

## DE2 Electronics 2

### Tutorial Sheet 4 – Step Response and Frequency Response (Lectures 7 - 8)

\* indicates level of difficulty

- 1.\* A first-order system has a transfer function given by:

$$H(s) = \frac{10}{0.1s + 1}$$

Derive an equation for the step response of the system. Plot the step response indicating the time that the system reaches 90% of the final value.

- 2.\*\* A second-order system has a transfer function given by:

$$H(s) = \frac{512}{2s^2 + 20s + 512}$$

What is the natural frequency of the system? Work out the system's damping factor and state whether the system is under-, over-, or critically damped.

- 3.\* For a system with transfer function as shown, write the differential equation relating the output  $y(t)$  to the input  $x(t)$ .

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

- 4.\*\* For the system in Q3, derive the frequency response of the system.