MAGBOJOS. CHERMILYN F. 20-07448
ME-4203

ASSIGNMENT 2

1.) $F(s) = \dfrac{1}{s(s^2+2s+2)}$

$$\left[\frac{1}{s(s^2+2s+2)}\right] = \frac{A}{s} + \frac{Bs+C}{s^2+2s+2}$$

$1 = A(s^2+2s+2) + s(Bs+C)$

$1 = A(s^2+2s+2) + Bs^2 + C$

IF $s=0$; $1 = 2A$

$A = \dfrac{1}{2}$

SUBSTITUTING A:

$$\left[1 = \frac{s^2+2s+2}{2} + Bs^2 + Cs\right]2$$

$2 = s^2 + 2s + 2 + 2Bs^2 + 2Cs$

$2 = s^2 + (2B+1) + s(2C+2) + 2$

$2B+1 \qquad 2C+2$

$2B = -1 \qquad 2C = -2$

$B = -\dfrac{1}{2} \qquad C = -1$

$\therefore \mathcal{L}^{-1} \dfrac{1/2}{s} - \dfrac{1/2 s + 1}{s^2+2s+2}$

$\dfrac{1}{2}\mathcal{L}^{-1}\dfrac{1}{s} - \dfrac{1}{2}\mathcal{L}^{-1}\dfrac{s+2}{s^2+2s+2} \Rightarrow \dfrac{1}{2}\mathcal{L}^{-1}\dfrac{1}{s} - \dfrac{1}{2}\mathcal{L}^{-1}\dfrac{s+2}{s^2+2s+1+1}$

$\dfrac{1}{2}\mathcal{L}^{-1}\dfrac{1}{s} - \dfrac{1}{2}\mathcal{L}^{-1}\dfrac{(s+1)+1}{(s+1)^2+1}$; WHERE $a=1$ AND $w=1$

$f(t) = \dfrac{1}{2} - \dfrac{1}{2}e^{-t} \cdot \cos t + \sin t$

$$\boxed{f(t) = \frac{1}{2} - \frac{1}{2}e^{-t}(\cos t + \sin t)}$$

2.) $F(s) = \dfrac{5(s+2)}{s^2(s+1)(s+3)}$

$5\mathcal{L}^{-1}\dfrac{s+2}{s^2(s+1)(s+3)}$

$$\left[\frac{s+2}{s^2(s+1)(s+3)} = \frac{A}{s+1} + \frac{B}{s+3} + \frac{C}{s} + \frac{D}{s^2}\right] s^2(s+1)(s+3)$$

$s+2 = As^3(s+3) + Bs^2(s+1) + Cs(s+1)(s+3) + D(s+1)(s+3)$

IF $s=-3$	IF $s=-1$	IF $s=0$
$-1 = B(-3)^2(-3+1)$	$1 = A(-1)^2(-1+3)$	$2 = D(0+1)(0+3)$
$-1 = 9B(-2)$	$1 = 2A$	$2 = 3D$
$-1 = -18B$	$A = \dfrac{1}{2}$	$D = \dfrac{2}{3}$

IF $s=1$

$3 = 4A + 2B + C(2)(4) + D(2)(4)$

$3 - 2 + \dfrac{1}{9} + 8C + \dfrac{16}{3}$

$C = -\dfrac{5}{9}$

$$5\left[\mathcal{L}^{-1}\left\{\frac{1/2}{s+1}+\frac{1/18}{s+3}+\frac{-5/9}{s}+\frac{2/3}{s^2}\right\}\right]$$

$$5\left[\frac{1}{2}\mathcal{L}^{-1}\frac{1}{s+1}+\frac{1}{18}\mathcal{L}^{-1}\frac{1}{s+3}-\frac{5}{9}\mathcal{L}^{-1}\frac{1}{s}+\frac{2}{3}\mathcal{L}^{-1}\frac{1}{s^2}\right]$$

WHERE $a=1$ AND $a=3$

$$5\left(\frac{1}{2}e^{-t}+\frac{1}{18}e^{-3t}-\frac{5}{9}e^{-t}+\frac{5}{18}e^{-3t}\right)$$

$$\boxed{f(t)=\frac{10}{3}t-\frac{25}{9}+\frac{5}{2}e^{-t}+\frac{5}{18}e^{-3t}}$$

3.) $F(s)=\dfrac{s^4+2s^3+3s^2+4s+5}{s(s+1)} \Rightarrow$

$$\begin{array}{r l}
 & s^2+s+2 \\
s^2+s & \overline{)\,s^4+2s^3+3s^2+4s+5} \\
 & \underline{s^4+s^3} \\
 & s^3+3s^2 \\
 & \underline{s^3+s^2} \\
 & 2s^2+4s \\
 & \underline{2s^2+2s} \\
 & 2s+5
\end{array}$$

$$\mathcal{L}^{-1}\, s^2+s+2+\frac{2s+5}{s^2+s}$$

$$\frac{d^2f}{dt^2}+\frac{df}{dt}+2\delta(t) \quad : \text{EQUATION 1}$$

$$\mathcal{L}^{-1}\frac{2s+5}{s^2+5} \Rightarrow \mathcal{L}^{-1}\frac{2s+5}{s(s+1)}$$

$$\mathcal{L}^{-1}\frac{(2s+2)+3}{s(s+1)}$$

$$2\mathcal{L}^{-1}\frac{(s+1)}{s(s+1)}+3\mathcal{L}^{-1}\frac{1}{s(s+1)}$$

$$2\mathcal{L}^{-1}\frac{1}{s}+3\mathcal{L}^{-1}\frac{1}{s(s+1)}$$

$$\left[\frac{1}{s(s+1)}=\frac{A}{s}+\frac{B}{s+1}\right]s(s+1)$$

$1=A(s+1)+Bs$

IF $s=-1$	IF $s=0$
$1=-1B$	$1=1A$
$B=-1$	$A=1$

$$3\left[\mathcal{L}^{-1}\frac{1}{s}-\mathcal{L}^{-1}\frac{1}{s+1}\right] \text{ WHERE } a=1$$

$$3-3e^{-t} \Rightarrow 2+3-3e^{-t}$$

$5-3e^{-t}$: EQUATION 2

SUBSTITUTING EQ. 1 AND EQ. 2

$$\boxed{f(t)=\frac{d^2f}{dt^2}+\frac{df}{dt}+2\delta(t)+5-3e^{-t}}$$