

# TASK 0

## Robotics and Control

### Control Systems



### PROBLEM STATEMENT:

We need to help Rick cook brownies by keeping the container at the right temperature. Rick has a laser gun that would heat at a particular rate and the brownies would lose heat at a particular rate modeled by two equations. It is our job to design a PID controller to cook the brownies to the right temperature in order for Rick to take us on his next adventure

Equation for Heating -  $\frac{\Delta T}{dt} = P \times I$

Equation for Cooling -  $\frac{\Delta T}{dt} = -K \times (T_{obj} - T_{env})$

Where,

- $\frac{\Delta T}{dt}$  – Rate of change of temperature
- $P, K$  – Constants (0.2, 0.05 Respectively)
- $T_{obj}$  – Temperature of brownie (Control Variable)
- $T_{env}$  – Temperature of surroundings (32 °C)
- $I$  – Input current (0 – 100 A)

### GUIDELINES:

A particular temperature can be taken as a set-point (for e.g., 220 °C). Assume the brownie's temperature is same as the surrounding at the start. Implement a PID controller in python (or language of your choice). Model the PID from scratch and tune it accordingly (no use of libraries). In order to simulate time, run the loop for multiple iterations considering each loop as a single time step. Assume suitable constants. Output the temperature of the brownie at each time step and the total iterations to achieve the set-point

**EVALUATION METRICS:**

- No plagiarism – automatic disqualification
- PID implementation
- If the process variable reaches set point
- PID tuning
- BONUS: Output the process variable w.r.t iterations as a graph

**COMPONENTS REQUIRED:**

- Python 3.x

**SUBMISSION:**

- Python Code file
- Video of the code running
- Graph (if done)
- Upload all the files into google drive and submit the link in the portal

**RESOURCES:**

Python

- [https://www.w3schools.com/python/python\\_intro.asp](https://www.w3schools.com/python/python_intro.asp)

PID Control

- <https://youtube.com/playlist?list=PLn8PRpmsu08pQBjxYFXSsODEF3Jqmm-y>
- [https://www.tutorialspoint.com/control\\_systems/control\\_systems\\_controllers.htm](https://www.tutorialspoint.com/control_systems/control_systems_controllers.htm)

MATPLOTLIB

- [https://www.w3schools.com/python/matplotlib\\_pyplot.asp](https://www.w3schools.com/python/matplotlib_pyplot.asp)
- <https://matplotlib.org/stable/tutorials/index.html>