Gyanmanjari Innovative University

Course Syllabus
Gyanmanjari Institute of Technology
Semester-6

Subject: Microprocessor and Microcontroller - BETEE16323

Type of course: Professional Core

Prerequisite: Digital Electronics, Digital Circuits and Basic Electronics.

Rationale:

This course builds a strong foundation for developing optimized computing solutions. Microprocessors manage complex, general-purpose tasks, while microcontrollers excel in real-time embedded control. Their continual evolution drives innovation across AI, IoT, high-performance computing, and space exploration, shaping the future of intelligent systems.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks					Total Marks
				Theory Marks		Practical Marks		CA	
CI	T	P	C	ESE	MSE	V	P	ALA	
4	0	2	5	60	30	10	20	30	150

Legends: CI-Classroom Instructions; T – Tutorial; P - Practical; C – Credit; ESE - End Semester Examination; MSE- Mid Semester Examination; V – Viva; CA - Continuous Assessment; ALA- Active Learning Activities.

Course Content:

Unit No.	Course content	Hrs	% Weightage
1.	**Introduction to Microprocessors** Introduction to Microprocessors, Von Neumann Architecture, Architecture of 8085, Difference between Micro computer & Microprocessor Pin Configuration and Function, internal register & flag register, Generation of Control Signals: Bus Timings: Demultiplexing of address/data bus; Fetch Cycle, Execute Cycle, Instruction Cycle, Machine cycles, T-states, memory interfacing.	12	20%

2.	**Programming with 8085** Instruction for Data Transfer, Arithmetic and Logical Operations, Branching Operation, Machine Cycle Concept, Addressing Modes, Instructions Format, Stacks, Subroutine and Related Instructions, Elementary Concepts of Assemblers, Assembler Directives, Looping and Counting, Software Counters with Time Delays, Simple Programs using Instruction Set of 8085, Debugging, Programs Involving Subroutines, Programs for Code Conversion e.g. BCD to Binary, Binary to BCD, Binary to Seven-Segment LED Display.Binary to ASCII, ASCII to Binary, Program for Addition Subtraction, Programs for Multiplication and Division of Unsigned Binary Numbers.	18	30%
3.	**Introduction to Microcontroller** A brief History of Microcontrollers, Harvard Vs Von-Neumann Architecture: RISC Vs CISC, Classification of MCS-51family based on their features (8051,8052, 8031, 8751,AT89C51), Comparison of microprocessors and microcontrollers, Pin configuration & Architecture of 8051, Registers of 8051, Inbuilt RAM, Register banks, stack, on-chip and external program code memory ROM, power reset and clocking circuits, I/O port structure.	12	20%
4.	**Programming & Real Time Control with 8051** Addressing modes, Data types and Assembler directives, Instruction set and programming. Counter/Timer and Interrupts of 8051: Introduction, Registers of timer/counter, Different modes of timer/counter, Timer/counter programming, Interrupt Vs Polling, Types of interrupts and vector addresses, register used for interrupts initialization, programming of external interrupts, Timer interrupts. Interfacing with 8051: Interfacing and programming of: ADC & DAC, DC motor, stepper motor, Relays, LED and Seven segment display, LCD, 4×4 keyboard matrix.	18	30%

Continuous Assessment:

Sr. No	Active Learning Activities	Marks
1	**Reverse Engineering Code Analysis:** The faculty will provide students with a working assembly language program without comments. Students must analyze the code and explain the program's functionality by adding comments & Flow Diagram to the code. Upload final program on GMIU Web portal.(Student in a Group size of 3)	10

2	**Embedded System Design** Present a real-world problem (e.g., automated plant watering, a simple security system). Students must design and simulate a microcontroller-based solution. Upload simulation Result on GMIU web portal.(Student in a Group size of 3).	10
3	**Micro Project** Students will design hardware module based on Microcontroller Application and Upload video of working Model on GMIU Web portal.(Student in a Group size of 3)	10
Total		30

Suggested Specification table with Marks (Theory):60

Distribution of Theory Marks (Revised Bloom's Taxonomy)						
Level	Remembrance (R)	Understanding (U)	Application (A)	Analyze (N)	Evaluate (E)	Create (C)
Weightage	15%	30%	30%	15%	10%	0

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 Outcome:

After learning the course, the students should be able to:	
CO1	Understand and analyze 8085 architecture, bus structure, and memory interfacing.
CO2	Write and debug assembly programs using 8085 instruction set and addressing modes
CO3	Compare microprocessor and microcontroller architectures; explain 8051 structure.
CO4	Implement real-time control systems using 8051 with peripheral interfacing and interrupts.

List of Practical:

Sr. No	Descriptions	Unit No	Hrs
1.	Add two 8-bit numbers stored at memory locations 2500H & 2501H. Store sum and carry at 2502H & 2503H respectively.	2	2
2.	Add ten 8-bit numbers stored from memory location 2400H onwards and store the result.	2	2

3.	Transfer a block of 8-bit data from memory location 2600H to 2500H.	2	2
4.	Find the 2's complement of 16-bit data.	2	2
5.	From a given array of ten signed numbers, count zero, positive, and negative elements.	2	2
6.	Determine smallest and largest numbers from an array of data stored from, 2500H.	2	2
7.	Obtain multiplication of two 8-bit numbers using (i) repeated addition and (ii) shifting technique	2	3
8.	Swap the nibbles of registers R0 and R1 so that the low nibble of R0 swaps with the high nibble of R1 and vice versa.	4	2
9.	Separate even and odd numbers stored in internal RAM and store them in different memory blocks.	4	2
10.	Check whether an 8-bit number is prime or not and display the result using the PSW flag and bit addressable memory.	4	2
11.	Generate the Gray code equivalent of an 8-bit binary number.	4	2
12.	Sort an array of 8-bit numbers in ascending order.	4	2
13.	Multiply a 16-bit number with an 8-bit number.	4	2
14.	Write a subroutine to generate software delay of 1 ms and extend it to 1 second delay assuming crystal frequency	4	3
	Total		**30**

Instructional Method:

The course delivery method will depend upon the requirement of content and the needs of students. The teacher, in addition to conventional teaching methods by black board, may also use any tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.

From the content, 10% topics are suggested for flipped mode instruction.

Students will use supplementary resources such as online videos, NPTEL/SWAYAM videos, e-courses, Virtual Laboratory

The internal evaluation will be done on the basis of Active Learning Assignment

Practical/Viva examination will be conducted at the end of semester for evaluation of performance of students in the laboratory.

Reference Books:

[1] R. Gaonkar, Microprocessor Architecture, Programming, and Applications with the 8085, 6th ed., Penram International Publication (India) Pvt. Ltd., 2013.
[2] S. K. Mandal, Microprocessors and Microcontrollers. New Delhi, India: McGraw Hill Education Pvt. Ltd.
[3] A. M. Mazidi, G. Mazidi, and R. D. McKinlay, The 8051 Microcontroller and Embedded Systems using Assembly and C, 2nd ed., Pearson, 2006.
[4] K. L. Short, Microprocessors and Programmed Logic, 2nd ed., Pearson Education Inc., 2003.
[5] S. Shah, 8051 Microcontrollers MCS 51 Family and its Variants, Oxford, 2010.