

Subject: EMBEDDED SYSTEMS DESIGN**Time: 3 Hours****Max. Marks: 100****JUNE 2011****NOTE: There are 9 Questions in all.**

- Question 1 is compulsory and carries 20 marks. Answer to Q.1 must be written in the space provided for it in the answer book supplied and nowhere else.
- The answer sheet for the Q.1 will be collected by the invigilator after 45 Minutes of the commencement of the examination.
- Out of the remaining EIGHT Questions answer any FIVE Questions. Each question carries 16 marks.
- Any required data not explicitly given, may be suitably assumed and stated.

Q.1 Choose the correct or the best alternative in the following: (2×10)

a. Identify which of these are real-time applications scenarios

- (A) An on-line bus ticketing system
- (B) Printing of annual report of a company's annual report
- (C) Reconciling a day's transactions in an account book of a small company
- (D) Examination system

b. Which of the following are commercially claimed RTOS

- (A) Linux
- (B) Windows 7
- (C) Windows 2000
- (D) Vx works

c. With _____ the processor can read from or write to a port directly just as it would a register

- (A) Port based I/O
- (B) Bus based I/O
- (C) Memory mapped I/O
- (D) None of the above

d. Which of the following strategy is employed for overcoming the priority inversion problem?

- (A) Abandon the notion of priorities altogether
- (B) Have only two priority levels
- (C) Allow for temporarily raising the priority of lower level priority process
- (D) Use pre-emptive policies strictly based on priorities

e. A/an _____ routine must not call any RTOS function that might block the caller

- (A) Timer
- (B) Serial Communication
- (C) I/O
- (D) Interrupt

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- f. Where are the device drivers located in RTOS with a microkernel?
- (A) In the kernel space
 - (B) In the user space
 - (C) In separately allocated space which is neither kernel space nor user space
 - (D) Anywhere in free space
- g. For what types of operations is DMA useful?
- (A) For large & fast data transfers between memory & I/O devices
 - (B) For large & slow data transfers between memory & I/O devices
 - (C) For slow & small data transfers between memory & I/O devices
 - (D) For small data transfers between memory & cache
- h. When a process is rolled out of memory, it loses its ability to use the CPU (at least for a while). Describe another situation where a process loses its ability to use the CPU, but where the process does not get rolled out.
- (A) When an interrupt occurs
 - (B) When thrashing occurs
 - (C) When deadlock occurs
 - (D) While swapping
- i. Running, ready and block are concerned to
- (A) Task State
 - (B) Semaphore State
 - (C) Mailbox State
 - (D) Pipe State
- j. Semaphores and queues are _____ so that interface between modules is a function call
- (A) Inherited
 - (B) Encapsulate
 - (C) Polymorphic
 - (D) Separate

Answer any FIVE Questions out of EIGHT Questions.
Each question carries 16 marks.

- Q.2** a. What is an embedded system? Give two examples for Small, Medium & sophisticated scale embedded systems. (8)
- b. Explain top-down design process technology for Embedded System. (4)
- c. Distinguish between a combinational circuit and a sequential circuit. (4)
- Q.3** a. What is microcontroller? What are the functional circuits of a microcontroller and give advantages of writing embedded software in Assembly Language?(6)
- b. What is GPP & ASIP? (4)

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- c. Explain the Hardware units of an Embedded System? Give advantages of writing embedded software in C Language. (6)
- Q.4** a. Given a 120-step stepper motor with its own controller, write a C function *Rotate (int degrees)*, which, given the desired rotation amount in degrees (between 0 and 360), pulses a microcontroller's output port the correct number of times to achieve the desired rotation. (6)
- b. Compute the memory needed in bytes to store a 4-bit digital encoding of a 3-second analog audio signal sampled every 10 milliseconds. (4)
- c. Explain the synchronous, asynchronous and isosynchronous communication techniques. Give their respective applications. (6)
- Q.5** a. Explain the following:- (6)
- (i) PROM
 - (ii) Flash EEPROM
 - (iii) NVRAM
- b. Explain ROM image, stack overhead and memory optimization. (6)
- c. A given design with cache implemented has a main memory access cost of 20 cycles on a miss and two cycles on a hit. The same design without the cache has a main memory access cost of 16 cycles. Calculate the minimum hit rate of the cache to make the cache implementation worthwhile. (4)
- Q.6** a. Define protocol. Name any two characteristics to be taken into account while interfacing a device. (4)
- b. Define interrupt handler. Explain the difference between port-based I/O and bus-based I/O. (4)
- c. Give advantages and disadvantages of using memory-mapped I/O versus standard I/O. (4)
- d. Differentiate between parallel, serial and wireless communication. Give two common applications for each. (4)
- Q.7** a. Differentiate between (9)
- (i) Recursive and Reentrant function
 - (ii) Queue and Stack
 - (iii) RTOS and Non-RTOS
- b. Define a semaphore and what is shared data problem? Briefly explain the problems that may arise while using semaphores? (7)
- Q.8** a. Explain the following (6)
- (i) Message Queue
 - (ii) Mailbox
 - (iii) Pipe
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- b. Explain any two features of RTOS. What are the strategies used by RTOS on interrupt source calls? (6)
- c. What is memory management and how will it influence the real-time behaviour of an operating system? (4)
- Q.9** a. Define the following:- (6)
- (i) Inter process communication
 - (ii) Soft Real time systems
 - (iii) Hard Real time Systems
- b. Differentiate between (10)
- (i) Kernel space versus user space versus real-time space.
 - (ii) Monolithic kernel versus micro-kernel.