USN

RV COLLEGE OF ENGINEERING®
(An Autonomous Institution affiliated to VTU)
IV Semester B. E. Grade Improvement Examinations Nov-2020
Computer Science and Engineering
MICROCONTROLLERS AND EMBEDDED SYSTEMS

Time: 03 Hours   *Maximum Marks: 100*

Instructions to candidates:
1. Answer all questions from Part A. Part A questions should be answered in first three pages of the answer book only.
2. Answer FIVE full questions from Part B.In Part B question number 2, 7 and 8 are compulsory. Answer any one full question from 3 and 4 & one full question from 5 and 6

PART A

1	1.1	Name the Microcontroller and memory (Flash, $SRAM, EEPROM$) capacities provided u in Aurdino Uno Board.	01
	1.2	A potentiometer is connected to Arduino Uno Board with Center pin of potentiometer goes to the analog pin $A0$, side pins of the potentiometer go to +5V and ground. Then following function is executed, after setting the potentiometer to provide 2.0 V. Indicate the value of sensor value. SensorValue-=analogRead($A0$);	01
	1.3	Write any four specifications/features of RasberryPie1-Model $B+$.	01
	1.4	Indicate the following statement True/False and justify the answer. "Temperature Sensor $LM35$ cannot be connected to RasberryPie, using $GPIO$ header".	01
	1.5	Name the Assembler directive, used to name the register used for execution of an instruction.	01

	1.6	Indicate the duty cycle of the waveform generated by the following code:
		$While(1)$
		{
		    $IO0CLR = 1U << 31;$
		    $delay\_ms(100);$
		    $IO0SET = 1U << 31;$
		    $delay\_ms(200);$
		    $delay\_ms(200);$
		}
			01

	1.7	Find the code for displaying '3', using common cathode seven segment display with segment 'a' at LSB and dp at MSB.	01
	1.8	Calculate the number of steps required to achieve 45 degree rotation for the stepper motor, given step angle= 1.8.	01
	1.9	Write the output in $R3$ after the execution of the following code: $MOV R0, \#1$ $MOV R1, \#2$ $MUL R3, R0, R0$ $MLA R3, R1, R0, R3$	02
	1.10	Write an ALP code snippet to compute $2's$ compliment of a 32 bit number.	02

	1.11	What is the answer in the $R1$ register after the execution of following program? Write the answer in Hex format. $MOV\ R0,\#01$ $MVN\ R0,R0$ $MOV\ R1,R0,LSL\ \#31$ $MOV\ R0,R0,LSL\ \#2$ $MOV\ R0,R0,ASR\ \#1$ $MOV\ R1,R0,LSR\ \#1$	02
	1.12	Write the $FLAG(CY,SIGN,OVERFLOW,ZERO)$ status after the execution of following instruction: $MOV\ R0,\#-5$ $MOV\ R1,\#1$ $ADDS\ R0,R1,LSL\ \#31$	02
	1.13	Indicate the value to be loaded into match Register $MR0$, so the timer counter $T0TC$ reaches the $MR0$ value after 5 milliseconds. Assume the $PCLK=10MHz, CCLK=40MHz, T0TC=0.$ Write the answer if the PrescalerRegister=0 and PrescalerRegister= 100. Show the calculation.	02
	1.14	What is the content of $R1$ after the execution of the following instructions? $MOV\ R8,\#80$ $MOV\ R1,R8,LSR\#3$ $CMP\ R1,\#10$ $ADDNE\ R1,\#10$ $ADDAL\ R1,\#10$	02

PART B

2	a	Design Smart Street Light Controller using Arduino Uno Board for the following specifications with the help of interfacing diagram and the related C code: System to be designed for 1 Tube Light operating at $220V\ AC$ using LDR and Relay. The Tube Light should be switched on during the night time automatically using the LDR and switched off during the day time.	08
	b	Summarize the different serial protocols supported by the Raspberry pie Interface ($GPIO$ header). Interface a LED to Raspberry Pie and write a program to blink the LED.	08
3	a	Define embedded system. Also list any six differences between normal Desktop/Laptop Systems and Embedded Systems.	08
	b	Describe register organization of $ARM\ ISA$ with a neat diagram and write the functions of $CPSR$ in detail.	08
		OR	

4	a	Write an *ARM 7 ALP* procedure to convert the following *C* code. Assume *R0* is pointed to array *A*, and the result is returned through *R1*. As suitable assumptions.
		
		`int SUM(int A[100], N)`
		`{`
		  `int i = 0;`
		  `while(i! = N)`
		   `{`
		    `sum = sum + A[i]`
		    `i + +;`
		   `}`
		`}`
			08

	b	Discuss any six features of *ARM* 7 core and explain the different operating modes supported by the core.	08
5	a	List the different addressing modes supported in *LOAD/STORE* instructions with examples.	04
	b	With an example explain the working of the following instructions: *MVN*, *MOVS, MOVEQ*	06
	c	Write an *ALP* for *ARM* 7, to count the number of 1's in a given 32 bit number. Assume the number and the results are stored in registers.	06

OR

6	a	Set of *N* 32 bit signed numbers representing temperatures are stored in the *FLASH* memory at the location *TEMP*. Apply the following functions: $f(x) = (x/2) + 3$ on all the numbers using *ALP*, after moving the numbers to *SRAM*. Write the appropriate comments.	08
	b	Write an *ARM ALP* with the suitable comments, to compute the factorial of a given 32-bit number using procedure.	08
7	a	With the help of a neat diagram, interfacing of 4 Line alphanumeric *LCD* with the micro-controller *LPC* 2148. Clearly describe the meaning of the *LCD* pins.	06

	b	Design Token Display system to be used in the banks with complete schematic circuit diagram and the related embedded *C* program to perform the following tasks:
		  i) Number Keypad (0 to 9) is provided to type the given number.
		  ii) 5 digit seven segment display is to be provided to display the typed number.
		  iii) When number (upto 5 digit) is typed and "Enter" key is pressed then that number to be displayed on seven segment display.
			10

8	a	Describe the working of *PWM* block of *LPC* 2148 Microcontroller and mention the use of different *PWM* registers.	08
	b	Develop the embedded *C* program to transmit the temperature (assume temperature is available in the integer variable, *TEMP*) through the serial port of *LPC* 2148 to *PC* at the baud rate 9600. Draw the connections between Microcontroller *UART* and *PC* serial port. Show the baud rate calculations.	08