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RV COLLEGE OF ENGINEERING®

(An Autonomous Institution affiliated to VTU)

IV Semester B. E. Examinations Oct/Nov - 2022

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	The Rasberry Pi is defined as the _____.	01
	1.2	List any two functions supported by the Arduino IDE.	02

	1.3	Write the value of R3 (32 bit number) after the execution of the following instructions: And status of Flags NZCV
		AREA RESET, CODE, READONLY
		MOV R3, #2
		MOV R4, #5
		SBCS R3, R4
		END
			02

	1.4	Name the registers of ARM Architecture, which are referred as Stack Pointer and Link register.	01
	1.5	Which protocol is used to interface the SD card to the microcontroller $LPC2148$?	02

	1.6	Write the value in $R0$ after executing the following instructions. Also write the status of the flags NZCV.
		MOV R4, #0X30
		MOV R0, #0X20
		LDR R7, =0XF000 0000
		MOVCS R4, R0
		MOVMI R0, R4
			02

	1.7	How many internal and external interrupts are supported by $LPC2148$ using C ?	01
	1.8	List the different signals used in $I2C$ bus of $LPC2148$.	01
	1.9	Mention the size of Flash memory (code) and SRAM provided by $LPC2148$ Microcontroller in kilo-bytes.	01
	1.10	How many number of steps are required to rotate the 2Phase, 4winding, 200steps per revolution stepper motor by 270 degrees?	01
	1.11	Interface LED to $P0.31$ and Switch $P1.14$ of $LPC2148$ using $GPIO$ pins and write an embedded C program for $LPC2148$ to perform the following operations: Blink the LED when the switch is pressed Stop the blinking when switch is released.	01

	1.12	$LPC\,2148\ PWM$ Unit channel 2 is programmed to generate PWM Waveform. Assume $MR0 = 10000$, $MR1 = 5000$, $MR2 = 2000$ are loaded and $PCLK = 15MHz$, $CCLK = 60MHz$. Indicate the duty cycle in percentage generated by the PWM Unit.	02
	1.13	Assume, $AD0GDR - 32$ bit Register of $LPC2148$ contain the following value: $AD0GDR = 0xFF82FFF2$; What is the value of the variable i after the execution of following instruction. $i = (AD0GDR \gg 6)\& \ 0x3FF$ (Hint: indicate the answer in decimal value; Example: 240)	02
	1.14	Assume all the pins of $P0$ of $LPC2148$ are configured as output and made to 0 after the reset. Indicate how many pins of the $P0$ of $LPC2148$ are set to 1 after the execution of following instructions: (Hint: Indicate the answer as decimal number, Example: 5) $IO0SET = 1 \ll 26 \mid 0x0000C080$ $IO0CLR = 1 \ll 26 \mid 0x80800000;$	01

PART-B

2	a	With a neat diagram explain the block diagram of raspberry Pi.	06
	b	Design an Automated Street Light System with Arduino / Rpie and suitable components. Describe with suitable block diagram, indicating the abstract name of the components and their usage with suitable program steps, indicating the meaning of the steps. Demonstrate how thingsspeak cloud can be used for this application. (Note: it is not required/essential to indicate actual pin numbers / names, actual function names while answering the question. Specifies are not important, but overall approach and understanding is valuated to mark your answers.)	10
3	a	Compare PC/Desktop Systems and Embedded Systems, by giving any four differences and mention any one application for each.	04
	b	Define assembler directives and explain the following assembler directives: AREA, ENTRY, DCB, END.	04
	c	List the ARM operating modes and describe the ARM architecture with the neat diagram.	08
		OR	
4	a	Briefly, discuss the classification of embedded systems with an example.	06
	b	List any six features of ARM 7 core and discuss the meaning of extensions referred in ARM-7TDMI core.	10
5	a	Write ARM ALP to compute GCD and LCM of two 32-bit numbers using procedures. Explain the program with suitable comments.	10
	b	Describe the working of rotate and shift instructions of ARM with suitable examples.	06
		OR	
6	a	Write an ARM ALP to perform the bubble sort on 'N' 32-bit numbers. Explain the program with suitable comments.	10

	b	Write the equivalent ARM code for the following C program: i) $Z = (A \ll 4)\|(B\&8)$ ii) $For\ (i = 0; i < 15, i++)$ $\{ j = j + 1; \}$	06
7	a	Design Interfacing circuit and develop application program using embedded C, to interface the stepper motor to $LPC2148$ microcontroller and rotate the motor connected switches at the following pins: i. P1.17 – 90 Degree Glow Red LED at P0.1 ii. P1.18 – 180 Degree Glow Yellow LED at P0.2	06
	b	Design the interfacing circuit and develop the application program for Microcontroller based door locking system. User will feed pre-stored 4 digit key code (say 9875), if the key code matches door must open. Opening and closing of door is controlled Solenoid actuated by the Relay. Draw the complete interfacing circuit and embedded C code to perform the required work. Make suitable assumptions.	10
8	a	Describe the working and programming of Timer unit of ARM microcontroller $LPC2148$ with an example program.	06
	b	Design the interfacing circuit and develop the application program for DC Motor Speed Control System using $ARM\ LPC2148$ microcontroller using PWM block. Draw the schematic diagram and embedded C code to perform the required work. Make suitable assumptions.	10