AIN SHAMS UNIVERSITY
FACULTY OF ENGINEERING
Computer and Systems Engineering Department
2nd Year, Electrical Engineering
Final Assignment

Spring 2020	**Course Code: *CSE 271***	***Deadline: 11 June @4 pm***

Systems Dynamics & Control Components

The instructions are in **Three** Pages. **1 / 3**

تعليمات هامة:

- غير مسموح بالتشابه بين الابحاث المقدمة من الطلاب
- ضرورة مراعاة الامانة العلمية والدقة في عرض المراجع التي تم الاستعانة بها
- ضرورة الالتزام بالقواعد المنصوص عليها المرتبطة بشكل وعدد الصفحات المنصوص عليها بورقة الامتحان
- يتم تجميع ملفات الاجابة في ملف واحد في صورة PDF ويتم رفعه على صفحة المادة المخصصة على منصة LMS
- ضرورة الالتزام بحجم الملفات المطلوب رفعها وفقا لما هو منصوص عليه بمنصة LMS

Part 1: Control Components

Using Proteus simulator, it is required to build a signal conditioning circuit that monitors oven temperature using a digital microcontroller. The microcontroller should take readings every second, it should display current temperature, average temperature at the last minute, an alarm if the signal exceeds the limit of 350 Celsius degrees. You should consider the following:

1. The signal is carried to the control room using a long wire of 100 m.
2. A noise signal of 60KHZ is applied directly to the sensor circuit.
3. Oven temperature may vary between 100 and 350.
4. It is required to have an additional non-digital alarm circuit that gives an alarm if temperature exceeds 350 degree or turned off when temperature goes below 340 degree.

Assumptions:

1. You should use standard resistance/capacitance as much as possible.
2. You should select suitable sensors.
3. Feel free to use any microcontroller type.
4. Feel free to use any display type.
5. Assume any missing information.

Self-study part:

- Using Proteus analog/digital simulator.
- Using and programming microcontroller with Proteus simulator.

Delivery (Files):

- team.txt: with team member's code/name.
- project.pdsprj: Proteus project file.
- project.docx: document contains following sections:
  - Title.
  - System diagram with general description.
  - System modules description with module circuit diagram.
  - Assumptions.

- Microcontroller program code.
- Complete circuit diagram copied (Screenshot from Proteus simulator).
- Components list.

Part 2: System Dynamics Project
(My Own System Simulator)
Assume any Missing Information

Given a LTI system in the following form:-

$$\sum_{k=0}^{n} a_k \frac{d^{(k)}y}{dt^k} = \sum_{i=0}^{m} b_i \frac{d^{(i)}u}{dt^i}$$

where (1) u is the input signal, y is the output signal, (2) a's and b's are arbitrary real parameters, (3) m and n are arbitrary integer, and (4) m ≤ n.

You are required to write your own program for computing and visualizing the system output for any input signal u. Your program must have at least the following specifications:-

1- You can use MATLAB or Python.
2- A GUI for entering system parameters like n, m, a's, and b's.
3- A GUI for selecting the input type (unit impulse, unit step).
4- A GUI for visualizing (plotting) the input and output signals.
5- The program computes the state space representation matrices (A, B, C, D) of the system.
6- A GUI to plot or visualize the system states ($x_1(t)$, $x_2(t)$, $x_3(t)$, … , $x_n(t)$).
7- You are not allowed to use any ready-made libraries or functions to implement your simulation.
8- Your program must be able to simulate up to fourth order systems.
9- You may use the available programming libraries for generating the system parameters (a's and b's) as random numbers.

Sources of Information:-
1- Internet documentation of Python and MATLAB programming.
2- Numerical approximation techniques are available on the internet for computing derivatives.
3- Course lectures.

Deliverables:-
You need to provide a detailed technical report with the following:
1- Abstract.
2- A brief introduction for the system simulation and model.
3- A brief description for the numerical approximations used in your simulation.
4- A description for your simulation algorithms for simulating first, second, and third order systems, etc…
5- Experimental results section with at least the following:-

a. First order system simulation results of 5 testing cases. It will show the system output for unit impulse and unit step inputs.
b. Second order system simulation results of 10 testing cases. It will show the system output for unit impulse and unit step inputs.
c. Third order system simulation results of 10 testing cases. It will show the system output for unit impulse and unit step inputs.
d. Fourth order system simulation results of 10 testing cases. It will show the system output for unit impulse and unit step inputs.
e. You need to give state space representation matrices for different cases as well.

6- Add and list you references clearly.
7- Add your source codes in the appendix section.

General Regulations:

- Students are allowed to work in groups up to 5.
- Group members code/name should be provided in text file “team.txt”
- All project files should be compressed and uploaded to LMS with the required reports.
- The role of each participant must be emphasized in the document.
- The report will go through a plagiarism check. Reports which show 25% or more similarity will be regarded as failed. Reports will be checked against internet databases and other internal documents from other students inside the university.
- The student SHOULD sign the following Plagiarism Statement:
  “I certify that this assignment / report is my own work, based on my personal study and/or research and that I have acknowledged all material and sources used in its preparation, whether they are books, articles, reports, lecture notes, and any other kind of document, electronic or personal communication. I also certify that this assignment / report has not been previously been submitted for assessment for another course. I certify that I have not copied in part or whole or otherwise plagiarized the work of other students and / or persons.”

END of Instructions, Good Luck

Examination Committee ***Submission Deadline: 11th of June, 2020***
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