

UNIVERSITY OF THE WEST INDIES
CAVE HILL CAMPUS

Department of Computer Science, Mathematics & Physics

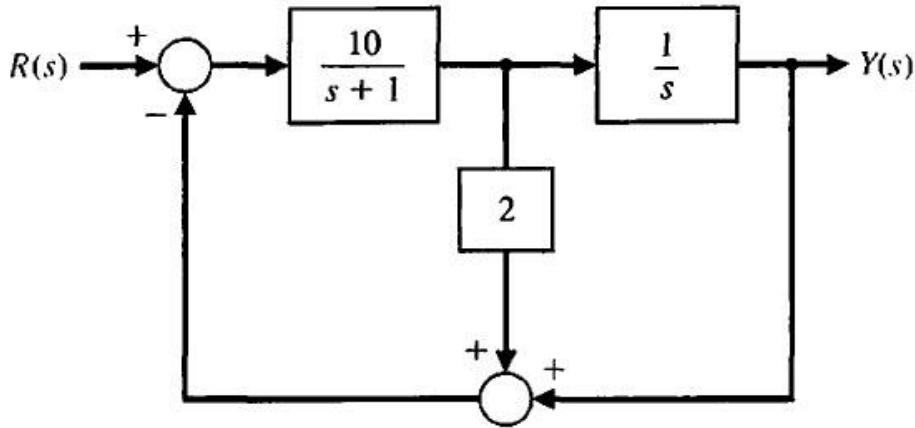
ELET3220 - Control Systems

Class Test 1

Friday, October 22, 2021

Please NOTE: this test has TWO pages

1. A control system is represented by the diagram below



Find the transfer function

$$\frac{Y(s)}{R(s)}$$

(Show all steps)

[7]

2. A control system is represented by

$$Y(s) = \frac{s+3}{s^2+9s+14} R(s)$$

- (a) Find output $y(t)$, if $r(t)$ is a unit step input
(b) Find the final value of $y(t)$

[7]

3. Consider the transfer function:

$$G(s) = \frac{2s+4}{3s^2+5s+10}$$

- Find the poles and zeros of this transfer function
Find the damping ratio and the natural frequency
Find the percentage overshoot
Find the settling time (2%)

[6]

Math Reference:
Laplace Transforms

$$f(t) = u(t) \leftrightarrow f(s) = \frac{1}{s}$$

$$f(t) = e^{-\alpha t} \leftrightarrow f(s) = \frac{1}{s + \alpha}$$

Representation of Second -Order systems

$$\frac{Y(s)}{R(s)} = \frac{K\omega_n^2}{s^2 + 2\zeta\omega_n s + \omega_n^2}$$

Performance Specification

$$(2\%)T_s = \frac{4}{\zeta\omega_n}$$

$$\%OS = 100e^{(-\zeta\pi)/\sqrt{(1-\zeta^2)}}$$