



**Ahmedabad  
University**

Course	ECE302 Embedded Systems Design	Semester	Monsoon Semester 2024	
Faculty Name(s)	Anurag Lakhani	Contact	anurag.lakhani@ahduni.edu.in	
School	SEAS	Credits	3	
GER Category:	Not Applicable	Teaching Pedagogy Enable:YES	P/NP Course: Can not be taken as P/NP	
Schedule	Section 1	02:30 pm to 04:00 pm	Mon	01-08-24 to 26-11-24
		04:00 pm to 05:00 pm	Mon	01-08-24 to 26-11-24
		05:00 pm to 06:00 pm	Mon	01-08-24 to 26-11-24
	Section 2	02:30 pm to 04:00 pm	Mon	01-08-24 to 26-11-24
		04:00 pm to 05:00 pm	Mon	01-08-24 to 26-11-24
		05:00 pm to 06:00 pm	Mon	01-08-24 to 26-11-24
	Section 3	02:30 pm to 04:00 pm	Mon	01-08-24 to 26-11-24
		04:00 pm to 05:30 pm	Mon	01-08-24 to 26-11-24
		05:30 pm to 07:00 pm	Mon	01-08-24 to 26-11-24

Prerequisite	CSE2XX Computer Organization and Architecture/CSE206 Computer Organization and Architecture & ECE209 Digital Design OR Students interested in studying this course should have studied (1) Computer Organization and Architecture (2) Digital Design
Antirequisite	Not Applicable
Corequisite	Not Applicable
Course Description	This course explores the design of embedded systems using AVR microcontrollers, widely used peripheral devices and C programming. The internal architecture and features (e.g., timers, interrupts and serial communication) of ATmega32 microcontroller will be discussed in detail. The interfacing of ATmega32 with widely used peripherals (e.g., LCD displays, keyboards, DC motors, etc.) using C programming will be performed.
Course Objectives	<ul style="list-style-type: none"> <li>* To introduce students to the fundamentals of AVR microcontrollers</li> <li>* To enable students to understand features of ATmega32 and C programming</li> <li>* To study microcontroller interfacing with major peripherals</li> <li>* To perform experiments based on ATmega32 microcontroller and peripherals</li> </ul>
Learning Outcomes	<p>After studying this course, students will be able to :</p> <ul style="list-style-type: none"> <li>* Understand fundamentals of microcontroller architecture and features</li> <li>* Write C programs for the above microcontroller</li> <li>* Interface major peripherals with the ATmega32/ATmega16 microcontrollers</li> </ul>
Pedagogy	ENABLE
Expectation From Students	.

Assessment/Evaluation	<ul style="list-style-type: none"><li>• Mid-Semester Examination:<ul style="list-style-type: none"><li>◦ Mid Semester Exam - 30%</li></ul></li><li>• End Semester Examination:<ul style="list-style-type: none"><li>◦ End Semester Exam - 25%</li></ul></li><li>• Other Components:<ul style="list-style-type: none"><li>◦ Conducting Laboratory Experiments - 20%</li><li>◦ Project - 25%</li></ul></li></ul>
Attendance Policy	As per Ahmedabad University Policy.
Project / Assignment Details	.
Course Material	
Additional Information	.

## Session Plan

NO.	TOPIC TITLE	TOPIC & SUBTOPIC DETAILS	READINGS,CASES,ETC.	ACTIVITIES	IMPORTANT DATES
1	Lecture: Course Introduction and Introduction to Embedded Systems	Embedded Systems Vs General Computing Systems, History and development of the field of Embedded Systems. Embedded System Classifications, Major Application areas of ES .	Text Book Chapter 1 and 2	Lecture and Discussion	
2	Lab: Introduction to AVR Tools	Introduction to the hardware and software tools for AVR microcontroller programming	Lab Hand-outs	Laboratory Experiments	
3	Lecture: Microcontroller Fundamentals	Overview of Microcontrollers, Differentiation between Microprocessors and Microcontrollers, Selection Criteria for Microcontrollers,	Text Book Chapter 1 and 2	Lecture and Discussion	
4	Lab: Introduction to AVR Tools	program I/O ports of ATmega 16/32. : Microcontroller Kit and Programming Tools	Text Book, Chapter 1 and 2, Laboratory Manuals	Laboratory Experiments	
5	Lecture: AVR Microcontrollers: Architecture and Programming	Introduction to AVR Microcontrollers, AVR architecture, RISC architecture of AVR, Addressing modes, Instruction set, I/O Ports, IO Port Programming in C	Text Book Chapter 3 and 4, Text Book Chapter 8, Section 2	Lecture and Discussion	
6	Lab: Introduction to AVR Tools and Programming	Programming for input and Output for the ATmega16/32 microcontroller.	Text Book, Chapter 3, Laboratory Manuals	Laboratory Experiments	
7	Lecture: AVR Microcontrollers: Architecture and Programming	AVR Timers and Programming: Timer 0 and Timer 2 Programming in C	Text Book, Chapter 10	Lecture and Discussion	
8	Lab: Timer Programming	Timer 0 Programming	Text Book, Chapter 10, Laboratory Manuals	Laboratory Experiments	

9	Lecture: AVR Microcontrollers: Architecture and Programming	AVR Timers and Programming: Timer 1 Programming in C, Counter Programming	Text Book, Chapter 10	Lecture and Discussion	
10	Lab: Timer Programming	Timer 1 and Timer 2 Programming	Text Book, Chapter 10, Laboratory Manuals	Laboratory Experiments	
11	Lecture: AVR Microcontrollers: Architecture and Programming	AVR Interrupts and Programming in C	Text Book, Chapter 11	Lecture and Discussion	
12	Lab: Interrupt Programming	Understand and program ATmega16 Interrupts	Text Book, Chapter 11, Laboratory Manuals	Laboratory Experiments	
13	Lecture:	Mid Semester Exam			
14	Lab:	Mid Semester Submission			
15	Lecture: AVR Microcontrollers: Architecture and Programming	AVR Serial Port Programming in C	Text Book, Chapter 12	Lecture and Discussion	
16	Lab: Counter Programming	Understanding and Programming for ATmega16/32 as Counter.	Text Book, Chapter 11, Laboratory Manuals	Laboratory Experiments	
17	Lecture: Embedded System Components, Peripherals, Interfacing and Programming	7-segment LED Interfacing, ADC/DAC Interfacing	Text Book, Chapter 13	Lecture and Discussion	
18	Lab: AVR Microcontroller Programming with Peripheral devices	AVR Microcontroller Interfacing and Programming with 7-Segment LED displays	Text Book, Chapter 13, Laboratory Manuals	Laboratory Experiments	

19	Lecture: Embedded System Components, Peripherals, Interfacing and Programming	LCD Interfacing and Programming, Keyboard Interfacing	Text Book, Chapter 13	Lecture and Discussion	
20	Lab: AVR Microcontroller Programming with Peripheral devices	AVR Microcontroller Interfacing and Programming with LCD	Text Book, Chapter 13, Laboratory Manuals	Laboratory Experiments	
21	Lecture: Embedded System Components, Peripherals, Interfacing and Programming	Sensor Interfacing, Relays, opto-isolators and Interfacing	Text Book, Chapter 14 and 15	Lecture and Discussion	
22	Lab: Serial Port Communication Programming	AVR Microcontroller Interfacing and Programming for Serial Communication	Text Book, Chapter 12, Laboratory Manuals	Laboratory Experiments	
23	Lecture: Embedded System Components, Peripherals, Interfacing and Programming	DC Motor Interfacing, Stepper Motor Interfacing	Text Book, Chapter 17	Lecture and Discussion	
24	Lab: AVR Microcontroller Programming with Peripheral devices	Programming for DC Motor	Text Book, Chapter 17, Laboratory Manuals	Laboratory Experiments	
25	Lecture: Embedded System Components, Peripherals, Interfacing and Programming	Pulse Width Modulation and Programming	Text Book, Chapter 15 and 17	Lecture and Discussion	

26	Lab: AVR Microcontroller Programming with Peripheral devices	DC Motor and Pulse Width Modulation Programming	Text Book, Chapter 15 and 17, Laboratory Manuals	Laboratory Experiments	
27	Lecture: Embedded System Components, Peripherals, Interfacing and Programming	Introduction to SPI and I2C Protocols	Text Book, Chapter 18 and 19	Lecture and Discussion	
28	Lab: AVR Microcontroller Programming with Peripheral devices	Laboratory Group Submissions		Laboratory Experiments	
29	Lecture:	Quiet Reading, Reflections and Reviews for End Semester Exam			
30	Lab:	Quiet Reading, Reflections and Reviews for End Semester Exam			

