FACULTY OF ENGINEERING & TECHNOLOGY

Effective from Academic Batch: 2022-23

Programme: **BACHELOR OF TECHNOLOGY (Electronics and Communication)**

Semester: **IV**

Course Code: **202060403**

Course Title: **Microprocessors and Microcontrollers**

Course Group: Professional Core Course

Course Objectives: The course will cover Microprocessor and AVR, 8-bit Microcontroller in detail with sufficient exposure to design an automated system. The architecture, instruction set, assembly level programming of 8085 microprocessor and AVR Microcontroller along with their interfacing with various peripherals will be covered.

Teaching & Examination Scheme:

Contact hours per week			Course Credits	Examination Marks (Maximum / Passing)				
				Theory		J/V/P*		Total
Lecture	Tutorial	Practical		Internal	External	Internal	External	
3	0	2	4	50/18	50/17	25/9	25/9	150/53

* **J**: Jury; **V**: Viva; **P**: Practical

Detailed Syllabus:

Sr.	Contents	Hours
1	**Fundamentals of Microprocessors:** History of microprocessor and microcontrollers, Difference between microprocessors and microcontrollers and Applications of microcontrollers, Architectural of 8-bit 8085 microprocessor, Pin details and functional operation of 8085	4
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
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.	12

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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**
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.	**11**
		45

List of Practicals / Tutorials:

1	Familiarization with 8085 simulator and trainer kit.
2	Write an 8085-assembly language program: A. To add two 8-bit numbers stored in memory locations 2050H and 2051H. Store result in location 2052H onwards (with/without carry). B. To subtract two 8-bit numbers stored in memory locations 2000H and 2001H. Store result in location 2002H onwards (with/without carry). C. To add an array of ten 8-bit numbers from the memory location 2000H.
3	A. Write an 8085-assembly language program to find the minimum from two 8-bit numbers. B. Write an 8085-assembly language program to get the minimum from block of N 8-bit numbers from memory locations 2100H. Store result in location 2200H. C. To separate out the numbers between 20H and 30H.
4	Familiarization with AVR simulator and trainer kit.
5	1] Write and assemble a program to add the following data and then use the simulator to examine the C, H and Z flags after the execution of each addition. [$92, $23, $66, $87, $F5] 2] Write and assemble the following program. Use the simulator to single-step and examine the flags and register content after the execution of each instruction.
6	1] Write and assemble the following program to add two array and store the result in another array. 2] Write and assemble the following program to add two arrays with carry.
7	1] Write and assemble the following program to toggle all bits of Port A. 2] Write and assemble the following program such that when PB3 becomes high write the value $45 to PORTC and also send high to low pulse to PD3. 3] Write and assemble the following program such that a switch is connected to pin PB2, check the status of switch and perform the following: If switch is zero send letter 'N' to PORTD. If switch is one send letter 'Y' to PORTD.
8	1] Write a program to transfer the value 41H serially one bit at a time via pin PB1. Put one high at the start and end of the data. Send the LSB first. 2] Write a program to find the number of 1's in a given byte. 3] Assume that R20 had packed BCD. Write a program to convert the packed BCD to two ASCII number and place them in R21 and R22.

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9	1] Assuming that program ROM space stating at $ 500 contains "WORLD PEACE". Write a program to send all the character to PORT B one byte at a time 2] Assume that lower three bits of PORTC are connected to three switches. Write a program to send the following ASCII character to Port D based on the status of the switches (000>0,001->1,010->2…….111->7). 3] Write a program to count how many times a system has been powered up.
10	1] A door sensor is connected to the port B pin 1, and an LED is connected to port C pin 7. Write an AVR C program to monitor the door sensor and, when it opens, turn on the LED. 2] A data pins of an LCD are connected to PORT B. The information is latched into the LCD whenever the Enable pin goes from HIGH to LOW. The enable pin is connected to pin5 of PROTC. Write a C program to send "ATMEGA 32" to LCD.
11	Interfacing of 16x2 LCD with Arduino board and display message on it
12	Interface 4x4 matrix keyboard with AVR microcontroller. Display value of pressed switch on LCD.
13	Open design problem based mini project based on AVR TINY MICROCONTROLLER

Reference Books:

1	**Microprocessor Architecture: Programming and Applications with the 8085**, R. S. Gaonkar, Penram International Publishing.
2	**The AVR Microcontroller and Embedded Systems: Using Assembly and C**, Muhammad Ali Mazidi, Sarmad Naimi and Sepehr Naimi, Pearson Education.
3	**Programming and Customizing the AVR Microcontroller**, Dhananjay Gadre, TMH Publication.

Supplementary learning Material:	
1	Open source AVR simulator
2	AVR ATmega32 data sheet
3	NPTEL Videos
4	www.vlab.co.in

Pedagogy:

- Direct classroom teaching
- Audio Visual presentations/demonstrations
- Assignments/Quiz
- Continuous assessment
- Interactive methods
- Seminar/Poster Presentation
- Industrial/ Field visits
- Course Projects

Internal Evaluation:

The internal evaluation comprised of written exam (40% weightage) along with combination of various components such as Certification courses, Assignments, Mini Project, Simulation, Model making, Case study, Group activity, Seminar, Poster Presentation, Unit test, Quiz, Class Participation, Attendance, Achievements etc. where individual component weightage should not exceed 20%.

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Suggested Specification table with Marks (Theory) (Revised Bloom's Taxonomy):

Distribution of Theory Marks in %						**R**: Remembering; **U**: Understanding; **A**: Applying; **N**: Analyzing; **E**: Evaluating; **C**: Creating
R	**U**	**A**	**N**	**E**	**C**	
20	20	25	15	10	10	

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.

Course Outcomes (CO):

Sr.	Course Outcome Statements	%weightage
CO-1	Explain the architecture of 8085 microprocessor and AVR 8-bit Microcontroller	**15**
CO-2	Differentiate microprocessor and microcontroller and describe the importance and function of each pin of AVR ATmega32 Microcontroller	**15**
CO-3	Learn and analyze assembly language programs for AVR Microcontroller	**25**
CO-4	Develop embedded C language programs for AVR Microcontroller	**25**
CO-5	Interface I/O peripheral devices with AVR microcontroller to develop embedded system	**20**

Curriculum Revision:	
Version:	**2.0**
Drafted on (Month-Year):	June -2022
Last Reviewed on (Month-Year):	-
Next Review on (Month-Year):	June-2025

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