

INDIAN INSTITUTE OF TECHNOLOGY

Date: FN/AN **Time:** 3 hrs **Full Marks:** 100 **No. of students:** 72
End Spring Semester, 2008-2009 Deptt: Electronics & Electrical Comm. Engg. Sub. No: EC31006
3rd year B.Tech (II) Sub Name: Microcontrollers & Embedded Systems

- Q1. State two major reasons that make FIQ interrupts faster than IRQ interrupts in ARM. [2]
 Q2. Two systems are accessing same memory chips (through proper arbitration). Each word is 32 bit and memory word size is also 32 bit. The first system uses little-endian, while the second one uses big-endian convention. If the word size is four bytes, do you find any problem in the following cases: [1 + 1 + 2]
 a. System 1 writes a word, System 2 reads that word
 b. System 1 writes a byte, System 2 reads that byte
 c. System 1 writes a word, System 2 reads it, however, the data bus lines of System 2 are connected wrongly – bit 31 is interchanged with bit 0, bit 30 with bit 1, and so on.
 Q3. What advantage does it provide – “immediate operands of ARM allows only a restricted class of numbers”? Enumerate the restrictions. Can the numbers 0xF000000F, 0xFE000000, and 0x0E0E0000 be specified in this format? [1+2+3]
 Q4. Distinguish between (i) ADD, ADDS, EQADD (ii) B, BL, BX, BLX [2+2]
 Q5. What is “early termination”? [3]
 Q6. How does the execution of SWI instruction in ARM differ from similar instructions in Intel processors? [3]
 Q7. What is the importance of SWAP instruction of ARM from system development view point? [3]
 Q8. Compare the performance of THUMB-coded program with ARM-coded program. [3]
 Q9. Compute the time required to transfer 256 bytes of data using SPI interface. Assume that the processor takes 2 microseconds to write into its SPI data register, while the device takes 2 milliseconds to read from its SPI register. The data can be transferred over MISO/MOSI lines at a rate of 64 kbps. [5]
 Q10. What is “bus enumeration” in USB operation? What is the maximum number of devices that can be connected to a host controller? Why is it difficult to make wrong USB connections? [2+1+1]
 Q11. Show the RZ and 4PPM coding for the bit stream 10011011. [3+3]
 Q12. What do you mean the terms: spread spectrum frequency hopping, piconet? What is the frequency range of Bluetooth? [3+1+1]
 Q13. Explain the difference between “kernel mode” and “user mode” execution. [3]
 Q14. Draw the state transition diagram of a process. What is PCB and what are its contents [3+1+2]
 Q15. Consider the following set of 5 processes, all arrived at time 0 in the order P1, P2, P3, P4, P5. Show the Gantt Chart for each of the scheduling algorithms: FCFS, SJF, nonpreemptive priority (higher value indicates higher priority). Compute the throughput and average waiting time in each case. [15]

Process	Burst time	Priority
P1	10	3
P2	1	1
P3	2	3
P4	1	4
P5	5	2

Q16. Rectify the following piece of code written for semaphore based solution to some synchronization problem.

You should not change statements or their order unnecessarily. [5]

Semaphore S1 = 0, S2 = 0;

Process P1:

```
Wait (S1);
Wait (S2);
<do operations>
Signal(S2);
Signal(S1);
```

Process P2:

```
Wait(S2);
Wait(S1);
<do operations>
Signal(S1);
Signal(S2);
```

- Q17. Distinguish between hard, firm and soft real-time tasks with examples. [5]
 Q18. Distinguish between periodic, sporadic and aperiodic tasks. [3]
 Q19. Compare RMS and EDF scheduling algorithms with respect to their relative advantages and disadvantages. [5]
 Q20. Perform RMS and EDF scheduling for the following set of tasks. [10]

Task	Execution time	Period
P1	1	3
P2	2	10
P3	3	15