Aerospace Engineering Department, IIT Bombay
AE 308 & AE 775 - Control Theory
Tutorial 2

Q1

Linearize the nonlinear equation

$$z = x^2 + 4xy + 6y^2$$

in the region defined by $8 \leq x \leq 10, \quad 2 \leq y \leq 4$.

Q2

Verify whether each of the following functions is linear or nonlinear.

1. $x(t-2)$
2. $x(t).x(t-2)$
3. $\frac{d}{dt}x(t)$

Q3

Verify whether each of the following functions is time-variant or time-invariant.

1. $x(t-2)$
2. $t.x(t)$
3. $2^{x(n)}x(n)$

Q4

Perform the convolution operation between the following pair of functions:

1. $u(t)$ and $u(t)$, where $u(t)$ stands for the unit step function.

Q5

Find the laplace transform of the following signals:

1. $u(t)$, where $u(t)$ stands for the unit step function.
2. t
3. e^{-at}

Q6

Evaluate the following:

1. $$\mathcal{L}^{-1}\left[\frac{2s-3}{s^2-3s+2}\right]$$
2. $$\mathcal{L}^{-1}\left[\frac{4s^2+s+1}{s^3+s}\right]$$
3. $$\mathcal{L}^{-1}\left[\frac{s^2+6s+8}{s^4+8s^2+16}\right]$$