B.E. Electronics & Telecommunication Engineering

Third Year, Semester 2 Examinations, May 2024

Embedded Systems (HONS.)

Ref. No.: Ex/ET/PC/H/T/325/2024

Time: 3 Hours **Full Marks: 100**

Instructions: (i) Questions must be answered serially. (ii) All parts of the same Section / Question must be answered at ONE place, only.

Section 1 (CO1):

1. (A) (a) An Embedded System is designed to perform a _____ _____, and is a combination of both _____
(b) For certain types of Embedded Systems like 'Hard Real Time' Systems, the Execution behavior is _____
(c) A RISC design places greater demands on the Hardware, while CISC relies more on the Software for functionality. (State True / False)
(d) In CISC Processors, the Instructions are often of _____ _____ and take _____ _____ to execute.
(e) _____ _____ _____ is another major requirement since Embedded Systems have limited memory due to cost and/or Physical size restrictions. (5X2=10 Marks)
(B) List and explain the characteristic features of ARM Instruction set that make it suitable for Embedded Applications. (5)
(C) For an ARM based Embedded device, list the four main hardware components with a brief explanation. (5)

Section 2 (CO2):

2. (A) (a) The 8051 Microcontroller Unit (MCU) provides _____ vectored interrupts, and they are ____, _____, _____, _____, and _____
(b) The On-Chip Data Memory (DM) available with 8051/8052 MCU are _____ and _____, respectively.
(c) In 8051 MCU, ALU pulses at the rate of _____ of the Oscillator frequency, and can be used for _____ purpose for Sub-systems.
(d) The number of Bit addressable locations in the DM of 8051MCU are _____ and the corresponding the memory map is _____
(e) The Memory map of the SFR in 8051 MCU is _____ and can be addressed only by _____ addressing. (5 X 2 = 10)
(B) Explain the On-Chip Timer operation of 8051 MCU in Mode-3. (5)
(C) In the Serial Interface of 8051 MCU, write the formula used to calculate baud rate and explain the terms involved. (5)

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Section 3 (CO3):

3. (A) (a) The ARM Processor, like all RISC Processors, uses a _____ Architecture.
   (b) _____ Instructions copy data from memory to registers in the core, and conversely, the _____ Instructions copy data from registers to memory.
   (c) In ARM, there are NO data processing instructions that directly manipulate data in _____
   (d) ARM instructions typically have _____ source registers, and a single _____ or _____ register.
   (e) In ARM, the data registers are visible to the Programmer as ___ (5 X 2=10)
   (B) List and explain the Functional Units that make up the ARM core data flow model. (10)

Section 4:

4. (A) (a) Identify the 8051 MCU addressing mode used for the instruction, MOVC A,@A+DPTR
   (b) Identify the addressing mode used for the instruction, MOV A,@R_i
   Also, identify the value of i, used in the Instruction.
   (c) Let (A)=0FH. What will be the (A), after the execution of the instruction, SWAP A?
   (d) Identify / Name the optimal JUMP instruction, if the Jump location is within the same 2K Block of the current instruction?
   (e) All the conditional branching instructions in 8051 MCU specify the destination address by _____ only. (5X2=10)
   (B) Write an Efficient 8051 MCU Assembly Language Program (ALP) to find the Bitwise EX-OR between two bits only. (5)
   (C) Write the 8051 MCU ALP to add the two BCD numbers $04BCD_1$ and $06BCD_2$ using immediate addressing, and to adjust the result to decimal (5)

Section 5 (CO5):

5. (A) (a) Name at least two examples of Wireless Communication Interface.
   (b) What is the minimum no. of interface lines required for implementing I2C Interface?
   (c) What is the minimum no. of interface lines required for implementing SPI Interface?
   (d) Name at least two synchronous serial interface.
   (f) Name at least two examples for on-board interface used by an Embedded System. (5x2=10)
   (B) Identify the important Trade-offs to be considered in the hardware – software co-design. (5)
   (C) Illustrate the application specific aspect of Embedded System with a Functional Block Diagram of a Washing Machine System. (5)