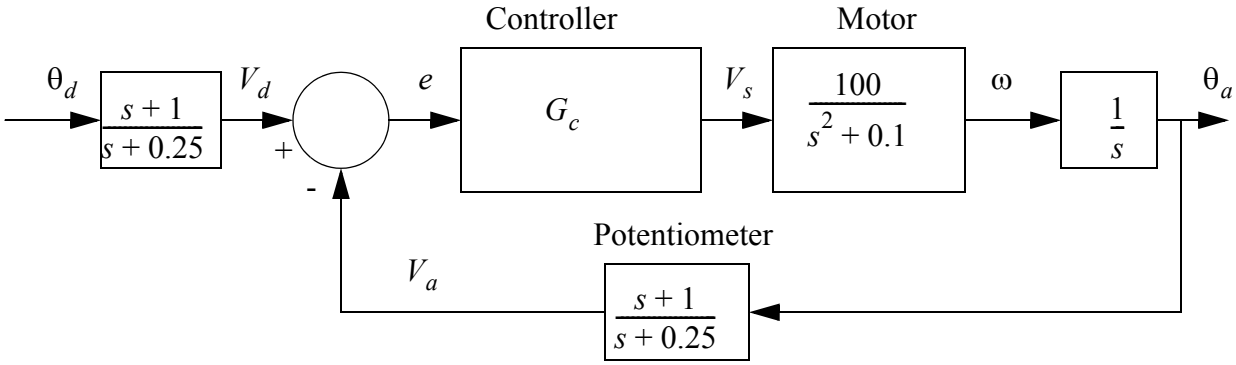
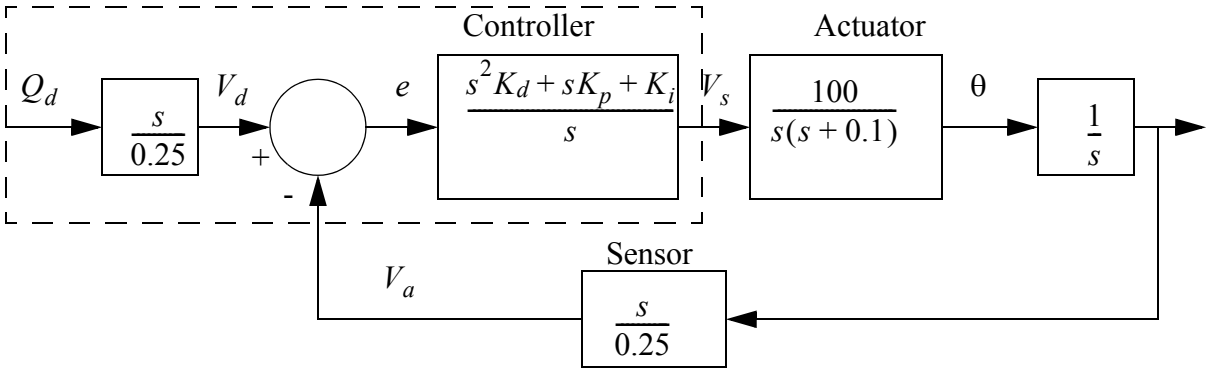
EGR 345 (Practice) Final Exam Name: _____

1. For the following control system select a controller transfer function, Gc, that will make the overall system performance match the desired transfer function.

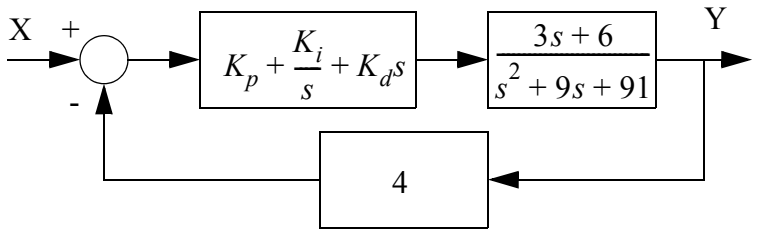


desired transfer function $\frac{\theta_a}{\theta_d} = \frac{1}{s^2 + 2(2)(10)s + 10^2}$

2. Write a C program for an ATMega microcontroller to implement the control system in the dashed line below with an update time of 10ms.



3. (NOTE: this would be a multi-page problem) A feedback control system is shown below. The system incorporates a PID controller. The closed loop transfer function is given.



a) Develop the transfer function for the system.
b) Select controller values that will result in a response that includes a natural frequency of 2 rad/sec and damping factor of 0.5. Verify that the controller will be stable.
c) If the values of Kp = Ki = Kd = 1 find the response to a unit ramp input as a function of time using LaPlace Transforms.
d) Find the response in part c) using numerical methods.
e) Find the system response to an input of X = 5sin(100t + 1)
f) If the input X is a trapezoidal motion profile with an acceleration time of 2 seconds, and a maximum velocity of 5, what would the response Y look like.

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4. Write the differential equations AND state equations for the systems below.