ME 121 Learning objectives for final

1 Introduction to MATLAB

- Be able to plot simple data sets with MATLAB
- Be able to perform simple statistics and plot histograms in MATLAB
- Be able to perform curve fitting in MATLAB for linear, and polynomial curve fits.

2 Salinity sensor

- Be able to describe the electrochemical reactions responsibility for the change in electrical conductivity with salt concentration
- Be able to describe the calibration procedure for the conductivity sensor
- Be able to describe the mean, median, and standard deviation of a data set
- Be able to explain the setup of the electrical circuit to power the conductivity sensor

3 Analysis of mass balance for batch processes

- Be able to write the mass balance equations for batch processes.
- Be able to use a systematic procedure to solve batch mass balance problems (with or without overflow).

4 Circuits for solenoid actuation

- Be able to identify the components in a cascade control circuit
- Be able to describe the purpose of the flyback diode on a relay coil or solenoid valve.
- Be able to explain the sequence of events that occur when a relay coil is powered
- Be able to identify the different types of relays (SPST, SPDT, DPST, and DPDT) and explain their operation
- Be able to assemble the cascade switching circuit for solenoid valves on the fish tank platform

5 Salinity control

- Be able to describe the role of UCL and LCL in the control algorithms.
- Be able to describe how to compute UCL and LCL
- Be able to describe and distinguish the terms, setpoint, deadband and deadtime
- Be able to describe a procedure for measuring deadtime

Be able to describe what variables are involved in determining the proportional control response

Be able to describe the skeleton of code for implementing the salinity control

Be able to describe the steps necessary to reduce the salinity sensor calibration data to a form that can be included in the salinity control algorithm for the fish tank

6 Thermistor

Be able to describe how the resistance of a NTC thermistor varies with temperature

Be able to sketch and describe the circuit used to measure thermistor temperature with an Arduino

Be able to describe the fabrication of a waterproof thermistor probe

Be able to describe the calibration procedure for the thermistor

Be able to describe the steps necessary to reduce the thermistor calibration data to a form that can be included in the temperature control algorithm for the fish tank

7 Temperature control

Be able to fabricate the fish tank heater

Be able to describe the role of RTV in the heater assembly

Be able to describe the role of the heat spreader in the heater assembly

8 Energy balance

Be able to write the energy balance equation

Be able to apply an energy balance model to the fish tank

9 Arduino

Be able to understand and use different variable types

Be able to understand and use basic program structure

Be able to communicate with host computer and LCD panel

Be able to understand, create and use user-defined functions

Be able to understand and use loops such as for and while loops

Be able to understand and use if/else statements

Be able to design and evaluate logical tests

Be able to understand and use analog and digital input/output, for simple sensors and actuators