Philadelphia University
Faculty of Engineering

Student Name:
Student Number:

First Exam, Summer Semester 2010/2011

Course Title:	Real-Time Systems	**Date:**	19/7/2011
Course No:	630581	**Time Allowed:**	1 Hour
Instructor:	Prof. Kasim Al-Aubidy	**No. of Pages:**	2

Question 1: [30%]

Objectives: Basic Concepts of Real-Time Systems.

List the differences between:

	Clock-based Real-time Systems	Event-based Real-time Systems
1		
2		

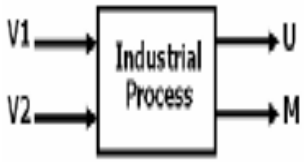
	Hierarchical Real-time Systems	Distributed Real-time Systems
1		
2		

Question 2: [70%]

Objectives: Real-Time System Design

It is required to design a microcomputer-based real-time controller for an industrial process, which has two analog measured signals (V_1 & V_2) and two actuating signals (U & M), as given bellow;

Variable	Type	Range	**Sampling rate** (sample/sec)
V_1	Analog	0-100 mV	1
V_2	Analog	0-0.5 V	10
U	PWM	10%-90% ON cycle	10
M	ON-OFF	TTL Signal	At start and stop



Instruction	CPI
ADD or SUB	*5*
MUL or DIV	*20*
LAD or STR	*10*
CPI: clock per instruction	

1. Give the general layout of the real-time system?
2. Design a complete hardware design of the input/output interface circuit? Calculate the value of each parameter in your design?
3. Calculate the required memory capacity for ONE hour real-time operation?
4. Determine the digital control law (U_n) that can be implemented by a microcomputer working with 4 MHz clock. The duty cycle of the PWM is calculated by a simple PI controller:

$$U_{(t)} = Ae_{(t)} + B\frac{d}{dt}e_{(t)}$$