Introduction

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Overview

Course Description

Communication System

Figure: Abstract block diagram of a communication system.

- A communication system conveys information from a source to a destination.
- Transmission process occurs in the source.
- Communication impairments occur in the channel.
- Reception process occurs in the destination.

Course Position

Communication vs Computation

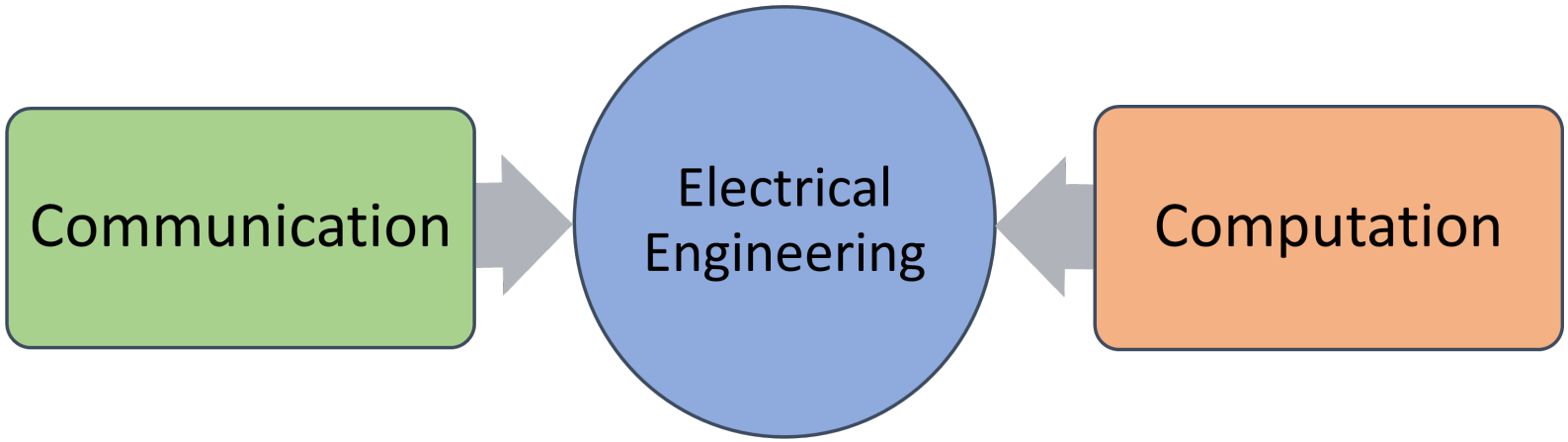

Figure: Communication and computation as the pillars of electrical engineering.

- Computation mainly deals with signal formats and addresses time dimension.
- Communication mainly deals with signal locations and addresses space dimension.

Analysis vs Design

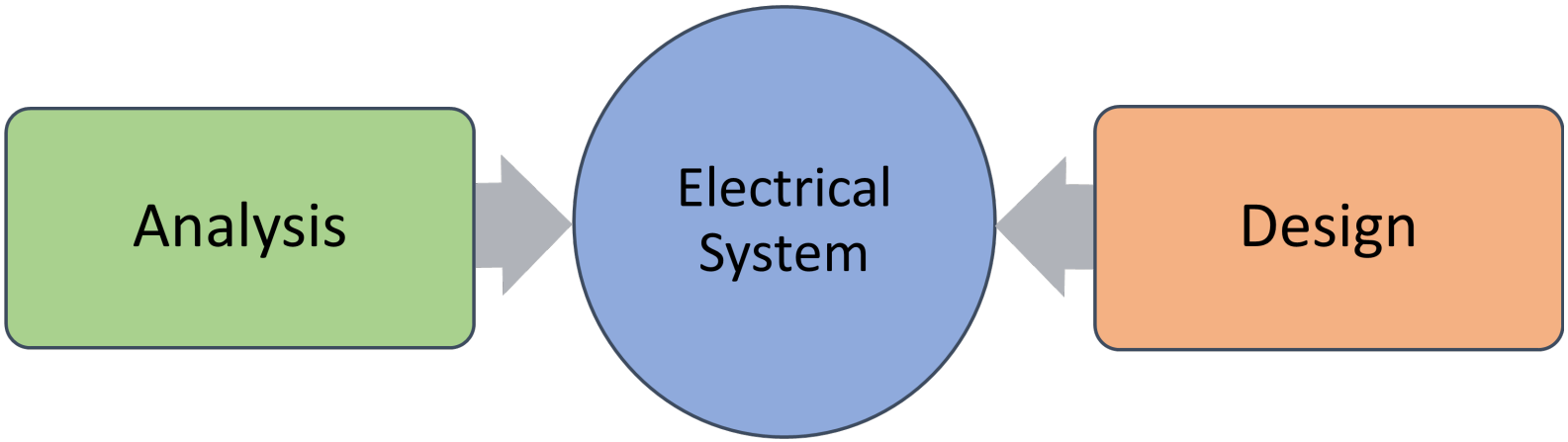

Figure: System analysis and system design.

- Analysis begins with system settings and ends with system metrics.
- Design begins with system metrics and ends with system settings.

Analog vs Digital

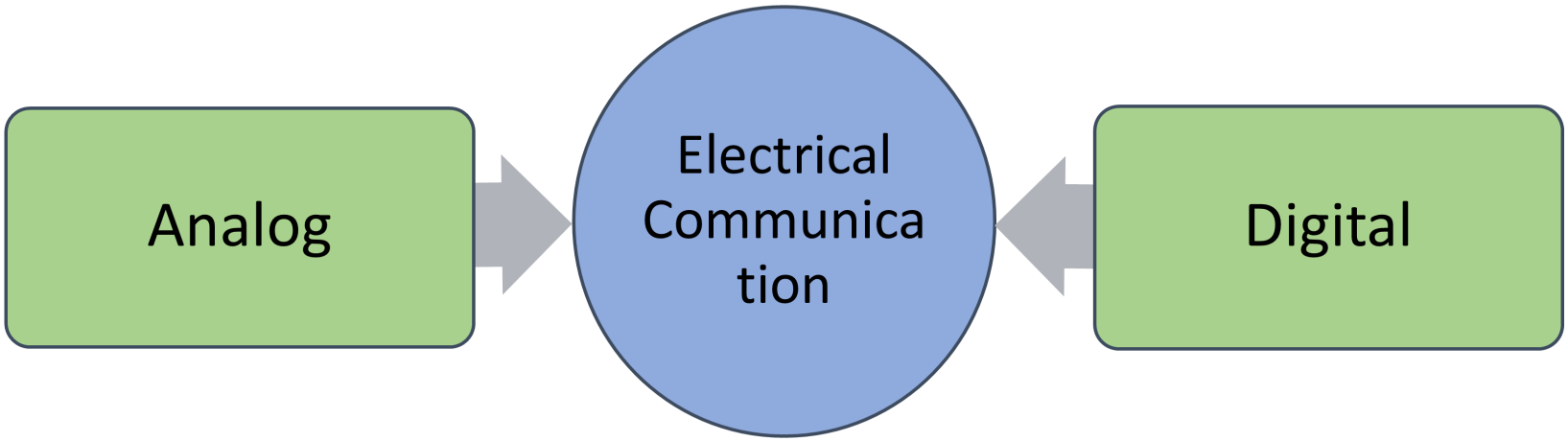

Figure: Communication types based on the signal specification.

- In analog communication, the input signal to transmitter and the output signal from receiver are analog.
- In digital communication, the input signal to transmitter and the output signal from receive are digital.

Traditional Course

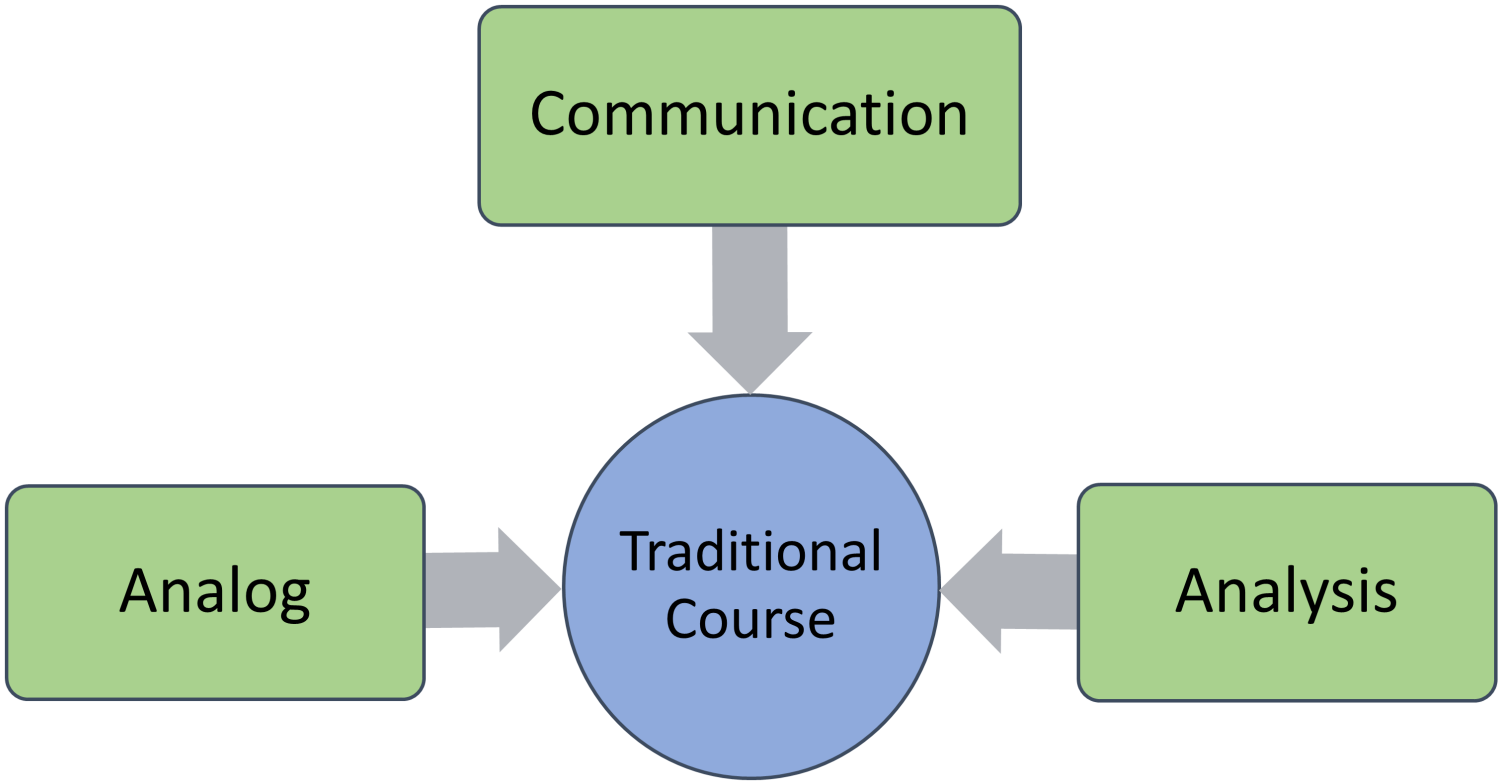

Figure: Position of the traditional course.

✓ The traditional course covered Analog Communication Analysis.

Offered Course

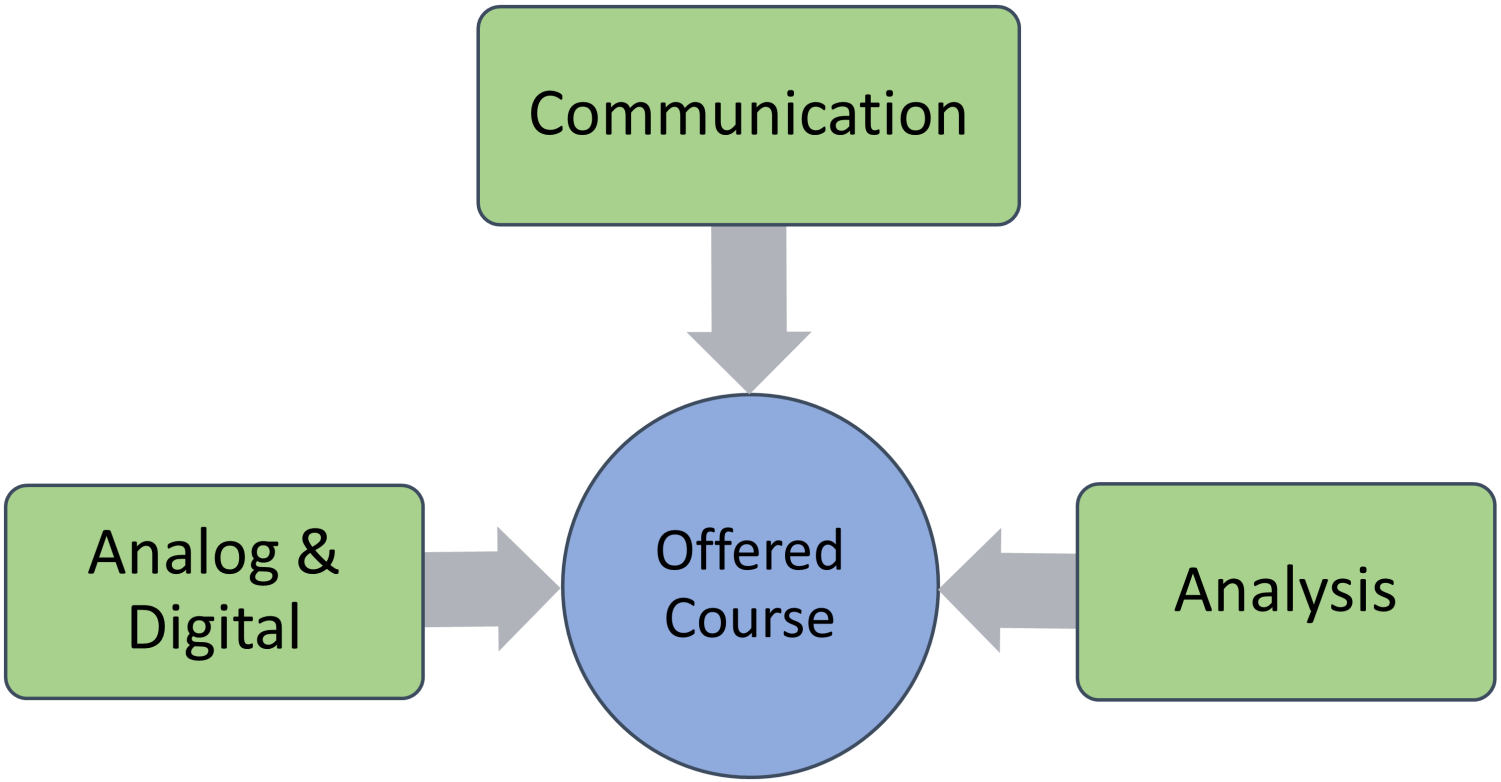

Figure: Position of the offered course.

✓ The offered course covers Digital & Analog Communication Analysis.

Course Coverage

Working Approach

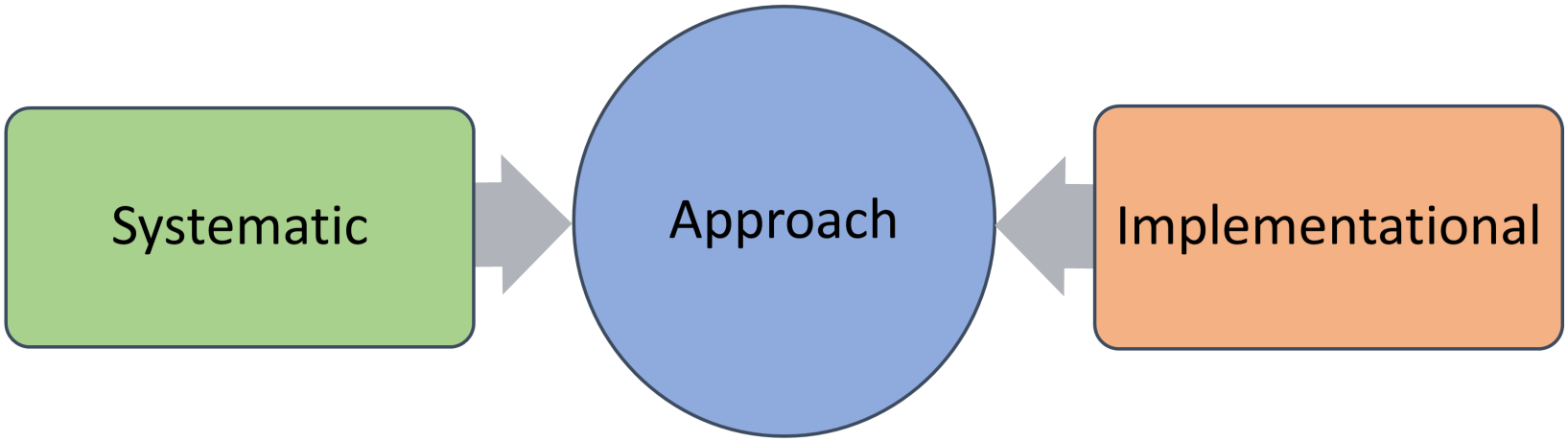

Figure: Systematic and implementational approaches.

1. What is system block diagram?
2. What are system metrics and settings?
3. What are system limitations and specifications?

Working Layer

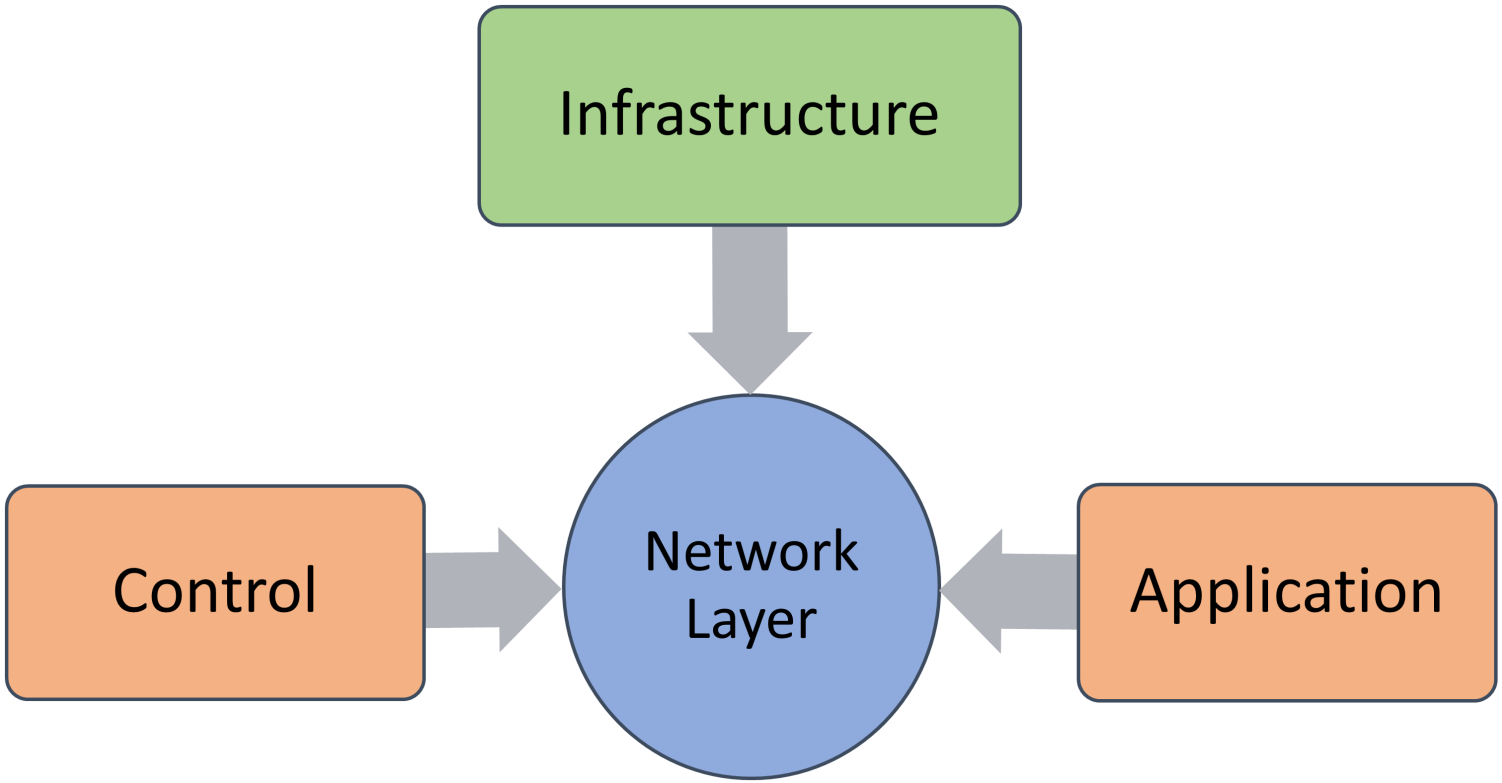

Figure: The main network layers.

1. What are physical resources?
2. What are physical constraints?
3. What are operational objectives?

Communication Channel

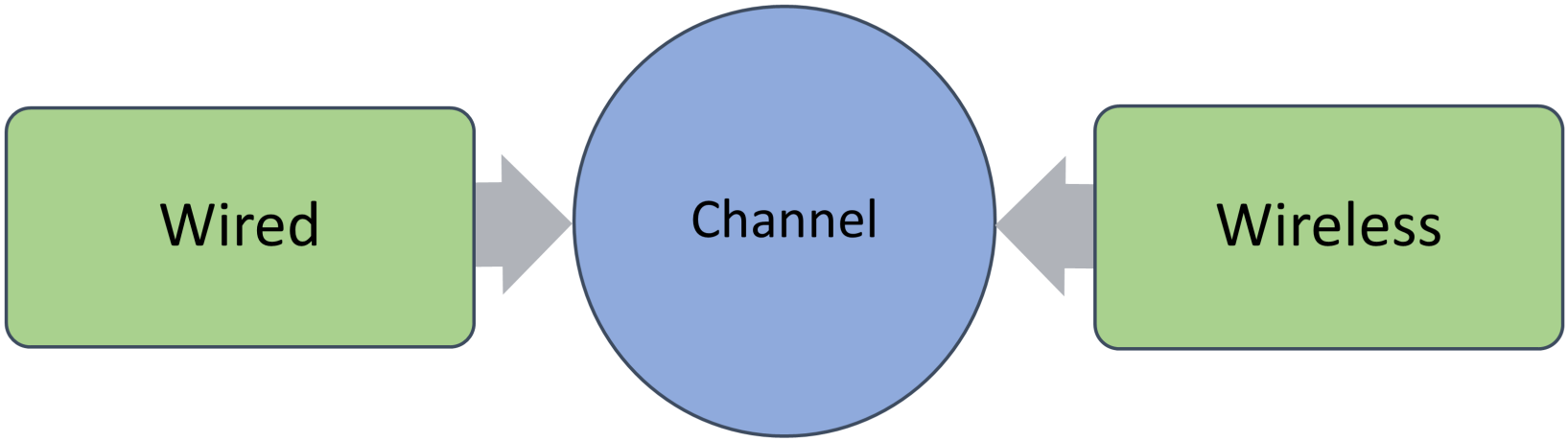

Figure: Types of communication channels.

1. What are channel specifications?
2. What are channel impairments?
3. What are channel models?

Communication Transceivers

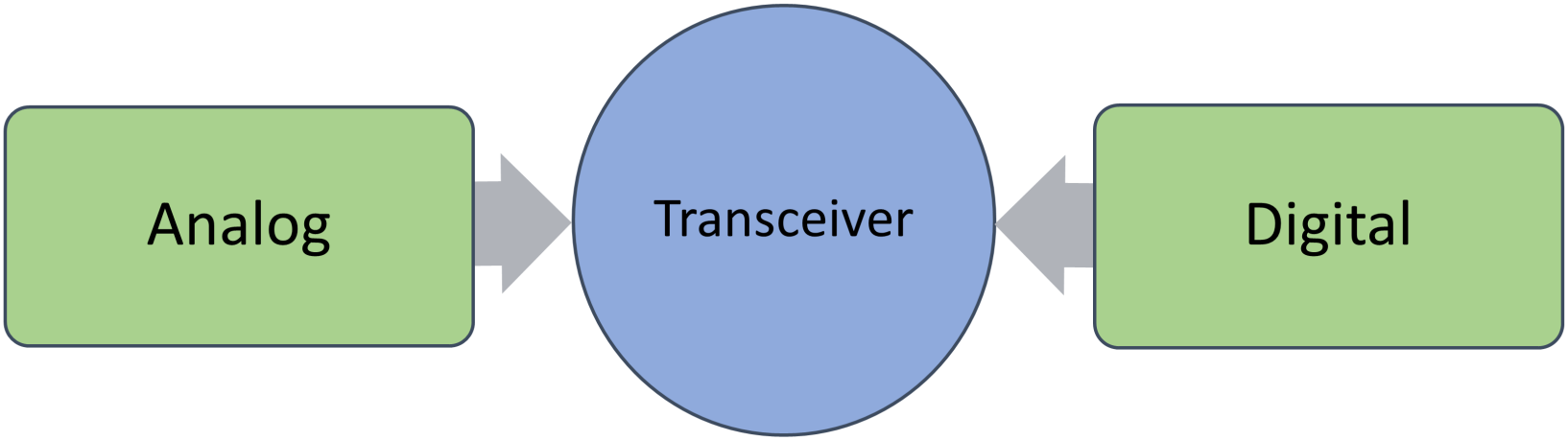

Figure: Types of communication transceivers.

1. What does a transmitter do?
2. What does a receiver do?
3. What are transceiving performance metrics?

Course Contents

Access

1. In-person teaching on Sundays and Tuesdays, 7:30-9:00 in Class 16, Ebn-e-Sina building
2. Online practice on Sundays, 18:00-19:00 at CW virtual classroom
3. Course website at `http://cw.sharif.edu`
4. Telegram group at `https://t.me/+NPE5nWrpZrllNGM8`
5. Personal website at `http://sharif.edu/~mohammad.hadi/`
6. Personal email to `mohammad.hadi@sharif.edu`

Sessions

Session	Frequency	Attendance
Review	4	C
Lesson	20	C
Lecture	4	V
Practice	7	V
Exam	6	C

Table: Course sessions. C and V stand for compulsory and voluntary, respectively.

Contents

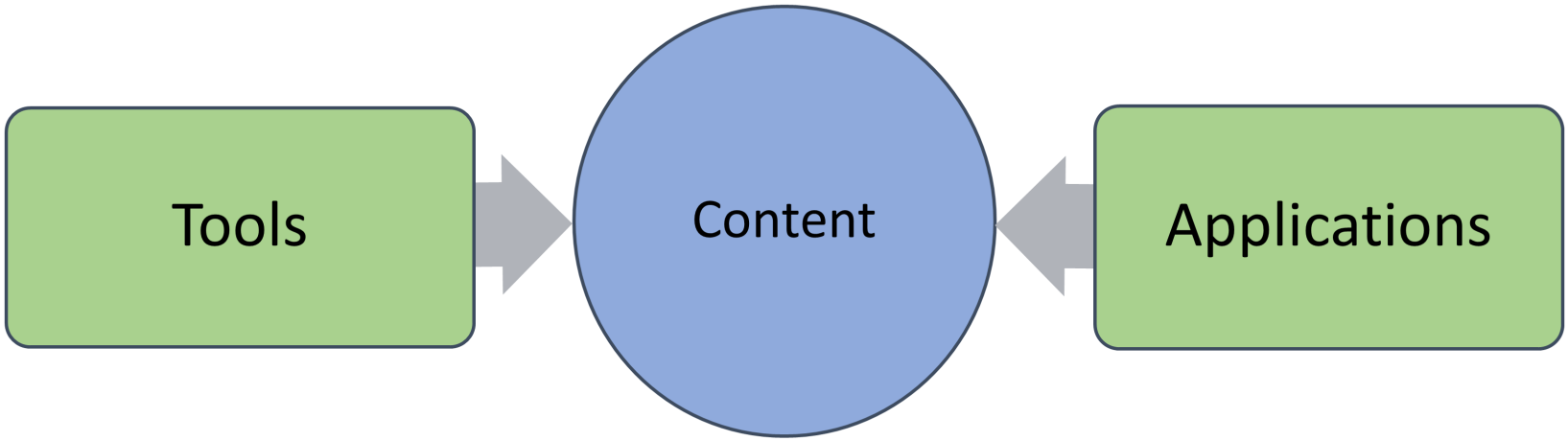

Figure: Course contents.

1. The tools include signals & systems and probability & random processes.
2. The applications include transceiver analysis and channel modeling.

Tools

- Signals & Systems
  1. Signals
  2. LTI Systems
  3. Fourier Transform
  4. Hilbert Transform
  5. Power & Energy
  6. Lowpass & Bandpass Representation
- Probability & Random Processes
  1. Probability
  2. Random Process
  3. Wide-Sense Stationary Process
  4. Gaussian Process
  5. White Process
  6. Additive White Gaussian Noise

Applications

- Transceivers
  - Analog Analysis
    1. Amplitude Modulation
    2. Angle Modulation
  - Digital Analysis
    1. Digitization
    2. Digital Modulation
    3. Multiple Access
- Channel
  - Impairments Modeling
    1. Noise
    2. Attenuation
    3. Delay
    4. Distortion
    5. Fading

Course Assessment

Assessments

Item	Frequency	Contribution	Bonus
Work Assignments	7	20%	✓
Short Quizzes	4	20%	✗
Midterm Exam	1	20%	✗
Final Exam	1	25%	✗
Software Project	1	10%	✓
Attendance & Activity	20	5%	✗

Table: Items involved in the course assessment. The specified contribution weights are tentative.

Course References

References

John G. Proakis, Masoud Salehi (2007)

Fundamentals of Communication Systems

Pearson Education

Bhagwandas P. Lathi and Zhi Ding (2010)

Modern Digital and Analog Communication Systems

Oxford University Press

A. Bruce Carlson, Paul B. Crilly (2009)

Communication Systems

McGraw-Hill

Simon Haykin (2009)

Communication Systems

John Wiley & Sons

Andrew S. Tanenbaum, David Wetherall (2010)

Computer Networks

Pearson Education

Course Assistants

Assistants

Figure: Course teaching assistants group.

The End