**Praveen Ravishankar** **Fall 2019**

**ME 4405 Section** **B**

**Lab Assignment Nine**

**Constructing and Characterizing a Thermal System Using the MSP432 and I2C Serial Communication**

**Questions:**

1. Fill in the missing steps for deriving the open-loop transfer function of the thermal system above, assuming zero initial conditions. This transfer function should describe the input-output relationship between the output T(s) (which is the difference between the canister and outside temperatures) and the input Qin. **(15 points)**
2. Collect the calibration and step response data from your system. Plot the calibration data vs. time (at 0% duty cycle), and the step response data vs. time. Recall that the time constant for a first-order system is the time it takes for the output to reach 63.2% of its final steady-state value, relative to its starting point. Calculate and state the time constant for this system. Show the time constant on your step response plot. **(10 points)**

A screenshot of a social media post

Description automatically generated

As seen in the plot above, the initial temperature of the system at 0% duty cycle is 23oC, while the final steady-state value of the 50% duty cycle step response of the system is approximately 29oC:

From observing the plot above, the time at which the system first reaches a temperature of 27oC is **368 seconds**: