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ME-4203

ASSIGNMENT 1

1. SOLVE FOR THE LAPLACE TRANSFORM OF THE FOLLOWING

1. $L[3 - e^{-3t} + 5\sin 2t] = F(s)$

$3L\{1\} = 3\left(\frac{1}{s}\right) = \frac{3}{s}$

$L\{e^{-3t}\} = \frac{1}{s+3}$

$5L\{\sin 2t\} = 5\left(\frac{2}{s^2+2^2}\right) = \frac{10}{s^2+4}$

$$\boxed{F(s) = \frac{3}{s} - \frac{1}{s+3} + \frac{10}{s^2+4}}$$

2. $L[3 + 12t + 42t^3 - 3e^{2t}] = F(s)$

$3L\{1\} = 3\left(\frac{1}{s}\right) = \left(\frac{3}{s}\right)$

$12L\{t\} = 12\left(\frac{1}{s^2}\right) = \left(\frac{12}{s^2}\right)$

$42L\{t^3\} = 42\left(\frac{3!}{s^{3+1}}\right) = 42\left(\frac{6}{s^4}\right) = \frac{252}{s^4}$

$3L\{e^{2t}\} = 3\left(\frac{1}{s-2}\right) = \frac{3}{s-2}$

$$\boxed{F(s) = \frac{3}{s} + \frac{12}{s^2} + \frac{252}{s^4} - \frac{3}{s-2}}$$

3. $L[(t+1)(t+2)] = F(s)$

$L[t^2 + 3t + 2] = F(s)$

$L\{t^2\} = \frac{2!}{s^{2+1}} = \frac{2}{s^3}$

$3L\{t\} = 3\left(\frac{1}{s^2}\right) = \frac{3}{s^2}$

$2L\{1\} = 2\left(\frac{1}{s}\right) = \frac{2}{s}$

$$\boxed{F(s) = \frac{2}{s^3} + \frac{3}{s^2} + \frac{2}{s}}$$

II. SOLVE FOR THE INVERSE LAPLACE TRANSFORM OF THE FOLLOWING:

1. $L^{-1}\left[\frac{8-3s+s^2}{s^3}\right] = f(t)$

$L^{-1}\left[\frac{8}{s^3}-\frac{3}{s^2}+\frac{1}{s}\right] = f(t)$

$4L\left\{\frac{2}{s^3}\right\} = 4(t^2)\,u(t) = 4t^2 u(t)$

$3L^{-1}\left\{\frac{1}{s^2}\right\} = 3(t)\,u(t) = 3t\,u(t)$

$L^{-1}\left\{\frac{1}{s}\right\} = u(t)$

$\boxed{f(t) = (4t^2 - 3t + 1)\,u(t)}$

2. $L^{-1}\left[\frac{5}{s-2} - \frac{4s}{s^2+9}\right] = f(t)$

$L^{-1}\left[\frac{5}{s-2}\right] - L^{-1}\left[\frac{4s}{s^2+9}\right] = f(t)$

$5L^{-1}\left\{\frac{1}{s-2}\right\} = 5(e^{2t})\,u(t) = 5e^{2t}\,u(t)$

$4L^{-1}\left\{\frac{s}{s^2+9}\right\} = 4(\cos 3t)\,u(t) = 4\cos 3t\,u(t)$

$\boxed{f(t) = (5e^{2t} - 4\cos 3t)\,u(t)}$

3. $L^{-1}\left[\frac{7}{s^2+6}\right] = f(t)$

$f(t) = \frac{7}{\sqrt{6}}\,L^{-1}\left\{\frac{\sqrt{6}}{s^2+6}\right\}$

$= \frac{7}{\sqrt{6}}(\sin\sqrt{6})\,u(t)$

$= \left[\frac{7}{\sqrt{6}}\sin\sqrt{6}\,u(t)\right]\left[\frac{\sqrt{6}}{\sqrt{6}}\right]$

$\boxed{f(t) = \frac{7\sqrt{6}}{6}\sin\sqrt{6}\,u(t)}$