UNIVERSITY OF THE WEST INDIES
CAVE HILL CAMPUS

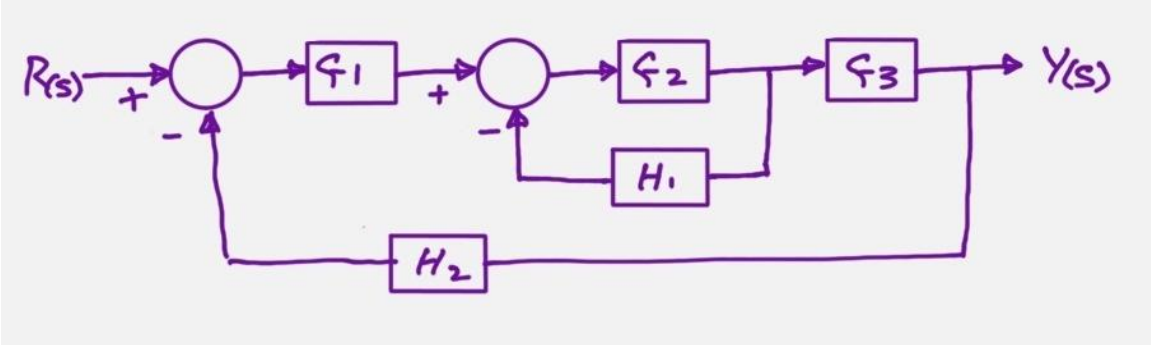
Department of Computer Science, Mathematics & Physics

ELET3220 - Control Systems

Class Test 1 **Thursday, October 29, 2020**

Please NOTE: this test has TWO pages

1. A control system is represented by the diagram below



Find the transfer function

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

[10]

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) [10]

3. Consider the transfer function:

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

Find the poles and zeros of this transfer function [10]
Find the damping ratio and the natural frequency
Find the percent overshoot
Find the settling time (2%)
Is this system critically damped, under damped or over damped ?

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

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

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

Mason's gain formula

$$T(s) = \frac{\sum_k P_k \Delta_k}{\Delta}$$