USN ☐☐☐☐☐☐☐☐☐☐ EC835

Eighth Semester B.E. Degree Examination, May/June 08
Embedded System Design

Time: 3 hrs. Max. Marks:100

Note : *Answer any FIVE full questions.*

1 a. Differentiate between the following
   i) Single purpose and general purpose processors.
   ii) Full custom IC and PLD technologies (08 Marks)
   b. Explain the following terms
   i) Characteristics of an embedded system
   ii) Ideal top – down design process. (06 Marks)
   c. Define time – to – market and NRE cost metrics. The lifetime of a product is 64 weeks. If the product is delayed by 7 weeks, determine the percentage revenue loss. Determine the per – product cost, if the NRE cost is Rs 4,00,000 and unit cost is Rs 8000 and the company produces 5000 units of that product. (06 Marks)

2 a. Write s simple algorithm for finding the GCD of two integer numbers. Write the FSMD for this algorithm and explain how it can be optimized and write the optimized FSMD and its advantages. (14 Marks)
   b. Explain the following 3 addressing modes with an example from any processor.
   i) Register indirect
   ii) Relative addressing
   iii) Direct (06 Marks)

3 a. Explain the following terms
   i) Superscalar architecture
   ii) Linker
   iii) Dhrystone Benchmark
   iv) Cross compiler (08 Marks)
   b. Differentiate between
   i) Harvard and Princeton architectures
   ii) Microcontrollers and DSPs. (06 Marks)
   c. Explain pipelining. If 6000 instructions are to be executed using a 4 stage pipelined processor at a clock frequency of 12 MHz, determine the speedup of the pipelined processor when compared to a non – pipelined processor. (06 Marks)

4 a. Describe the working of PWM with necessary diagrams and explain how it can be used in the speed control of DC motor. (08 Marks)
   b. What is a WDT and what is its use? A 16 bit timer operates at a clock frequency of 20 MHz. Determine the resolution and range of this timer. If a $\div$ 4 – prescaler is also used, what is the range and resolution of this design? (06 Marks)
   c. The analog input range for an 8 bit ADC is from -2.5 V to $+ 7.5$ V. Determine the resolution of ADC and digital output in hexadecimal when the input voltage is 1.2 V. Trace successive approximation steps and show the binary output of the ADC. (06 Marks)

5   a. Compare the following
        i)   SRAM and DRAM
        ii) Direct mapped and fully associative cache memory designs.   (08 Marks)
    b. Explain the following terms in brief
        i)   Flash memory
        ii) NVRAM
        iii) IrDA   (06 Marks)
    c. Compose 1k × 8 ROMs for the design of a 2 k × 16ROM. Write a block diagram showing
        the connections and the memory map. Determine the average memory access time, if the
        cache miss ratio is 0.2, cache access requires 2 cycles and main memory access requires 10
        cycles when the clock frequency is 20 MHz.   (06 Marks)

6   a. Explain shared data problem with an example show how interrupt facility can be used for
        solving this problem.   (08 Marks)
    b. Compare i) CAN Bus and PCI Bus ii) Serial and Parallel communication. (06 Marks)
    c. Consider three processes with high, medium and low priorities respectively. The execution
        time values of these three processes be 100μ sec, 200μ sec and 300μ sec respectively. The
        minimum interrupts latency of the system be 150μ sec. Let the deadline of the low priority
        process be 600μ sec. Is it possible for the low priority process to execute before the
        deadline if the other two interrupts also occur or only medium priority process interrupts
        it? Determine the worst case Interrupt latency values for both the cases. (06 Marks)

7   a. Describe RR with interrupts with an algorithm. Mention a practical application for the
        same.   (08 Marks)
    b. Explain RTOS architecture with an algorithm.   (06 Marks)
    c. Compare the characteristics of the four software architectures for scheduling. (06 Marks)

8   a. Write a major difference for the following topics
        i)   Queues and Mailboxes
        ii) Ready and Running states
        iii) Encapsulating semaphores and encapsulating queues
        iv) Saving memory space and saving power.   (08 Marks)
    b. What are semaphores? Explain the structure and use of binary semaphores for data
        protection.   (06 Marks)
    c. Explain the 2 rules that the interrupt routines in a RTOS must follow. (06 Marks)

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2002 SCHEME   EC835

Eighth Semester B.E. Degree Examination, Dec.08/Jan.09
Embedded Systems Design

Time: 3 hrs.   Max. Marks:100

Note : *Answer any FIVE full questions*

1 a. List and define the three main processor technologies. What are the benefits of using each of the three different processor technologies? **(06 Marks)**

   b. Describe the design of ATM using watch Dog Timer. **(10 Marks)**

   c. What is the "Market Window" and why is it so important for products to reach the market early in this window? **(04 Marks)**

2 a. Using the revenue model of Fig.2 (a), compute the percentage revenue loss if D=5 and W=10. If the company whose product entered the market on time earned a total revenue of $25 million, how much revenue did the company that entered the market 5 months late lose? **(04 Marks)**
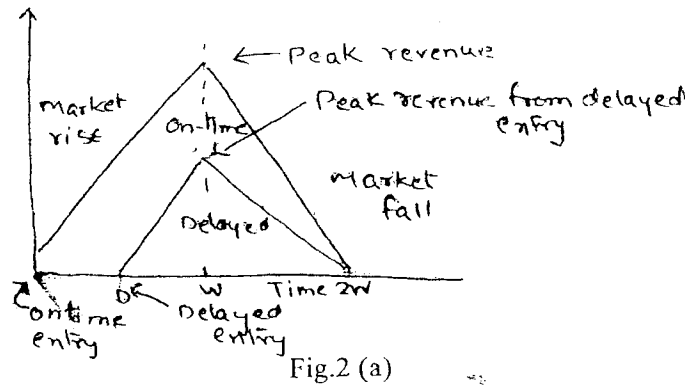

Fig.2 (a)

   b. Draw the basic architecture of a General-purpose processor and briefly explain the different blocks. **(06 Marks)**

   c. Develop an efficient algorithm for GCD, convert it to FSMD and show the optimized FSMD. **(10 Marks)**

3 a. Explain the different cache mapping techniques with suitable diagrams. **(12 Marks)**

   b. Describe why a general-purpose processor could cost less than a single-purpose processor. **(02 Marks)**

   c. List the three main Transmission mediums used for data communication. **(06 Marks)**

4 a. Given an analog input signal of voltage ranging from 0 to 15 V, and an 8-bit digital encoding. Explain the process to calculate the correct encoding of 5 V. **(08 Marks)**

   b. List the different wireless protocols available and explain each of them briefly. **(06 Marks)**

   c. Explain briefly the general software tools that are used by embedded system designers in design, test and debugging of embedded software. **(06 Marks)**

5 a. Explain the concept of shared data problem with respect to interrupts and how it can be solved. **(05 Marks)**

   b. Explain the concept of Tasks and Task states in Real time operating systems. **(05 Marks)**

   c. Discuss one method of removing the bug without disabling interrupt or using semaphores. **(06 Marks)**

   d. What is interrupt latency? What factors affect it? **(04 Marks)**

6 a. Explain the methods to save code space and methods to save power. **(08 Marks)**

   b. Explain with an example, how Round Robin scheduling works. When is it not suitable? **(08 Marks)**

   c. Explain the role of Timer function in RTOS. **(04 Marks)**

7 a. Illustrate with suitable examples, the problems of 'Deadly embrace' and 'Priority inversion'. **(14 Marks)**

   b. What is reentrant function? Give the 3 rules to decide reentrant function. **(06 Marks)**

8 a. Explain the 2 rules that interrupt routines must follow in RTOS environment. What is the effect of blocking on interrupts? Explain with a diagram. **(05 Marks)**

   b. What is meant by encapsulating the semaphores? Bring out the need for it. **(06 Marks)**

   c. Explain how a stepper motor is controlled using driver. Give relevant hardware and software details. **(09 Marks)**

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06CS74

Seventh Semester B.E. Degree Examination, Dec.09-Jan.10
Embedded Computing Systems

Time: 3 hrs.   Max. Marks:100

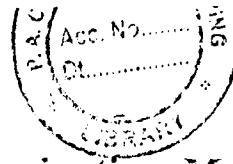**Note: *Answer any FIVE full questions, selecting atleast TWO questions from each Part.***

PART – A

1   a. Compare the definitions of embedded system from the following authors i) Wayne Wolf
       ii) Todd.D. Mortan.   **(04 Marks)**
    b. What are the major differences between Harvard and Von Neuman architecture? Give an
       example.   **(06 Marks)**
    c. What are the functional circuits in a microcontroller chip? Explain them in detail. **(10 Marks)**

2   a. What is charge pump? Explain the following terms related to embedded hardware units :
       i)   Clock oscillator circuit   ii)   System timer   iii)   Power – up reset and watch – dog
       timer.   **(10 Marks)**
    b. Comprehend the procedure to code high level and assembly software into m/c
       implementable software, for an embedded system. Highlight their differences.   **(10 Marks)**

3   a. Compare the parallel ports interfaces for the keypad, stepper motor and touch screen.
                                                                              (10 Marks)
    b. Describe and compare UART and HDLC protocol.   **(10 Marks)**

4   a. Show the procedure of diversion to higher priority interrupts.   **(06 Marks)**
    b. What is DMAC? Explain the steps of DMA to facilitate a multi byte data transfer. **(06 Marks)**
    c. What is virtual device driver? Explain any two of them in detail.   **(08 Marks)**

PART – B

5   a. What are the Task and ISR? Distinguish among the ISRs, Tasks and functions.   **(10 Marks)**
    b. What is a semaphore? What are the IPC functions used by a software programmer? Explain
       them.   **(10 Marks)**

6   a. What is the function of Kernal in RTOS? Comprehend the different memory management
       strategy for a system.   **(10 Marks)**
    b. What is RTOS? List and explain the different services of RTOS.   **(10 Marks)**

7   a. What are the design principles of RTOS to design an embedded system? Explain them.
                                                                              (10 Marks)
    b. What is the significance of spin lock? Narrate the petrinet based model for critical section
       service, by a preemptive scheduler.   **(10 Marks)**

8   a. What is industry standard file format for storing the locator file? Show the memory needed
       in case of Princeton and Harvard architecture in the system.   **(10 Marks)**
    b. What is a simulator? Illustrate the detailed design development process using a simulator.
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Seventh Semester B.E. Degree Examination, May/June 2010
Embedded Computing Systems

Time: 3 hrs.

Max. Marks:100

Note: *Answer any FIVE full questions, selecting*
at least TWO questions from each part.

PART – A

1 a. How does an embedded system differ from a general purpose computer? (04 Marks)
 b. What are the possible devices available to a system designer to use it as a processor in an embedded system? What are the important considerations when selecting a processor? (10 Marks)
 c. What are the challenges faced in designing an embedded system? (06 Marks)

2 a. Explain briefly the different software modules and tools for designing an embedded system. (06 Marks)
 b. Describe the internal serial communication ports available in microcontroller 68HC11. (08 Marks)
 c. Draw the functional diagram of a typical parallel port showing the handshaking signals. Describe the communication using it. (06 Marks)

3 a. Explain how port-based input/output is different from bus-based input/output. (04 Marks)
 b. Describe the features of CAN bus and its protocol for serial communication. (08 Marks)
 c. What is PCI bus? Explain the features of PCI bus and standards available. (08 Marks)

4 a. How are the various interrupt sources classified? (06 Marks)
 b. What is interrupt latency? How the worst case latency can be estimated? (06 Marks)
 c. What are the points that must be known and the information that must be available before writing a software for a device driver in assembly language? (08 Marks)

PART – B

5 a. Explain the state machine programming model. Draw the state transition diagram to show the finite state machine of a task in a multi-tasking program. (08 Marks)
 b. What are the parameters of a task control block (TCB) of a task? Why should each task have a distinct TCB? (06 Marks)
 c. Differentiate between function, task and ISR. (06 Marks)

6 a. What is a process manager? What are the services of process manager? (06 Marks)
 b. How does memory allocation differ in RTOS as compared to conventional OS? Explain what is memory locking. (06 Marks)
 c. Briefly explain the three ways in which RTOS handles the ISRs in a multitasking environment. (08 Marks)

7 a. What are the steps by RTOS to meet hard-real time dead lines? (06 Marks)
 b. What are the methods of optimizing memory space in RTOS? (06 Marks)
 c. Describe earliest deadline first (EDF) and rate monotonic schedule (RMS) scheduling models. (08 Marks)

8 a. What is a target system? With the help of a block dia, illustrate the different components of target a system. How d target system er from the final embedded system? (08 Marks)
 b. What is locator? What are the features of locator? (06 Marks)
 c. With a neat block schematic, explain how would you get an embedded software into the target system? (06 Marks)