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| King Saud University  Computer Engineering Department  College of Computer and Information Sciences |
| **HW # 2: CEN455** |
| Name: ID: |

**Problem 1 (design via pole placement)**

Use a PD controller to control the system to meet the specifications 𝜁=0.5 𝑎𝑛𝑑 𝜔𝑛=3 𝑟𝑎𝑑/𝑠𝑒𝑐.

**Problem 2 (design via rootlocus)**

A unity feedback system with the forward transfer function

is operating with a closed-loop step response that has 30% overshoot. Do the following:

a. Evaluate the steady-state error for a unit ramp input (use Matlab).

b. Design a lag compensator to improve the steady-state error by a factor of 10.

c. Evaluate the steady-state error for a unit ramp input to your compensated system.

d. Evaluate how much improvement in steady-state error was realized.

**Problem 3 (digital controller)**

Given the system of Figure, a lead compensator 𝐺𝑐(𝑠) yields a 20% overshoot (𝜁= 0.456) and *Kv* = 40, with a peak time of 0.1 second. In order to meet the requirements, the design yielded *K =* 1440 and a lead compensator,

If the system is to be computer controlled, find the digital controller, 𝐺𝑐(𝑧)

