



# **SNS COLLEGE OF TECHNOLOGY**

**Coimbatore-35**  
**An Autonomous Institution**



Accredited by NBA – AICTE and Accredited by NAAC – UGC with 'A+' Grade  
Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai

## **DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING**

### **19ECB204 – LINEAR AND DIGITAL CIRCUITS**

II YEAR/ III SEMESTER

#### **UNIT 2 – COMPARATORS AND SPECIAL FUNCTION IC's**

#### **TOPIC 7 - Analog to Digital Converter**



## ***WHAT IS ADC?***



- ADC is an electronic device that converts a continuous analog input signals to discrete digital number.

### **WHERE IT IS USED?**

- Microcontrollers can store information using digital logic.
- Digital data is easily reproducible.
- It compress information to digital form for efficient storage.



# ***ANALOG TO DIGITAL CONVERSION***



## **1. SAMPLING**

In signal processing, sampling is the reduction of a continuous signal to discrete signal.

## **2. QUANTIZING**

It breaks down analog value is a set of finite states.

## **3. ENCODING**

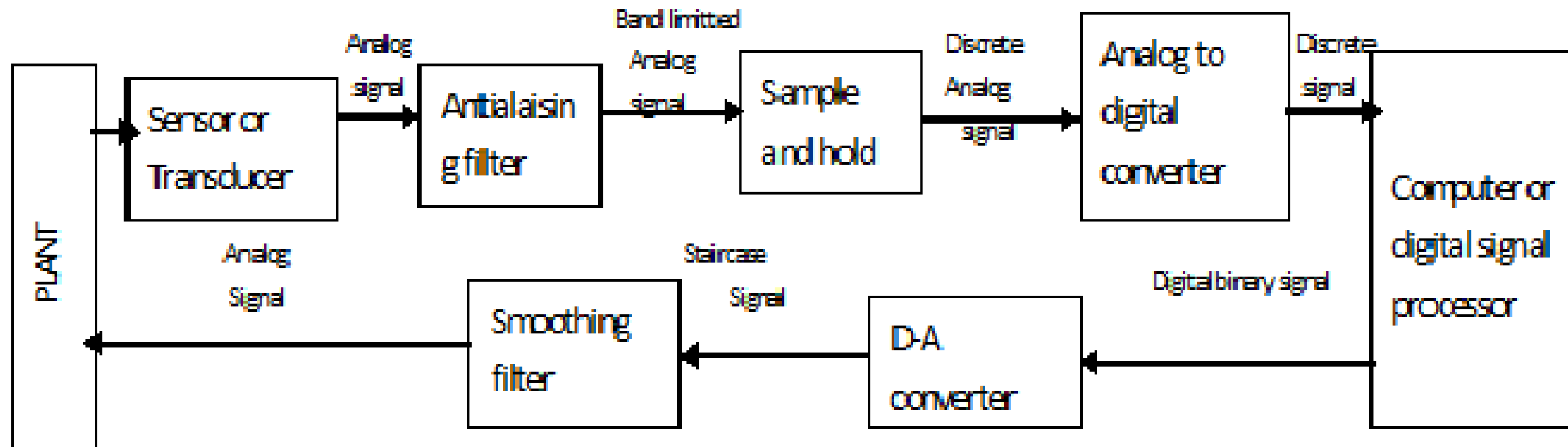
It assigns a digital word or number to each state and matches it to the input signal.



# Block Diagram of ADC & DAC



BLOCK DIAGRAM OF ADC & DAC





# ***ANALOG TO DIGITAL CONVERSION***



- In modern life, electronic equipment is frequently used in different fields such as communication, transportation, entertainment, etc.
- ADC and DAC are very important components in electronic equipment.
- Since most real world signals are analog, these two converting interfaces are necessary to allow digital electronic equipments to process the analog signals.



# ANALOG TO DIGITAL CONVERSION





# ***ANALOG TO DIGITAL CONVERSION***



- In electronics, an ADC is a device for converting an analog signal (voltage, current etc.) to a digital code, usually binary.
- In the real world, most of the signals sensed and processed by humans are analog signals.
- Analog to Digital conversion is the primary means by which analog signals are converted into digital data that can be processed by computers for various purposes.
- The sensor & transducer connects the input analog signal to the Analog to Digital converter & it converts the non electrical input signal into electrical signal.



# ***ANALOG TO DIGITAL CONVERSION***

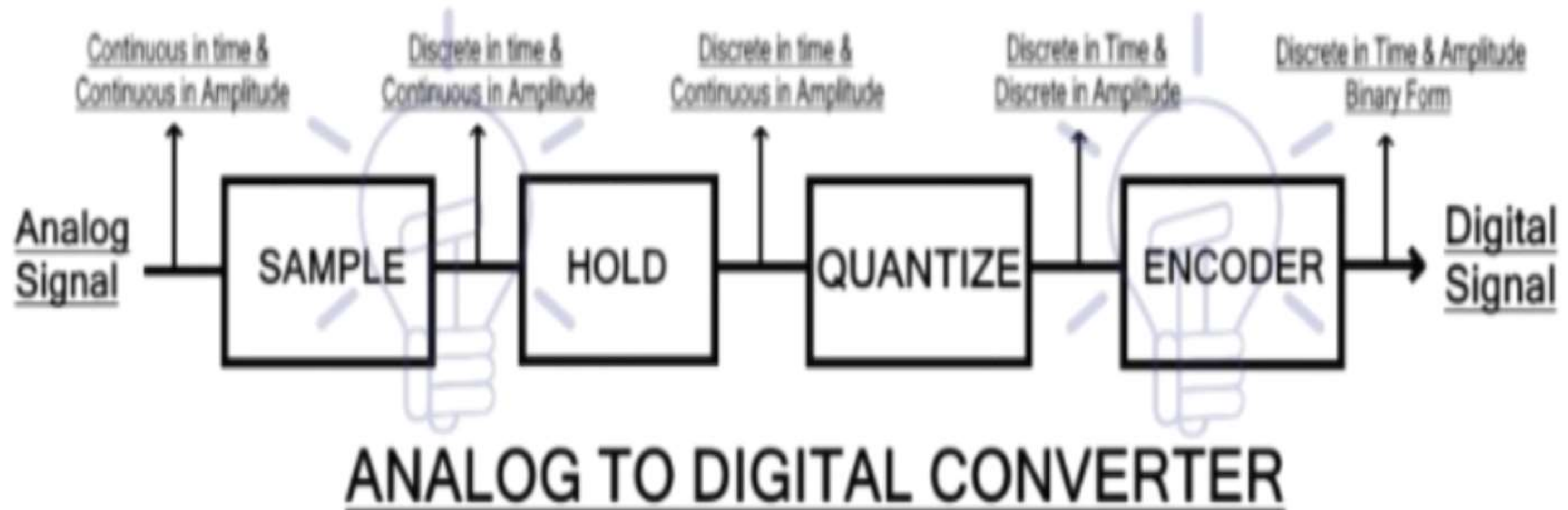


- Antialiasing filter is used to band limit the analog signal i.e., there by band width requirement is reduced.
- Sample & hold circuit is used to sample the band limited signal based on the sample theorem.
- So the signal becomes a discretized signal. Though the signal is in analog form, hold the discrete signal until the conversion is completed.
- Analog to Digital converter converts the discretized signal into binary digits i.e., discrete digital signal and then it is given to the processors.





# Block Diagram of Analog to Digital





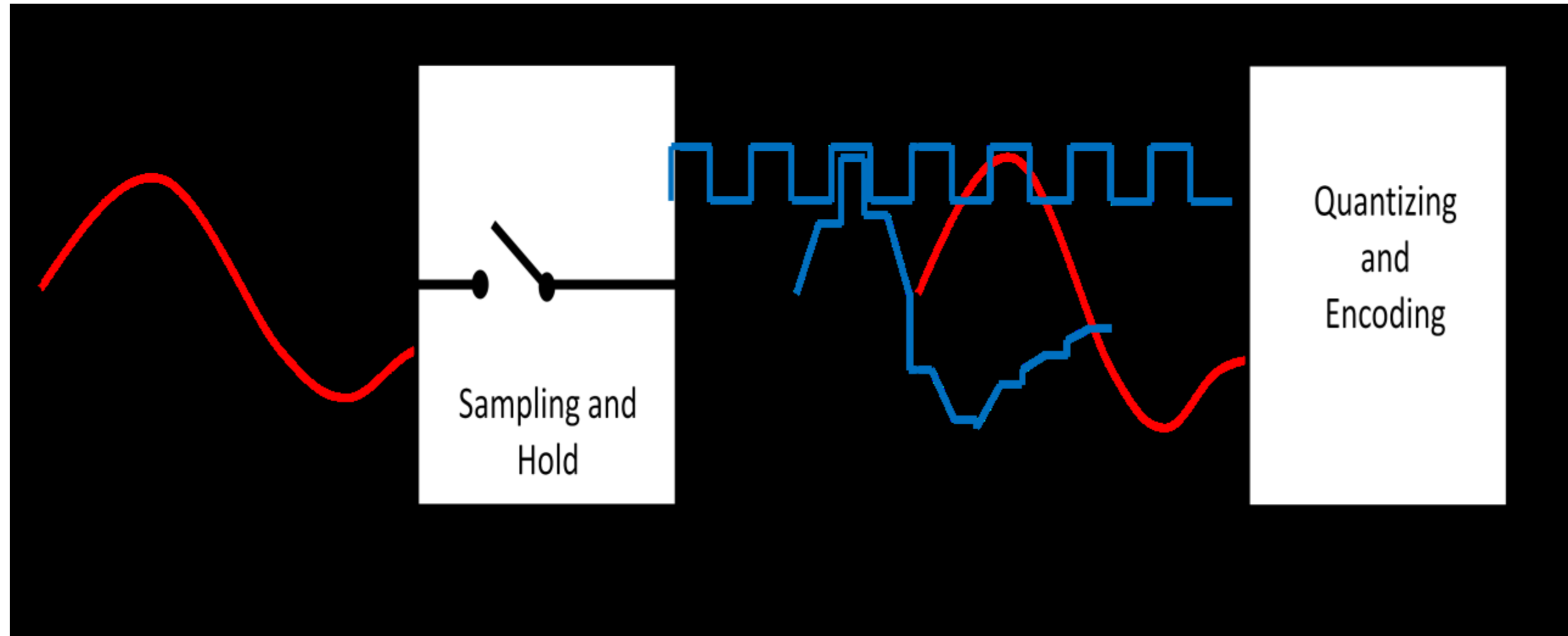
# ***ANALOG TO DIGITAL CONVERSION***



- In A/D conversion, there are two main steps of process
  - 1. Sampling and Holding
  - 2. Quantization
  
- In order to be able to perform digital signal processing on natural signals that are analog in nature, they must first be sampled and quantized into digital form.

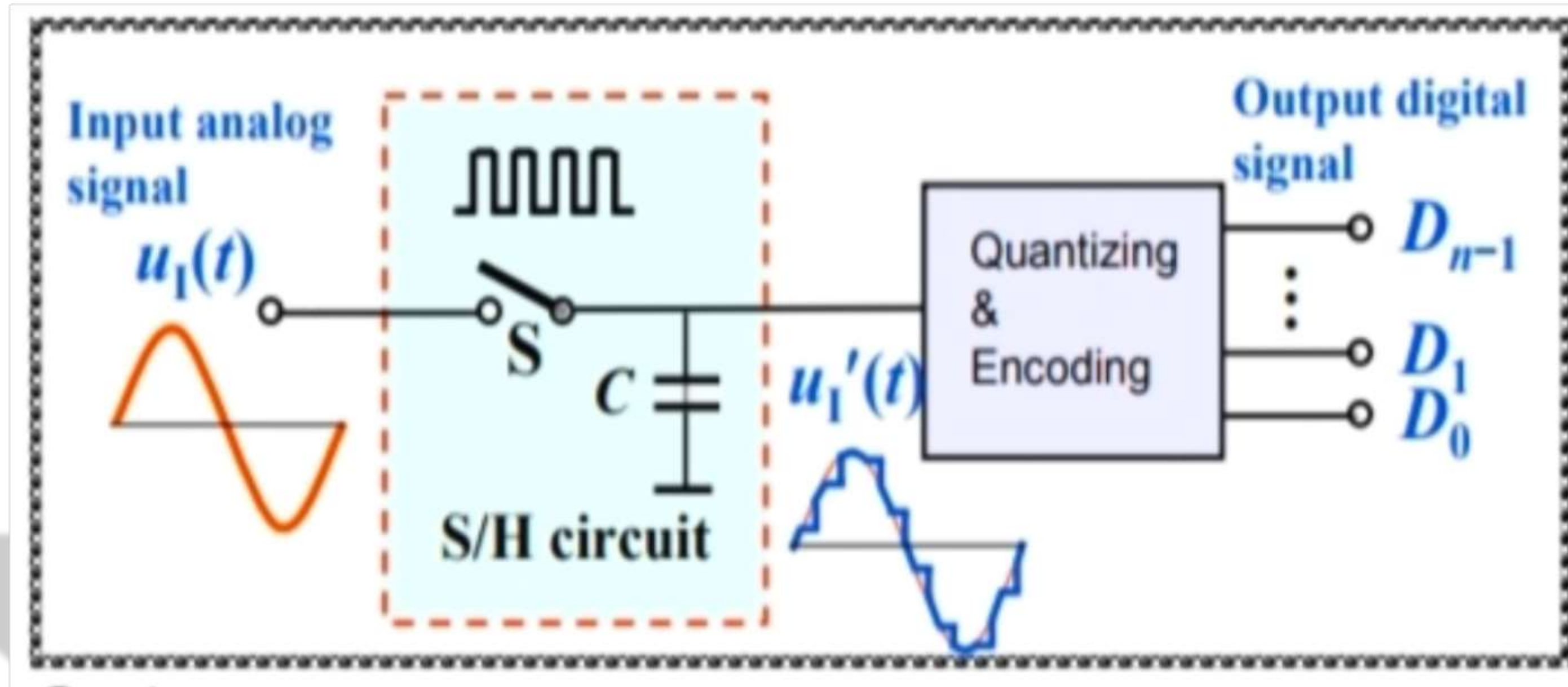


# ANALOG TO DIGITAL CONVERSION





# ANALOG TO DIGITAL CONVERSION





# LIST OF SPECIFICATION



- Analog Input Voltage Range It is the maximum allowable input–voltage range in which ADC will operate properly.
- Typical values are 0 to 10 V, 0 to 12 V,  $\pm 5$  V,  $\pm 10$  V, and  $\pm 12$  V.
- Quantization error: The error is a process of quantization called quantization error. .
- The accuracy of an ADC depends on quantization error, digital system noise, gain error, offset error, and deviation from linearity, etc.





# LIST OF SPECIFICATION



- Resolution The resolution is defined by the ratio of reference voltage to number of output states.

Resolution = Reference voltage /  $(2^N - 1)$

where N = number of bits of the ADC.

- conversion time varies from 50  $\mu$ s to a few ns for slow/medium speed to a high-speed ADC.
- Temperature Stability Accuracy of an A/D converter depends on temperature variation. Typical temperature coefficients of error are 30 ppm/ $^{\circ}$ C.



**THANK YOU**