



**ECE DEPARTMENT, NITR**  
**End-Semester Examination, Spring 2013**  
**Course Title: Embedded Computing Systems**

**Maximum Marks: 100**

**Course id: EC 424**

**Time: 3 Hours**

(Answer all the questions. Figures in the right hand margin indicate marks. Brevity without cut down of major content is welcome. Symbols used throughout carry usual meaning. State assumptions clearly in choosing any component value or data if not specified)

1. a. What is RISC design philosophy? Describe the difference between RISC and CISC processor.  
b. Draw and Explain the ARM data path architecture and all available registers.

[5+5]

2. Write ARM assembly language program for the following:

[5+5]

i. Division of two numbers using repetitive subtraction

ii. Write a program to find the sum of  $4X+3Y+8Z$ , where  $X=3$ ,  $Y=2$ , and  $Z=1$

3. a. Illustrate the results of the following load-store instructions:

[5+5]

$R0 = 0x00000000$ ,  $R1 = 0x00008000$ ,  $mem[0x00008000] = 0x00124578$ ,  
 $mem[0x00008004] = 0x02020202$

i. LDR  $R0, [R1, \#4]$  ii. LDR  $r0, [r1], \#4$  iii. LDR  $R0, [R1], \#4$

- b. Illustrate the results of the following load-store instructions:

$mem32[0x80018] = 0x03$ ,  $mem32[0x80014] = 0x01$ ,  $mem32[0x80010] = 0x02$ ,  $R0 = 0x80010$

i. LDMIA  $R0, \{R1-R3\}$  ii. LDMIA  $R0!, \{R1-R3\}$  iii. STMIA  $R0, \{R1, R3\}$

4. a. What is pipelining and with an example explain how pipeline can improve the throughput of a system.

b. Explain the role of a data path in microprocessor and explain its different units.

[5+5]

5. Write short notes on the following:

[2.5 × 4]

i. UART, ii. LCD Interfacing, iii. Pulse width modulation iv. Timer

6.

[ 3 + 3 +4]

- a) What are the features we look into while selecting an FPGA for an Embedded application?
- b) What is the difference between Hard IP, soft IP and firm IP.
- c) Briefly explain the flowchart of Hardware/software co-design process? Briefly explain the system partitioning.

7.

[ 6 + 4]

- a) List and describe eight parts of the closed loop control system. Give a real life example of each?
- b) Draw the transistor level schematic for a two input NAND gate. Draw the top down view of the circuit on an IC (layout) clearly indicating the layers.

8.

[4 + 6]

- a. Conduct the case studies for the following applications in terms of processing speed, architecture requirement, memory requirement etc. and hence suggest an appropriate computing platform
  - Real Time Robot
  - Battery charger
- b. Briefly explain three communication medium usually adopted in Embedded Systems. Give two examples in each case.

9.

[6 + 4]

- a. Sketch the high level view of a Platform FPGA. Explain each component briefly.
- b. Can the function  $f(w,x,y,z)=xy +yz$  be implemented in a 3 LUT. Explain.

10.

[5 + 5]

- a. Explain briefly real time operating systems in terms of their features.
- b. Describe CAN protocol briefly. Which features and attributes makes it suitable for Embedded application particularly automotive and why?

**Good luck**