Philadelphia University
Faculty of Engineering

Student Name:
Student Number:

Dept. of Computer Engineering
Final Exam, Second Semester: 2008/2009

Course Title: Real-Time Computer Control System	Date: 3/6/2009
Course No: (630581)	Time Allowed: 2 Hours
Lecturer: Dr. Mohammed Mahdi	No. of Pages: 2

Question 1:   *(15 Marks)*
Objectives:
This question is about the basic concepts of RTCC systems.

A) **Complete the following** *briefly*.   (10 Marks)

1. **Real-Time computer control systems can be defined by.......**
2. **Computer-based systems can be assembled from...............**
3. **Sensor-based systems are used extensively to.........................**
4. **The advantages of analog controllers are................................**
5. **Digital computer in supervisory control scheme is used to....**
6. **Digital computer in DDC scheme implements the following procedural steps....**
7. **In centralized computer control scheme the DM element signals are....**
8. **As a Man Machine Interface, the control engineer has the following tasks.......**
9. **In polling data transfer technique the two procedures used are..............**
10. **The suspended task state can be defined as..**

B) **Explain how one can choose the suitable combination of the PID controller, and then write down the velocity form of PID control equation.**   (5 Marks)

Question 2:   *(15 Marks)*
Objectives:
This question is about interfacing design and real-time programming languages.

A) **Given the following simple hot-air blower plant, it is required to design the less cost and detailed DDC interfacing scheme.**   (10 Marks)
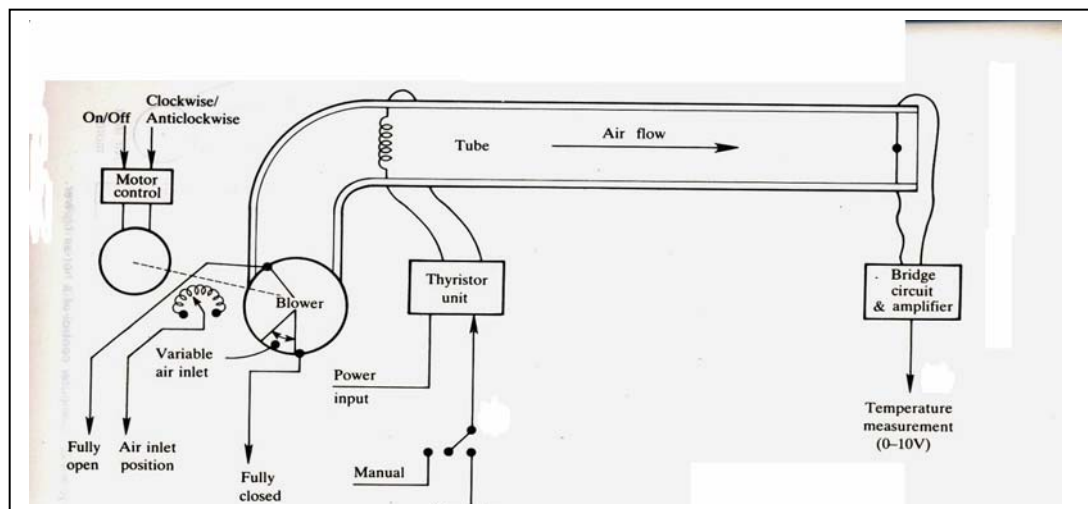

Fig. Hot-air blower plant

B) In Real-time programming languages there are two kinds of requirements. Explain briefly the software requirements and state only the user ones. (5 Marks)

Question 3: *(10 Marks)*
Objectives:
This question is about z-transformation.

A) As for ramp input x(t) = vt, find x(z), then explain when one can use such input in real systems. (5 Marks)

B) Given the following difference equation: -

$$x(k+2) + 3x(k+1) + 2x(k) = 0, \text{ with } x(0) = 0 \text{ and } x(1) = 1$$

Solve it using z-transform, check its absolute stability using unit circle and then find x(∞). (5 marks)

Question 4: *(10 Marks)*
Objectives:
This question is about jury test and finding G(z).

A) Given the following characteristic equation: - (5 Marks)

$$z^3 - 1.3\,z^2 - 0.08\,z + 0.64 = 0$$

Check its absolute stability using jury test.

B) Given Gp(s) = e^{-5s} / (10s+1) with sampling time = 5 sec., use Z.O.H element to find G(z), then write down the closed loop difference equation for a unit step change in input. (5 Marks)