Embedded Systems
(VLSI 5131)

Time Allotted : 3 hrs   Full Marks : 70

Figures out of the right margin indicate full marks.

**Candidates are required to answer Group A and
any 5 (five) from Group B to E, taking at least one from each group.**

Candidates are required to give answer in their own words as far as practicable.

Group – A
(Multiple Choice Type Questions)

1. Choose the correct alternatives for the following: 10 x 1=10

(i) What is latency in design metric
   - (a) processing a task per unit time
   - (b) time between start and end of a task
   - (c) sample frequency
   - (d) none of these.

(ii) What is the address range of SFR Register bank?
   - (a) 00H-77H
   - (b) 40H-80H
   - (c) 80H-7FH
   - (d) 80H-FFH.

(iii) RTL statement T3: $R2 \leftarrow R1, R1 \leftarrow R2$ is a
   - (a) Information transfer
   - (b) Conditional Statement
   - (c) Concurrent condition
   - (d) none.

(iv) Fetch instruction is the ------ stage of pipelining
   - (a) 1
   - (b) 3
   - (c) 2
   - (d) none of these.

(v) Property which do not characterize an embedded system is
   - (a) random output
   - (b) real time output
   - (c) of low manufacturing cost
   - (d) of low power consumption.

(vi) Watchdog timers enable an embedded system to
   - (a) reduce overhead
   - (b) restart in case of failure
   - (c) reduce unit cost
   - (d) improve efficiency.

(vii) Which interrupt has the highest priority in 8051?
   - (a) IE1
   - (b) TF0
   - (c) IE0
   - (d) TF1.

(viii) A flash memory is an extension of-------------
   - (a) OTP ROM
   - (b) EPROM
   - (c) EEPROM
   - (d) none .

(ix) Protocol that perform Parallel Communication:
   - (a) CAN
   - (b) I2C
   - (c) PCI
   - (d) none.

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(x) How many type of cache mapping techniques are there?

 (a) 1   (b) 2   (c) 3   (d) 4.

Group – B

2.(a) Give the definition of an embedded system? Illustrate with two examples the application of embedded system processors in the field of communication.

 (b) Describe the design metrics of embedded system. Give a comparative study of General – Purpose, Single – Purpose and Application – Specific Processors.

$$(2+3) + (4+3) = 12$$

3.(a) Give a comparative study of IC Technology Full-Custom, Semicustom and Programmable logic device.

 (b) What are the differences between real time and non-real time system?

 (c) What is the role of RTOS in embedded system? How does it differ from GPOS?
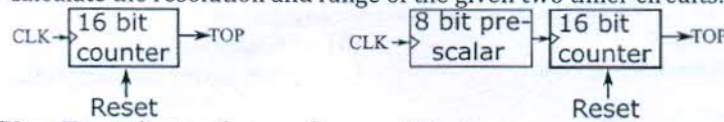
$$(2+2+2)+3+3 =12$$

Group – C

4. Design a single-purpose processor that outputs Fibonacci numbers up to n places. Start with a function computing the desired result, translate it into state diagram and sketch a probable datapath.

$$(4+4+4) =12$$

5.(a) Calculate the resolution and range of the given two timer circuits:

(Here Top indicates the overflow condition).

 (b) Draw and describe the operation of a serial communication using I2Cprotocol?

$$(3+3)+6 = 12$$

Group – D

6.(a) Draw the block diagram and explain 8 bit Peripheral Interface Controller (PIC) operational model.

 (b) Describe the different Timer Modes in 8051 microcontroller. Describe the Timer Mode Control Register of 8051.

$$6 + (4 + 2) = 12$$

7. (a) Illustrate the different stages of pipeline used in ARM processor architecture.

   (b) Show the status of CY, AC and P flags after addition of $9C_h$ and 64_h in the following instruction :

          MOV A, #9CH
          ADD A, #64H

   (c) Write a program in assembly language to clear the accumulator and then add 3 to the accumulator ten times.

          6+3+3 = 12

Group – E

8.(a) What are the common memory types? Explain the operation of floating Gate MOSFET as the programmable switch in PROM.

   (b) What is the difference between isolated I/O and memory mapped I/O?

   (c) Explain DMA data transfer between memory and terminal peripheral.

          (2+4) + 3+3 =12

9.(a) Explain how the output module, LCD controller can be interfaced in an embedded system.

   (b) Describe the working principle of any D/A convertor used in embedded system controller 8051.

          6 + 6 =12