

**P.E.S. College of Engineering, Mandya - 571 401***(An Autonomous Institution affiliated to VTU, Belagavi)***Fourth Semester, B.E. - Computer Science and Engineering****Semester End Examination; Sep. / Oct. - 2023****AVR Microcontroller**

Time: 3 hrs

Max. Marks: 100

Course Outcomes*The Students will be able to:**CO1: Explain the basic architecture and AVR instructions.**CO2: Apply AVR assembly instructions to process the data stored in memory/register/io.**CO3: Apply AVR C instructions to process the data.**CO4: Analyze the given assembly program to identify bugs and write correct code and output.**CO5: Implement and demonstrate the concept identified in the co-course.***Note: I) PART - A is compulsory. Two marks for each question.****II) PART - B: Answer any Two sub questions (from a, b, c) for a Maximum of 18 marks from each unit.**

Q. No.	Questions	Marks	BLs	COs	POs
I : PART - A		10			
1 a.	List the advantage of using the EQU directive to define a constant value.	2	L2	CO1	PO1
b.	Explain BRNE in AVR.	2	L2	CO2	PO1,2,3
c.	Differentiate between CALL and RCALL instruction.	2	L2	CO2	PO1,2,3
d.	Show the binary and hex for 76 and its BCD version.	2	L3	CO2	PO1,2,3
e.	Find the content of PORTB after the execution of the following C code in each case;	2	L3	CO2	PO1,2,3
	PORTB = 0x37&0xCA				
	PORTB = 0x37&0xCA				
II : PART - B		90			
UNIT - I		18			
2 a.	Compare and contrast the microprocessor system with the microcontroller system.	9	L2	CO1	PO1
b.	Explain the AVR data memory with neat diagram	9	L2	CO1	PO1
c.	i) Show the code to perform the following				
	* ADD 0x05 to 0x20 and store the result in location 0x120, and				
	*ADD the contents of PIND to P ₁ NB and store the result in PORTC				
	ii) Find the C, Z, and H flag bits for the following code:	9	L3	CO2	PO1,2,3
	LDI R20, 0x9F				
	LDI R21, 0x61				
	ADD R20, R21				

UNIT - II		18
3 a. With code snippets, illustrate the working of the following JUMP instructions:	9	L3 CO2 PO1,2,3
i) BRLT ii) BRVS iii) BRSH		
b. I) Write a program to subtract 18H from 29H and store the result in R21,		
i) Without using SUBI instruction	9	L3 CO2 PO1,2,3
ii) Using the SUBI instruction		
II) Write a program to subtract 18H from 2917H and store the result in R25 and R24.		
c. Write function to find factorial of a number and use this function to evaluate the equation $2! + 5!$	9	L2 CO2 PO1,2,3
UNIT - III		18
4 a. Write a ALP to convert the packed BCD to two ASCII numbers and place them in R21 and R22 assume that R20 has packed BCD.	9	L3 CO2 PO1,2,3
b. Write a program to multiply n bytes of data stored starting from \$300 and \$400 respectively (Use in direct addressing mode).	9	L4 CO4 PO1,2,3
c. Define macros. Explain how the macros are used in AVR microcontroller with code snippet.	9	L2 CO2 PO1,2,3
UNIT - IV		18
5 a. Write a program to toggle all bits of PORT B by sending to it the value \$55 and \$AA continuously put a time delay between each issuing a data to PORT B.	9	L3 CO2 PO1,2,3
b. Explain the role of DDRX, PORTX and PINX in I/O operations.	9	L2 CO1 PO1
c. Explain the following instructions with example:	9	L2,3 CO2 PO1,2,3
i) SBI ii) CBI iii) SBIC iv) SBIS		
UNIT - V		18
6 a. Write an AVR C program to send hex values for ASCII characters of 0,1, 2, 3, 4, 5, A, B, C, and D to PORT B.	9	L3 CO3 PO1,2,3
b. Explain three ways to create a time delay in AVR C programming with example.	9	L2,3 CO3 PO1,2,3
c. Write an AVR C program to monitor the door sensor and, when it opens, turn on the LED A door sensor is connected to bit 1 of PORTB, and LED is connected to bit 7 of PORTC.	9	L3 CO3 PO1,2,3