ME131 Vehicle Dynamics and Control
HW1: Systems / Introduction to ROS
Assigned: 1/29/2019   Due: 2/5/2019, 11:59pm (On bCourses)

Please submit your homework solutions on bCourses as a **single PDF** of your solutions. When videos are required, please only **submit the link** as part of the solution PDF document. Late homeworks will not be accepted.

Problem 1   Systems Response (20pt)

(20pt) Below are 7 different input-output differential equation models.

A. $\dot{y} + y = u$
B. $\ddot{y} + 1.5\dot{y} + 16y = 16u$
C. $\ddot{y} + \dot{y} + 4y = \dot{u} + 4u$
D. $\ddot{y} + 2.4\dot{y} + 9y = 5\dot{u} - 9u$
E. $\ddot{y} + 1.5\dot{y} + 9y = -2\dot{u} - 9u$
F. $\ddot{y} + 4\dot{y} + 2y = -3\dot{u} + 2u$
G. $y^{(3)} + 305\ddot{y} + 21500\dot{y} + 100000y = 100000u$. (Note, for this system G the roots of the associated characteristic polynomial are -5,-100,-200)

The unit-step responses, starting from zero initial conditions at t=0, are shown below for six of these models. Match these step responses with the models. (Note, the response of one of the models is not sketched, so you will only submit six answers.)

1
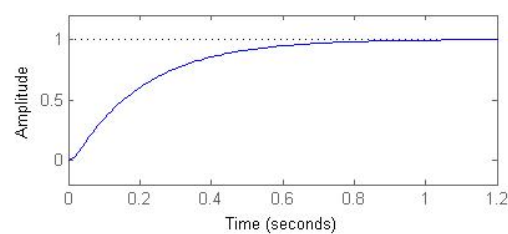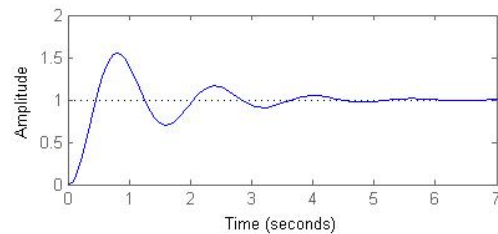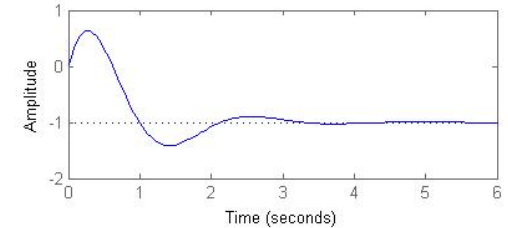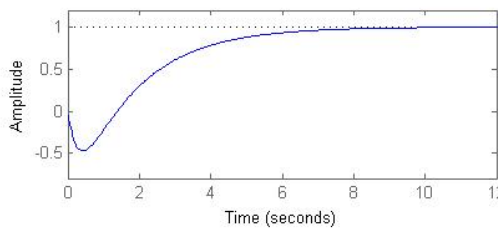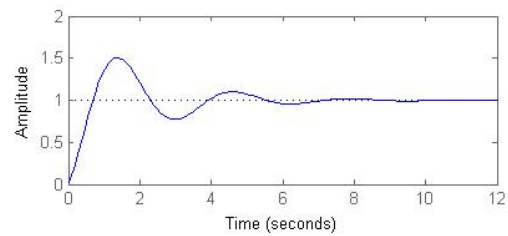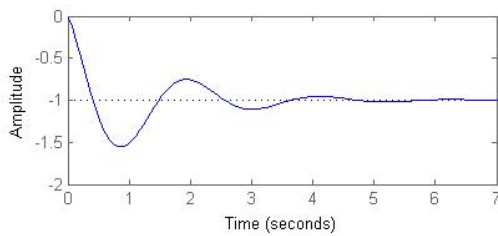
Lab Deliverables   (5pt) each

1. Screenshot of your terminal from Sec. 2.1.a.

2. Screenshot of your terminal from Sec. 2.1.b.

3. Video showing your turtle moving in response to your key presses from Sec. 3.1.e.

4. rqt_graph during turtle teleoperation from Sec. 3.1.f.
   Explain what the graph is showing you.

5. Video showing your turtle moving in a continuous circle from Sec. 3.1.g.

6. rqt_graph during turtle circle movement from Sec. 3.1.g.
   Explain what the graph is showing you. How does it differ from the rqt_graph during turtle teleoperation?
   Why?

7. rqt_plot of the turtle's x and y position from Sec. 3.1.h.
   Are these the x and y position values you expected to see? Why or why not?