

**EMBEDDED SYSTEMS DESIGN
(VLSI 5102)**

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 alternative for the following: **10 × 1 = 10**
- (i) In a Real Time system *Time means that* the correctness of the system depends not only on logical results but also
 - (a) the time the results are produced
 - (b) on Random Output
 - (c) on low Manufacturing Cost
 - (d) on Power Consumption.
 - (ii) An embedded system must have
 - (a) hard disk
 - (b) processor and memory
 - (c) processor and I/O units
 - (d) operating system.
 - (iii) System which is strictly not embedded is a
 - (a) digital Camera
 - (b) treadmills
 - (c) vending machine
 - (d) personal Laptop.
 - (iv) The logic family with the fastest speed of execution is
 - (a) TTL
 - (b) RTL
 - (c) CMOS
 - (d) ECL.
 - (v) UART device
 - (a) receives parallel data and stores as parallel data
 - (b) receives serial data and stores as serial data
 - (c) receives serial data and stores as parallel data
 - (d) receives parallel and stores as serial data
 - (vi) DMA can be used to transfer data directly between memory and a
 - (a) peripheral Unit
 - (b) Flipflop
 - (c) Counter
 - (d) Register.
 - (vii) After reset, SP register initialize to address
 - (a) 8H
 - (b) 9H
 - (c) 7H
 - (d) 6H.

- (viii) A CAN device is a
 (a) serial and unidirectional (b) serial and bidirectional
 (c) parallel and unidirectional (d) parallel and bidirectional.
- (ix) A hardware accelerator is _____ a co-processor
 (a) not (b) also (c) twice (d) thrice.
- (x) A watchdog timer enables the implementation of real time system by providing
 (a) a regularly timed interrupt for starting real time task
 (b) a very flexible interrupt which is set for individual, critical real time tasks
 (c) a mechanism for the safe shut - down of a system if any task takes too long to complete
 (d) a time of day alarm to synchronise all tasks at a fix time.

Group - B

2. (a) What are the common characteristics of an embedded system?
 (b) Which design metrics are optimized to meet the design challenges of an embedded system?
 (c) Which are the differences between a real time and non-real time system?
 (d) What is role of RTOS in embedded system? How does it differ from GPOS?
3 + 3 + 3 + (2 + 1) = 12
3. (a) What are the design challenges to optimize design metrics of an embedded system?
 (b) Implement the function $F(X,Y,Z) = XY' + Y'Z + X'Y$, using a 3×8 decoder and a logic gate.

6 + 6 = 12

Group - C

4. (a) Compare general purpose, single purpose and application specific processor.
 (b) What are the various operations present in RTL language? Represent the RTL statement for information transfer from one register to another, conditional statement and concurrent conditional statement. Do as directed: I. Obtain the circuit diagram from the RTL code if $s=1$ then $R0 \leftarrow R1$ else $R0 \leftarrow R2$. II. Obtain the RTL code for a 3-8 decoder.

4 + (2 + 4 + 2) = 12

5. (a) Explain the concepts of Watchdog timer and Reaction timer. Write the applications of both the times.

- (b) What is "bouncing" in keypad? How does debouncing work?
(4 + 3) + (2 + 3) = 12

Group - D

6. (a) Discuss about the interrupts in the 8051 microcontroller. Describe the Timer Mode Control Register of 8051.
 (b) Write a program to generate 2 KHz square wave on pin P1.0 of port 1 of 8051 microcontroller using interrupt.

(5 + 3) + 4 = 12

7. (a) Name different ARM MPCORE processors. Explain their uses with brief examples.
 (b) Explain the final contents of the memory locations 100C h, 1010h, 1014h, and 1018 h after execution of the three ARM instructions I1, I2, and I3.

Initial Register and Memory contents are as follows:-

Register (r9) = 100C h;

Memory (100C h) = 4; Memory (1010 h) = 5; Memory (1014 h) = 6;

Program:

I1: LDMIA r9!, { r0, r1, r5};

I2: MLA r4, r5, r1, r0 ;

I3: STMIB r9!, { r5, r4, r1};

(2 + 4) + 6 = 12

Group - E

8. (a) Describe the concept of memory interfacing with embedded processor with any example.
 (b) Explain the basic working principle of a pressure sensor. Describe how that can be interfaced in an embedded system.

5 + (3 + 4) = 12

9. (a) Distinguish between SRAM and DRAM. Explain their reading and writing operation.

- (b) An 8 bit DAC has a resolution of 15 mV/LSB. Determine:

i. Full scale output voltage V_{fs} ?

ii. Output voltage when the input digital word is "0001 0010".

(3 + 3) + (3 + 3) = 12