Midterm Exam

ME 5200/6200 – Fall 2002

Thursday, October 24, 2002

Notes:

1. **DO NOT OPEN THIS EXAM UNTIL YOU ARE NOTIFIED.**

2. Permitted resources: one single sided sheet of notes, calculator, pencil, and eraser. This is a closed book exam.

3. A 60 minute period will be provided to take this exam.

Name: _________________________________

Student Number: _______________________

#1. _______

#2. _______

#3. _______

#4. _______

TOT: _______
1) Consider the closed loop step response of the unity feedback system shown.
   a) ME 5200: Determine the closed loop transfer function. (25 pts)
   b) ME 6200: Determine the **plant** transfer function, G(s). (25 pts)
2) Consider the following block diagram

![Block Diagram]

a) ME5200: Determine the transfer function \( \frac{C(s)}{R(s)} \). (25 pts)

b) ME6200: Determine the transfer function \( \frac{C(s)}{D_2(s)} \). (25 pts)
3) ME5200 & 6200: Plot the root locus for the following system as K varies from 0 to $\infty$. Calculate and indicate break-away points, asymptotes, imaginary axis crossings, and the stable range of control gain k. (25 pts)
4) ME 5200 & 6200: Design a controller, $G_c(s)$, for the following system such that the point $s = -2 + 2j$ is (approximately) a closed loop root of the system and such that the steady state error to a Unit Step input is less than 0.1. (25 pts)