RV Educational Institutions
RV College of Engineering

Autonomous Institution Affiliated to Visvesvaraya Technological University. Belagavi | Approved by AICTE. New Delhi

Academic year 2022-2023 (Even Semester)

DEPARTMENT OF
ELECTRONICS & COMMUNICATION ENGINEERING

Date	12-7-2023	Maximum Marks	50
Course Code	22EM211	Duration	90 Min
Semester	II	CIE-1	
Introduction to Embedded Systems			

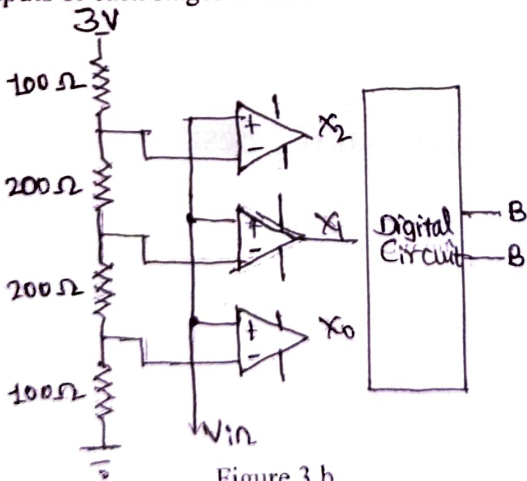| No	Questions	M	BT	CO
1	Describe the structure and functioning of embedded systems, providing a detailed explanation of how they work. Include a block diagram illustrating the components and their interactions within an embedded system. Additionally, provide examples of typical embedded systems and discuss their significance in various applications.	10	2	1
2	Compare and contrast microprocessors and microcontrollers, with a focus on their key differences. Additionally, discuss the role of microcontrollers in Arduino boards, highlighting their key features and provide examples of microcontrollers commonly used in Arduino boards.	10	2	1
3	Explain the functions and significance of memory, interrupts, power supply, clocks, and reset in the context of embedded systems?	10	1	1
4	Analyze the impact of choosing appropriate data types, utilizing functions effectively, and leveraging libraries in embedded system programming, considering factors such as memory utilization, code efficiency, and development productivity. Provide one example code for each concept and explain their significance.	10	3	2
5	Provide code examples and explanations to illustrate the concepts of arithmetic and logical operations in Arduino programming, highlighting their significance and demonstrating their implementation in practical scenarios?	10	3	2

	Particulars		CO1	CO2	CO3	CO4	L1	L2	L3	L4	L5	L6
Marks Distribution	Test	Max Marks	30	20	--	--	--	20	30	--	--	--

RV Educational Institutions ®
RV College of Engineering ®
Autonomous
Institution Affiliated
to Visvesvaraya
Technological
University, Belagavi

Approved by AICTE.
New Delhi

Go. change the world

IRV22AI007

Academic year 2022-2023 (Even Semester)

DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

Date	09-09 2023	Maximum Marks	50
Course Code	22EM211	Duration	90 Min
Semester	II Semester	Improvement Test	

Introduction to Embedded Systems

No	Questions	M	BT	CO
1	a. What are the three basic operations in analog-to-digital data conversion? Explain each operation briefly with the help of a diagram.	05	1	4
	b. What is the SPI communication protocol, and how is it used in embedded systems? What are the advantages and disadvantages of using SPI over other protocols?	05	1	4
2	a. How does the I2C communication protocol work in embedded systems, and what are its key features?	05	2	4
	b. With neat diagram, explain the working of 3-bit Flash ADC	05	2	3
3	a. With neat circuit diagram, explain the working of R2R ladder type DAC.	05	2	3
	b. A two-bit flash ADC is shown in figure.3.b. The input voltage varies from $0 < V_{in} < 5$ Volts. Find the digital Output for a given input voltage $V_{in} = 3.5V$. Mention the outputs of each stages in the circuit.	05	3	3

Figure.3.b

4	a. How do you 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.	05	2	3
	b. Why are motor drivers necessary for interfacing motors with an Arduino board, and how does an H-Bridge motor driver circuit work?	05	3	3
5	a. Explain the working principles of DC and stepper motors using a neat diagram?	05	3	4

RV Educational Institutions ®

RV College of Engineering ®

Autonomous
Institution Affiliated
to Visvesvaraya
Technological
University, Belagavi

Approved by AICTE,
New Delhi

Go, change the world

Academic year 2022-2023 (Even Semester)

		05	3	4

b. Write a program to rotate the DC motor in clock wise direction with 100rpm and anti-clockwise with 200rpm using Arduino and L298 H bridge IC. IN1 pin of the L298 IC 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 L298 IC is connected to the PWM pin 2 of Arduino. This will control the speed of the motor. The table 10.b shows which direction the motor will turn based on the digital values of IN1 and IN2.

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

Marks Distribution		Particulars		CO1	CO2	CO3	CO4	L1	L2	L3	L4	L5	L
	Test	Max Marks		--	--	25	25	10	20	20	--	--	

USN | 1 | R | V | 2 | 2 | A | I | 0 | 0 | 7 |

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 $0 < V_{in} < 5 Volts$. Find the digital Output for a given input voltage $V_{in} = 3V$. Mention the outputs of each stages in the circuit.	

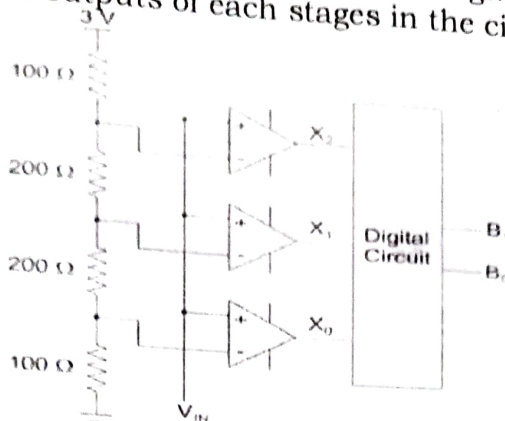Fig 7b

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 L298 H bridge IC.	

IN1 pin of the L298 IC 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 L298 IC 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.

Tab 10b

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