

EMBEDDED

Systems



CURRICULUM

3 Months

» 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
- type conversion
- cast Operator
- Multiple assignment
- Type definitions
- Input/Output Routines
- Formatted and unformatted I/O operations

» Control Flow Statements In 'C'

- If statement
- else-if statement
- While statement
- for loop, do, while loop
- Switch
- break and continue
- goto

» Functions

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

» Array and String

- 1-D,2-D array and string
- String handling library functions
- Additional string functions
- Searching
- Sorting with different algorithms

» 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
- Typedef 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
- Formatted input output functions used in file
- handling fscanf(),
- fprintf(),
- fgets(), fputs()
- Flushing buffers,
- Functions used in file handling - fseek(),

- ferror()
- ftell()
- feof(),
- fopen, fwrite, fread,
- File handling system calls - open(),
- read(), write(), lseek(), close(),
- Database handling in C

» **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 ATMEL 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
- 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

» **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

» Interrupt driven Programming

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

» Interfacing of ADC

- Introduction to ADC
- Interfacing circuit of ADC
- Working & Interfacing of Temperature Sensor (DS1621 & LM35)

» Interfacing of External Memory

- Introduction to External Memory Interfacing
- Introduction to I2C Protocol
- Using I2C library to read/write External Memory

» Introduction of EMBEDDED C

- Introduction to Embedded C
- Different between C & Embedded C
- Data Type of Embedded C
- Operators 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 (PIC18XXXX)

» 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 Harvard Architecture

- 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 over Assembly
- Constants, Variables & Data Types
 - Keywords & Identifiers
 - Data type & its memory representation
 - User Define data types (Structure)
 - Array
 - Pointers
- Operators
 - Arithmetic Operator
 - Logical Operator
 - Bitwise Operators
- Control Statement and Loops
 - If
 - Switch
 - For
 - While
 - Do While
- Introduction to preprocessor directives
- Assembly within C (Inline Assembly)

» 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 – MOTORS

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

» 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 232 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

» 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

- 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
 - Accelerometer
 - IR Sensor
 - Gas Sensor
 - Alcohol Sensor
 - 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

» 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

- 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

Partners :



Java



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