EE5111/EE5061:Fault diagnosis and fault-tolerant control
Assignment 1

1. Write your Name, Matriculation Number, Module Code (EE5111/5061) on the cover page,

2. List your answers in order; Name your report as A1234567.pdf (where A1234567 is your matric number)

3. Submit your report to the website by 16 Nov. 2021.

Based on the lecture notes, and any additional reading materials of yours, answer the following questions:

1. It is observed that a sensor has fault. The input/output data is shown in the table below. Please fit the nonlinear relationship between the input and output in an equation below

Input(x)	0.9	2.2	3.5	4.5	5.7	6.7
Output(y)	1.1	1.6	2.6	3.2	4.0	5.1

$$y = b_0 + b_1 x \quad + b_2 x^2 + \cdots + b_p x^p \tag{1}$$

a) Please select p=1,2,3,4,5 and compute the corresponding fault model (1) and plot the data in the graph;

b) According to the point (a) and working range of input [0.9, 6.7], please give the best fault model among them (p=1,2,3,4,5) and explain it.

2. Hardware sensor fault diagnosis method can be used for detecting various faults in machines. Now we use one sensor to detect the possible faults in one machine. From the experimental test, we collected the sensor readings from the healthy state as shown below and wanted to do fault diagnosis.

Table 2.1 Healthy state (time from 1 to 9)

Input (time)	1	2	3	4	5	6	7	8	9
Sensor readings	4.1	4.2	4.3	4.15	4.66	4.7	4.8	4.75	4.8

After time 100, it was observed that we had the following sensor readings.

Table 2.2 Sensor readings (time from 100 to 108)

Input (time)	100	101	102	103	104	105	106	107	108
Sensor readings	6.1	6.2	6.15	6.5	6.7	7.2	7.4	8.5	9.8

Please choose a **suitable technique** to check if the machine has a fault (if you select the threshold decision method, the tolerance number is 0.15) and explain why you select this method. You may use the graph to illustrate your conclusion. Also, please give the fault detection time if a fault is detected.

3. For model-based fault detection method, please draw a block diagram to demonstrate it and explain it briefly.