**Philadelphia University** **Student Name:**

**Faculty of Engineering** **Student Number:**

**Dept. of Computer Engineering**
**Final Exam, Second Semester: 2014/2015**

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| **Course Title:** Real-Time Computer Control Systems | **Date:** 18/6/2014 |
| **Course No:** (630512) | **Time Allowed:** 2 Hours |
| **Lecturer:** Dr. Mohammed Mahdi | **No. of Pages:** 2 |

***Question 1:*** ***(10 Marks)***

**Objectives: This question is about the basic concepts RTCCS.**

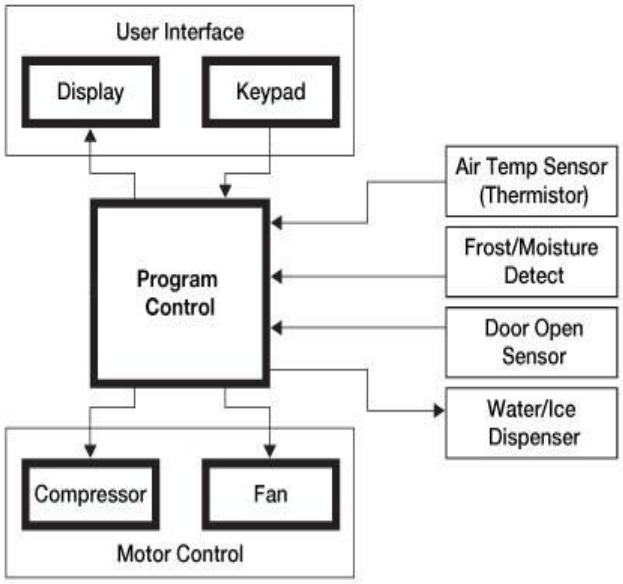
Answer the following briefly "along with simple example": -

1. In RTCCS the sampling rate selection is considered as a critical design parameter.
2. Micro controller based system has many advantages compared with the analog one.
3. Supervisory control scheme was used to achieve some certain jobs.
4. Sequence control scheme is used extensively in batch systems.

***Question 2:*** ***(10 Marks)***

**Objectives: This question is about DDC system design and data transfer techniques.**

Given the digital control refrigerator system.




It is required to: -

1. Sketch its minimum hardware I/O interfacing scheme.
2. Explain data transfer techniques that may one use for such system.
3. What kind of digital PID controller do you suggest for the motor control?

***Question 3:*** ***(10 Marks)***

**Objectives: This question is about Task scheduling, RT languages, and Z.O.H**

Explain the following: -

1. Suspended task state.
2. Ready list in Round-Robin scheduling strategy.
3. Real Time software requirements.
4. Efficiency measure in real time languages.
5. Zero Order Hold effect on the overall system performance.

***Question 4:*** ***(10 Marks)***

**Objectives: This question is about discrete time systems.**

A) For the following discrete function $X(z) = \frac{2z^3 + z}{(z-2)^2(z-1)}$, find

- X(k) using $z^{-1}$.
- X(0) and X(∞)
- sketch the system simulation diagram.

Knowing that $z^{-1}\{ \frac{z}{(z-2)^2}) \} = k(2^{k-1})$.

B) Apply Jury test to check the absolute stability of the following characteristic equation:

$$P(z) = z^4 - 0.6z^3 - 0.81z^2 + 0.67z - 0.12$$