

1

a) Sketch a schematic block diagram representing a person following a certain line.

On the diagram write down what represents :

the feedforward element , the reference value , the feedback element , the comparator and its output and possible disturbances.

b) A system is given by the transfer function $G(s) = \frac{1}{s^2 + s + 4}$;

Introduce if possible the minimum number of additional components in order to have :

i) $\omega_n = 2$ rad/s and a steady state output of 1.6 .

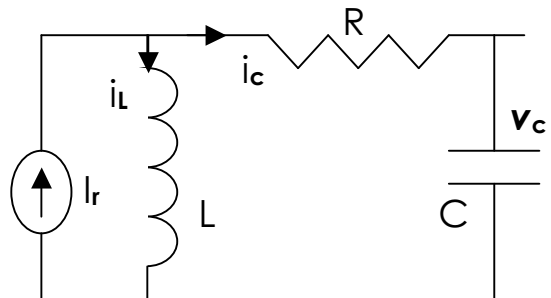
ii) $\omega_n = 4$ rad/s and $\zeta = 0.75$ and a steady state output of 2 , **without introducing a zero into the system.**

iii) a steady state error of 0.5 sec due to **a unit ramp** .

2

a) Consider the circuit shown where I_r is a current source. Obtain a block diagram with $I_r(s)$ as the set value , $V_c(s)$ as the output.

The transfer functions involve integrators only and no summing (adding) points.



b) The transfer function for the position control of a certain lift is given by $G(s) = \frac{11s^2 + 62s + 10}{5s^2 + 51s + 10}$
Find :

the unit step time response

and comment on the **suitability** of that lift given that a unit step input should move the lift one floor .

c) **With minimum number** of components and a power supply of +10V ;

simulate $\dot{x} + 4x = 8$, $x(0) = -1$.

sketch the time response .