



ECE DEPARTMENT, NITR
Mid-Semester Examination, Spring 2013
Course Title: Embedded Computing Systems

Maximum Marks: 60

Course id: EC 424

Time: 2 Hours

(Answer all the questions. Figures in the right hand margin indicate marks. Brevity without cut down of major content is welcome. Symbols used throughout carry usual meaning. State assumptions clearly in choosing any component value or data if not specified)

F. valued
1.

Wdf
↓

[1 × 8]

- 293-1- List and explain briefly three main characteristics of an embedded system that distinguish such systems from other computing systems.
- 2- OS functions as a 'Transformer' and also as an 'Effective Scheduler'. How?
- 3- Briefly describe the distinction between requirements and specification. — P812.
- 4- What is the difference between soft cores and hard cores?
- 5- Explain the terms repeatability, reproducibility and stability. in the context of ECE.
- 6- Briefly describe the distinction between Top-down and bottom-up design
- 8-16, 4-9-8- Briefly describe the distinction between Real Time system and Real Time clock.
- 9- Mention various design metric that need to be considered for Embedded System design.

2.

[5 × 2]

- a) Consider three periodic tasks with periods and execution time as given in Table: 1. Find the CPU utilization and find out whether it is schedulable using the RM algorithm. Draw Gantt Charts corresponding to how these tasks will be scheduled, assuming that all the jobs have same release time.

Table:1

Tasks	Period	CPU burst
T1	15	4
T2	12	2
T3	20	5

- 7-5- b) Sketch a block diagrammatic representation of spiral model used for embedded life cycle. Briefly explain. Compare the advantages vis-à-vis disadvantages of this model with waterfall model

3.

[4 × 3]

Let us consider a system to control elevators in a building with m floors. We need to move elevators between floors according to a set of constraints, as follows.

- Each elevator has a set of m buttons, one for each floor. These can be pressed to cause the elevator to stop at that floor. The buttons also illuminate when pressed, and are turned off when the floor is reached.
- Each floor excepting the first and top, has two buttons, one to request up, the other to request down. These buttons also illuminate when pressed and are turned off when an elevator visits that floor and moves in the desired direction.
- In case there are no requests, an elevator remains at its current floor with door closed.

Draw the detailed class diagram for the system. Draw the collaboration and sequence diagrams.

4.

[3 +5 +7]

- Describe why a general purpose processor could cost less than a custom designed single-purpose processor?
- What is data path? Draw a data path for a 16-bit general purpose processor and describe its different functional units.
- What is control unit and control word? What are the various aspects considered in designing a control unit for above data-path design? What are the control words for the following instructions?
ADD A, 011; (011 is a register); SUB A, 001; IN A; LDA A, 011;

5.

[3 +6 +6]

- What is a single-purpose processor? Describe its benefits.
- Write down the algorithm to find out the factorial of N number. Design a dedicated data-path, which will perform the above computation.
- Write down a summation algorithm to add the numbers from n down to 1. Construct a FSM with a minimal set of states for the summation algorithm.