The general form of the closed loop transfer function of a second order system with unity feedback is;

Where

The poles are the solution for the equation:

Using the general form of solution for quadratic equations:

Thus,

**Assignment#1:**

**Step Response for Underdamped case ()**

Since;

So for a step input,

Simplifying as generalised partial fractions:

So,

Equating coeffocients of

:

:

:

So, , , &

Hence,

Now,

So,

**Assignment#2:**

**Step Response for Critically Damped case ()**

Since;

So for a step input,

Since , so must be . Critically Damped conditions mean that bothe poles are , so

Simplifying as generalised partial fractions:

So,

Equating coeffocients of

:

:

:

So, , , &

Hence,