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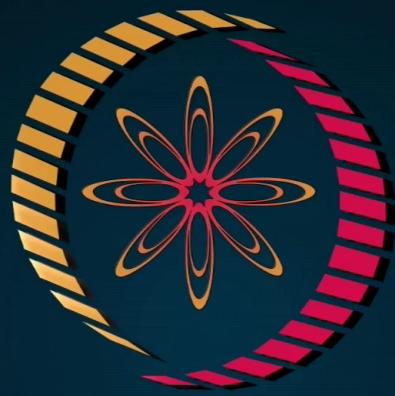




**NPTEL**

## **NPTEL ONLINE CERTIFICATION COURSE**

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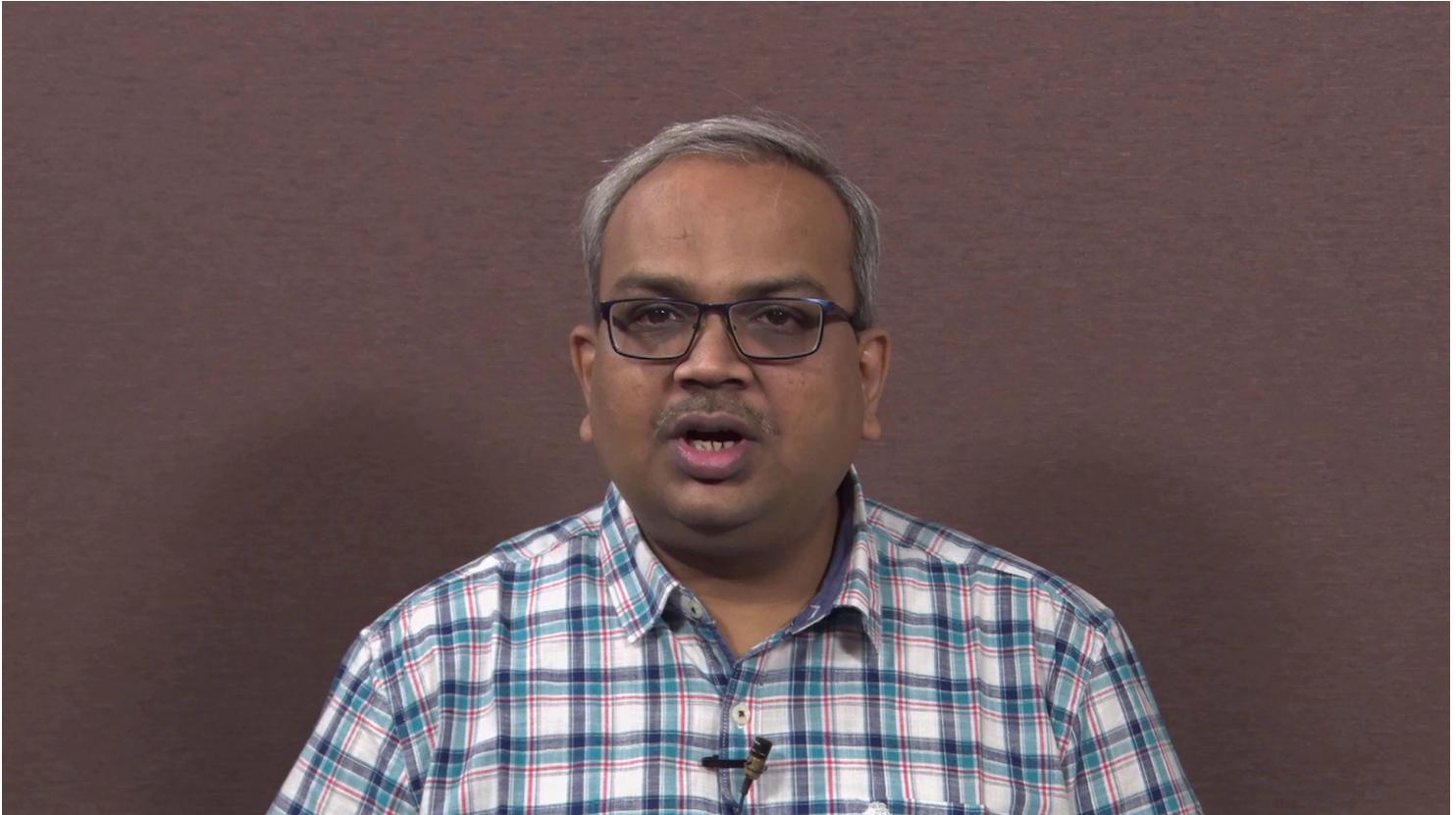


**NPTEL**

# **NPTEL ONLINE CERTIFICATION COURSE**

An Initiative of MHRD

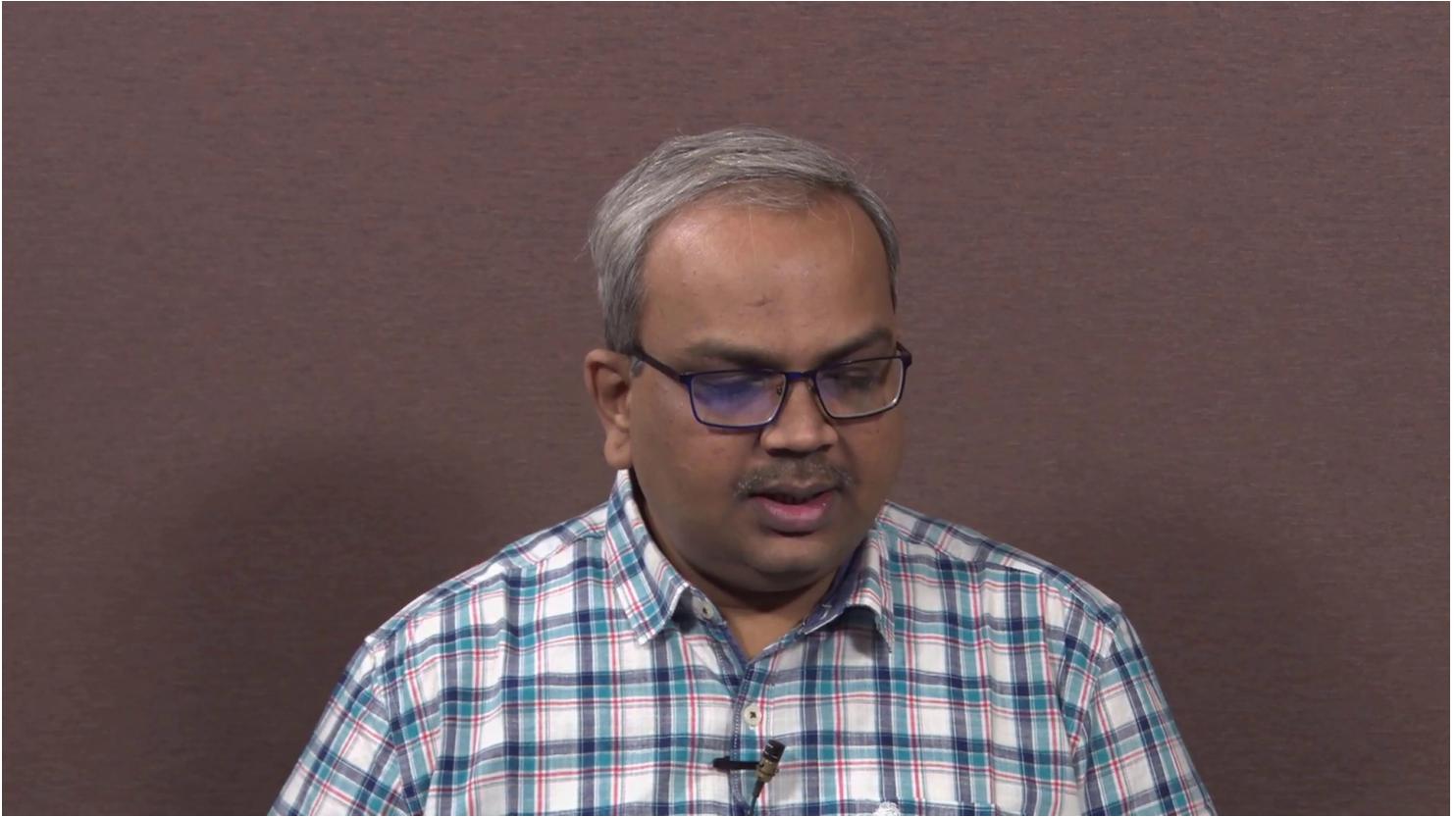
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# Week 5: Signal conditioning and Microprocessor Technology

## Lecture 4: Microprocessor Technology



In this week we will be studying the important building block of an automated system that is microprocessor technology.

# Outline



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# Outline

- ❖ Microprocessors: introduction



re at start of the lecture we will see the definition of a microproc

# Outline

- ❖ Microprocessors: introduction
- ❖ Architecture, elements, operation



essor then we will see its architecture it has various elements how these elements o

# Outline

- ❖ Microprocessors: introduction
- ❖ Architecture, elements, operation
- ❖ Micro-controllers: definition and difference
- ❖ Micro-computers



perate then we will learn what is the difference between a microcontroller and a microprocessor the definition of microcontroller will be studied after that we will study the microcomputers which we are using for our regular da

# Outline

- ❖ Microprocessors: introduction
- ❖ Architecture, elements, operation
- ❖ Micro-controllers: definition and difference
- ❖ Micro-computers
- ❖ Programmable logic controllers (PLCs): elements, configuration and operation



y-to-day activities at the end of the lecture we will study about the plcs the programmable logic controllers which are used in the automation industry its elements configuration and operation will be studied in detail fine let

# Programmable Logic Devices (PLD)

- Programmable Logic Devices (PLD) - to perform different control functions, according to the programs written in its memory, using low level languages of commands.

us begin in this lecture we will be studying various programmable logic devices in a in our previous lectures we have seen the elements of measurement system such as the sensors and the signal conditioning devices after that we have also seen how we can convert the signals from one form to the another form now let us look at the fundamentals of programmable logic devices as the name suggests the programmable logic devices has two words these are programmable and logic the devices which are carrying out logical operations on the data are called as the logic devices but when we are able to program them when the users are able to program these logic devices then we are call them as the programmable logic devices programmable means we can teach we can instruct we can train these logic devices to carry out a certain set of instructions in the given sequence so what kind of operations these programmable logical logic devices are carrying out they are carrying out various control functions according to the instructions written in its memory so whatever the commands that we are giving they are the low level language commands we will see what is the meaning of the low level and the high level language in the next few sl

# Programmable Logic Devices (PLD)

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  - Microprocessor, a digital integrated circuit - digital functions necessary to *process* information



ides the first pld is the microprocessor microprocessor is a digital integrated circuit it is an electronic circuit and it carries out various digital functions which are necessary to process the information which are necessary to process the data given to the micropo

# Programmable Logic Devices (PLD)

- Programmable Logic Devices (PLD) - to perform different control functions, according to the programs written in its memory, using low level languages of commands.
  - Microprocessor, a digital integrated circuit - digital functions necessary to *process* information
  - Microcomputer - uses microprocessor as its central processing unit and contains all functions of a computer

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cessor the microcomputer is utilizing the microprocessor as its cpu that is a central processing unit and it contains all functions of a computer so micro computer may have memory it can communicate with the outside world with input output devices so here you must know the difference between the processor and a computer processor is a simple circuit while computer is a system it has processor as the cpu central process

# Programmable Logic Devices (PLD)

- Programmable Logic Devices (PLD) - to perform different control functions, according to the programs written in its memory, using low level languages of commands.
  - Microprocessor, a digital integrated circuit - digital functions necessary to *process* information
  - Microcomputer - uses microprocessor as its central processing unit and contains all functions of a computer
  - Programmable Logic Controller (PLC) - to control the operation of *electro-mechanical* devices

ing unit third pld which is very widely used which is very important as far as the automated system is concerned is plc that is programmable logic controller programmable logic controller also incorporates the microprocessor as the central processing unit and it controls the operations of electromechanical devices but plc is working in very harsh condition so the construction of the plc must be very rugged very r

# Use of Microprocessors in automation

- Embedded microprocessor
  - Dedicated to controlling a specific function
  - Self-starting

obust the general microprocessors which are used in automation industry are the embedded microprocessor some of the features of this microprocessor are first these kind of microprocessors are dedicated to a specific function control of a specific function for example we want to have an automatic control system to control the temperature of an electric furnace here the function is to control the temperature of the furnace if the temperature if the inside temperature of the furnace is above the set value the microprocessor should cut off the supply of electricity to that electric furnace so a simple electronic circuitry which is embedded inside the electric furnace is nothing but the embedded microprocessor so it is dedicated to carry out specific functions second feature of the embedded microprocessor is they are self starting so the processors are starting on their own as we switch on the system the processor will start on i

# Use of Microprocessors in automation

- Embedded microprocessor
  - Dedicated to controlling a specific function
  - Self-starting
  - Requires no human intervention

ts own why we are incorporating the microprocessor is in automation as we have seen the definition of automation that we want to reduce the human intervention we want to have no intervention so to carry out the operations in auto mode we are taking help of the electronic spec circuitry that is nothing but th

# Use of Microprocessors in automation

- Embedded microprocessor
  - Dedicated to controlling a specific function
  - Self-starting
  - Requires no human intervention
  - Completely self-contained

For microprocessors these are completely self-contained the embedded microprocessor has their own memory and may have their own battery backup as well they may have their own energy source

# Use of Microprocessors in automation

- Embedded microprocessor
  - Dedicated to controlling a specific function
  - Self-starting
  - Requires no human intervention
  - Completely self-contained
  - Own operating system

as well the microprocessor which are used in automation which are embedded in the products or systems has their own operating system so we can say an embedded microprocessor will be dedicated to a specific function it is self-starting it doesn't require any human intervention these are completely self-contained everything is there inside the system and they do have their own operating system

# Microprocessor

- a multi-purpose, programmable device
  - reads binary instructions from a storage device called memory

the microprocessor a multi-purpose programmable device it basically reads the binary instructions from a storage device that called memory the memory may be the temporary memory or it may be the permanent memory so whatever the signals which are getting in will be stored in a temporary memory the microprocessor process this information as per the need as per the instructions given in the

# Microprocessor

- a multi-purpose, programmable device
  - reads binary instructions from a storage device called memory
  - processes data according to the instructions
  - provides results as output



program it process that information according to the instructions and it provides the results as the output so getting the information reading the information and processing the information based upon the instructions given are the functions of a microprocessor but how these functions are carried out to carry out these functions the microprocessor basically has three elements the processor memory element and input output devices to carry out these functions the microprocessor basically has hardware and this and the hardware is nothing but the electronic parts which are integrated together to carry out the intended operation the processor is an electrical circuitry memory is an electronic part and input output devices are are the electromechanical parts well these components are integrated together but their coordinated operation will be carried out by a set of instructions and that of set of instruction is nothing but the program and when we group together a variety of programs then we call that as a software so let us see what this processor does the processor recognizes the program instructions and it carry out it execute that program instructions as per the order given as per the sequence given the microprocessor has the in input output interfaces so the microprocessor is also carrying out the communication between the cpu that is the processor and the outside world through the

input output interfaces so in general we call the interface as port in our day to day language as well we are using the word port quite often the third element which is there that is a memory the memory basically holds the program instructions and the data the applications of microprocessor can be classified basically in two categories so based upon the applications of the microprocessor we can say that the microprocessor can be utilized as a reprogrammable system device such as the microcomputer so whatever the computing devices that we do have we can reprogram these systems we can change its operating system we can install some programs we can modify uh these programs we can edit the programs so to carry out these operations in microcomputers we are using the microprocessor so when we are using the microprocessor utility for developing the reprogrammable system that we call the application of microprocessor to have the microcomputers in the second application we want to have the dedicated functions that to be carried out by the microprocessor and these are nothing but the embedded systems which we have already talked about let us consider the typical automated system such as a conveyor belt automated guided vehicles automatic furnaces all the manufacturing industry equipment whether it may be processing equipment or it is the conveying equipment or it is the monitoring equipment so whenever we are saying we want to carry out the intended application the desired application in automatic mode there also we need the microprocessor so the application of microprocessor to carry out specific functions in automatic mode that is nothing but the embedded system these processors do operate in binary digits that is 0 and 1 these digits are called bits if the electrical voltage given to the machine is of low level then the bit would be 0 and if a high voltage is applied high electrical energy is applied then we are considering that as the beat 1.