



**Lecture Plan 2**

Semester:-V

Class:-ECS

Course code: IC-403-F

Subject: EMBEDDED SYSTEM DESIGN

**Section:A**

| S. No. | Topic :-Introduction of MICROCONTROLLER  | Time Allotted:- |
|--------|--|-----------------|
| 1.     | <b>Introduction</b><br>Circumstances that we find ourselves in today in the field of microcontrollers had their beginnings in the development of technology of integrated circuits. This development has made it possible to store hundreds of thousands of transistors into one chip. That was a prerequisite for production of microprocessors , and the first computers were made by adding external peripherals such as memory, input-output lines, timers and other. Further increasing of the volume of the package resulted in creation of integrated circuits. These integrated circuits contained both processor and peripherals. That is how the first chip containing a microcomputer , or what would later be known as a microcontroller came about. | <u>5</u>        |
| 2      | <b>Division of the Topic</b><br><br>History<br>Use & Application<br>Different types of microcontrollers:<br>Embedded microcontrollers,<br>External memory microcontrollers   | <u>30</u>       |
| 3.     | <b>Conclusion</b><br><br>Microcontrollers are used in a wide number of electronic systems such as: <ul style="list-style-type: none"> <li>• Engine management systems in automobiles.</li> <li>• Keyboard of a PC.</li> <li>• Electronic measurement instruments (such as digital multimeters, frequency synthesisers, and oscilloscopes)</li> <li>• Printers.</li> <li>• Mobile phones.</li> <li>• Televisions, radios, CD players, tape recording equipment.</li> <li>• Hearing aids.</li> <li>• Security alarm systems, fire alarm systems, and building services systems</li> </ul>  | <u>5</u>        |
| 4      | <b>Question / Answer</b><br><br>What is an ESD?<br>What are the Applicatins of ESD?  | <u>10</u>       |

**Reference Readings:-**

- Design with PIC Microcontrollers by John B. Peatman
- Programming and Customizing the 8051 Microcontroller : Predko.

### Lecture Plan 3

Semester:-V

Class:-ECS

Course code: IC-403-F

Subject: EMBEDDED SYSTEM DESIGN

Section:A

| S. No. | Topic :-Introduction of MICROCONTROLLER   | Time Allotted:- |
|--------|---|-----------------|
| 1.     | <b>Introduction</b><br><br>Basically, a microcontroller is a device which integrates a number of the components of a microprocessor system onto a single microchip.<br><br>So a microcontroller combines onto the same microchip : <ul style="list-style-type: none"><li>• The CPU core</li><li>• Memory (both ROM and RAM)</li><li>• Some parallel digital I/O</li></ul> | <u>5</u>        |
| 2      | <b>Division of the Topic</b><br><br>Processor Architectures: Harvard V/S Princeton ,<br>CISC V/S RISC   | <u>30</u>       |
| 3.     | <b>Conclusion</b><br><br>Microcontrollers with Harvard architecture are also called "RISC microcontrollers". RISC stands for Reduced Instruction Set Computer. Microcontrollers with von-Neumann's architecture are called 'CISC microcontrollers'. Title CISC stands for Complex Instruction Set Computer.   | <u>5</u>        |
| 4      | <b>Question / Answer</b><br><br>Explain Different Processor Architectures: Harvard V/S Princeton?<br>Differentiate between CISC V/S RISC?   | <u>10</u>       |

#### Reference Readings:-

Design with PIC Microcontrollers by John B. Peatman  
Programming and Customizing the 8051 Microcontroller : Predko.

#### Text Book :

Raj Kamal: Embedded Systems- Architecture, Programming and Design, TMH, New Delhi  
Mazidi and Mazidi: The 8051 Microcontroller and Embedded Systems, Pearson Education V. Deshmukh:  
Microcontroller (Theory and Application), TMH.  
D. V. Hall: Microprocessors and Interfacing, TMH Reference Book

## Lecture Plan 4

Semester:-V

Class:-ECS

Course code: IC-403-F

Subject: EMBEDDED SYSTEM DESIGN

Section:A

| S. No. | Topic :-Introduction of MICROCONTROLLER  | Time Allotted:- |
|--------|--|-----------------|
| 1.     | <b>Introduction</b><br>Memory is part of the microcontroller whose function is to store data. The easiest way to explain it is to describe it as one big closet with lots of drawers. If we suppose that we marked the drawers in such a way that they can not be confused, any of their contents will then be easily accessible. It is enough to know the designation of the drawer and so its contents will be known to us for sure.   | <u>5</u>        |
| 2      | <b>Division of the Topic</b><br><br>microcontrollers memory types;<br>Microcontroller's features: clocking, i/o pins, interrupts, timers, peripherals.   | <u>30</u>       |
| 3.     | <b>Conclusion</b><br>Memory components are exactly like that. For a certain input we get the contents of a certain addressed memory location and that's all. Two new concepts are brought to us: addressing and memory location. Memory consists of all memory locations, and addressing is nothing but selecting one of them.<br><br>Those locations we've just added are called "ports". There are several types of ports : input, output or bidirectional ports. When working with ports, first of all it is necessary to choose which port we need to work with, and then to send data to, or take it from the port.<br><br>However, in order to utilize it in industry we need a few additionally blocks. One of those is the timer block which is significant to us because it can give us information about time, duration, protocol etc. | <u>5</u>        |
| 4      | <b>Question / Answer</b><br><br>Explain different microcontrollers memory types?<br>What are the main Microcontroller's features?  | <u>10</u>       |

### Reference Readings:-

Design with PIC Microcontrollers by John B. Peatman  
Programming and Customizing the 8051 Microcontroller : Predko.

### Text Book :

Raj Kamal: Embedded Systems- Architecture, Programming and Design, TMH, New Delhi  
Mazidi and Mazidi: The 8051 Microcontroller and Embedded Systems, Pearson Education V. Deshmukh: Microcontroller (Theory and Application), TMH.  
D. V. Hall: Microprocessors and Interfacing, TMH Reference Book

## Lecture Plan 5

Semester:-V

Class:-ECS

Course code: IC-403-F

Subject: EMBEDDED SYSTEM DESIGN

Section:A

| S. No. | Topic :-Introduction of MICROCONTROLLER  | Time Allotted:- |
|--------|--|-----------------|
| 1.     | <b>Introduction</b><br>In electronics and especially synchronous digital circuits, a clock signal is a signal used to coordinate the actions of two or more circuits. A clock signal oscillates between a high and a low state, normally with a 50% duty cycle, and is usually a square wave. Circuits using the clock signal for synchronization may become active at either the rising or falling edge, or both, of the clock signal.<br>I/O may refer to:<br>Input/output, a system of communication for Microcontrollers | <u>5</u>        |
| 2      | <b>Division of the Topic</b><br><br>Microcontroller's features: clocking, i/o pins, interrupts, timers, peripherals.   | <u>30</u>       |
| 3.     | <b>Conclusion</b><br><br>Those locations we've just added are called "ports". There are several types of ports : input, output or bidirectional ports. When working with ports, first of all it is necessary to choose which port we need to work with, and then to send data to, or take it from the port.  | <u>5</u>        |
| 4      | <b>Question / Answer</b><br><br>Explain different microcontrollers memory types?<br>What are the main Microcontroller's features?  | <u>10</u>       |

### Reference Readings:-

Design with PIC Microcontrollers by John B. Peatman  
Programming and Customizing the 8051 Microcontroller : Predko.

### Text Book :

Raj Kamal: Embedded Systems- Architecture, Programming and Design, TMH, New Delhi  
Mazidi and Mazidi: The 8051 Microcontroller and Embedded Systems, Pearson Education Reference Book

A. V. Deshmukh: Microcontroller (Theory and Application), TMH.  
D. V. Hall: Microprocessors and Interfacing, TMH Reference Book

## Lecture Plan 6

Semester:-V

Class:-ECS

Course code: IC-403-F

Subject: EMBEDDED SYSTEM DESIGN

Section:**B**

| S. No. | Topic :- MICROCONTROLLER ARCHITECTURE   | Time Allotted:- |
|--------|---|-----------------|
| 1.     | <b>Introduction</b><br>Microchip manufacture a series of microcontrollers called PIC. You can see the range of their microcontrollers here. There are many different flavours available, some basic low memory types, going right up through to ones that have Analogue - To- Digital converters and even PWM built in. I am going to concentrate on the 16F84 PIC. Once you have learnt how to program one type of PIC, learning the rest is easy.<br>There are several ways of programming the PIC - using BASIC, C, or Assembly Language | <u>5</u>        |
| 2      | <b>Division of the Topic</b><br><br>Introduction to PIC microcontrollers  | <u>30</u>       |
| 3.     | <b>Conclusion</b><br>Microchip's range of PIC microcontrollers are unbelievably powerful for their size. They are also an amazingly flexible solution to hardware problems which only a few years ago would have taken hundreds if not thousands of discrete components to make..   | <u>5</u>        |
| 4      | <b>Question / Answer</b><br><br>Explain the features of PIC microcontrollers?   | <u>10</u>       |

### Reference Readings:-

Design with PIC Microcontrollers by John B. Peatman  
Programming and Customizing the 8051 Microcontroller : Predko.

### Text Book :

Raj Kamal: Embedded Systems- Architecture, Programming and Design, TMH, New Delhi  
Mazidi and Mazidi: The 8051 Microcontroller and Embedded Systems, Pearson Education Reference Book

A. V. Deshmukh: Microcontroller (Theory and Application), TMH.  
D. V. Hall: Microprocessors and Interfacing, TMH Reference Book

## Lecture Plan 7

Semester:-V

Class:-ECS

Course code: IC-403-F

Subject: EMBEDDED SYSTEM DESIGN

**Section:B**

| S. No. | Topic :- MICROCONTROLLER ARCHITECTURE  | Time Allotted:-   |
|--------|--|---|
| 1.     | <p><b>Introduction</b></p> <p>Architecture (from Latin, architectura and ultimately from Greek, αρχιτεκτων, "a master builder", from αρχι- "chief, leader" and τεκτων, "builder, carpenter")[1] is the art and science of designing buildings and structures. A wider definition often includes within its scope the design of the total built environment: from the macrolevel of town planning, urban design, and landscape architecture to the microlevel of creating furniture. The term "Architecture" is also used for the profession of providing architectural services.</p> <p>An instruction pipeline is a technique used in the design of computers and other digital electronic devices to increase their instruction throughput (the number of instructions that can be executed in a unit of time).</p> <p>Pipelining assumes that successive instructions in a program sequence will overlap in execution, as suggested in the next diagram (vertical 'i' instructions, horizontal 't' time).</p> | <u>5</u><br><br><br><br><br><br><br><br><br><br><u>30</u> |
| 2      | <p><b>Division of the Topic</b></p> <p>Architecture and pipelining,</p>  |   |
| 3.     | <p><b>Conclusion</b></p> <p>Instruction cycle consists of cycles Q1, Q2, Q3 and Q4. Cycles of calling and executing instructions are connected in such a way that in order to make a call, one instruction cycle is needed, and one more is needed for decoding and execution. However, due to pipelining, each instruction is effectively executed in one cycle..</p>   | <u>5</u>  |
| 4      | <p><b>Question / Answer</b></p> <p>What is pipelining?<br/>What are the different Addressing Modes?</p>  | <u>10</u>   |

### Reference Readings:-

Design with PIC Microcontrollers by John B. Peatman  
Programming and Customizing the 8051 Microcontroller : Predko.

### Text Book :

Raj Kamal: Embedded Systems- Architecture, Programming and Design, TMH, New Delhi  
Mazidi and Mazidi: The 8051 Microcontroller and Embedded Systems, Pearson Education Reference Book

A. V. Deshmukh: Microcontroller (Theory and Application), TMH.  
D. V. Hall: Microprocessors and Interfacing, TMH Reference Book

## Lecture Plan 8

Semester:-V

Class:-ECS

Course code: IC-403-F

Subject: EMBEDDED SYSTEM DESIGN

**Section:B**

| S. No. | Topic :- MICROCONTROLLER ARCHITECTURE  | Time Allotted:- |
|--------|--|-----------------|
| 1.     | <b>Introduction</b><br><br>Memory is part of the microcontroller whose function is to store data. The amount of memory contained within a microcontroller varies between different microcontrollers. Some may not even have any integrated memory (eg. Hitachi 6503, now discontinued). However, most modern microcontrollers will have integrated memory. The memory will be divided up into ROM and RAM, with typically more ROM than RAM  | <u>5</u>        |
| 2      | <b>Division of the Topic</b><br><br>program memory considerations,<br>Addressing modes   | <u>30</u>       |
| 3.     | <b>Conclusion</b><br><br>Addressing modes, a concept from computer science, are an aspect of the instruction set architecture in most central processing unit (CPU) designs. The various addressing modes that are defined in a given instruction set architecture define how machine language instructions in that architecture identify the operand (or operands) of each instruction. An addressing mode specifies how to calculate the effective memory address of an operand by using information held in registers and/or constants contained within a machine instruction or elsewhere. | <u>5</u>        |
| 4      | <b>Question / Answer</b><br><br>What is pipelining?<br>What are the different Addressing Modes?  | <u>10</u>       |

### Reference Readings:-

Design with PIC Microcontrollers by John B. Peatman  
Programming and Customizing the 8051 Microcontroller : Predko.

### Text Book :

Raj Kamal: Embedded Systems- Architecture, Programming and Design, TMH, New Delhi  
Mazidi and Mazidi: The 8051 Microcontroller and Embedded Systems, Pearson Education Reference Book

A. V. Deshmukh: Microcontroller (Theory and Application), TMH.  
D. V. Hall: Microprocessors and Interfacing, TMH Reference Book



**Lecture Plan 10**

Semester:-V

Class:-ECS

Course code: IC-403-F

Subject: EMBEDDED SYSTEM DESIGN

**Section:B**

| <b>S. No.</b> | <b>Topic :- MICROCONTROLLER ARCHITECTURE</b>   | <b>Time Allotted:-</b> |
|---------------|--|------------------------|
| 1.            | <b>Introduction</b><br><br>Complete set which includes 35 instructions. A reason for such a small number of instructions lies primarily in the fact that we are talking about a RISC microcontroller whose instructions are well optimized considering the speed of work, architectural simplicity and code compactness. The only drawback is that programmer is expected to master "uncomfortable" technique of using a reduced set of 35 instructions. | <u>5</u>               |
| 2             | <b>Division of the Topic</b><br><br>Instruction set,<br>simple operations  | <u>30</u>              |
| 3.            | <b>Conclusion</b><br><br>Data transfer<br><br>Transfer of data in a microcontroller is done between work (W) register and an 'f' register that represents any location in internal Arithmetic and logic<br><br>Flags C, DC and Z are set depending on a result of addition or subtraction, Bit operations<br><br>Instructions BCF and BSF do setting or cleaning of one bit anywhere in the memory.  | <u>5</u>               |
| 4             | <b>Question / Answer</b><br>Explain instruction set.   | <u>10</u>              |

**Reference Readings:-**

Design with PIC Microcontrollers by John B. Peatman

**Text Book :**

Raj Kamal: Embedded Systems- Architecture, Programming and Design, TMH, New Delhi

Mazidi and Mazidi: The 8051 Microcontroller and Embedded Systems, Pearson Education Reference Book

A. V. Deshmukh: Microcontroller (Theory and Application), TMH.

D. V. Hall: Microprocessors and Interfacing, TMH Reference Book





**Lecture Plan 13**

Semester:-V

Class:-ECS

Course code: IC-403-F

Subject: EMBEDDED SYSTEM DESIGN

**Section:B**

| <b>S. No.</b> | <b>Topic :- MICROCONTROLLER ARCHITECTURE</b>  | <b>Time Allotted:-</b> |
|---------------|---|------------------------|
| 1.            | <b>Introduction</b><br>COMF    Complement f<br>BCF    Reset bit b in f<br>BSF    Set bit b in f<br>BTFSC    Test bit b in f, skip if it = 0<br>BTFSS    Test bit b in f, skip if =1<br>INCFSZ    Increment f, skip if=0<br>DECFSZ    Decrement f, skip if = 0<br>GOTO    Jump to address<br>CALL    Call a program<br>RETURN    Return from a subprogram            | <u>5</u>               |
| 2             | <b>Division of the Topic</b> <ul style="list-style-type: none"> <li>• <u>A.21 COMF</u></li> <li>• <u>A.22 BCF</u></li> <li>• <u>A.23 BSF</u></li> <li>• <u>A.24 BTFSC</u></li> <li>• <u>A.25 BTFSS</u></li> <li>• <u>A.26 INCFSZ</u></li> <li>• <u>A.27 DECFSZ</u></li> <li>• <u>A.28 GOTO</u></li> <li>• <u>A.29 CALL</u></li> <li>• <u>A.30 RETURN</u></li> </ul> | <u>30</u>              |
| 3.            | <b>Conclusion</b><br>Explained all instructions with example.   | <u>5</u>               |
| 4.            | <b>Question / Answer</b><br>Explain all machine control instruction .   | <u>10</u>              |

**Reference Readings:-**

Design with PIC Microcontrollers by John B. Peatman  
Programming and Customizing the 8051 Microcontroller : Predko.

**Text Book :**

Raj Kamal: Embedded Systems- Architecture, Programming and Design, TMH, New Delhi  
Mazidi and Mazidi: The 8051 Microcontroller and Embedded Systems, Pearson Education Reference Book

A. V. Deshmukh: Microcontroller (Theory and Application), TMH.  
D. V. Hall: Microprocessors and Interfacing, TMH Reference Book



## Lecture Plan 15

Semester:-V

Class:-ECS

Course code: IC-403-F

Subject: EMBEDDED SYSTEM DESIGN

**Section:B**

| S. No. | Topic :- INTERRUPTS AND I/O PORTS  | Time Allotted:- |
|--------|--|-----------------|
| 1.     | <b>Introduction</b><br>Circumstances that we find ourselves in today in the field of microcontrollers had their beginnings in the development of technology of integrated circuits. This development has made it possible to store hundreds of thousands of transistors into one chip. That was a prerequisite for production of microprocessors , and the first computers were made by adding external peripherals such as memory, input-output lines, timers and other. Further increasing of the volume of the package resulted in creation of integrated circuits. These integrated circuits contained both processor and peripherals. That is how the first chip containing a microcomputer , or what would later be known as a microcontroller came about. | <u>5</u>        |
| 2      | <b>Division of the Topic</b><br><br>Timer2 scalar initialization,<br>IntService Interrupt service routine  | <u>30</u>       |
| 3.     | <b>Conclusion</b><br>Timer is used to count the internal frequency of microcontroller and events of microcontroller.   | <u>5</u>        |
| 4      | <b>Question / Answer</b><br><br>Explain the Timer2 scalar initialization ?   | <u>10</u>       |

### Reference Readings:-

Design with PIC Microcontrollers by John B. Peatman  
Programming and Customizing the 8051 Microcontroller : Predko.

### Text Book :

Raj Kamal: Embedded Systems- Architecture, Programming and Design, TMH, New Delhi  
Mazidi and Mazidi: The 8051 Microcontroller and Embedded Systems, Pearson Education Reference Book

A. V. Deshmukh: Microcontroller (Theory and Application), TMH.  
D. V. Hall: Microprocessors and Interfacing, TMH Reference Book

## Lecture Plan 16

Semester:-V

Class:-ECS

Course code: IC-403-F

Subject: EMBEDDED SYSTEM DESIGN

Section:**B**

| S. No. | Topic :- INTERRUPTS AND I/O PORTS   | Time Allotted:- |
|--------|---|-----------------|
| 1.     | <b>Introduction</b><br>A subroutine is a section of code, or program, than can be called as and when you need it. Subroutines are used if you are performing the same function more than once, for example creating a delay. The advantages of using a subroutine are that it will be easier to alter the value once inside a subroutine rather than, say, ten times throughout your program, and also it helps to reduce the amount of memory your program occupies inside the PIC   | <u>5</u>        |
| 2      | <b>Division of the Topic</b><br><br>loop time subroutine,<br>External interrupts and timers,  | <u>30</u>       |
| 3.     | <b>Conclusion</b><br>As we have separate lines for receiving and sending, it is possible to receive and send data (info.) at the same time. So called full-duplex mode block which enables this way of communication is called a serial communication block. Unlike the parallel transmission, data moves here bit by bit, or in a series of bits what defines the term serial communication comes from. After the reception of data we need to read it from the receiving location and store it in memory as opposed to sending where the process is reversed. Data goes from memory through the bus to the sending location, and then to the receiving unit according to the protocol.. | <u>5</u>        |
| 4      | <b>Question / Answer</b><br><br>What is loop time subroutine?<br>What are the External interrupts and timers ?  | <u>10</u>       |

### Reference Readings:-

Design with PIC Microcontrollers by John B. Peatman  
Programming and Customizing the 8051 Microcontroller : Predko.

### Text Book :

Raj Kamal: Embedded Systems- Architecture, Programming and Design, TMH, New Delhi  
Mazidi and Mazidi: The 8051 Microcontroller and Embedded Systems, Pearson Education  
A. V. Deshmukh: Microcontroller (Theory and Application), TMH.  
D. V. Hall: Microprocessors and Interfacing, TMH Reference Book

## Lecture Plan 17

Semester:-V

Class:-ECS

Course code: IC-403-F

Subject: EMBEDDED SYSTEM DESIGN

**Section:B**

| S. No. | Topic :- INTERRUPTS AND I/O PORTS   | Time Allotted:- |
|--------|---|-----------------|
| 1.     | <p><b>Introduction</b></p> <p>In computing, a serial port is a serial communication physical interface through which information transfers in or out one bit at a time (contrast parallel port). Throughout most of the history of personal computers, data transfer through serial ports connected the computer to devices such as terminals or modems. Mice, keyboards, and other peripheral devices also connected in this way.</p> <p>While such interfaces as Ethernet, FireWire, and USB all send data as a serial stream, the term "serial port" usually identifies hardware more or less compliant to the RS-232 standard, intended to interface with a modem or with a similar communication device.</p> | <u>5</u>        |
| 2      | <p><b>Division of the Topic</b></p> <p>Synchronous serial port module,<br/>Serial peripheral device</p>   | <u>30</u>       |
| 3.     | <p><b>Conclusion</b></p> <p>In computer hardware, a peripheral device is any device attached to a computer in order to expand its functionality. Some of the more common peripheral devices are printers, scanners, disk drives, tape drives, microphones, speakers, and cameras. A device can also refer to a non-physical item, such as a pseudo-tty, a RAM drive, or a network adapter.</p>  | <u>5</u>        |
| 4      | <p><b>Question / Answer</b></p> <p>What is loop time subroutine?<br/>What are the External interrupts and timers ?</p>  | <u>10</u>       |

### Reference Readings:-

Design with PIC Microcontrollers by John B. Peatman  
Programming and Customizing the 8051 Microcontroller : Predko.

### Text Book :

Raj Kamal: Embedded Systems- Architecture, Programming and Design, TMH, New Delhi  
Mazidi and Mazidi: The 8051 Microcontroller and Embedded Systems, Pearson Education  
A. V. Deshmukh: Microcontroller (Theory and Application), TMH.  
D. V. Hall: Microprocessors and Interfacing, TMH Reference Book

## Lecture Plan 18

Semester:-V

Class:-ECS

Course code: IC-403-F

Subject: EMBEDDED SYSTEM DESIGN

Section:**B**

| S. No. | Topic :- INTERRUPTS AND I/O PORTS  | Time Allotted:- |
|--------|--|-----------------|
| 1.     | <b>Introduction</b><br><br>Those locations we've just added are called "ports". There are several types of ports : input, output or bidirectional ports. When working with ports, first of all it is necessary to choose which port we need to work with, and then to send data to, or take it from the port.                              | <u>5</u>        |
| 2      | <b>Division of the Topic</b><br><br>O/p port Expansion,<br>I/p port expansion,   | <u>30</u>       |
| 3.     | <b>Conclusion</b><br><br>The Universal Asynchronous Receiver/Transmitter (UART) controller is the key component of the serial communications subsystem of a computer. The UART takes bytes of data and transmits the individual bits in a sequential fashion. At the destination, a second UART re-assembles the bits into complete bytes. | <u>5</u>        |
| 4      | Serial transmission is commonly used with modems and for non-networked communication between computers, terminals and other devices..<br><b>Question / Answer</b><br><br>Explain UART? Why it is used?   | <u>10</u>       |

### Reference Readings:-

Design with PIC Microcontrollers by John B. Peatman  
Programming and Customizing the 8051 Microcontroller : Predko.

### Text Book :

Raj Kamal: Embedded Systems- Architecture, Programming and Design, TMH, New Delhi  
Mazidi and Mazidi: The 8051 Microcontroller and Embedded Systems, Pearson Education  
A. V. Deshmukh: Microcontroller (Theory and Application), TMH.  
D. V. Hall: Microprocessors and Interfacing, TMH Reference Book

## Lecture Plan 19

Semester:-V

Class:-ECS

Course code: IC-403-F

Subject: EMBEDDED SYSTEM DESIGN

Section:**B**

| S. No. | Topic :-UART   | Time Allotted:- |
|--------|--|-----------------|
| 1.     | <b>Introduction</b><br><br>The Universal Asynchronous Receiver/Transmitter (UART) controller is the key component of the serial communications subsystem of a computer. The UART takes bytes of data and transmits the individual bits in a sequential fashion. At the destination, a second UART re-assembles the bits into complete bytes.<br><br>Serial transmission is commonly used with modems and for non-networked communication between computers, terminals and other devices..  | <u>5</u>        |
| 2      | <b>Division of the Topic</b><br><br>UART   | <u>30</u>       |
| 3.     | <b>Conclusion</b><br><br>UART, universal asynchronous receiver / transmitter is responsible for performing the main task in serial communications with computers. The device changes incoming parallel information to serial data which can be sent on a communication line. A second UART can be used to receive the information. The UART performs all the tasks, timing, parity checking, etc. needed for the communication. The only extra devices attached are line driver chips capable of transforming the TTL level signals to line voltages and vice versa. | <u>5</u>        |
| 4      | <b>Question / Answer</b><br><br>Explain UART? Why it is used?  | <u>10</u>       |

### Reference Readings:-

Design with PIC Microcontrollers by John B. Peatman  
Programming and Customizing the 8051 Microcontroller : Predko.

### Text Book :

Raj Kamal: Embedded Systems- Architecture, Programming and Design, TMH, New Delhi  
Mazidi and Mazidi: The 8051 Microcontroller and Embedded Systems, Pearson Education  
A. V. Deshmukh: Microcontroller (Theory and Application), TMH.  
D. V. Hall: Microprocessors and Interfacing, TMH Reference Book

## Lecture Plan 20

Semester:-V

Class:-ECS

Course code: IC-403-F

Subject: EMBEDDED SYSTEM DESIGN

Section:D

| S. No. | Topic :- SOFTWARE  | Time Allotted:- |
|--------|--|-----------------|
| 1.     | <b>Introduction</b><br><br>A programming tool is a program or application that software developers use to create, debug, or maintain other programs and applications. The term usually refers to relatively simple programs that can be combined together to accomplish a task, much as one might use multiple hand tools to fix a physical object.  | <u>5</u>        |
| 2      | <b>Division of the Topic</b><br><br>Development tools/ environments,   | <u>30</u>       |
| 3.     | <b>Conclusion</b><br>Physically, " <b>Program</b> " represents a file on the computer disc (or in the memory if it is read in a microcontroller), and is written according to the rules of assembler or some other language for microcontroller programming. Man can understand assembler language as it consists of alphabet signs and words. When writing a program, certain rules must be followed in order to reach a desired effect. A <b>Translator</b> interprets each instruction written in assembly language as a series of zeros and ones which have a meaning for the internal logic of the microcontroller. | <u>5</u>        |
| 4      | <b>Question / Answer</b><br><br>What are various Development tools/ environments ?<br>Explain the components of Assembly language programming?   | <u>10</u>       |

### Reference Readings:-

Design with PIC Microcontrollers by John B. Peatman  
Programming and Customizing the 8051 Microcontroller : Predko.

### Text Book :

Raj Kamal: Embedded Systems- Architecture, Programming and Design, TMH, New Delhi  
Mazidi and Mazidi: The 8051 Microcontroller and Embedded Systems, Pearson Education  
A. V. Deshmukh: Microcontroller (Theory and Application), TMH.  
D. V. Hall: Microprocessors and Interfacing, TMH Reference Book

**Lecture Plan 21**

Semester:-V

Class:-ECS

Course code: IC-403-F

Subject: EMBEDDED SYSTEM DESIGN

**Section:D**

| S. No. | Topic :- SOFTWARE  | Time Allotted:-                  |
|--------|--|----------------------------------|
| 1.     | <p><b>Introduction</b></p> <p>The ability to communicate is of great importance in any field. However, it is only possible if both communication partners know the same language, i.e follow the same rules during communication. Using these principles as a starting point, we can also define communication that occurs between microcontrollers and man . Language that microcontroller and man use to communicate is called "assembly language". The title itself has no deeper meaning, and is analogue to names of other languages , ex. English or French. More precisely, "assembly language" is just a passing solution. Programs written in assembly language must be translated into a "language of zeros and ones" in order for a microcontroller to understand it. "Assembly language" and "assembler" are two different notions. The first represents a set of rules used in writing a program for a microcontroller, and the other is a program on the personal computer which translates assembly language into a language of zeros and ones. A program that is translated into "zeros" and "ones" is also called "machine language".</p> | <p><u>5</u></p> <p><u>30</u></p> |
| 2      | <p><b>Division of the Topic</b></p> <p>Assembly language programming style</p>   | <p><u>5</u></p>                  |
| 3.     | <p><b>Conclusion</b></p> <p>An assembly language is a low-level language for programming computers. It implements a symbolic representation of the numeric machine codes and other constants needed to program a particular CPU architecture</p>   | <p><u>10</u></p>                 |
| 4      | <p><b>Question / Answer</b></p> <p>What are various Development tools/ environments ?<br/>                     Explain the components of Assembly language programming?</p>  |                                  |

**Reference Readings:-**

Design with PIC Microcontrollers by John B. Peatman  
 Programming and Customizing the 8051 Microcontroller : Predko.

**Text Book :**

Raj Kamal: Embedded Systems- Architecture, Programming and Design, TMH, New Delhi  
 Mazidi and Mazidi: The 8051 Microcontroller and Embedded Systems, Pearson Education  
 A. V. Deshmukh: Microcontroller (Theory and Application), TMH.  
 D. V. Hall: Microprocessors and Interfacing, TMH Reference Book

## Lecture Plan 22

Semester:-V

Class:-ECS

Course code: IC-403-F

Subject: EMBEDDED SYSTEM DESIGN

Section:D

| S. No. | Topic :-Introduction of EMBEDDED SYSTEM DESIGN   | Time Allotted:- |
|--------|--|-----------------|
| 1.     | <b>Introduction</b><br>Interpreting or interpretation is the intellectual activity that consists of facilitating oral or sign language communication, either simultaneously or consecutively, between two or among three or more speakers who are not speaking, or signing, the same language.<br><br>Note that the words interpreting and interpretation both can be used to refer to this activity, the word interpreting is commonly used in the profession and in the translation studies field in avoiding the other meanings of the word interpretation.                                 | <u>5</u>        |
| 2      | <b>Division of the Topic</b><br><br>Interpreters,  | <u>30</u>       |
| 3.     | <b>Conclusion</b><br>The word interpreter refers to the practitioner who orally translates for parties conversing in different languages or in sign language. Interpreters must convey not only all elements of meaning, but also the intentions and feelings of the original, source language speaker. In fact, the end result is an intermediate stage of spoken communication, which aims to allowing target language listeners to hear, perceive, and experience the message in a way that is as close as possible to the experience of those who understand the original, source language | <u>5</u>        |
| 4      | <b>Question / Answer</b><br><br>Explain Assembler & Compiler?<br>Explain why we require debugging of a program?  | <u>10</u>       |

### Reference Readings:-

Design with PIC Microcontrollers by John B. Peatman  
Programming and Customizing the 8051 Microcontroller : Predko.

### Text Book :

Raj Kamal: Embedded Systems- Architecture, Programming and Design, TMH, New Delhi  
Mazidi and Mazidi: The 8051 Microcontroller and Embedded Systems, Pearson Education  
A. V. Deshmukh: Microcontroller (Theory and Application), TMH.  
D. V. Hall: Microprocessors and Interfacing, TMH Reference Book

**Lecture Plan 23**Semester:-VClass:-ECS

Course code: IC-403-F

Subject: EMBEDDED SYSTEM DESIGN

**Section:D**

| <b>S. No.</b> | <b>Topic :-Introduction of EMBEDDED SYSTEM DESIGN</b>  | <b>Time Allotted:-</b> |
|---------------|--|------------------------|
| 1.            | <b>Introduction</b><br>A high-level programming language is a programming language that, in comparison to low-level programming languages, may be more abstract, easier to use, or more portable across platforms. Such languages often abstract away CPU operations such as memory access models and management of scope.   | <u>5</u>               |
| 2             | <b>Division of the Topic</b><br><br>High level languages,  | <u>30</u>              |
| 3.            | <b>Conclusion</b><br>Physically, " <b>Program</b> " represents a file on the computer disc (or in the memory if it is read in a microcontroller), and is written according to the rules of assembler or some other language for microcontroller programming. Man can understand assembler language as it consists of alphabet signs and words. When writing a program, certain rules must be followed in order to reach a desired effect. A <b>Translator</b> interprets each instruction written in assembly language as a series of zeros and ones which have a meaning for the internal logic of the microcontroller. Lets take for instance the instruction "RETURN" that a microcontroller uses to return from a sub-program.<br>When the assembler translates it, we get a 14-bit series of zeros and ones which the microcontroller knows how to interpret. . | <u>5</u>               |
| 4             | <b>Question / Answer</b><br><br>Explain Assembler & Compiler?<br>Explain why we require debugging of a program?  | <u>10</u>              |

**Reference Readings:-**

Design with PIC Microcontrollers by John B. Peatman

Programming and Customizing the 8051 Microcontroller : Predko.

**Text Book :**

Raj Kamal: Embedded Systems- Architecture, Programming and Design, TMH, New Delhi

Mazidi and Mazidi: The 8051 Microcontroller and Embedded Systems, Pearson Education

A. V. Deshmukh: Microcontroller (Theory and Application), TMH.

D. V. Hall: Microprocessors and Interfacing, TMH Reference Book

## Lecture Plan 24

Semester:-V

Class:-ECS

Course code: IC-403-F

Subject: EMBEDDED SYSTEM DESIGN

Section:D

| S. No. | Topic :-Introduction of EMBEDDED SYSTEM DESIGN  | Time Allotted:- |
|--------|---|-----------------|
| 1.     | <b>Introduction</b><br>Error made in writing a program, which error we are not aware of. Errors can be quite simple such as typing errors, and quite complex such as incorrect use of program language. Assembler will find most of these errors and report them to '.LST' file. Other errors will need to be searched for by trying it out and watching how device functions.<br>Software package for PC which simulates the internal function of microcontroller. It is ideal for checking software routines and all the parts of the code which do not have over demanding connections with an outside world. Options are installed to watch the code, movement around the program back and forth step by step, and debugging. | <u>5</u>        |
| 2      | <b>Division of the Topic</b><br><br>Intel hex format object files,<br>Debugging.  | <u>30</u>       |
| 3.     | <b>Conclusion</b><br>This is a file made by assembler translator when translating a source file, and has a form "understood" by microcontrollers. A continuation of the file is usually File_name.HEX where the name HEX file comes from.<br><br>Debugging is a methodical process of finding and reducing the number of bugs, or defects, in a computer program or a piece of electronic hardware thus making it behave as expected. Debugging tends to be harder when various subsystems are tightly coupled, as changes in one may cause bugs to emerge in another.  | <u>5</u>        |
| 4      | <b>Question / Answer</b><br><br>Explain Assembler & Compiler?<br>Explain why we require debugging of a program?   | <u>10</u>       |

### Reference Readings:-

Design with PIC Microcontrollers by John B. Peatman  
Programming and Customizing the 8051 Microcontroller : Predko.

### Text Book :

Raj Kamal: Embedded Systems- Architecture, Programming and Design, TMH, New Delhi  
Mazidi and Mazidi: The 8051 Microcontroller and Embedded Systems, Pearson Education  
A. V. Deshmukh: Microcontroller (Theory and Application), TMH.  
D. V. Hall: Microprocessors and Interfacing, TMH Reference Book

## Lecture Plan 25

Semester:-V

Class:-ECS

Course code: IC-403-F

Subject: EMBEDDED SYSTEM DESIGN

Section:C

| S. No. | Topic :- MICROCONTROLLER 8051  | Time Allotted:- |
|--------|--|-----------------|
| 1.     | <b>Introduction</b><br>CPU + I/O + Timer(s) [+ ROM] [+ RAM]♣Microcontrollers ♣ Limited RAM space, ROM space and I/O pins ♣ Low to moderate performance only ♣ Low-cost♣ Low chip-count to implement a small system ♣EPROM version available at large quantities Development tools readily available at reasonable cost | <u>5</u>        |
| 2      | <b>Division of the Topic</b><br><br>Introduction to microcontroller 8051.  | <u>30</u>       |
| 3.     | <b>Conclusion</b><br>Microcontroller is concerned with rapid movement of bits within chip.<br>Microcontroller can function as a computer with the addition of no external digital parts.   | <u>5</u>        |
| 4      | <b>Question / Answer</b><br><br>Explain the applications of microcontroller 8051 in real life  | <u>10</u>       |

### Reference Readings:-

Design with PIC Microcontrollers by John B. Peatman  
Programming and Customizing the 8051 Microcontroller : Predko.

### Text Book :

Raj Kamal: Embedded Systems- Architecture, Programming and Design, TMH, New Delhi  
Mazidi and Mazidi: The 8051 Microcontroller and Embedded Systems, Pearson Education  
A. V. Deshmukh: Microcontroller (Theory and Application), TMH.  
D. V. Hall: Microprocessors and Interfacing, TMH Reference Book

## Lecture Plan 26

Semester:-V

Class:-ECS

Course code: IC-403-F

Subject: EMBEDDED SYSTEM DESIGN

Section:C

| S. No. | Topic :- :- MICROCONTROLLER 8051- ARCHITECTURE   | Time Allotted:- |
|--------|--|-----------------|
| 1.     | <b>Introduction</b><br>In the architecture of 8051 it includes hardware and software parts. In hardware part it includes the oscillator and clock circuit, program counter and data pointer, A and B CPU registers, PSW and flags, RAM and ROM and special function registers. | <u>5</u>        |
| 2      | <b>Division of the Topic</b><br><br>Clock circuit RAM and ROM SFRs.  | <u>30</u>       |
| 3.     | <b>Conclusion</b><br><br>A complete circuitry of hardware and software parts make a microcontroller system ready for any application.  | <u>5</u>        |
| 4      | <b>Question / Answer</b><br>Draw the block diagram of 8051.  | <u>10</u>       |

### Reference Readings:-

Design with PIC Microcontrollers by John B. Peatman  
Programming and Customizing the 8051 Microcontroller : Predko.

### Text Book :

Raj Kamal: Embedded Systems- Architecture, Programming and Design, TMH, New Delhi  
Mazidi and Mazidi: The 8051 Microcontroller and Embedded Systems, Pearson Education  
A. V. Deshmukh: Microcontroller (Theory and Application), TMH.  
D. V. Hall: Microprocessors and Interfacing, TMH Reference Book

**Lecture Plan 27**Semester:-VClass:-ECS

Course code: IC-403-F

Subject: EMBEDDED SYSTEM DESIGN

**Section:C**

| <b>S. No.</b> | <b>Topic :- MICROCONTROLLER PIN DIAGRAM</b>  | <b>Time Allotted:-</b> |
|---------------|--|------------------------|
| 1.            | <b>Introduction</b><br>It includes 40 pins. Where two pins for crystal oscillator . 24 pins for input and output ports, and other pins are for timing and control purpose.   | <u>5</u>               |
| 2             | <b>Division of the Topic</b><br><br>Explained each pin with function   | <u>30</u>              |
| 3.            | <b>Conclusion</b><br><br>The internal hardware configuration of 8051 registers and control circuit has examined at the functional block diagram level. The 8051 may be considered to be a collection of RAM and ROM and addressable registers that has some unique function. | <u>5</u>               |
| 4             | <b>Question / Answer</b><br><br>Draw and Explain the pin diagram of 8051 ?   | <u>10</u>              |

**Reference Readings:-**

Design with PIC Microcontrollers by John B. Peatman

Programming and Customizing the 8051 Microcontroller : Predko.

**Text Book :**

Raj Kamal: Embedded Systems- Architecture, Programming and Design, TMH, New Delhi

Mazidi and Mazidi: The 8051 Microcontroller and Embedded Systems, Pearson Education

A. V. Deshmukh: Microcontroller (Theory and Application), TMH.

D. V. Hall: Microprocessors and Interfacing, TMH Reference Book

Doc. No.: DCE/0/15  
Revision :00

## Lecture Plan 28

Semester:-V

Class:-ECS

Course code: IC-403-F

Subject: EMBEDDED SYSTEM DESIGN

**Section:C**

| S. No. | Topic :- :- ADDRESSING MODES   | Time Allotted:- |
|--------|--|-----------------|
| 1.     | <b>Introduction</b><br>Indirect Addressing: Full 8 bit register address is written the special function register FSR• INDF is used to get the content of the address pointed by FSR.<br>Direct Addressing: Uses 7 bits of 14 bit instruction to identify a register file address 8th and 9th bit comes from RP0 and RP1 bits of STATUS register. | <u>5</u>        |
| 2      | <b>Division of the Topic</b><br><br>Addressing modes   | <u>30</u>       |
| 3.     | <b>Conclusion</b><br><br>Addressing modes are the various techniques to specify the data and opcode and operands.  | <u>5</u>        |
| 4      | <b>Question / Answer</b><br><br>What are the different addressing modes?   | <u>10</u>       |

### Reference Readings:-

Design with PIC Microcontrollers by John B. Peatman  
Programming and Customizing the 8051 Microcontroller : Predko.

### Text Book :

Raj Kamal: Embedded Systems- Architecture, Programming and Design, TMH, New Delhi  
Mazidi and Mazidi: The 8051 Microcontroller and Embedded Systems, Pearson Education  
A. V. Deshmukh: Microcontroller (Theory and Application), TMH.  
D. V. Hall: Microprocessors and Interfacing, TMH Reference Book

## Lecture Plan 29

Semester:-V

Class:-ECS

Course code: IC-403-F

Subject: EMBEDDED SYSTEM DESIGN

**Section:C**

| S. No. | Topic :- MICROCONTROLLER TIMERS  | Time Allotted:- |
|--------|--|-----------------|
| 1.     | <b>Introduction</b><br>Microcontroller has two two 16-bit timer named T0& T1. These are divided in to two 8- bit registers named TH0 and TL0 and high TH1 and TL1. All counters registers is controlled by bit states in the timer mode control register TCON and TMOD and certain instructions. | <u>5</u>        |
| 2      | <b>Division of the Topic</b><br><br>Timers and counters  | <u>30</u>       |
| 3.     | <b>Conclusion</b><br><br>Many microcontroller applications require the counting of external events as the frequency of a pulse train or generation of the internal timer delay. For this purpose thje timer and counter regioster is required.   | <u>5</u>        |
| 4      | <b>Question / Answer</b><br>What is timer control register TCON? What is watch dog timer?  | <u>10</u>       |

### Reference Readings:-

Design with PIC Microcontrollers by John B. Peatman  
Programming and Customizing the 8051 Microcontroller : Predko.

### Text Book :

Raj Kamal: Embedded Systems- Architecture, Programming and Design, TMH, New Delhi  
Mazidi and Mazidi: The 8051 Microcontroller and Embedded Systems, Pearson Education  
A. V. Deshmukh: Microcontroller (Theory and Application), TMH.  
D. V. Hall: Microprocessors and Interfacing, TMH Reference Book

### Lecture Plan 30

Semester:-V

Class:-ECS

Course code: IC-403-F

Subject: EMBEDDED SYSTEM DESIGN

**Section:C**

| <b>S. No.</b> | <b>Topic :- INSTRUCTION SET</b>  | <b>Time Allotted:-</b> |
|---------------|--|------------------------|
| 1.            | <b>Introduction</b><br>Complete set which includes 35 instructions. A reason for such a small number of instructions lies primarily in the fact that we are talking about a RISC microcontroller whose instructions are well optimized considering the speed of work, architectural simplicity and code compactness. The only drawback is that programmer is expected to master "uncomfortable" technique of using a reduced set of 35 instructions. | <u>5</u>               |
| 2             | <b>Division of the Topic</b><br><br>Data transfer Arithmetic and logic Bit operations  | <u>30</u>              |
| 3.            | <b>Conclusion</b><br><br>Explained all instructions with example.  | <u>5</u>               |
| 4             | <b>Question / Answer</b><br><br>Explain all instructions with example.   | <u>10</u>              |

#### Reference Readings:-

Design with PIC Microcontrollers by John B. Peatman  
Programming and Customizing the 8051 Microcontroller : Predko.

#### Text Book :

Raj Kamal: Embedded Systems- Architecture, Programming and Design, TMH, New Delhi  
Mazidi and Mazidi: The 8051 Microcontroller and Embedded Systems, Pearson Education  
A. V. Deshmukh: Microcontroller (Theory and Application), TMH.  
D. V. Hall: Microprocessors and Interfacing, TMH Reference Book

## Lecture Plan 31

Semester:-V

Class:-ECS

Course code: IC-403-F

Subject: EMBEDDED SYSTEM DESIGN

Section:C

| S. No. | Topic:- MICROCONTROLLER APPLICATION  | Time Allotted:- |
|--------|--|-----------------|
| 1.     | <b>Introduction</b><br>In real world some of the microcontroller applications are in LCD, LED Seven segment display devices, motor control data reception and transmission, sensor modules.if keyboards are the prominent means of interface to human input then visible displays are the universal means of human output. | <u>5</u>        |
| 2      | <b>Division of the Topic</b><br>Interface of LCD and LED Interface of motor control  | <u>30</u>       |
| 3.     | <b>Conclusion</b><br>Hardware designs and programs have been illustrated to solve several command application problems that are especially suitable for solution using a microcontroller.  | <u>5</u>        |
| 4      | <b>Question / Answer</b><br>Explain interfacing of display devices with program. Explain how microcontroller can control the speed of motor?   | <u>10</u>       |

### Reference Readings:-

Design with PIC Microcontrollers by John B. Peatman  
Programming and Customizing the 8051 Microcontroller : Predko.

### Text Book :

Raj Kamal: Embedded Systems- Architecture, Programming and Design, TMH, New Delhi  
Mazidi and Mazidi: The 8051 Microcontroller and Embedded Systems, Pearson Education  
A. V. Deshmukh: Microcontroller (Theory and Application), TMH.  
D. V. Hall: Microprocessors and Interfacing, TMH Reference Book