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M.Tech. Degree Examination, May/June 2010
Real Time Embedded Systems

Time: 3 hrs.

Max. Marks:100

Note: Answer any FIVE full questions.

- 1
 - a. Define the following terms: deterministic system, real time system, embedded system and failed system. (04 Marks)
 - b. Differentiate between: i) Hard and soft real time systems. (08 Marks)
ii) RISC and CISC architectures.
 - c. A microcontroller has an inbuilt ADC and a WDT. Determine the resolution of this 8 bit ADC which can operate in the range of -5 V and +5 V and the digital output produced is binary when the analog input is -3V. Determine the resolution of this 16 bit WDT operating at 40 MHz. What is the terminal count in HEX for producing a delay of 200 μ sec? Mention the use of both of these devices. (08 Marks)

- 2
 - a. List the design issues to be considered in the design of a real time system. Give two examples for real time applications. (04 Marks)
 - b. Describe the operation of a DMA controller, with timing and block diagrams. Mention its merits over programmed I/O technique. (08 Marks)
 - c. A processor has a pipelined architecture with four necessary stages and a cache memory of size 1 K byte. Describe the operation of pipelining. Determine the speedup and efficiency of this processor for executing 4000 instructions at a rate of 20 MHz clock frequency. Determine the average memory access time, if the main memory access needs 12 clock cycles, cache memory access needs 2 clock cycles and cache memory miss ratio is 0.8. (08 Marks)

- 3
 - a. Explain context switching and interrupt latency, considering processes with different priorities. (04 Marks)
 - b. Compare : i) Two address and three address instruction formats. (08 Marks)
ii) EPROM and Flash memory.
 - c. Describe the various hardware components in a general embedded system, with a block diagram. (08 Marks)

- 4
 - a. Compare : i) SISD and SIMD architectures. (04 Marks)
ii) ARM and THUMB modes.
 - b. Describe the architectural features of ARM7 processor along with its PSW format. (08 Marks)
 - c. How does an exception differ from an interrupt? Describe the various exceptions available in ARM7. Explain the actions performed by ARM7, when an exception occurs. (08 Marks)

- 5
 - a. Explain foreground-background system, with an example. Determine the execution period of a background process if the execution time of the background process is 6 msec and the CPU is time loaded for 92% of the time. (04 Marks)
 - b. Explain the following terms: Coroutines, Mailboxes, Priority Inversion and paging technique. (08 Marks)
 - c. Describe Kernel hierarchy and the functions at different Kernel levels / layers. Explain polled loop with its algorithm, merits and demerits. (08 Marks)

- 6 a. Calculate the processor utilization and write the rate monotonic task schedule for the following task set: (04 Marks)

Task τ_i	Execution time e_i msec	Period P_i msec
τ_1	1	4
τ_2	2	5
τ_3	3	20

- b. Describe the functions of the various states, with a task state transition diagram and TCB for task management. (08 Marks)
- c. Explain cyclic executive approach for task scheduling and the three conditions for the frame size calculation, with an example. (08 Marks)
- 7 a. Determine the total number of page faults for the following page reference string, when the total number of frames allocated is 3 and the first page reference itself causes a page fault as the frames are initial empty. The page replacement policy used is LRU technique. Page Ref string: 0, 1, 2, 4, 2, 3, 7, 2, 1, 3, 1. (04 Marks)
- b. Explain critical section problem, the algorithms for binary semaphores and their usage in solving this problem. What is the problem with the set operation and how it can be remedied? (08 Marks)
- c. Describe : i) Deadlock and ii) Segmentation and overlay structure. (08 Marks)
- 8 a. Write the block diagram for automatic chocolate vending machine and mention the hardware components required. (04 Marks)
- b. Explain : i) VX works features and ii) Double buffering. (08 Marks)
- c. Design cruise control of a car or traffic light control system, with the required hardware and software technique. (08 Marks)