

EEE302 CONTROL SYSTEMS PRE-LABORATORY REPORT

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ASSIGNMENT NUMBER : 1

OBJECTIVES OF THE LABORATORY ASSIGNMENT:

Objectives of this lab are learning MATLAB environment and how to find laplace and inverse laplace of a function.

CODES:

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% CONTROL SYSTEM LAB ASSIGNMENT-1
% TURHAN CAN KARGIN 150403005
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clear all % clears all variable definitions
close all % closes all figures
clc % clears the screen

syms s w t u b a % Creating Symbolic Variables

%QUESTION-1)
A=((3*exp(-5*t))*cos(t))-exp(-5*t)*sin(t);
A_Laplace=laplace(A)

%QUESTION-2)
B=(dirac(t)+2*heaviside(t-3)+(a*(t^2))+b*t*sin(w*t));
B_laplace=laplace(B)

%QUESTION-3)
C=((s+4)/(s^2+5*s+6));
C_inverse=ilaplace(C)

%QUESTION-4)
D=((11*s+28)/(((s+2)^2)*(5+s)));
D_inverse=ilaplace(D)

%QUESTION-4,With Partial Fraction
D_partfrac=partfrac(D);
D_inverse2=ilaplace(D_partfrac)
```

% COMMAND WINDOW

A_Laplace =

$$(3*(s + 5))/((s + 5)^2 + 1) - 1/((s + 5)^2 + 1)$$

B_laplace =

$$(2*\exp(-3*s))/s + (2*a)/s^3 + (2*b*s*w)/(s^2 + w^2)^2 + 1$$

C_inverse =

$$2*\exp(-2*t) - \exp(-3*t)$$

D_inverse =

$$3*\exp(-2*t) - 3*\exp(-5*t) + 2*t*\exp(-2*t)$$

D_inverse2 =

$$3*\exp(-2*t) - 3*\exp(-5*t) + 2*t*\exp(-2*t)$$

SOLUTIONS:

QUESTION-1:

Assignment-1

Question-1 = Find the laplace transform for,

$$f(t) = 3e^{-5t} \cos(t) - e^{-5t} \sin(t)$$

Solution = $L \{ e^{at} \sin(bt) \} = \frac{b}{(s-a)^2 + b^2}$ = not a lot

$$L \{ e^{at} \cos(bt) \} = \frac{s-a}{(s-a)^2 + b^2}$$

$$\rightarrow \left[\frac{3(s+5)}{(s+5)^2 + 1} - \frac{1}{(s+5)^2 + 1} \right] = F(s)$$

QUESTION-2:

Question-2 = Find the laplace transformation for,

$$f(t) = g(t) + 2u(t-3) + at^2 + bt \sin(\omega t)$$

where a and b are symbolic constants.

Solution =

$$L\{g(t-a)\} = e^{-as}$$

$$L\{u(t-a)\} = e^{-as}/s$$

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

$$L\{t^n \sin(\omega t)\} = \frac{d^n}{ds^n} \left(\frac{a}{s^2 + \omega^2} \right) \cdot (-1)^n$$

$$\rightarrow \boxed{1 + \frac{2e^{-3s}}{s} + \frac{2a}{s^3} + \frac{2b\omega s}{(s^2 + \omega^2)^2} = F(s)}$$

QUESTION-3:

Question-3 = Find the inverse laplace transform for,

$$F(s) = \frac{s+4}{s^2+5s+6}$$

Solution =

$$\frac{s+4}{s^2+5s+6} = \frac{A}{s+3} + \frac{B}{s+2} \rightarrow \begin{matrix} A = -1 \\ B = 2 \end{matrix}$$

$$\rightarrow L^{-1} \left\{ \frac{s+4}{s^2+5s+6} \right\} = L^{-1} \left\{ \frac{-1}{s+3} + \frac{2}{s+2} \right\} \rightarrow L \left\{ e^{at} \right\} = \frac{1}{s-a}$$

$$\rightarrow \boxed{f(t) = 2e^{-2t} - e^{-3t}}$$

QUESTION-4:

Question - 4 = For $f(s) = \frac{11s+28}{(s+2)^2(s+5)}$ function, solve

using partial fraction decomposition.

Solution = $\frac{11s+28}{(s+2)^2(s+5)} = \frac{A}{s+5} + \frac{B}{s+2} + \frac{C}{(s+2)^2}$

$B=3$ $C=2$

$A=-3$

$$\rightarrow L^{-1} \left\{ \frac{11s+28}{(s+2)^2(s+5)} \right\} = L^{-1} \left\{ \frac{-3}{s+5} + \frac{3}{s+2} + \frac{2}{(s+2)^2} \right\}$$

$$\rightarrow f(t) = 3e^{-2t} - 3e^{-5t} + 2te^{-2t}$$