

Wks Mapped with the course

WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9
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Mark Distribution:

Total Marks	CIE Marks	ESE Marks	ESE Duration
100	60	40	2.5 hrs

Continuous Internal Evaluation Pattern:

Attendance : 5 marks

Continuous Assessment Test : 25 marks

Course Project : 30 marks

Assessment and Evaluation for Project Activity

Sl. No	Evaluation for	Allotted Marks
1	Project Planning and Proposal	5
2	Contribution in Progress Presentations and Question Answer Sessions	4
3	Involvement in the project work and Team Work	3
4	Execution and Implementation	10
5	Final Presentations	5
6	Project Quality, Innovation and Creativity	3
	Total	30

Project Assessment and Evaluation criteria (30 Marks)

- Project Planning and Proposal (5 Marks)
 - Clarity and feasibility of the project plan
 - Research and background understanding
 - Defined objectives and methodology
- Contribution in Progress Presentation and Question Answer Sessions (4 Marks)
 - Individual contribution to the presentation
 - Effectiveness in answering questions and handling feedback
- Involvement in the Project Work and Team Work (3 Marks)
 - Active participation and individual contribution

- Teamwork and collaboration
4. Execution and Implementation (10 Marks)
- Adherence to the project timeline and milestones
 - Application of theoretical knowledge and problem-solving
 - Final Result
5. Final Presentation (5 Marks)
- Quality and clarity of the overall presentation
 - Individual contribution to the presentation
 - Effectiveness in answering questions
6. Project Quality, Innovation, and Creativity (3 Marks)
- Overall quality and technical excellence of the project
 - Innovation and originality in the project
 - Creativity in solutions and approaches

SYLLABUS

Module 1 (14 Hrs)

Microcontrollers and Embedded Processors: General internal architecture of 8051, Pin configuration, Features, Block diagram Address bus, Data bus, Control bus, PSW, Accumulator, Program Counter. Memory organization: RAM & ROM, Register banks, Stack. Special Function Registers (SFRs), I/O port organization, Interrupt overview.

Module 2 (14 Hrs)

Instruction Set & Addressing Modes: Classification of instruction set – Data transfer, Arithmetic, Logical, Branching. Addressing modes – Immediate, Register, Direct, Indirect, Indexed. Accessing internal and external memory.

Module 3 (14 Hrs)

Programming and Interfacing of 8051: Simple programming examples in assembly language. Interfacing with 8051 using Assembly language programming: Seven segment display, Stepper Motor. Data types, Directives, Subroutines, Software delay programming. Embedded C programming: Advantages, Simple programs.

Module 4 (14 Hrs)

Timers, Counters & Serial Communication: Timer registers (Timer0, Timer1) – configuration, modes, programming. Counter operation. Serial communication: modes, RS-232 pin configuration, transmitting & receiving. Introduction to ARM – ARM family, ARM 7 register architecture. ARM programmer's model.

Text Books

1. Mazidi, M. A., Mazidi, J. G., & McKinlay, R. D. (2013). *The 8051 microcontroller and embedded systems: Using assembly and C* (3rd ed.). Pearson Education.
2. Furber, S. (2000). *ARM system-on-chip architecture*. Pearson Education.
3. Ayala, K. J., & Gadre, D. V. (2019). *The 8051 microcontrollers: Architecture, programming and applications* (3rd ed.). Cengage Learning.

Reference Books

1. Gaonkar, R. S. (2002). *8085 microprocessors: Architecture, programming and applications* (5th ed.). Penram International.
2. Uma Rao, K., & Pallavi, A. (2011). *The 8051 microcontrollers: Architecture, programming and applications*. Pearson Education.
3. Intel Corporation. (1992). *8051 hardware description: Datasheet*. Intel Corp.
4. Das, L. B. (2011). *Microprocessors and microcontrollers*. Pearson Education.

END SEMESTER EXAMINATION – MODEL QUESTION PAPER

Course Code	25UECT403
Course Name	MICROCONTROLLER BASED SYSTEM DESIGN
Max. Marks: 40	Duration: 2.5 Hours

Part A (Answer all questions. Each question carries 2 marks)				
Qn No.	Question	Marks	CO	BL
1	Explain the difference between address bus and data bus.	2	1	L2
2	Show the status of carry flag, auxiliary carry flag and parity flag after the following instructions. Draw the program status word (PSW) and mark the bits. MOV A, #46H ADD A, #91H	2	1	L2
3	A microcontroller-based embedded system is designed to process sensor data using 8051 instructions. During execution, the program uses instructions such as ANL A,@R1 for bitwise data manipulation and MOVX A,@R0 for external memory access. Apply the function of these instructions and explain their operation in the given context.	2	2	L4
4	A microcontroller-based system executes nested subroutines during real-time processing where stack memory is used to temporarily store and retrieve register contents during program execution; illustrate the difference between PUSH and POP operations with respect to stack memory management in a microcontroller.	2	2	L3
5	Explain any three data types of variables in 8051 embedded C programming.	2	3	L2
6	A microcontroller-based embedded system processes high-	2	3	L3

	precision sensor data where two 32-bit values are stored in memory and need to be added for real-time computation; illustrate how an assembly language program can be written to add two 32-bit numbers.			
7	A microcontroller-based industrial monitoring system uses an 8051 microcontroller to communicate with a computer terminal for data logging, but requires proper serial interfacing using the RS-232 standard for reliable data exchange over long distances; analyze the pin configuration of the RS-232 standard and explain how it is interfaced with the 8051 microcontroller to establish serial communication.	2	4	L4
8	An 8051-based embedded control system handles multiple asynchronous events such as timer overflow, serial communication, and external hardware signals, requiring efficient interrupt handling through the interrupt vector table; apply the concept of 8051 interrupts to identify the different interrupts along with their corresponding vector addresses in the interrupt vector table.	2	4	L3
Part B (Answer any one full question from each Module. Each carry 6 marks)				
Qn No.	Question	Marks	CO	BL
Module I				
9	Explain using a block diagram, the architecture of 8051 microcontroller chip.	6	1	L2
OR				
10	Explain the interrupts available in the 8051 microcontroller.	6	1	L2
Module II				
11	A microcontroller-based data acquisition system using 8051 transfers sensor values between registers, internal memory, and external memory during program execution, requiring different addressing modes for efficient data movement. Analyze the data transfer instructions of the 8051 microcontroller with suitable examples and specify the addressing modes used in each case.	6	2	L4
OR				
12	An 8051-based embedded system is designed for real-time control applications where data is frequently moved between registers, memory locations, and immediate values, requiring different addressing techniques for efficient execution. Analyze the addressing modes used in the 8051 instruction set architecture with two suitable MOV instruction examples for each mode.	6	2	L4
Module III				

13	A microcontroller-based LED control system uses the 8051 to generate a periodic blinking pattern for indication purposes, where Port 1 outputs must be toggled at fixed time intervals using software delay. Illustrate an 8051 C program to toggle the bits of Port 1 continuously with a 250 ms delay and comment each line of the program.	6	3	L3
OR				
14	A microcontroller-based embedded arithmetic unit processes two 8-bit input values for mathematical computation in a digital system, where the highest common factor (HCF) is required for further processing. Illustrate an assembly language program to determine the HCF of two 8-bit numbers.	6	3	L3
Module IV				
15. a	A microcontroller-based embedded system is designed to measure and control time-dependent events such as pulse generation and delay routines using 8051 timers, where correct register configuration is essential for accurate timing. Illustrate and explain the format of 8051 Timer registers.	3	4	L3
15. b	A microcontroller-based communication system uses an 8051 to transmit character data to a remote terminal for real-time monitoring, where reliable serial data transfer at a defined baud rate is essential for correct operation. Analyze the steps required for serial data transfer in 8051 and develop an assembly language program to continuously transmit the string 'EXAM' at a baud rate of 4800 through the serial port.	3	4	L4
OR				
16. a	A microcontroller-based embedded control system is designed to generate precise timing signals for digital devices, where a stable square wave of specific frequency is required for proper system operation. Illustrate an 8051 assembly language program to generate a continuous 1 kHz square wave using Timer 1 in Mode 2, assuming a 1 microsecond machine cycle.	3	4	L3
16. b	A microcontroller-based industrial monitoring system uses an 8051 to communicate sensor data to a central computer for real-time analysis, where proper serial communication setup is critical for reliable data exchange. Analyze the step-by-step procedure to implement serial data transfer in the 8051 microcontroller and illustrate how the required registers are configured and data transmission is initiated.	3	4	L4

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