



SARVAJANIK UNIVERSITY
Sarvajani College of Engineering and Technology
Bachelor of Technology



B. Tech. Semester IV

Subject Name: Microprocessor and Microcontroller

Subject Code: BTEC13402

Type of course: PCC

Prerequisite: Zeal to learn the subject.

Rationale: Microcontrollers play an essential role in design of embedded systems. The current era is migrating towards automation rapidly and hence the knowledge of microcontroller is needed for a UG student of Electronics and Communication Engineering. The subject has zeal to learn the architecture and programming of typical microcontroller. Students will be taught the basic use of an assembly as well as embedded C programming environment to control peripheral devices. UG Students will also understand the interfacing of various peripheral elements with microcontroller to design an automated system. The course will cover introduction to basic 8085 microprocessor as well as AVR, 8-bit Microcontroller in detail with sufficient exposure to design an embedded system

Teaching and Examination Scheme:

Teaching Scheme				Theory Marks			Practical Marks		Total
L	T	P	C	TEE	CA1	CA2	TEP	CA3	
3	0	2	4	60	25	15	30	20	150

CA1: Continuous Assessment (assignments/projects/open book tests/closed book tests) **CA2:** Sincerity in attending classes/class tests/ timely submissions of assignments/self-learning attitude/solving advanced problems **TEE:** Term End Examination **TEP:** Term End Practical Exam (Performance and viva on practical skills learned in course) **CA3:** Regular submission of Lab work/Quality of work submitted/Active participation in lab sessions/viva on practical skills learned in course

Content:

Sr. No.	Topics	Teaching Hrs.	Module Weightage
1.	Introduction advance Microprocessor: Intel 8086 Microprocessor architecture, Addressing Modes, 8086 pin configuration & function of each pin. Introduction and advance features of 8088, 80186, 80286, 80386 and 80486 microprocessor	7	15
2.	Architecture and instruction set of 8-bit AVR Microcontroller: AVR Microcontroller architecture: Registers, AVR status register, Memory Space, ATmega32 pin-configuration & function of each pin, Addressing mode and instruction set of AVR microcontroller, Data transfer, Arithmetic, Logic and Compare, Rotate and Shift, Branch and Call instructions, Bit manipulation instructions	8	15



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3.	AVR Assembly and C Programming: AVR data types and assembler directives, AVR assembly language programs, AVR I/O Port Programming, Time delay loop, BCD, ASCII conversion Program, Look-up table, Bit addressability, MACROS, Pros and cons of C and assembly language programming, Data types, Intel Hex file format, Simple C programs for general purpose I/O and bit addressability.	8	25
4.	AVR on-chip peripherals and its programming: General purpose I/O Ports, Timers, Interrupts, serial port, Serial port Interfacing protocols, SPI, I2C, UART. Assembly and C Language programming for peripherals.	10	25
5.	Device interfacing and its programming: LCD and GLCD interfacing, Keyboard Interfacing, TFT interfacing, ADC, DAC and sensor interfacing, Relay, Opto-isolator and Stepper Motor Interfacing, Industrial servo interfacing, Input capture and Wave Generator, PWM programming and DC motor control, SPI protocol and Display interfacing, I2C Protocol and RTC interfacing. Assembly and C Programming	12	20

Suggested Specification Table of Marks (Theory/Practical):

% Distribution of Marks					
R Level	U Level	A Level	N Level	E Level	C Level
25	25	30	10	10	0

Legends: **R:** Remembrance, **U:** Understanding; **A:** Application, **N:** Analyze, **E:** Evaluate **C:** Create and above Levels.

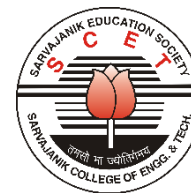
Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

Sr. No.	Title of book /article	Author(s)	Publisher and details like ISBN	Year of publication	Publication Edition
1.	The AVR Microcontroller and Embedded Systems” Using Assembly and C	Muhammad Ali Mazidi, Sarmad Naimi and Sepehr Naimi	Pearson	2013	1



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2.	Microprocessor and interfacing programs and hardware	Andrew Rood Douglas V. Hall	McGraw-Hill	1991	2
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Course Outcome:

Sr. No.	CO Statement After learning this subject students will be able to,	Marks % weightage
CO-1	Explain the architecture of the AVR 8-bit Microcontroller and describe the importance and function of each pin of the AVR ATmega32 Microcontroller.	20
CO-2	Write, debug and simulate assembly as well as embedded C language programs.	25
CO-3	Explain Timer operation, Interrupt environment, and Serial Communication.	20
CO-4	Interface I/O peripheral devices with microcontroller.	25
CO-5	Explain advanced microprocessor on x86 architecture.	10

Mapping with POs:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO-1	3	2	3	3	1	2	3	1	2	2	3	1	3	2	1
CO-2	3	3	3	3	2	3	3	2	3	3	2	2	2	3	1
CO-3	3	2	3	3	1	2	3	1	2	2	3	1	3	3	2
CO-4	3	3	3	2	1	1	3	2	1	3	2	1	1	3	2
CO-5	3	2	3	3	1	2	3	1	2	2	3	1	3	1	1

List of Open learning website:

- <http://nptel.ac.in/syllabus/117103063/>
- <https://swayam.gov.in/course/3595-basic-electronics>
- <https://nptel.ac.in/noc/courses/noc21/SEM1/noc21-ee55/>

List of Open Source Software:

- LTSpice, TinkerCade



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Practical list:

1. Write and simulate program in AVR Studio to perform following task.
 - 1).Transfer data from one register to another.
 - 2).Store two numbers in registers and perform addition operation.
 - 3).Store two numbers in registers and perform subtraction operation.
 - 4).Store two numbers in registers and perform multiplication operation.
 - 5).Store two numbers in registers and perform logical operation like AND, XOR, OR
2. A)Ten 8 bit values are stored at data memory starting from 0x0060H onwards. Write an AVR assembly program to add these ten values and store the result at 0x006AH.
 B)Write a program to count number of positive, negative and zero's from given 10 data stored at any location in Atmega32.
3. A) Write an AVR assembly level program to compute the following for ten 8-bit numbers. Store the result in memory.
 1. Find average of numbers.
 2. Find Maximum of number
 3. Find Smallest number
 B)Write an assembly language program to separate even numbers from the given list of 20 numbers and store them in the another list starting from 0090H. Assume starting address of 20 number list is 0060H.
4. A) A string in lower case is stored at location 0060H onwards. The end of string is given by 0x00. Write a program to convert string into upper case and store at location 0090H onwards.
 Note: Use input string as follow:
 your name middle name surname
 B)The following string is stored at memory location starting from 0060H "THE QUICK BROWN FOX JUMPS OVER LAZY DOG." The String is stored in the ASCII format and is terminated with 00H. Write a program to count number of words and spaces in the given string. Store the count of words and space at location 0090H and 0091H.
5. A) Write an assembly program to blink LED's connected on PORTD 0 to PORTD 7 and reset them in reverse manner. Simulate program in Proteus and implement it on kit
 B)Write a program to perform the following.
 Keep monitoring bit 2 of PORTA until it becomes high.
 1. When it becomes high write value 45H on PORTD.
 2. Sent a high to low pulse to PA3
6. A)8 switches are connected on PORTA. Generate square wave of 50% duty cycle on PC0 if switches read a value 0xAA else generate square wave of 75% duty cycle. Use a delay routine.
 B)8 switches are connected on PORTA. If the switch reads an even value, generate a square wave of 5KHz frequency else of 10KHz frequency. Use a timer delay.
7. A)A switch is connected on PA0. WAP to read status of the switch and if switch reads a value '0' implement MOD 10 up counter on PORTB else implement 4 bit down counter on PORTB.
 B)Two switches are connected on PB0 and PB1. Write a program to do the following

PB1	PB0	Result on PC0 to PC3
0	0	4 bit up counter



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0	1	Activate buzzer for 100 ms
1	0	
1	1	4 bit down counter

8. A) Write a program to display SCET and EC on 7 segment LED.(anode configuration).If the switch =1 then display SCET and if switch=0 display EC.
B) 8 switches are connected on PortA in active pull up configuration as well as 7 segment common anode LED is connected on Port B. Write a program to identified the key pressed and display the key number on 7 segment LED.
9. A) Write a program to display “Microcontroller” on LCD connected to AVR Microcontroller. Simulate program in Proteus and demonstrate on kit.
B) Write a program to
1. Monitor status of switch. If it reads a ‘0’ value display “microcontroller” on LCD else display “Electronics” on LCD
 2. Display “microcontroller and Interfacing” on LCD. Use both the rows of LCD. Simulate program in Proteus and demonstrate on development kit.
10. Write an assembly and C program to send “Microcontroller” from Atmega32 to PC using Serial Communication.
Simulate program in Proteus and demonstrate on development kit.
11. Write a C language program to monitor PB0 continuously an soon as it goes high activate the buzzer connected on PB1 and send a high to low pulse on PB2
Simulate program in Proteus and demonstrate on development kit.
12. Write a C program to display “Microcontroller” on LCD connected to AVR Microcontroller.
Simulate program in Proteus and demonstrate on development kit.
14. Study the implementation of Wireless Communication using Zigbee Devices using Proteus simulation and hardware setup.
15. With the help of Proteus simulation and hardware configuration, study the implementation of interfacing GSM modem. Demonstrate the AT commands for GSM modem configuration on Hyper Terminal.
16. Study the operation of relays and interfacing with microcontroller device for home automation.
17. Mini-Project