

# Question Paper

Exam Date & Time: 30-Apr-2024 (02:30 PM - 05:30 PM)



## MANIPAL ACADEMY OF HIGHER EDUCATION

FOURTH SEMESTER B.TECH. DEGREE EXAMINATIONS - APRIL / MAY 2024

SUBJECT: CSE 2223/CSE\_2223 - EMBEDDED SYSTEMS

(SPL: COMPUTER SCIENCE AND ENGINEERING - CYBER SECURITY/COMPUTER SCIENCE/COMPUTER SCIENCE AND ENGINEERING - ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING)

Marks: 50

Duration: 180 mins.

Answer all the questions.

- 1A) Identify the assembler directives in the following statements and explain each of them along with their attributes. (4)

```
RAMI _ADDR EQU 0x40000000
AREA mycode, CODE, READONLY
VAL1 RN R1
LONG _VAR SPACE 4
```

- 1B) Analyse the following program and write the contents of register R4, R5 and R6. (3)

```
AREA mycode, CODE, READONLY
ENTRY
    LDR R0, =0xE64578AE
    LDR R1, =0x1298EDED
    MOV R2, #0x85
    MOV R3, #0x67
    SUBS R4, R3, R1
    RSB R5, R0, #0
    MUL R6, R2, R3
    STOP B STOP

SRC1 DCD 0x44535567, 0x67633677
SRC2 DCD 0x11236540, 0x6642AED5

    AREA mydata, DATA, READWRITE
    DSD DCD 0
    END
```

- 1C) List and explain all possible instructions used for performing push and pop operations on a fully descending stack with the help of a neat diagram. (3)

- 2A) The textile shop had a sale, but employees decided not to write down the original price of all the items. All the prices are 1/3 of their original amounts. The owner needs to compute the original amount of each item. Write an ARM assembly language program to compute the original amount of each item using subroutines. (4)

- 2B) Illustrate the importance of conditional execution of ARM assembly language instructions with a (3)

suitable example.

- 2C) Assume that there is a class of ten people with the following grades: 69, 87, 96, 43, 78, 84, 90, 49, 45, and 75. Write an ARM assembly language program to find the highest grade and store the highest grade in the register R8. (3)
- 3A) Develop an Embedded C program to implement packed BCD down counter in eight LEDs interfaced with LPC1768 microcontroller. Assume that the eight LEDs are connected to port pins P1.10 to P1.17. (4)
- 3B) Write the code snippet using GPIO registers to perform the following: (3)
- a) Configure port pins P1.0 to P1.18 as output and P1.19 to P1.31 as input.
  - b) Hide the values at port pins P1.13 to P1.18 and P1.5 to P1.9.
  - c) Set the output at port pins P1.5 to P1.18.
  - d) Clear the output at port pins P1.9 to P1.11.
  - e) Read the values from Port1.
- What will be the output of the read operation after execution of all the above set of instructions? (Note: Assume the other port pins read a value of 0).
- 3C) Assume the values already in memory from address 0x4000FF8 to 0x4001008 are 0x100 to 0x104, respectively. Other memory locations contain zeros. The current value of the Stack Pointer (R13) is 0x4001000. Write the LDM instructions with appropriate suffixes other than EA, FA, ED and FD to pop the values from the stack to the registers R0-R4 using empty ascending, empty descending and fully ascending stack structures. Draw the stack structure before and after the pop operations for each type of stack and write the output in registers after pop operations. (3)
- 4A) Write an embedded C program to utilize the pin P0.26 on the LPC1768 microcontroller as the DAC output pin to generate a sawtooth waveform using DAC. (4)
- 4B) Explain about MAX232 in serial communication. (3)
- 4C) Explain the role of UART in serial Communication. Write an embedded C program using UART to transfer the message "Hello World" serially on TXD0 (P0.2, Function 2) at a 9600 baud rate. Assume parity disabled, 1 stop bit, 8bit word length, and PCLK=3MHz. (3)
- 5A) Develop an embedded C program to turn on LED1 and LED2 connected to MAT2.0 and MAT2.1 output of Timer2 after 100ms and 200ms, respectively. Note: MAT2.0 and MAT2.1 are 3rd alternate functions of P0.6 and P0.7. (4)
- 5B) Develop an embedded C program to toggle LED connected to P2.11 upon an external interrupt EINT0. Set the EINT0 as rising edge sensitive. Note: EINT0 is 1st alternate function of P2.10. (3)
- 5C) Explain the importance of TCR, PR and MR in the LPC1768 PWM module. (3)

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