**Sheet (of extra problems)**

[1] For the following block diagram:

[a] Write the transfer function of the system and determine its poles and zeroes

**Transfer function**

**Poles of the system:**

Poles are:

Note that the poles are the complex conjugate of each other

**Zeroes of the system:**

So there is a zero at:

[b] Write the impulse response of the system.

From the properties of L.T., it is clear that the first term is the Laplace transform of shifted by with and the second term is the Laplace transform of shifted by with , so the impulse response is:

[c] Derive the output for a unit step input.

By partial fractions:

Comparing the coefficients of both sides:

From (3):

From (1):

From (2):

[2] Write the system transfer function of the following closed loop system. Find the values of K that turns the system into stable system.

Poles of the system:

System is stable if the poles are in the left half of the s-plane. This means that the real part of the poles should be negative.

Note that when the roots are complex and their real part will be: which is negative if , i.e. .

When the poles are real (no imaginary part) and are both negative if:

This is always true also when K>5.

So, the range of values of K that turns the system into stability is: K>5