



**Course Title: Embedded Microcontroller**

**Course Code: ECE603**

**Credit Units: 6**

**Level: PG**

L	T	P/ S	SW/F W	TOTAL CREDIT UNITS
3	1	4	0	6

**Course Objectives:** This course introduces the concept of architecture and programming of ATMEL AVR family of RISC based microcontrollers that are widely used in consumer electronics, automation and industrial systems.

**Prerequisites:** Digital Electronics

	Weightage (%)
<b>Module I AVR Architecture and Assembly Language Programming</b>	25%
<ul style="list-style-type: none"><li>• CISC vsRISC,</li><li>• AVR family architecture</li><li>• General purpose Registers</li><li>• I/O memory, EEPROM, I/O ports, SRAM</li><li>• AVR Status Register</li><li>• Data Format and Directives Introduction to Assembly Programming</li><li>• Program Counter and PROM Space in AVR</li></ul>	
<b>Module II: Branch, Call, Time Delay Loop and I/O Port Programming</b>	25%
<ul style="list-style-type: none"><li>• Branch Instruction and Looping</li><li>• Call Instruction and Stack</li><li>• AVR Time Delay and Instruction Pipelining</li><li>• I/O Port Programming in AVR</li></ul> I/O Bit Manipulation Programming	
<b>Module III: Arithmetic, Logic Instructions and Programs</b>	20%
<ul style="list-style-type: none"><li>• Addressing Modes</li></ul>	

<ul style="list-style-type: none"> <li>• Arithmetic Instructions</li> <li>• Signed Number Concepts and Arithmetic Operations</li> <li>• Logic and Compare Instructions</li> <li>• Rotate and Shift Instructions and Data Serialization</li> <li>• Look up Table and Table Processing</li> <li>• BCD and ASCII Conversion</li> </ul>	
<b>Module IV: AVR Timer Programming, Serial Port Programming in C</b>	<b>15%</b>
<ul style="list-style-type: none"> <li>• Timer and Counter operation</li> <li>• Programming Timer and Counter in C</li> <li>• Basics of Serial Communication</li> <li>• AVR connection to RS232 using Line driver</li> <li>• Serial port programming for data Transmission and Receiving in C</li> </ul>	
<b>Module V: AVR Interrupt Programming and Interfacing</b>	<b>15%</b>
<ul style="list-style-type: none"> <li>• Interrupt vs Polling</li> <li>• AVR Interrupts</li> <li>• Interrupt priority in AVR</li> <li>• Programming Timer Interrupt in C</li> <li>• Programming External Hardware Interrupt in C</li> <li>• Programming Serial Interrupt in C</li> <li>• LCD Interfacing</li> <li>• Relay Interfacing</li> <li>• Stepper Motor Interfacing</li> </ul>	

### Student Learning Outcomes:

- Analyze the performance and on chip peripherals of different controllers.
- Design and develop the systems based on RISC based AVR microcontrollers and understanding of versatile ARM controllers.
- Identify the building blocks in design of more sophisticated systems like Automobile, plant Instrumentation etc.

### List of Laboratory Experiment

1. Study of AVR core processor kit.
2. Subtraction of two numbers using AVR processor.
3. Finding Square of numbers using AVR processor.
4. To make the output from port pin and light an LED in AVR Family.
5. To give single bit input from switch to port pin and read the value of output on LEDs at other port pin for AVR Family
6. To give the input from switches to one port and analyze result on LEDs on other port after some delay in both ARM and AVR.
7. To study basic light chaser using AVR ATMEGA324P.

### Open Ended Experiments:

8. To interface LDR sensor with AVR Family; Display sensor voltage value on LCD and finally to control room light based on light intensity.
9. To open a door based on switch condition using AVR ATMEGA324P and display status on LCD.

To study the timed counter using AVR ATMEGA324P

### Assessment/ Examination Scheme:

Theory L/T (%)	Lab/Practical/Studio (%)	Total
66.67%	33.33%	100%

### Theory Assessment (L&T):

Continuous Assessment/Internal Assessment					End Term Examination
Components (Drop down)	Mid-Term Exam	S/V/Q	HA	Attendance	
Weightage (%)	10%	8%	7%	5%	70%

### Lab Assessment:

Continuous Assessment/Internal Assessment					External Assessment
Components (Drop down)	Performance	Lab Record	Viva	Attendance	
Weightage (%)	10%	10%	5%	5%	70%

### Text & References:

1. Programming and Customizing the AVR Microcontroller by DhananjayGadre- McGraw-Hill, 2000.

2. The AVR Microcontroller and Embedded Systems: Using Assembly and C by M.A. Mazidi, Second Edition, Pearson Education Limited, 2011.
3. Embedded C Programming And The Atmel AVR, by Richard H. Barnett - Delmar Cengage Learning; 2 edition (June 5, 2006)
4. Embedded systems: architecture, programming and design by Raj Kamal- McGraw-Hill, 2003.