Philadelphia University   **Student Name:**

Faculty of Engineering   **Student Number:**

Dept. of Computer Engineering
Final Exam, Second Semester: 2009/2010

Course Title: Real-Time Computer Control Systems (RTCCS)	**Date: 6/6/2010**
Course No: (630581)	**Time Allowed: 2 Hours**
Lecturer: Dr. Mohammed Mahdi	**No. of Pages: 2**

Question 1:   *(12 Marks)*

Objectives: This question is about RTCCS general concepts.

Answer the following with "Yes" or "No" giving reasons.

1. **The development of microprocessors in 1974 led to wide applications in the field of RTCCS.**

2. **The position of the air - inlet cover of a hot-air blower plant is adjusted by a reversible motor.**

3. **In RTCCS the operator is often provided with a control panel.**

4. **Clock-based RTCCS help in a very fast response to interrupt.**

5. **One of the disadvantages of analog controllers is the lack of integrated process information display to the process operator.**

6. **In Direct Digital Control (DDC) systems the calculation of the required control signal takes a very short time.**

7. **To determine and implement a satisfactory supervisory control scheme one should include Man Machine Interface.**

8. **One should use pulse generator in the pulse input interface.**

9. **In conditional data transfer there is a must to check the peripheral device status.**

10. **Task is defined as an activity carried out by the computer and it has 5-possible states.**

11. **Reliability is considered as the main important feature the Real-Time language should have.**

12. **Zero-Order-Hold element has no effect at all on the performance of a discrete control system whatever the sampling time value is.**

Question 2:   (12 Marks)

Objectives: This question is about the kinds of RTCCS control schemes.

A) **Sequence control occurs in some parts of most systems, it often predominates in batch systems. Suggest a simple chemical reactor vessel as an application of sequence control; it is required to sketch its proposed schematic diagram along with writing its suggested sequence control steps.** **(6 Marks)**

B) **Explain the 3-procedural steps which are repeatedly implemented in DDC systems.** **(6 Marks)**

Question 3: (12 Marks)

Objectives: This question is about interrupts and discrete control systems.

A) Interrupt techniques are essential for the correct operation of most RTCCS; explain the main situations where one should use these techniques. (6 Marks)

B) Explain the mapping rules from s-plane to z-plane. (6 Marks)

Question 4: (14 Marks)

Objectives: This question is about stability, analysis, and control of discrete control systems.

Given the open loop pulse transfer function G (z) = $\dfrac{k(0.1z + 0.5)}{(z - 0.5)(z + 0.2)}$, with H(z)=1.

It is required to: -

1. Apply Jury test to determine the range of gain k for stability of the closed loop system. (5 Marks)

2. Taking $k = 1$, write down and sketch the closed loop system difference equation. (3 Marks)

3. Find the output final value for unit step change in input and $k = 1$. (3 Marks)

4. What suitable combination of digital PID controller "show equation" do you suggest? Why? (3 Marks)