6.2. Pure Proportional Control.

(1) **DESCRIBE** in words what generally happens to the response and the steady state error (aka "Speed Error") as you keep increasing $k_p$. Also, **DISCUSS** how well the simulated response corresponds to the actual response.

(2) **CALCULATE** the expected $k_{pc}^{theory}$. Then, looking at the DC motor, **FIND** the $k_{pc}$ that appears to give a critically damped solution, labeling it $k_{pc}^{actual}$. **CALCULATE** the relative error between the two $k_{pc}$ values.

(3) **RECORD** the value of the $k_p$ at the critical instability, $k_{pu}$, and **RECORD** the corresponding period of oscillation of the instability, $T_u$, and **DESCRIBE** what happens to the voltage control.
(4) PRINT out the screenshot of the speed as a function of time at $k_p = k_{pc}^{\text{actual}}$, label it 6.2.3a, and attach it to your report. PRINT another screenshot this time for $k_p = k_{pu}$, label it 6.2.3b, and attach it to your report.

6.3. Pure Integral Control.

(1) RECORD in words what generally happens to the response and the steady state error as you increase $k_i$. Also, DISCUSS how well the simulated response corresponds to the actual response.

(2) From the Prelab, CALCULATE the expected $k_{ic}^{\text{theory}}$. Then, looking at the DC motor, FIND the $k_{ic}$ that appears to give a critically damped solution, labeling it $k_{ic}^{\text{actual}}$. CALCULATE the relative error between the two $k_{ic}$ values.

(3) PRINT out the screenshot of the speed as a function of time at $k_i = k_{ic}^{\text{actual}} V/s/rad$, label it 6.3.3a, and attach it to your report.

(4) With $k_i = k_{ic}^{\text{actual}}$, CALCULATE the theoretical settling time from the Prelab and compare it with the actual settling time.
6.4. Proportional and Integral Control, $b_{sp} = 0$.

(1) **CALCULATE** the gain coefficients $k_i$ and $k_p$ that are predicted to produce critical damping and a $T_s = 0.25$.

(2) **PRINT** out the screenshot of the response, labeling it 6.4.2, and attach it to the end of the report.

(3) **COMPARE** the estimated settling time with the actual settling time and how well the prediction produced a critical damping case.

(4) **COMPARE** these manually tuned parameters with the predicted parameters and **MEASURE** the improvement in the settling time for the manually tuned case, if there is any.
6.5. **Proportional and Integral Control**, $b_{sp} = 1$.

(1) **CALCULATE** the proportional and integral gain parameters as suggested by the ZN method.

(2) **PRINT** the screenshot, label it 6.5.2, and attach it to the end of your report.

(3) **MEASURE** the overshoot (you may not have any) and the settling time. Be sure to **COMMENT** on whether your system had a saturation in the control response.

(4) **COMPARE** these manually tuned parameters with the predicted parameters and **MEASURE** the improvement in the settling time for the manually tuned case, if there is any.

6.6. **Effect of the set point weighting parameter**.

(1) **RECORD** your observations about what happens as the set point weighting factor is increased.
(2) **RECORD** the settling time you obtained.

(3) **COMMENT** on how each method performed according to the specifications with regards to steady state error, overshoot, and 2% steady state error.