## **Question Paper**

Exam Date & Time: 06-Jan-2024 (02:30 PM - 05:30 PM)



## MANIPAL ACADEMY OF HIGHER EDUCATION

FIFTH SEMESTER B.TECH. EXAMINATIONS - JANUARY 2024 SUBJECT: ICT 3158- EMBEDDED SYSTEMS

Marks: 50

## Answer all the questions.

1A)	Assume that columns of a 3x3 matrix keyboard are connected to P2.2-P2.0 and rows are connected to P1.2-P1.0. Write an embedded C program to display the row and column number of the key pressed on the LCD. LCD is interfaced using P2.8 to P2.3.	(5)
1B)	Write an embedded C program to simulate an 8 bit Johnson counter on LEDS connected to P0.11-P0.4.	(3)
1C)	Write an assembly language program using ARM LPC1768 to count the negative numbers in an array stored in code memory and store the result in data memory.	(2)
2A)	What is the role of Nested Vectored Interrupt Controller in handling the interrupts? Assume that a switch is connected to EINT0 (P2.10, function-01) input. Write an embedded C program using interrupts to display the number of times the switch is pressed for every 10 seconds on a seven-segment display.	(5)
2B)	Calculate the resolution of a 15 - bit analog to digital converter with -5V to 5V as its measurement range. A particular sensor output in analog form is given to LPC 1768 to AD0.2 (P0.25 in function 1). Write an embedded C function to read the analog input and return the digital equivalent of the sensor output.	(3)
2C)	With graphical illustration explain the memory map of ARM Cortex.	(2)
3A)	Write a C program to display a single digit BCD up count on seven segment (P3.31 to P3.28) if a switch connected to P2.12 is pressed else display a down count.	(5)
3B)	What is UART? Explain the role of UART and MAX-232 in serial communication.	(3)
3C)	Assume R1= 0x90, R0 = 0x28, xPSR = 0x F000F000. Write the content of R1 register after the execution of the following instructions i) RSB R1, R0, #0x3 ii) SBC R1, R0, #0x3	(2)
4A)	Discuss the steps for configuring DAC (Digital-to-Analog Converter in ARM Cortex-M3 LPC1768 microcontroller and write an embedded C program to utilize the pin P0.26 on the LPC1768 microcontroller as the DAC output pin to generate a square wave with a frequency of 1 Hz. Use delay of 500ms.	(5)
4B)	Write an embedded C program to rotate the stepper motor in clockwise and anticlockwise directions at a particular speed continuously.	(3)
4C)	Developing an assembly-level language program to find factorial of numbers using recursion.	(2)
5A)	Explain the external match register of timer block in LPC1768. Estimate the delay generated by the timer, if the Prescaler register (PR) value is 59999, and match register value is 4999 and the frequency of the peripheral clock (Pclk) is 50 MHz.	(5)
5B)	Illustrate and explain the execution of STM, STMDB and LDMDB Instruction in ARM.	(3)
5C)	Write and explain a code snippet for each of the following instructions to illustrate the difference	(2)

Duration: 180 mins.

between them. Logical Shift Right (LSR) and Rotate Right with Extend (RRX)

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