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RV COLLEGE OF ENGINEERING®
(An Autonomous Institution affiliated to VTU)
I/II Semester B. E. Examinations October-2023
Common to all Programs
INTRODUCTION TO EMBEDDED SYSTEM

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 and 11 are compulsory. Answer any one full question from 3 and 4, 5 and 6, 7 and 8, 9 and 10.

PART-A

1	1.1	State some typical examples of embedded systems and provide a brief definition of an embedded system.	01
	1.2	List the characteristics of embedded systems?	01
	1.3	Identify the commercial off-the-shelf(COTS) components commonly used in embedded systems.	01
	1.4	Explain the functions of Memory, Interrupts, Power Supply, Clocks, and Reset in Embedded Systems.	01
	1.5	Classify the data type of Variable "x" in the statement "$int\ x = 10;$".	01
	1.6	Predict the output of the code "$printf("\%d", 10 + 202);$" in C programming.	01
	1.7	Describe the roles of an editor and linker in an IDE.	01
	1.8	Determine the output of the code "$printf(\%d, 5 > 2 || 2 < 1);$" in C programming.	01
	1.9	Compare and contrast digital data and analog data.	01
	1.10	What is the number of devices that can be connected to an I2C bus.	01
	1.11	Identify the line used for synchronizing the clock signal in SPI communication protocol.	01
	1.12	State the voltage range of Arduino UNO's digital I/O pins.	01
	1.13	Select the function used to set a digital I/O pin to output mode in Arduino.	01
	1.14	Choose the Arduino pins commonly used to interface LEDs from the available analog, digital and PWM pins.	01
	1.15	Create a program using Arduino IDE to blink an LED connected to pin 13 with a one-second delay.	01
	1.16	Develop a program in Arduino that interfaces with an LCD module and displays the message "Hello,World!" on the screen.	01
	1.17	Develop a program in Arduino that interfaces with a GPS module and display the latitude and longitude on the serial monitor.	01
	1.18	What is the maximum input voltage that a 10-bit ADC can handle when the reference voltage is 5V?	01
	1.19	Calculate the output of a DAC for an input of 100, given its reference voltage is 5V and its resolution is 8 bits.	01
	1.20	What is the resolution of the ADC module used in the Arduino UNO board?	01

PART-B

2	a	Explain the concept of an embedded system with a neat block diagram, what are the major areas where embedded systems play a significant role?	06
	b	What is the role of embedded systems in Antilock Brake Systems (ABS)? How do they enhance the safety and performance of ABS?	06
	c	What are the architectural features of the ATMEGA328 microcontroller? How do they contribute to its performance and capabilities in embedded systems design?	04

3	a	i) Write an Embedded C code snippet to multiply two integer variables 'p' and 'q' and store the result in a third variable 'r'. ii) Write a C code snippet to compare two integer variables 'x' and 'y' and return true if 'x' is less than or equal to 'y', otherwise return false.	06
	b	i) Write a program in embedded C for Arduino to print the numbers from 1 to 10 using a for loop. ii) Write a program in embedded C for 8051 to find the maximum of two numbers using a function.	06
	c	Define the following : Editor, Compiler, Linker, Loader and Debugger.	04

OR

4	a	What is the difference between a signed and an unsigned integer data type in embedded C? Write an embedded C program to multiply two unsigned integer numbers.	06
	b	Explain the concept of data types in embedded C programming. Write a program in embedded C for Arduino to perform any one arithmetic and logical operations on any two variables of int type.	06
	c	Write a program in embedded C for 8051 to find the sum of the first n natural numbers using a while loop. Also, explain the working of a while loop and its syntax in embedded C.	04

5	a	What are the three basic operations in analog-to-digital data conversion? Explain each operation briefly with the help of a diagram.	06
	b	What is the purpose of SPI communication protocol, and how is it used in embedded systems? What are the advantages and disadvantages of using SPI over other protocols?	06
	c	What are port pins and GPIOs in an Arduino board? How are they used in embedded systems design?	04

OR

6	a	How does the I2C communication protocol work in embedded systems, and what are its key features?	06
	b	How to you program the port pins and GPIOs in an Arduino board using the Arduino board using the Arduino IDE? Can you provide an example code?	06
	c	Write schematic diagram of interfacing Arduino to control led using push button. Write a programs to power on the LED when the button is pressed, and power off the LED when the button is not pressed.	04

7	a	With neat diagram, explain the working of $R - 2R$ DAC.	08
	b	A two-bit flash ADC is shown in fig 7b. The input voltage varies form $0 < V_{in} < 5Volts$. Find the digital Output for a given input voltage $V_{in} = 3V$. Mention the outputs of each stages in the circuit.	

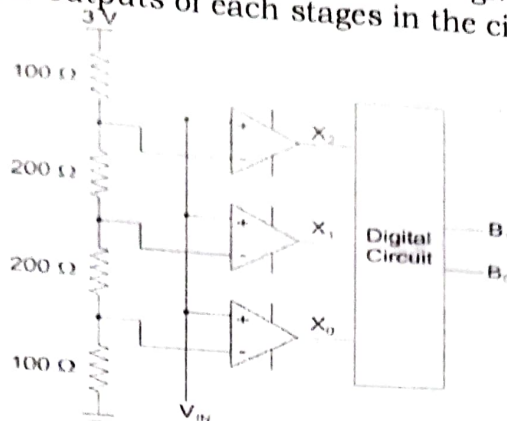
Fig 7b

OR

8	a	With neat diagram, explain the working of Successive Approximation ADC Type.	08
	b	How do you measure and display the room temperature using an LM35 temperature sensor and an Arduino Uno R3 board? Provide and interfacing diagram.	08

9	a	Generate a PWM signal with a 75% duty cycle on pin number 3 using an Arduino board? Also, explain the principle of DC motor speed control using PWM technique.	08
	b	Why are motor drivers necessary for interfacing motors with an Arduino board, and how does an H-Bridge motor driver circuit work?	08

OR

10	a	Explain the working principles of DC and stepper motors using a neat diagram?	08
	b	Write a program to rotate the DC motor in clock wise direction with $100rpm$ and anti-clockwise with $200rpm$ using Arduino and $L298H$ bridge IC. IN1 pin of the $L298IC$ is connected to pin 8 of the Arduino while IN2 is connected to pin 9. These two digital pins of Arduino control the direction of the motor. The EN A pin of $L298IC$ is connected to the PWM pin 2 of Arduino. This will control the speed of the motor. The table 10b shows which direction the motor will turn based on the digital values of IN1 and IN2.	08

Tab 10b

IN1	IN2	MOTOR
0	0	BRAKE
1	0	FORWARD
0	1	BACKWARD
1	1	BRAKE