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ENR 305: Sensors, Instrumentation, and Experimentation

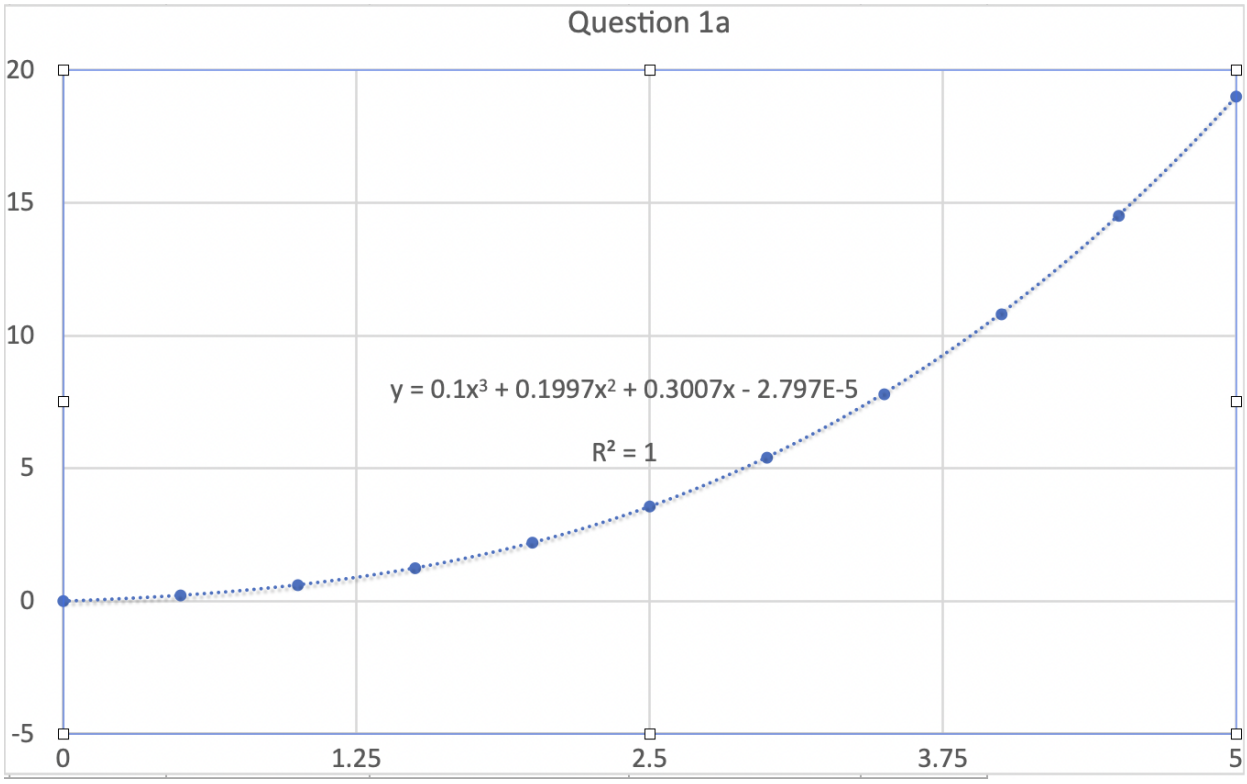
Section 3 Monsoon Semester 2021

Faculty: Professor Ashok Ranade

Teaching Assistant: Professor Sanket Patel

Question 1:

(a)

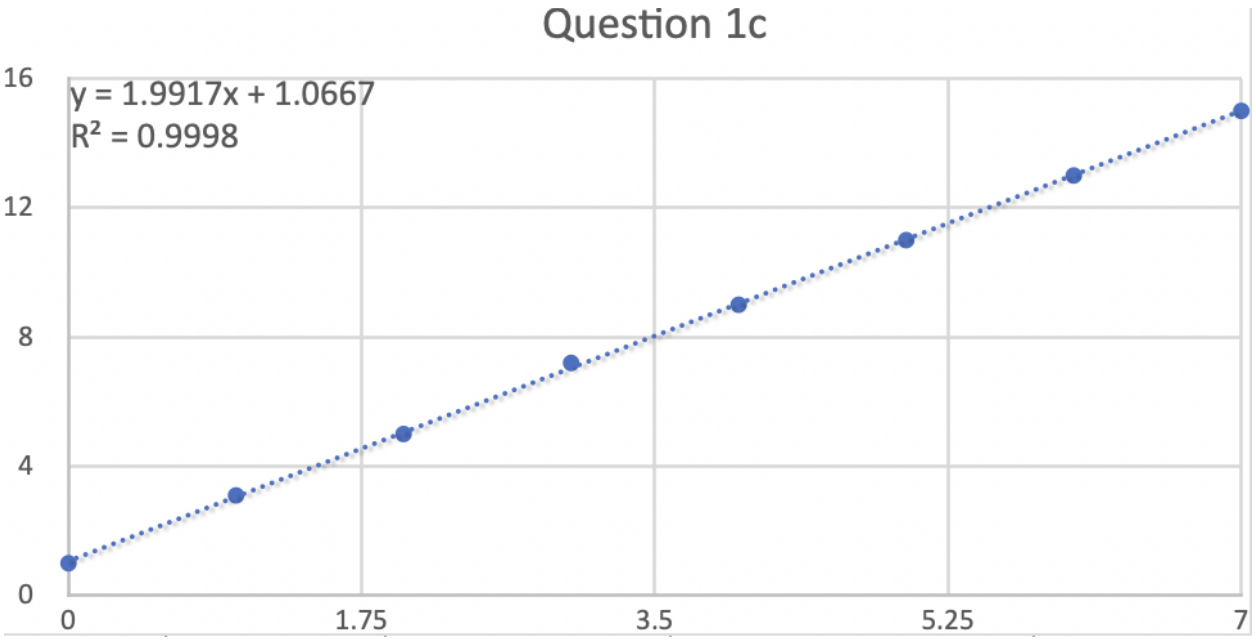


(b)

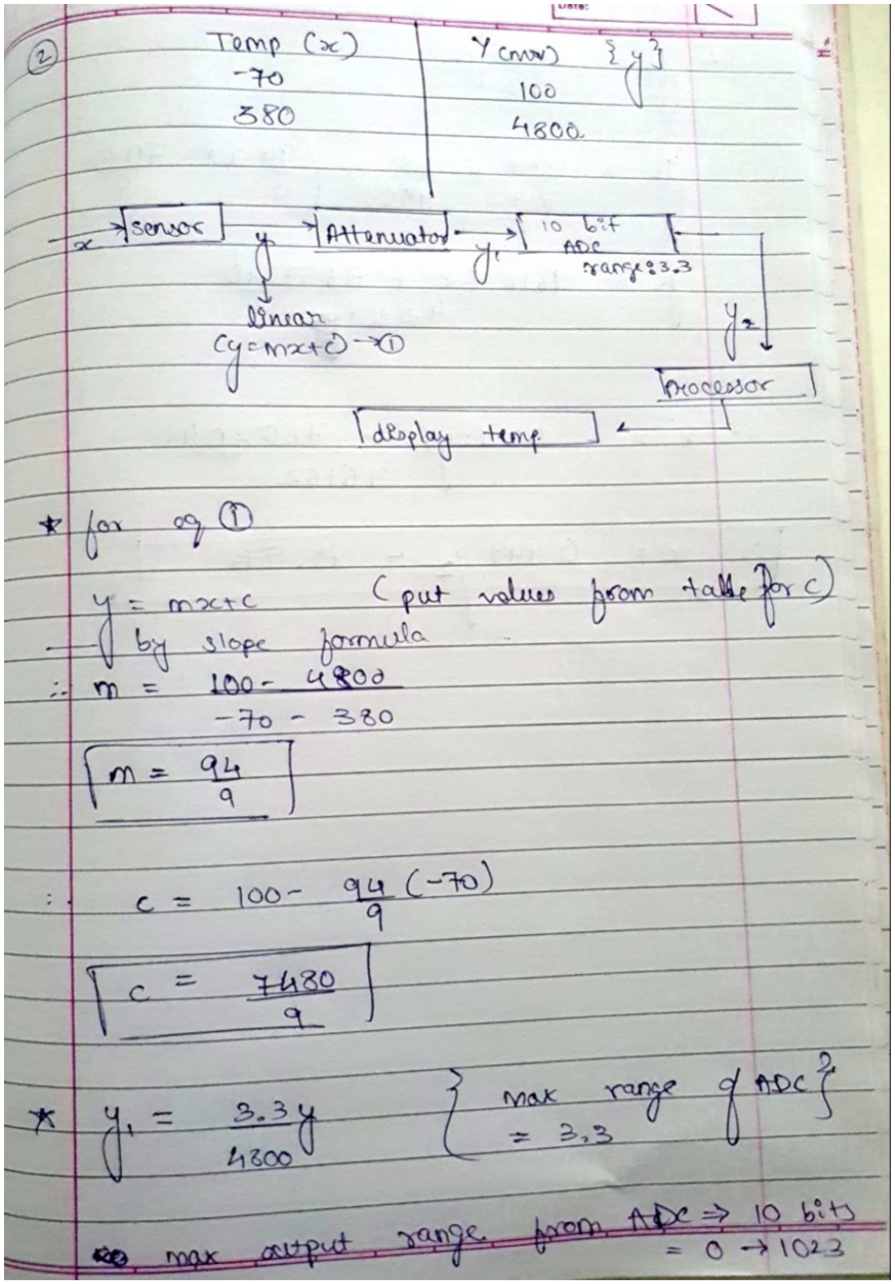
x	y	y-calculated	Error	Mean Square Error
0	0	-0.00003	0.0000000009	0.0000005409
0.5	0.213	0.21277	0.0000000529	
1	0.6	0.60047	0.0000002209	
1.5	1.238	1.23807	0.0000000049	
2	2.2	2.20057	0.0000003249	
2.5	3.563	3.56297	0.0000000009	
3	5.4	5.40027	0.0000000729	
3.5	7.788	7.78747	0.0000002809	
4	10.8	10.79957	0.0000001849	
4.5	14.51	14.51157	0.0000024649	
5	19	18.99847	0.0000023409	
			0.0000059499	

(c)

x	y	y-calculated	Error	Mean Square Error
0	1	1.0667	0.00444889	0.004479195
1	3.1	3.0584	0.00173056	
2	5	5.0501	0.00251001	
3	7.2	7.0418	0.02502724	
4	9	9.0335	0.00112225	
5	11	11.0252	0.00063504	
6	13	13.0169	0.00028561	
7	15	15.0086	0.00007396	
			0.03583356	



Question 2:


Temp (x)
-70
380
Y (mV)
100
4800
Sensor
Attenuator
10 bit ADC range: 3.3
Linear
(y = mx + c) → (1)
Processor
display temp
for eq (1)
y = mx + c
(put values from table for c)
by slope formula
m = 100 - 4800 / -70 - 380
m = 94/9
c = 100 - 94/9 (-70)
c = 7480/9
y1 = 3.3y / 4800
{ max range of ADC = 3.3 }
max output range from ADC ⇒ 10 bits
= 0 → 1023

$$\therefore \quad y_2 = \frac{1023}{3.3} y_1$$

$$y_2 = \frac{1023}{3.3} \times \frac{3.2}{4800} \times \left(\frac{94}{9} x + \frac{7480}{9} \right)$$

$$y_2 = \frac{9616\,2x + 7652040}{43200}$$

$$\therefore \quad x = \frac{43200 y_2 - 7652040}{96162}$$

$$\therefore \quad x = 0.449\, y_2 - 79.574$$