BME 301 Numerical Methods in Biomedical Engineering
HOMEWORK 7

DUE ***March 22, 2017, 11:59 pm***.
Late policy: 20% deducted each late day.

The following data were obtained by measuring the length of a hydrogel patch immersed in 1.0M KCl solution as the temperature of the solution increased. All questions in this homework relate to these data. Show all MATLAB code.

Temperature, T (C)	Length (mm)
30	5.60
31	5.75
32	5.82
33	5.87
34	5.90
35	5.92
36	5.94
37	5.94
38	5.95
39	5.96
40	5.97
41	6.00
42	6.03

1. [1 point] Using MATLAB, plot the length as a function of temperature.
2. Complete the following using MATLAB.
    a. [3 points] Use the MATLAB command polyfit, fit a linear curve to the data and state the equation of best fit for the data.
    b. [1 point] What is the value of the residual error at T=37 C?
    c. [1 point] What is the residual sum of square error (E_i) for your fit?
    d. [2 points] Add the linear fit to the MATLAB figure.
3. Repeat the process for a quadratic fit:
    a. [3 points] Use the MATLAB command polyfit, fit a quadratic curve to the data and state the equation of best fit for the data.
    b. [1 point] What is the value of the residual error at T=37 C?
    c. [1 point] What is the residual sum of square error (E_i) for your fit?
    d. [2 points] Add the quadratic fit to the figure of 2(d)
4. Now use spline fits.
    a. [3 points] By hand, calculate the equations for *linear* splines that could be used to interpolate values between 36 and 37 C and 37 and 38 C. Using the equation between 37 and 38 C, compute the length at 37.1 C.
    b. [2 points] Using the MATLAB command `spline,` and natural boundary conditions (state what these are) find the length of the gel at 37.1 C.