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RV COLLEGE OF ENGINEERING®

(An Autonomous Institution affiliated to VTU)

IVSemester B. E. Grade Improvement ExaminationsNov-2021

Computer Science and Engineering

MICROCONTROLLERS AND EMBEDDED SYSTEMS

Time: 03 Hours ***Maximum Marks: 100***

Instructions to candidates:

Answer any FIVE full questions out of TEN. Each carries 20 marks

1	1.1	Name the Microcontroller and its word length(bit size) used in Auduino Uno Board.	01
	1.2	Name the different communication interfaces provided by Raspberry Pie boards for embedded system development.	01
	1.3	How many Digital and Analog Pins are provided in Arduino Uno board for interfacing external devices.	01
	1.4	If an instruction takes 3 cycles for execution, then how many cycles are needed for executing 4 instructions of the same type in a sequence using a 3-stage pipeline? Assume that there are no interrupts or exceptions while executing them.	01
	1.5	What are the contents of R1 and R2 after MVN R1,R2 are executed, assume R2 is 0x01010101	01
	1.6	Write the ARM ALP to perform the following operations, on the 32 bit number stored in R0 register. i. Compliment the Odd bits of R0 register, then ii. Clear the bits – D31 to D28 of R0 register.	01
	1.7	Write the ARM C code to make Port p1.16as output pin. IO1DIR=1U<<16 IO1DIR=0x00010000;	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	Indicate the values of carry, Auxiliary carry and parity flags after the execution of following instructions:
		MOV A,#9CH
		ADD A,#64H
			02

	1.10	Write ARM ALP code snippet to implement the following C code.
		while(i<4)
		sum=sum+i*i;
			02

	1.11	Given 1.45 V of analog input to AD0.1 input of LPC 2148, what is the digital output generated by the ADC module of LPC 2148, and given digital input of 380 to DACR of LPC 2148, what is the analog output generated by the DAC module of LPC 2148 at the pin AOUT,(Assume Vref=3.3V)	02
	1.12	Indicate the value to be loaded into match register MR0, so that timer counter T0TC reaches the MR0 value after 5 miliseconds. Assume the PCLK=10MHz,CCLK=40MHz,T0TC=0. Write the answer if the Prescaler Register=0 and Prescaler Register=100. Show the calculation.	02

	1.13	Write the suitable seven segment codes for displaying the following: i. For common cathode seven segment display, with segment 'a' at LSB and dp at MSB, the code for displaying F. ii. For common cathode seven segment display, with segment 'a' at LSB and dp at MSB, the code for displaying 3.	02
	1.14	Write one application each, for using Relays and opto-Isolators in embedded systems with justification.	02
2	a	Design a Smart Weather Monitoring system with Raspberry Pie and suitable components like DHT-11 sensor. Describe with suitable block diagram and illustrate how thingspeak cloud can be used for this application.	10
	b	Design a smart parking system with Arduino and suitable components like Ultrasonic IR sensor. Describe with suitable block diagram and illustrate how thingspeak cloud can be used for this application.	10
3	a	Design a smart gardening system with Arduino and suitable components and sensors. Describe with suitable block diagram and illustrate how thingspeak cloud can be used for this application.	10
	b	Design a Smart farming system with Raspberry Pie and suitable components and sensor. Describe with suitable block diagram and illustrate how thingspeak cloud can be used for this application.	10
4	a	Define embedded system and mention any five characteristics of these systems. Compare normal Desktop/laptop and embedded systems, with any five differences.	10
	b	Describe register organization of ARM7 ISA with the neat diagram and write the functions of CPSR.	10
5	a	List the different operating modes of ARM7 core. Discuss how registers are distributed and when and how the mode switching happens.	10
	b	Write ARM7 ALP with suitable comments, to find the biggest/smallest of five numbers stored in the code memory and store the result in data memory. Suggest the condition codes used for processing of signed and unsigned numbers.	10
6	a	Write ARM ALP program to simulate simple calculator to perform arithmetic operations(addition/subtraction/ multiplication/division operation) using the procedures. Make suitable assumptions and write suitable comments.	10
	b	Write ARM ALP to solve the following expression without using MUL and DIV instructions, with suitable comments. Z=16X + (Y/2)-10 Z=9X+7Y+11Z	10
7	a	Interface 4-digit seven segment display to LPC 2148 Microcontroller with a neat diagram and write an embedded C program to display the string "Fire"	10
	b	Design Door locking System using LPC 2148 microcontroller, using Stepper motor, matrix keypad. Draw the neat interfacing diagram and write embedded C code for the designed hardware.	10
8	a	With a neat diagram explain the interfacing of Stepper motor to LPC 2148 Micro controller. Write an embedded C program to rotate the motor by 270 degrees when a switch is pressed.	10

	b	Explain DAC and its applications. Write an embedded C program to generate triangular wave using DAC of LPC 2148 Microcontroller.	10
9	a	Describe the working of Timers and design a 10ms delay program using LPC2148 timers. Assume CCLK=60MHz and PCLK=15MHz.	10
	b	Describe the working of PWM unit of LPC2148 Microcontroller and write an embedded C program to generate 25% duty cycle PWM waveform, make suitable assumptions.	10
10	a	Describe the working of UART module of LPC 2148. Draw the connections between Microcontroller UART and PC serial port. Show the baud rate calculations.	10
	b	Compare the following serial interface standards, and suggest any two types applications of each type of protocol. i. I2C ii. SPI	10