

IV B.Tech. I Semester Regular Examinations, November -2005
EMBEDDED SYSTEM DESIGN
(Common to Information Technology and Computer Science & Systems Engineering)

Time: 3 hours

Max Marks: 80

Answer any FIVE Questions
All Questions carry equal marks

1. Draw the functional blocks of the following embedded systems and briefly explain them.
 - (a) A digital camera
 - (b) A process control system
 - (c) A Multimeter
 - (d) A Handheld computer [4+4+4+4]
2. What is DMA operation in a Computer? Why is it required in a computer? Clearly explain how it is implemented? [5+5+6]
3. What are the important features of Assembly Language? Explain the reasons why Assembly Language programming is preferred for some types of embedded systems. [8+8]
4. For each of the following situations, discuss which of the three shared-data protection mechanisms most likely to be best and explain why.
 - (a) Task A and Task B share an 'int array' and each often must update many elements in an array.
 - (b) Task B shares a single 'char' variable with one of the interrupt routines. [8+8]
5. Explain the features of the following methods of inter-task communication
 - (a) Semaphores
 - (b) Queues
 - (c) Mail boxes
 - (d) Pipes [4+4+4+4]
6. Discuss various methods adopted to reduce power consumption in embedded applications. [16]
7. Explain the role of following tools in software development for embedded systems.
 - (a) Instruction Set Simulators
 - (b) In-Circuit Emulators [8+8]

8. Explain the functional blocks and the specification of the software of a GPS system.
[16]

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1. Explain the functional block diagram of the following embedded applications.
 - (a) A GPS system
 - (b) A speech synthesizer
 - (c) An IVR system
 - (d) A digital Multimeter [4+4+4+4]

2. Suppose that a processor has 20 address lines and 8 data lines in addition to Memory Read and Memory write signal lines. Clearly show how to connect two ROM chips and two RAM chips whose sizes are as given below. Also design the part of the circuit that takes the address lines and produce the chip enable signals for each of these four memory parts. [16]

| | Size | Low Address | High Address |
|-----|--------|-------------|--------------|
| ROM | 128 KB | 00000H | 1FFFFH |
| ROM | 128 KB | 20000H | 3FFFFH |
| RAM | 64 KB | 80000H | 8FFFFH |
| RAM | 64 KB | 90000H | 9FFFFH |

3. What is an interrupt? Why they are required in a computer? Explain clearly how multiple are handled by the computer? [3+3+10]

4. Write short notes on the following in the context of an RTOS
 - (a) Priority inversion
 - (b) Deadly embrace
 - (c) Mutex
 - (d) Counting Semaphore [4+4+4+4]

5. Why do we need timer functions in RTOS? Briefly discuss how they are provided. [8+8]

6. Explain the hard real-time scheduling considerations. [16]

7. What are the main goals of software development for embedded systems? Explain how an Host system meets these goals. [8+8]

8. Explain the important features of the following programming languages for embedded system development.

- (a) Assembly language
- (b) C-language
- (c) C++
- (d) Java

[4+4+4+4]

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1. Draw the functional blocks of the following embedded systems and briefly explain them.
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 - (c) A Multimeter
 - (d) A Handheld computer [4+4+4+4]
2. What is a Computer Bus? Explain how the bus signals are used to interface memory to the CPU in a computer. [4+12]
3. Explain the role of interrupts in embedded applications. Describe how they are handled by the CPU. [16]
4. For each of the following situations, discuss which of the three shared-data protection mechanisms most likely to be best and explain why.
 - (a) Task A and Task B share an 'int array' and each often must update many elements in an array.
 - (b) Task B shares a single 'char' variable with one of the interrupt routines. [8+8]
5. Explain the features of the following methods of inter-task communication
 - (a) Semaphores
 - (b) Queues
 - (c) Mail boxes
 - (d) Pipes [4+4+4+4]
6. Explain various design considerations that are common to broad range of embedded systems. [16]
7. Explain the role of following tools in software development for embedded systems.
 - (a) Instruction Set Simulators
 - (b) In-Circuit Emulators [8+8]
8. Explain the functional blocks and the specification of the software of a GPS system. [16]

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1. Explain the different types of memory devices used in embedded systems with their relative merits and demerits. [4+4+4+4]
2. Briefly explain the various hardware functional blocks of a typical embedded system. [16]
3. What is an interrupt? Why they are required in a computer? Explain clearly how multiple are handled by the computer? [3+3+10]
4. For each of the following situations, discuss which of the three shared-data protection mechanisms most likely to be best and explain why.
 - (a) Task A and Task B share an 'int array' and each often must update many elements in an array.
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5. Explain the features of the following methods of inter-task communication
 - (a) Semaphores
 - (b) Queues
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 - (d) Pipes [4+4+4+4]
6. Discuss various methods adopted to reduce power consumption in embedded applications. [16]
7. Explain the following software development tools
 - (a) A Cross-Compiler
 - (b) A Cross-Assembler
 - (c) A Linker
 - (d) A loader/locator [4+4+4+4]
8. Explain the important features of the following operating systems that are relevant to embedded applications.
 - (a) RT Linux

(b) Windows XP

(c) Win CE

(d) V_x works

[4+4+4+4]

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