ASSIGNMENT BRIEF

HTU Course No: 00103101	HTU Course Name: STEM 1 LAB
BTEC UNIT No: N/A	BTEC UNIT Name: N/A

Version: 1

جامعة الحسين التقنية
Al Hussein Technical University

Assignment Brief

Student Name/ID Number/Section	
HTU Course Number and Title	00103101, STEM LAB I
Academic Year	2022/2023
Assignment Author	Eng. Dima Bader
Course Tutor	Engs. Dima Bader, Mohammad AlZubi, Heba Jaradat and Rasha Shaheen
Assignment Title	Assignment 1
Issue Date	Dec.31, 2022
Formative Assessment dates	Jan.2, 2023 – Jan.22, 2023
Submission Date	Jan.23, 2023
IV Name & Date	Dr. Muhannad Al-Tarifi Dec 30th 2022

Submission Format

The submission should be provided by uploading the following files to **eLearning:**

1. A well-organized report following the technical report style in pdf. The answers need to follow clear and coherent steps. Final answers without detailed steps are not accepted. Name it "YourName-ID"
2. The MATLAB files and Excel files, each properly named with student name and Task number.

There will be an oral session with assessor as part of the evaluation. Details about it will be given to you later

Guidelines

1. Your final submission should be a single file in PDF format (report) as well as all related MATLAB and Excel files.
2. The front page should include the course name, your section, assignment name, your name and student ID, HTU LOGO, and your tutor name.
3. The font for the code must be courier new; readable and the comments colored in green.
4. The final report should be concise (15 pages maximum), where the quality of your comments on each of the tasks will have a strong influence on the marks awarded. The report should be typed using a computer, not handwritten.
5. Remember, the objective of the assignment is to assess understanding rather than the ability to simply reproduce analytical procedures and this requires you to explain the steps in your analysis.
6. Whenever you are asked to write a MATLAB code, make sure that you include your code in the report, comment your code to show your steps, and explain them.
7. Whenever plots are required, make sure to include them within your report, assure that all your figures/plots are well labeled and numbered in the report.

8. The soft-copy of the assignment must be included in the compressed file and submitted on Moodle, the pdf file name must be as follows: AhmadAlShabali_17120024.pdf
9. If plagiarism is detected, the students' mark will be "Unclassified".

Unit Learning Outcomes

LO1 Analyze a various applications using flowcharts and software packages for coding and plotting.

LO2 Implement scientific projects using Arduino.

Assignment Brief and Guidance

Task 1

The figure below shows a PC cooling fan that changes its rotational speed (ratio to full speed) based on temperature readings from 3 temperature sensors that detect the ambient temperature at different locations inside the PC case in Celsius degree. The fan speed is controlled based on the average of the readings per the following:

➢ 0-40 °C: 25% fan speed
➢ 40-55 °C: 35% fan speed
➢ 55-70 °C: 65% fan speed
➢ Greater than 70 °C: 100% fan speed
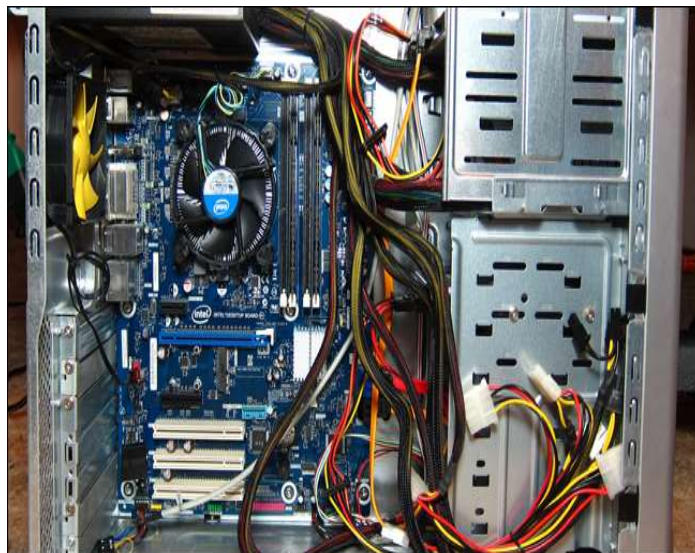
Draw a flow chart and write a MATLAB code that takes temperature readings from the sensors, stores them, calculates their average and stores it, determines the speed of the fan and stores it. All stored data should be structured in a matrix style.

Task 2

The electric circuit in the figure below contains a current source driving a series inductive and resistive load with a shunt capacitor across the load. The circuit is representative of motor drive systems and induction heating systems used in manufacturing processes. Excessive peak currents during transients in the input could damage the inductor. Therefore, the equation below is used to compute response of the current through the inductor to a step in the input current to ensure that the manufacturers stated maximum current is not exceeded during start up as per the underdamped system.
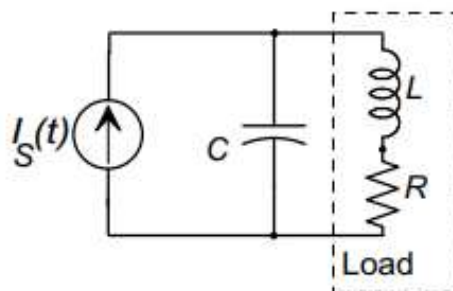
$$i_L(t) = e^{-0.599\,t}\,[0.678\ \sin(1.3227\,t) + \cos(1.3227\,t)] \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (1)$$

2-A) Use Excel to plot i_L vs t per equation (1). The range of t should be from 0 to 13 seconds. The range of i_L is to be chosen adequately by you. Make sure to label all axes, add grid lines, and title your graph. Note that the arguments of trigonometric functions are all in radian.

2-B) Use your plot in part (2-A) to accurately estimate the time it took for i_L to reach the maximum value, the minimum value, and the steady state value (i.e. within 1% of its final value).

2-C) The same system has some of its parameters changed, and now the system response is 'overdamped' as described by the following equation:

$$i_{Lnew}(t) = -0.0774\,e^{-5.277\,t} + 1.0774\,e^{-0.379\,t} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (2)$$

Use the same Excel sheet to plot i_{Lnew} vs t overlaid on the same graph of i_L from part (2-A).

2-D) Which equation shows better performance in reaching within 5% of the maximum value? Explain clearly.

2-E) Use MATLAB to plot both equations on the same graph. Label all axes, add grid lines, and title your graph.

Task 3

You are working at an electric battery factory. Your supervisor asked you to conduct a study showing the sales for different types of batteries during the period from 1992 to 1998, per the following table:

Number of Different Types of Batteries Sold by a Company Over the Years (Numbers in Thousands)

year	Types of Batteries				
	4AH	7AH	32AH	35AH	55AH
1992	75	144	114	102	108
1993	90	126	102	84	126
1994	96	114	75	105	135
1995	105	90	150	90	75
1996	90	75	135	75	90
1997	105	60	165	45	120
1998	115	85	160	100	145

To automatize the process, you have to perform the following tasks using MATLAB:

3-A)   Create a matrix, A, that represents the sales of five types of batteries over 7 years where each row is defined for one year and each column is for one type of batteries. What will be the dimensions of A?

3-B)   Store the sales of the years 1994, 1995 and 1996 of the 32AH battery type in a row vector, B.

3-C)   Using matrix A, define a column vector C such that each element in C represents the total sales of each corresponding year. (*Hint: use sum function*)

3-D)   Using matrix, A, define a column vector D, such that each element in D represents the average sales of each corresponding year.

3-E)   Modify matrix A by adding 10 for each type of battery with less than 90 over the given years.

3-F)   Modify matrix A by subtracting 6 from the number of sales for 35AH battery type over the given years.

3-G)   Modify matrix A by keeping the types 4AH, 7AH, 35AH and 55AH sales numbers as they are, while replacing those for 32AH battery type with zeros (*Hint: use element by element multiplication*).

3-H)   Plot five curves on the same graph, where the x-axis is the year and the y-axis is the number of sales. Each curve corresponds to one battery type. All curves should be with different colors and use different markers. Use legends to distinguish different curves. Label all axes, add grid lines, andtitle your graph.

Task 4

Write down a detailed report about two ARDUINO projects defined to you by your instructor. Your report should describe the purposes, components, and all procedural steps in a clear manner. It should also contain measured results and photos of practical project setups. Finally, critical conclusions must be presented neatly.

Learning Outcomes and Assessment Criteria			
Learning Outcome	Pass	Merit	Distinction
LO1 Analyze various applications using flowcharts and software packages for coding and plotting.	**P1** Construct a flowchart of real life scenarios. **P2** Produce clear graphical representations of multiple equations. **P3** Apply coding solutions to perform specific functionalities.	**M1** Demonstrate how flowcharts are translated to proper representations using coding.	**D1** Evaluate the outcome of coding solutions and their ability to overcome changing demands.
LO2 Implement scientific projects using Arduino.	**P4** Summarize all the steps required to complete Arduino projects using sensors and actuators.	**M2** Illustrate the contribution of digital and analog inputs and outputs to achieve complicated tasks.	**D2** Critically analyze the performance of each element within a realistic project.

STUDENT ASSESSMENT SUBMISSION AND DECLARATION

When submitting evidence for assessment, each student must sign a declaration confirming that the work is their own.

Student name: Abdallah Hamed Faleh Daradkeh	**Assessor name:** Mohammad Alzubi
Student ID: 21110446	

Issue date: Dec 31, 2022	**Submission date:** Jan 23, 2023	**Submitted on:** Jan 23, 2023

Programme:

HTU Course Name: STEM I Lab **BTEC UNIT Title *:** NA

HTU Course Code: 00103101   **BTEC UNIT Code:** NA

I AM REPEATING THIS UNIT*:   (YES)   (NO)

Plagiarism

Plagiarism is a particular form of cheating. Plagiarism must be avoided at all costs and students who break the rules, however innocently, may be penalised. It is your responsibility to ensure that you understand **correct referencing practices**. As a university level student, you are expected to use appropriate references throughout and keep carefully detailed notes of all your sources of materials for material you have used in your work, including any material downloaded from the Internet. Please consult the relevant unit lecturer or your course tutor if you need any further advice.

Student declaration

I certify that the assignment submission is entirely my own work and I fully understand the consequences of plagiarism. I understand that making a false declaration is a form

Student signature: **Date:** 1/23/2023