



EMBEDDED Systems

➤ **MODULE- 1**

➤ **C programming with data Structure**

➤ **Introduction to “C”**

- Objectives of C
- Applications of C
- Relational and logical operators
- Bit wise operators
- The assignment statement
- Intermixing of data types
- Types conversion
- Cast Operators
- Multiple assignment
- Type definitions
- Input / Output Routines
- Formatted and unformatted I/O operations

➤ **Control Flow Statements In “C”**

- If statements
- Else-if statements
- While statements
- For loop, do, while loop
- Switch
- Break and continue
- Goto

➤ **Functions**

- Definition of function and it's user
- Format of a function
- Calling the function
- C storage classes - extern
- Automatic variables
- Register variables
- Recursive functions
- Command line arguments

➤ **Array and String**

- 1-D, 2-D array and string
- String handling library function
- Additional string functions
- Searching
- Sorting with different algorithms
- Ferror ()
- Ftell ()
- Feof ()
- Fopen, fwrite, fread,
- File handling system call – open ()
- Read (), write (), lseek(), close(),
- Database handling in



➤ **MODULE-2** (Anyone among a/b/c/d)

➤ **(a) 8051**

(Microcontrollers using Assembly and C)

➤ **Introduction to Embedded System**

- History & Need of Embedded system
- Basic components of Embedded system
- Hardware Classification of Embedded system
- Programming Language Classification of Embedded system
- Advantage & Disadvantage of Low level & High level programming language of Embedded system

➤ **Microprocessor & Microcontroller Classification**

- Difference between Microprocessor & Microcontroller
- Classification based on architecture

- Classification based on Instruction Set
- Type of Microcontroller
- Memory classification

➤ **Introduction to 8051 Microcontroller**

- Introduction of ATMEEL 8051 family
- Block diagram description of AT89C51
- Special feature of AT89C51
- Pin description of AT89C51

➤ **Registers & Memory of AT89C51**

- Description of RAM
- Description of CPU Registers
- Function of SFR

➤ **Assembly Language Programming of AT89C51**

- Addressing modes of AT89C51
- Directives of Assembly Language
- Data Transfer Instruction



- Introduction to 12C Protocol

- Jump Instruction
- Arithmetic Instruction
- Logical Instruction
- Branching instruction

➤ **Interfacing of LED AND MATRIX**

- Introduction of LED's
- Interfacing Circuit
Description of LED's
- Programming of LED's
Interfacing
- Interfacing of LED Matrix

➤ **Interrupt driven Programming**

- Introduction to Interrupt
- Types of Interrupt
- Programming of Software & Hardware Interrupt

➤ **Interfacing of ADC**

- Introduction of ADC
- Interfacing circuit of ADC
- Working & interfacing of Temperature sensor (DS1621 & LM35)

➤ **Interfacing of External Memory**

- Introduction to External Memory Interfacing

- Using 12C library to read/write External Memory

➤ **Introduction of EMBEDDED C**

- Introduction to Embedded C
- Different between C & Embedded C
- Data Type of Embedded C
- Statements & Loops of Embedded C

➤ **Interworking of Assembly & Embedded C**

- Inline Function
- Inline Assembly Routines

➤ **Programming & Interfacing using Embedded C**

- Programming of Timer & Counter
- Programming of Serial Port
- Programming of interrupt
- LCD Interfacing
- Motor Interfacing
- Key board Matrix Interfacing



➤ **(b) Advanced Embedded System PIC (PIC 18XXXX)**

➤ **Introduction to Embedded Systems**

- History & need of Embedded system
- Basic components of Embedded system
- Hardware Classification of Embedded system
- Programming language
- Classification of Embedded system

➤ **Classification of Microprocessor & Microcontroller**

- Difference between Microprocessor & Microcontroller
- Classification based on Architecture
- Classification based on Instruction Set
- Type of Microcontroller
- Memory classification

➤ **Brief Introduction to Computer Architecture**

- Classification of Von-Neumann and Hardware Architecture

➤ **Introduction to PIC18 Compiler/Simulator**

- MPLAB Compiler
- MPLAB C 18 Compiler
- Micro Pro C Compiler
- PIC18 Simulator IDE
- Proteus

➤ **Real world interfacing – LED**

- Brief introduction to P-N Junction Semiconductor Devices and LED
- Circuit Description of Interfacing LED
- LED Programming Patterns

➤ **Real world interfacing – 7 segment display**

- Theory of 7-Segment Displays
- Writing Decoding Chart for 0-f character
- Writing one digit UP/DOWN Counter Program
- Programming 2 Digit/3 Digit /4 Digit Counter
- Introduction To TLC (Traffic Light Controller) Programming



➤ **Real world interfacing – LCD**

- Block Diagram of LCD
- Types of LCD
- Pin Structure of 16x2 LCD
- Hardware Interfacing Circuit
- LCD Command set
- Writing program to drive LCD

➤ **Timer/Counter programming**

- Description of SFR associated with Timer/Counter
- Configuring as a Timer
- Configuring as Counter
- Delay Count Calculations

➤ **Interfacing of switches & keyboard matrix**

- Introduction to Switches & Keyboard Matrix
- Interfacing Circuit of Switches & Keyboard Matrix
- Programming of Keyboard Matrix & Switches
- Controlling of LED's by using Switches
- Key board Matrix & LCD Interfacing Program

➤ **Real world interfacing – MOT ORS**

- Different kind of Motors

- Interfacing of DC Motors and Stepper Motor
- Motor Drivers Interfacing
- L293D
- ULN2003

➤ **Introduction to CCP and ECCP programming**

- Standard CCP Module
- Enhanced CCP Module
- Compare mode programming
- Capture mode programming

➤ **Using Internal/External Memories**

- Introduction to External Memory Interfacing using Intel Bus Timing
- SFR configuration to read/write Internal Memory (EEPROM)
- Using library to read/write Internal EEPROM

➤ **(C) Embedded Systems with Microcontroller (AVR)**

➤ **Embedded system**

- Brief idea of Embedded Systems & Industrial applications
- Application/Area wise need of Embedded



- Hardware classification for Embedded

➤ **Brain of Embedded Appliances**

- Brief idea of Micro-controller/processor
- Why Microcontroller?
- Architecture of Microcontroller
- System architecture – RISC, CISC, Harvard, Von Neumann
- Architecture of Microcontroller

➤ **Embedded C**

- Introduction classes
- Basic syntax & programming Structure
- Data types, variables & operator
- if-else & switch selection statement
- Conditional statements or looping
- While, do-while
- For, nested-for statements
- Infinite loops C – Array
- Introduction to array
- Initialization & defining arrays

➤ **Microcontroller (AVR)**

- Features of microcontroller
- Pin out of microcontroller

- GP I/O Port specification
- Description about all Ports
- Description about IDE for programming
- Proteus Simulation for microcontroller
- I/O programming using Embedded C
- Led on/off programming
- Delay generation through function

➤ **Working with file**

- Unix file Structure
- File and directory maintenance
- Changing the attributes of a file systems
- File handling concepts
- Normal level file handling
- Fread
- Fwrite
- Fclose
- Fopen
- Fseek
- Low level File handling
- Write
- Read
- Open
- Umask
- Close
- Lseek

➤ **Processes and Signals**

- What is process?
- Process Structure



- The Process Table
- Viewing Processes
- System Processes
- Process Scheduling
- **Getting Started**
 - Kill a process
 - Fork
 - Starting New Processes
 - Waiting for a Process
 - Zombie Processes
 - Input and Output Redirection
 - Execve, exec, execv, execlp, execl, execve
 - Process commands
 - Signal handling
- **Threads**
 - What is thread
 - Thread programming
 - Wait queues
 - Spin lock
- **Pointers**
 - Introduction to pointers
 - The 'address of' and 'indirection' operators
 - Pointer expression
 - Data types of pointers
 - Pointers and arrays
 - Assignment of pointers
 -
 - Pointer arithmetic
 - Comparison of two pointers
 - Pointers and functions
 - Pointers and strings
- **C Preprocessor**
 - Macros with Arguments
 - Macro Versus Function
 - Directive
 - Conditional Directive
- **Structures**
 - Introduction to structures
 - Declaration and reference,
 - Accessing structure elements,
 - Array of structures,
 - Nested structures,
 - Self-referential structures,
- **Union & Enumerated Data Type**
 - Introduction to Union
 - Dynamic memory allocation
 - Type def statement
- **Files**
 - Introduction and need for a file
 - Library functions to open/close a file,
 - Functions to read/write a single
 - Character from a file For matted input output functions used in file handling fscanf(), fprintf(), fgets(), fputs()
 - Flushing buf fers,



- Functions used in file handling - fseek(),
- **Interfacing of Seven and Fourteen Segment Display**
 - Introduction to 7 Segment Display
 - Types of 7 Segment Display
 - Interfacing Circuit
 - Description of 7 Segment Display
 - Programming of 7 Segment Display
 - Interfacing
 - Introduction to 14 Segment Display
 - Types of 14 Segment Display
 - Interfacing Circuit
 - Description of 14 Segment Display
- **Interfacing of LCD**
 - Introduction to 16 x 2 LCD
 - Commands of 16 x 2 LCD
 - Interfacing Circuit
 - Description of 16 x 2 LCD
 - Programming of 16 x 2 LCD
- **Interfacing of Switches & Keyboard Matrix**
 - Introduction to Switches & Keyboard Matrix
 - Interfacing Circuit of Switches & Keyboard Matrix
 - Programming of Keyboard Matrix & Switches
 - Controlling of LED's by using Switches
 - Key board Matrix & LCD Interfacing Program
- **Interfacing of Motors**
 - Introduction to Motors
 - Types of Motors used in Embedded System
 - Programming & Controlling of Motors in Embedded System
- **Timers & Counter Programming**
 - Introduction to Timer & Counter
 - Difference between Timer and Counter
 - Description of SFR associated with Timer & Counter
 - Programming of Timer & Counter
- **Serial Communication Programming**
 - Introduction to Serial Communication
 - Types of Serial Communication



- Description of SFR associated with Serial Communication
- Introduction & Interfacing of UART
- Programming of UART
- Difference between RISC and CISC
- Memory Classification
- Primary Memory
- Secondary Memory
- **Computer Languages**
 - Low Level Languages
 - Middle Level Language
 - High Level Language
 - Advantage & Disadvantage of Low level & High level programming language of Embedded System
 - Interaction of language with Compilers
- **Embedded Development Tools**
 - Assembler
 - Interpreter
 - Compiler
 - Simulator
 - Emulator
 - Debugger
- **Designing with Microcontrollers**
 - Introduction to 8051 and Family
 - Introduction to Microchip and Family
- Block Description of PIC 18F458
- PIN diagram Description of PIC 18F458
- Introduction of File Register (RAM)
- Introduction To RAM Architecture
- Access Bank
- Special Features of PIC18F458
- **Introduction of EMBEDDED C**
 - Why C
 - Benefits of C
 - Constants, Variables & Data Types
 - Keywords & Identifiers
 - Data type & its memory representation
 - User Define data types (Structure)
 - Array
 - Pointers
 - Operators
 - Arithmetical Operator
 - Logical Operator
 - Bitwise Operators
 - Control Statement and Loops
 - If
 - Switch
 - For



- While
- Do While
- Introduction to preprocessor directives
- Assembly within C (Inline Assembly)
- **Serial Communication programming**
 - Introduction to the Communication System
 - Types of communication System
 - Analog / Digital
 - Serial / Parallel
 - Synchronous/ Asynchronous
 - Introduction to Serial Communication
 - Simplex
 - Half Duplex
 - Full Duplex
 - Description of SFR associated with Serial Communication
 - Data Framing and UART Introduction
 - RS232 Protocol
 - Introduction & Interfacing of UART
 - MAX 23 IC
 - Programming of UART
- **Interrupt driven programming**
 - SFR associated with Interrupts
- Interrupt Handling Methods
- Programming Hardware Interrupts
- Programming Timer Interrupts
- Programming Serial Interrupts
- **Using and configuring adc**
 - Introduction to ADC
 - ADC Initialization
- **Introduction of sensors**
 - Introduction of
 - Transducers Types of Sensors
 - Sensor Interfacing
 - IR Sensor
 - Temperature Sensor
- **Introduction to signal Decoder IC**
 - DTMF
- **Protocol Interfacing**
 - SPI Protocol
 - Introduction to SPI Protocol
 - SPI Protocol Framing
 - Programming of SPI
 - I2C Protocol
 - Introduction to I2C Protocol
 - I2C Protocol Framing
 - Programming of I2C
 - Led pattern programming
 - Data shifting from left to right & right to left



- Curtain open/close programming
- Even/odd bit toggling
- Sensor interfacing with microcontroller
- LM35(Temperature Sensor)
- RFID
- RF Receiver/Transmitter
- Accelarameter
- IR Sensor
- Gas Sensor
- Alchohol Senser
- Touch Screen
- Motor interfacing
- Program for controlling direction of DC motor
- Stepper motor
- 16x2 LCD Display 16x2 LCD command & data register
- Name/Data printing over LCD
- Moving message display
- **Advanced features of Microcontroller**
 - TIMER
 - TIMER register explanations
 - Programming of TIMER
 - ADC
 - ADC register explanations
 - Programming of ADC
 - Interfacing of temperature sensor
 - Serial communication
- Communication between microcontroller & computer system
- Advance Communication Protocol
- SPI (Serial Peripheral interface)
- I2C (Inter integrated circuit)
- Project as per Module
- Synchronization
- Synchronization with semaphores
- Synchronization with mutexes
- **Inter-process communication:**
- **Pipes**
 - what is pipe
 - Process Pipes
 - The pipe call
 - Parent and child processes
 - Named pipes
- **Semaphores, message queues and shared memory**
 - Semaphores
 - Semaphore Definition
 - Linux Semaphore Facilities
 - Using Semaphores
- **Shared Memory**
 - shmget
 - shmat
 - shmdt



- shmctl
- **Message Queues**
 - msgget
 - msgsnd
 - msgrcv
 - msgctl
- **Sockets**
 - What is socket
 - Socket connection
 - Socket Attributes
 - Creating a Socket
 - Socket Addresses
 - Naming a Socket
 - Creating a Socket Queue
 - Accepting Connections
 - Requesting Connections
 - Closing a Socket
 - Socket Communications