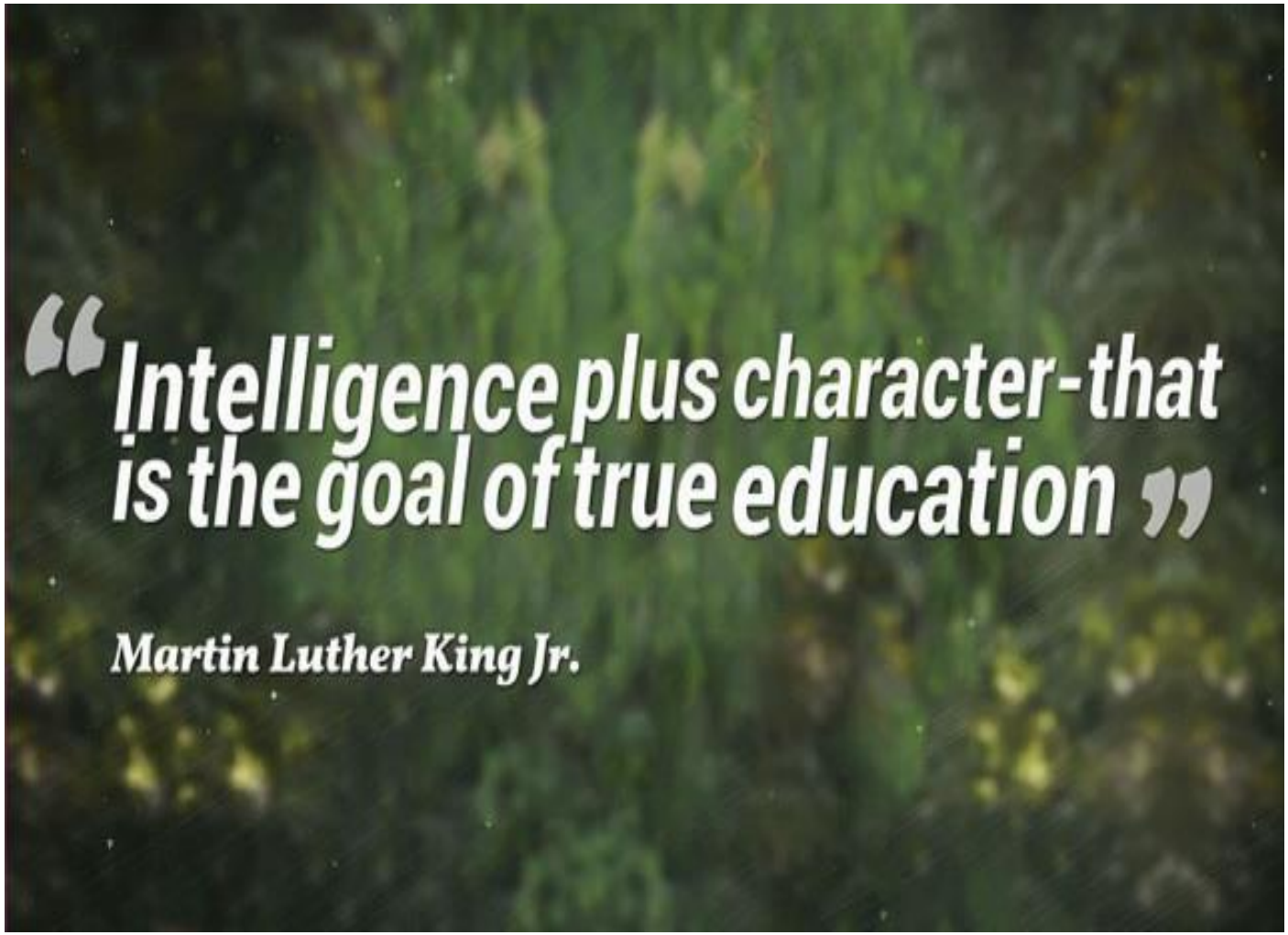

“Intelligence plus character-that is the goal of true education”
Martin Luther King Jr.

Why Analog electronics

- **Analog electronics** are electronic systems with a continuously variable signal.
- Analog links real-world senses like hearing, touching and seeing to the digital world.
- A typical electronic design can have 15-20 analog chips for every embedded processor

What is the difference between analog and digital signals?

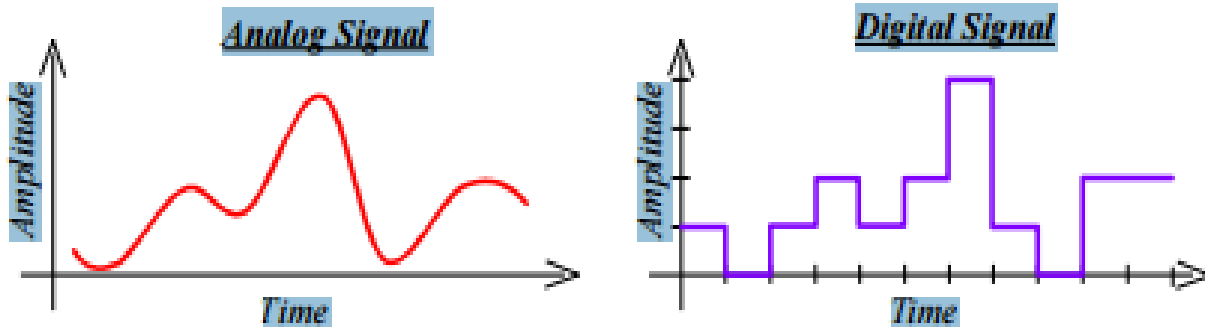
Definitions

Analog Signal: Continuous over time and space.

→ "Analogous" to the physical signal it represents.

Digital Signal: Sampled at discrete points in time and discrete values (amplitude).

→ Signal is quantized, so it is an approximation.



Infinite versus finite number of states → Analog = Digital + Every point in between.

Why analog?

Fact: Physical signals are continuous in time and amplitude → *Analog*.

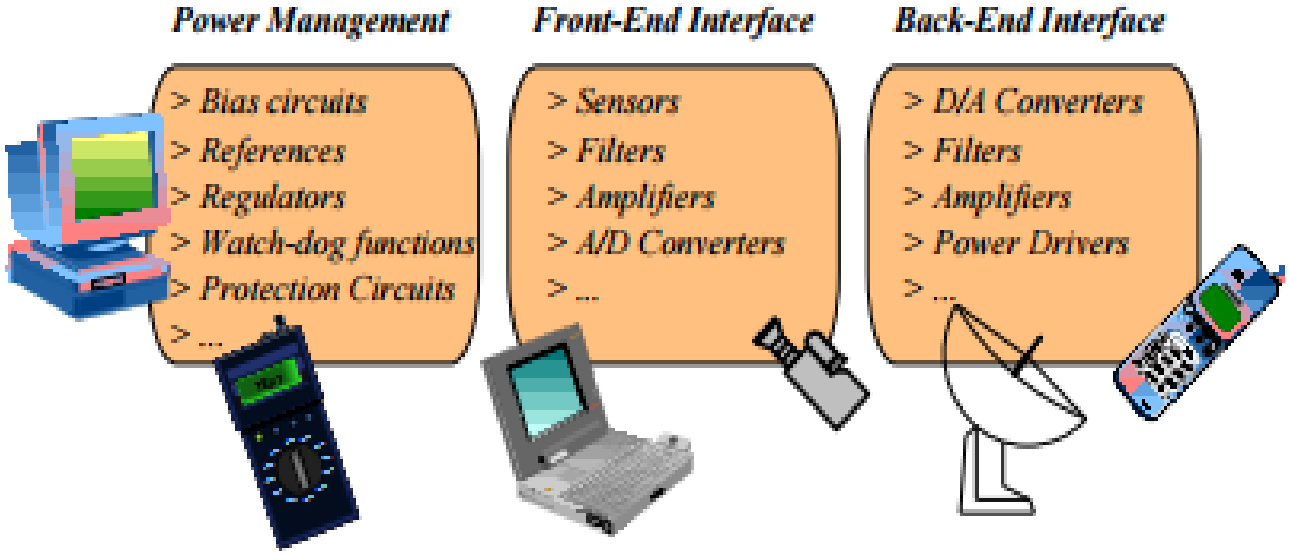
E.g.: Seismic, audio, video, biological, and so on.

But: Digital signals are easier to process and more robust.

I.e.: More room for error → Higher noise immunity.

So: Interface and process analog signals,

and *when possible*, convert into and process digital stream.



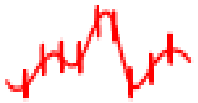
- Electrical signals may represent information by changing their voltage, current, frequency, or total charge. Information is converted from some other physical form (such as sound, light, temperature, pressure, position) to an electrical signal by a transducer which converts one type of energy into another (e.g. a microphone).
- All operations that can be performed on an analogue signal such as amplification, filtering, limiting, and others.

What is the difference between analog and digital IC design?

Trend: On-chip integration → Mixed-signal design

Digital circuits inject switching noise via substrate, supplies, circuits, and traces.

Trend: 50%–90% of chip is digital and 10%–50% is analog.



Die is mostly digital ∴ Engineers optimize technologies for digital circuits.

Design-Time Syndrome:

In a 10% analog–90% digital die, 10% analog requires 90% of total design time.

Pass(attempts)-to-Success Ratio: Digital Designs ≈ 1 and Analog Designs ≈ 2–3.

High-performance analog design cannot be automated ∴ No standard cell libraries.

E.g.: Operational Amplifier → Optimizing *all* possible parameters is impossible,

And not all parameters are equally important ∴ Continually redesigned.

Analog design is difficult, challenging, and always new,

so good analog IC designers are always in high demand.

Analog microelectronics

- Microelectronics relates to the study and manufacture (or microfabrication) of very small electronic designs and components. Usually, but not always, this means micrometre-scale or smaller.
- These devices are typically made from semiconductor materials.
- The use of microelectronics has made digital devices cheap and widely available.

- Many components of normal electronic design are available in a microelectronic equivalent.
- These include transistors, capacitors, inductors, resistors, diodes and (naturally) insulators and conductors can all be found in microelectronic devices.

Prerequisites:

Elements of Electronics Engineering

TEXT BOOKS:

1.Microelectronic Circuits-Theory and applications by ADEL S. SEDRA and KENNETH C.SMITH

FIFTH EDITION

(OXFORD INTERNATIONAL STUDENT EDITION)

2.Electronic Devices and Circuit Theory-Robert L.Boylestad and Louis Nashelsky.(Pearson education)

REFERENCE BOOKS:

1. Electronic Devices and Circuits- Millman and Halkias, TMH
2. Electronic Devices and Circuits- David A Bell - PHI 4th edition

List of On-line Courses:

(1) www.pyroelectro.com/edu/analog

(2) http://freevideolectures.com/Course/3020/Circuits-for-Analog-System-Design

CO1	**Ability to define, understand and explain the structure, V-I characteristics, working and applications of analog electronic devices like diodes, Bipolar Junction Transistors (BJTs) and MOSFETs**
CO2	Ability to apply the knowledge of KVL and KCL to obtain voltage /current/waveform at different points in analog electronic circuits such as diode clippers, clampers, amplifiers using BJTs and MOSFETs, current sources, current mirrors, power amplifiers, feedback amplifiers
CO3	Ability to analyze analog electronic circuits such as diode clippers, clampers, amplifiers using BJTs and MOSFETs, current sources, current mirrors, power amplifiers, feedback amplifiers etc. to obtain voltage /current/waveform at different points for given specifications
CO4	Ability to design analog electronic circuits such as diode clippers, clampers, amplifiers using BJTs and MOSFETs, current sources, current mirrors, power amplifiers, feedback amplifiers for given specifications
CO5	Ability to conduct experiments using analog electronic components and electronic instruments to function as switch, regulator, clippers, clampers, small signal amplifiers, oscillators, power amplifiers
CO6	Ability to engage in self-study/independent study to formulate, design, implement, analyze and demonstrate an application using analog electronic components through an open ended experiment
CO7	Ability to engage in self-study/independent study to submit a seminar report

EVALUATION PATTERN FOR ANALOG INTEGRATED CIRCUITS,15ES4GCAIC
COURSE INSTRUCTOR: Preethi k Mane ,E & I DEPT

CONTINUOUS INTERNAL ASSESMENT	**MARKS/WEIGHTAGE**
A.THEORY COMPONENT	
1.Three internals	**40%**
(Best two of three)	
2.QUIZ(BEST OF TWO)	**10%**
B.LABORATORY COMPONENT	**30%**
1.PRACTICAL RECORD	20%
2. CONTINOUS INTERNAL EVALUATION	10%
C. **SELF STUDY**	**20%**
1.SEMINAR	
ORAL PRESENTATION WITH REPORT	10%
2.CONDUCTION AND DEMONSTRATION	10%