University of Portland
School of Engineering

EE 262
Spring 2018
A. Inan

Homework # 4—Laplace Transform and MATLAB
(Assigned: Monday, February 19, 2018)
(Due: Wednesday, February 28, 2018, 9:15a.m.)

Inan problem # 8: Laplace transform of signals.
Find the Laplace transform of each of the following signals using Laplace-transform tables and properties:

(a) $x_1(t)=3e^{-2t}u(t-1)$; (b) $x_2(t)=14te^{-3t+5}u(t-2)$; (c) $x_3(t)=4\cos^2(3t)u(t)$

(d) $x_4(t)=10te^{-t}\sin(3t)u(t)$; (e) $x_5(t)=3(t-4)u(t-2)$; (f) $x_6(t)=8\cos(4t-2\pi/3)u(t)$

(g) $x_7(t)=3t^2\cos\left(\frac{5\pi t}{6}\right)\delta(t-2)$; (h) $x_8(t)=12te^{-2t}\cos(3t)u(t)$; (i) $x_9(t)=\frac{5\sin(4t)}{3t}u(t)$

(j) $x_{10}(t)=6t^2\text{rect}\left(\frac{2t-3}{6}\right)$; (k) $x_{11}(t)=\frac{d^2}{dt^2}\left[2e^{2(2-t)}u(t)\right]$; (l) $x_{12}(t)=3(2t-3)^2u(t)$

(m) $x_{13}(t)=\frac{4t}{\pi}\sin(2\pi-t)\delta(2t-\pi)$

Inan problem # 9: Initial and final value theorems.
Find $x(0^+)$ and $x(\infty)$ given that:

(a) $X(s)=\frac{8s^2+15}{2s^3+6s^2+5s}$; (b) $X(s)=\frac{2(13-7e^{-2s})}{s(s+3)^2}$; (c) $X(s)=\frac{4s+3e^{-4s}}{s(3s+4)}$

Inan problem # 10: Inverse Laplace transform using partial fraction expansion.
Find the inverse Laplace transform of each of the following functions by using partial-fraction expansion:

(a) $X_1(s)=\frac{2(3s+13)}{s^2+4s+3}$; (b) $X_2(s)=\frac{3s^2+8s+1}{(s+1)^2(s+2)}$; (c) $X_3(s)=\frac{4s^2+7s+25}{(s+3)(s^2+4s+13)}$

(d) $X_4(s)=\frac{12s(2-3e^{-s})}{(2s+3)^3}$; (e) $X_5(s)=\frac{6(s-2)}{(s+2)(s^2+4)}$; (f) $X_6(s)=\frac{3(4s^2-6s+9)}{s^2(s^2+9)}$

(g) $X_7(s)=\frac{(2s^2+s+4)e^{-2s}}{(s+1)^2}$

Inan MATLAB Problem # 1: Impulse and unit-step responses of an LTI system.
Use MATLAB program to find the impulse and unit-step responses of the LTI system governed by the differential equation $\frac{dy(t)}{dt}+4y(t)=2\frac{dx(t)}{dt}+5x(t)$.

Inan MATLAB Problem # 2: Impulse and unit-step responses of an LTI system.

Use MATLAB program to find the impulse and unit-step responses of the LTI system governed by the differential equation $\frac{d^2y(t)}{dt^2}+5\frac{dy(t)}{dt}+4y(t)=\frac{dx(t)}{dt}+10x(t)$.

Inan MATLAB Problem # 3: Convolution integral.

Use MATLAB program to find and sketch the following convolution integrals:

(a) $y(t)=u(t)*r(t)$; (b) $y(t)=3\text{rect}\left(\frac{t-1}{2}\right)*2\text{rect}\left(\frac{t-3}{4}\right)$

(c) $y(t)=[\delta(t-1)-\delta(t-2)]*\text{rect}\left(\frac{t-1}{2}\right)$

(d) $y(t)=x(t)*x(t)$ where $x(t)=r(t)-2r(t-1)+r(t-2)$

Please use the following guidelines for your homework solutions:

1) On the first sheet, at the top center, write: Homework #4-Solutions.
2) Provide your full name on the upper right corner of the first sheet.
3) Also write: EE 262/Spring 2018 on the upper left corner of the first sheet.
4) Solve each problem on a separate sheet unless your solution is very short.
5) Box all of your answers.
6) Staple your solutions in the above order before you turn them in.

Please turn in your homework on time.

Reminder: EE 262 Midterm Exam # 1
Friday, March 2, 2018, 9:15-10:10am