$x(t)$ ... $X(jw)$

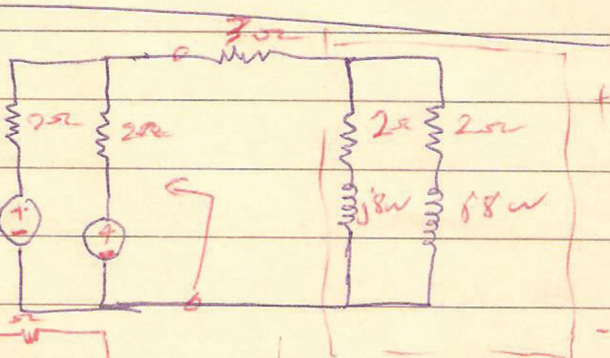
cos ... spectrum 2 π

$\frac{1}{2}(c+c)$ ...

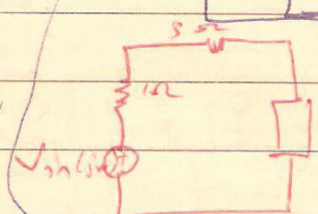




$y_2(t) = \frac{1}{2}\cos 50t + \frac{1}{2}\cos 60t + \frac{1}{2}\cos 70t$ ← ... التحويل



$$\frac{V_o(jw)}{V_{in}(jw)} = \frac{1+j4w}{5+j4w}$$



$$\frac{(2+j8w)(2+j8w)}{4+16jw}$$

$V_{in}(t) = \mu(t-1)$

$V_{in}(jw) = \left(\pi\delta w + \frac{1}{jw}\right)e^{-jw}$

$$V_o(jw) = \left(\frac{1+j4w}{5+jw}\right)\left(\pi\delta w + \frac{1}{jw}\right)e^{-jw}$$

$$= \left[\frac{\pi}{5}\delta(w) + \frac{A}{jw} + \frac{B}{jw+\frac{5}{4}}\right]e^{-jw}$$

$$V_o(t) = \frac{1}{5}\mu(t-1) + Be^{-5/4(t-1)}\mu(t-1)$$