

Unit – I

Overview of Embedded Systems, Features, Requirements and Applications, Recent Trends in the Embedded System Design, Common architectures for the Embedded System Design, Embedded Software design issues. Introduction to microcontrollers, Overview of Harvard architecture and Von Neumann architecture, RISC and CISC microcontrollers

Unit – II

Introduction to AVR RISC Microcontrollers, Architecture overview, status register, general purpose register file, memories, Instruction set, Data Transfer Instructions, Arithmetic and Logic Instructions, Branch Instructions, Bit and Bit-test Instructions, MCU Control Instructions. Simple programs in Assembly Language / C Language

Unit – III

Introduction to System Clock, Reset sources, Introduction to interrupts, External interrupts, IO Ports, 8-bit and 16-bit Timers, introduction to different modes, Input Capture and Compare Match.

Unit – IV

Analog Comparator, Analog-to-Digital Converter, Serial Peripheral Interface (SPI), The Universal Synchronous and Asynchronous serial Receiver and Transmitter (USART), Two Wire Interface (TWI) / I<sup>2</sup>C bus

Essential Texts:

1. AVR Microcontroller and Embedded Systems: Using Assembly and C by Muhammad Ali Mazidi, Sarmad Naimi, Sepehr Naimi, PHI
2. Programming and Customizing the AVR Microcontroller by D V Gadre, McGraw-Hill
3. Atmel AVR Microcontroller Primer: Programming and Interfacing by Steven F. Barrett, Daniel J. Pack, Morgan & Claypool Publishers
4. An Embedded Software Primer by David E Simon, Addison Wesley
5. AVR Microcontroller Datasheet, Atmel Corporation, [www.atmel.com](http://www.atmel.com)

Practical Experiments on AVR Microcontroller

1. To calculate simple mathematical expressions such as  $N!$ ,  $2^N$ ,  $M^N$ , etc.
2. To generate first N terms of infinite series such as Fibonacci series, A.P. series, G.P. series, etc.
3. To sort data in an array.
4. To interface a simple keyboard and LED with microcontroller. To display key status on LED using various algorithms such as (i) LED should be ON till the corresponding key is

pressed. (ii) LED should be ON when the corresponding key is pressed once. Led should be switched OFF when the key is pressed next.

5. To display different patterns on LEDs using Timers.
6. To interface an LCD with microcontroller. Write an initialization subroutine and display a custom message on it.
7. To measure analog voltage using ADC and display its value on LCD.
8. To measure the frequency of an AC signal.
9. To control speed of an DC motor.
10. To control speed of a Stepper motor