Day..... Month..... Year........ ۹۸۲۴۴۵۳ Subject.........

-۲

$$Y(j\omega) = \mathcal{F}\{y(t)\} = \mathcal{F}\{x(t) * h(t)\} =$$

$$\mathcal{F}\{x(t)\} \cdot \mathcal{F}\{h(t)\} = X(j\omega) \cdot H(j\omega)$$

$$G(j\omega) = \mathcal{F}\{g(t)\} = \mathcal{F}\{x(3t) * h(3t)\} =$$

$$\mathcal{F}\{x(3t)\} \cdot \mathcal{F}\{h(3t)\} = \frac{X(\frac{j\omega}{3})}{3} \cdot \frac{H(\frac{j\omega}{3})}{3}$$

$$G(j\omega) = \frac{Y(\frac{j\omega}{3})}{9} \xleftrightarrow{\mathcal{F}} g(t) = \frac{y(3t)}{3}$$

$$A = \frac{1}{2} \qquad B = 3$$

۳_الف)

$$e^{-3|t|}\sin(2t) = e^{-3t}\sin(2t)u(t) + e^{3t}\sin(2t)u(-t) =$$

$$x_1(t) + x_2(t) = x_1(t) - x_1(-t)$$

$$X_1(j\omega) = \mathcal{F}\{e^{-3t}\sin(2t)u(t)\} = \frac{1}{2\pi}\mathcal{F}\{e^{-3t}u(t)\} *$$

$$\mathcal{F}\{\sin(2t)\} = \frac{1}{2\pi}\left(\frac{1}{3+j\omega} * \left(\frac{\pi}{j}[\delta(\omega-2) - \delta(\omega+2)]\right)\right)$$

$$= \frac{1}{2j}\left(\frac{1}{3+j(\omega-2)} - \frac{1}{3+j(\omega+2)}\right) = -\frac{2}{-13+\omega(\omega-6i)}$$

$$X(j\omega) = X_1(j\omega) + X_2(j\omega) = X_1(j\omega) - X_1(-j\omega)$$

$$X(j\omega) = \int_{-\infty}^{+\infty} \sum_{k=0}^{\infty} a^k \delta(t-kT) e^{-j\omega t} dt$$ ۳-ب)

$$= \sum_{k=0}^{\infty} a^k \int_{-\infty}^{+\infty} \delta(t-kT) e^{-j\omega t} dt =$$

$$\sum_{k=0}^{\infty} a^k e^{-j\omega kT} = \frac{1}{1-ae^{-j\omega T}}$$

۴- الف)

$$G(j\omega) = \mathcal{F}\{g(t)\} = \mathcal{F}\{x(t)\cos(t)\} =$$

$$\frac{1}{2\pi}\left(\mathcal{F}\{x(t)\} * \mathcal{F}\{\cos(t)\}\right) =$$

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

$$\frac{X(j(\omega-1)) + X(j(\omega+1))}{2} = \begin{cases} 1 & |\omega| \leq 2 \\ 0 & o.w \end{cases} \Rightarrow$$

$$X(j\omega) = \begin{cases} 2 & |\omega| \leq 1 \\ 0 & o.w \end{cases} \Leftrightarrow x(t) = \frac{2\sin(t)}{\pi t}$$

$$G(j\omega) = \mathcal{F}\{g(t)\} = \mathcal{F}\{x(t)\cos(\tfrac{۲}{۳}t)\} =$$ (ج-۴

$$\frac{1}{۲\pi}\left(\mathcal{F}\{x(t)\} * \mathcal{F}\{\cos(\tfrac{۲}{۳}t)\}\right) =$$

$$\frac{1}{۲\pi} * \left(X(j\omega) * \pi\left(\delta(\omega-\tfrac{۲}{۳}) + \delta(\omega+\tfrac{۲}{۳})\right)\right) =$$

$$\frac{X(j(\omega-\frac{۲}{۳})) + X(j(\omega+\frac{۲}{۳}))}{۲} = \begin{cases} 1 & |\omega| \leqslant ۲ \\ 0 & o.w \end{cases}$$

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$$H_1(j\omega) = \frac{j\omega}{2} \mathcal{F}\left\{ \frac{\sin(\omega_c t)}{\pi t} \right\} = \begin{cases} \frac{j\omega}{2} & |\omega| < \omega_c \\ 0 & \text{O.W} \end{cases}$$

$$H_2(j\omega) = \mathcal{F}\left\{ \frac{\sin(3\omega_c t)}{\pi t} \right\} = \begin{cases} 1 & |\omega| < 3\omega_c \\ 0 & \text{O.W} \end{cases}$$

$$H_4(j\omega) = \mathcal{F}\{ u(t) \} = \frac{1}{j\omega} + \pi\delta(\omega)$$

$$h(t) = \left(h_1(t) + \left(h_1(t) * h_2(t)\right)\right) * h_3(t) * h_4(t)$$

$$H(j\omega) = \left(H_1(j\omega) + H_1(j\omega) H_2(j\omega)\right) H_3(j\omega) H_4(j\omega)$$

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۱- الف)

$$(j\omega)^۲ Y(j\omega) + ۶ (j\omega) Y(j\omega) + ۸ Y(j\omega) = ۲ X(j\omega)$$

$$H(j\omega) = \frac{Y(j\omega)}{X(j\omega)} = \frac{۲}{(j\omega)^۲ + ۶(j\omega) + ۸} = \frac{1}{(j\omega+۲)} - \frac{1}{(j\omega+۴)}$$

$$h(t) = F^{-1}\left\{H(j\omega)\right\} = e^{-۲t}u(t) - e^{-۴t}u(t)$$

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