The University of Jordan
School of Engineering
Electrical Engineering Department

EE 449
Instrumentation and Control Lab

EXPERIMENT 8 REPORT
PID CONTROLLER

Section # _____ Group # _____

	Student Name	ID
1.		
2.		
3.		
4.		

EXPERIMENT 8
PID CONTROLLER

PROCEDURE A – CONTROLLING A HIGH-ORDER SYSTEM

3. Show below the mathematical calculations which illustrate that the ACS-13001 and ACS-13006 blocks combined produce the transfer function:

$$\frac{T}{s+T}$$

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

4. Calculate the transfer function produced by the blocks ACS-13005 and ACS-13008 combined:

. . . . . .

. . . . . .

. . . . . .

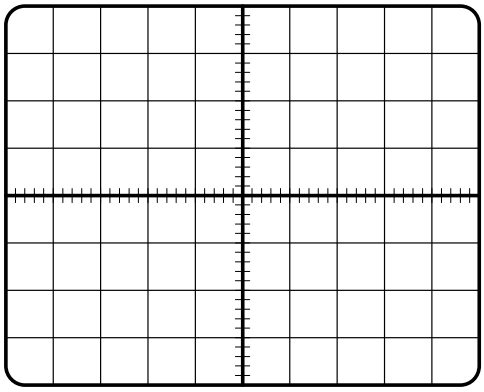
. . . . . .

. . . . . .

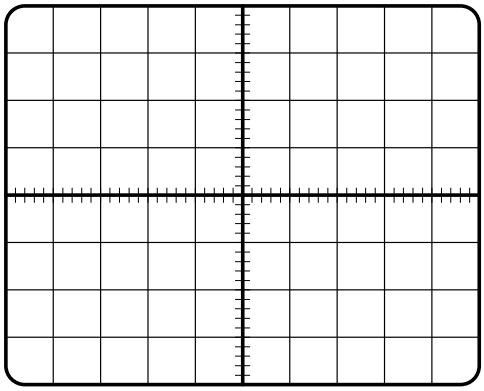
. . . . . .

. . . . . .

16. Measure and record below the signals at ACS-13010 STEP+ output and ACS-13006 Vo output terminals. Only show the **10 seconds** when the input signal goes from low voltage (**0 V**) to high voltage (**2 V**). Wait for a minute or so for the system to settle before recording the output.



17. Adjust ACS-13002 **K_P = 6.84** (i.e., **displayed value of 68.4 and x1 position**), ACS-13003 **K_I = 0.66** (i.e., **displayed value of 6.6 and x1 position**), and ACS-13004 **K_D = 0.628** (i.e., **displayed value of 62.8**). Measure and record below the signals at ACS-13010 STEP+ output and ACS-13006 Vo output terminals. Only show the **10 seconds** when the input signal goes from low voltage to high voltage. Wait for a minute or so for the system to settle before recording the output.



18. Explain the effect of increasing the proportional gain K_P on your results:

. . . . . .

. . . . . .

. . . . . .

. . . . . .

19. Explain the effect of increasing the integral gain K_I on your results:

. . . . . .

. . . . . .

. . . . . .

. . . . . .

20. Explain the effect of increasing the derivative gain K_D on your results:

. . . . . .

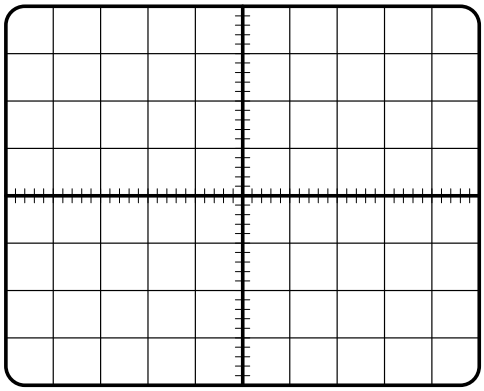
. . . . . .

. . . . . .

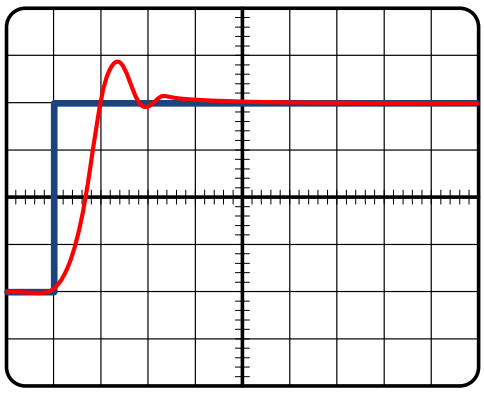
. . . . . .

PROCEDURE B – CONTROLLING MOTOR POSITION

6. Adjust ACS-13002 **K_P = 93.1** (i.e., **displayed value of 93.1 and x10 position**), ACS-13003 **K_I = 66.6** (i.e., **displayed value of 66.6 and x10 position**), and ACS-13004 **K_D = 0.913** (i.e., **displayed value of 91.3**). Measure and record below the signals at PULSER output V1a (on CH1 of the oscilloscope), and the motor position potentiometer reading V1b (on CH2 of the oscilloscope). Only show the part when the input signal goes from low voltage to high voltage. However, make sure you keep pressing the PULSER switch until you see the motor position reach steady state.



7. Use the trial-and-error method to adjust **K_P** (for ACS-13002), **K_I** (for ACS-13003) and **K_D** (for ACS-13004) to let the DC servo motor position control system produce the output response shown below (which in this case has some overshoot to reduce response time). The figure shows both the PULSER output V1a (on CH1 of the oscilloscope), and the motor position potentiometer reading V1b (on CH2 of the oscilloscope).



9. The controller $\mathbf{K_P}$, $\mathbf{K_I}$ and $\mathbf{K_D}$ parameters that you used to produce the above response are (state both actual values and displayed values):

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

10. Explain why those values managed to change the motor position response from the one in step 6:

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

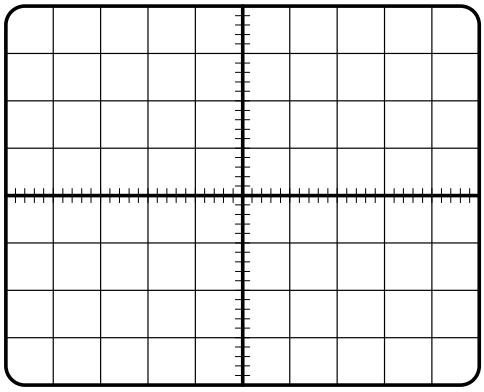
. . . . . .

11. Measure and record the amount of overshoot (in Volts), which is the difference between the maximum value of the response and its steady-state value:

. . . . . .

. . . . . .

12. Keep the same ACS-13002 $\mathbf{K_P}$, ACS-13003 $\mathbf{K_I}$, and ACS-13004 $\mathbf{K_D}$ parameters you used in step 8 above. However, set the Eddy current breaks to the **HIGH load** setting. Measure and record below the signals at PULSER output V1a (on CH1 of the oscilloscope), and the motor position potentiometer reading V1b (on CH2 of the oscilloscope). Only show the part when the input signal goes from low voltage to high voltage. Make sure you keep pressing the PULSER switch until you reach steady state.



13. Explain why the motor position response changed compared to the one in step 8 even though you maintained the same controller $\mathbf{K_P}$, $\mathbf{K_I}$, and $\mathbf{K_D}$ gain parameters:

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

**** End ****