Introduction to Communications Engineering

IT4593E

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ONE LOVE. ONE FUTURE.

Thông tin chung

- Tên học phần: **Nhập môn kỹ thuật truyền thông**
- Mã học phần: **IT4593E**
- Khối lượng: **2 TC (2-1-0-4)**
- Lý thuyết và bài tập: **10 buổi lý thuyết, 5 buổi bài tập**
- Đánh giá học phần:

  30% QT (kiểm tra + bài tập/project + chuyên cần-quiz)

  70% CK (trắc nghiệm + tự luận)
- Tài liệu tham khảo:
  - Lecture slides
  - Lecture notes
  - Textbooks, ví dụ ***Communication Systems Engineering***, 2nd Edition, by John G. Proakis Masoud Salehi
  - Internet

Lec 01: Overview

Course Objectives

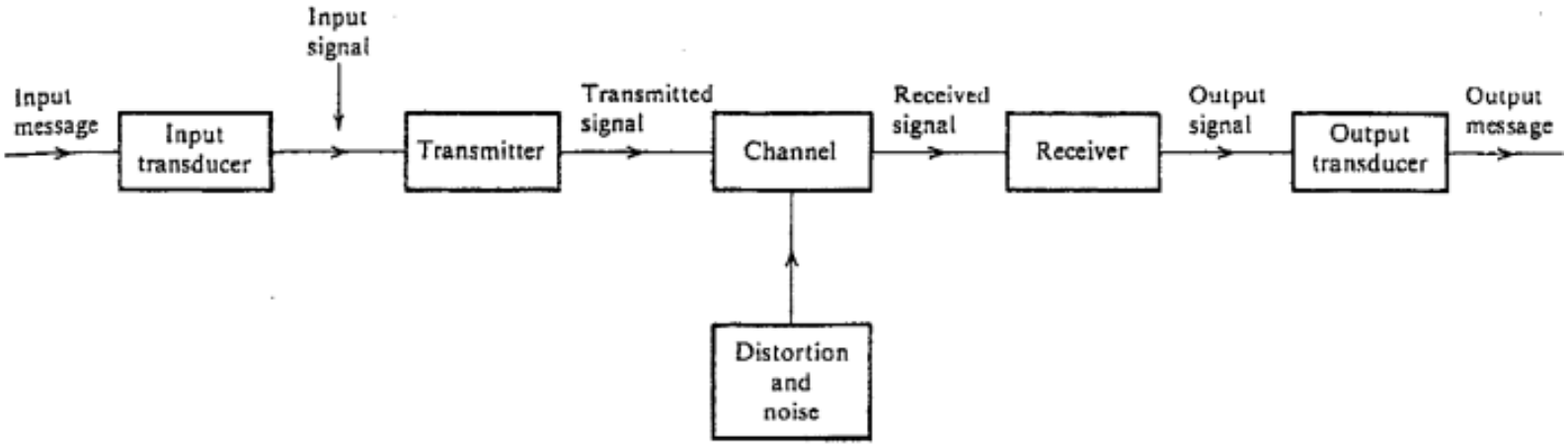
To introduce the fundamental principles of communication systems, as well as methods used in modulation and demodulation of signals in order to transfer information from a source to a destination.

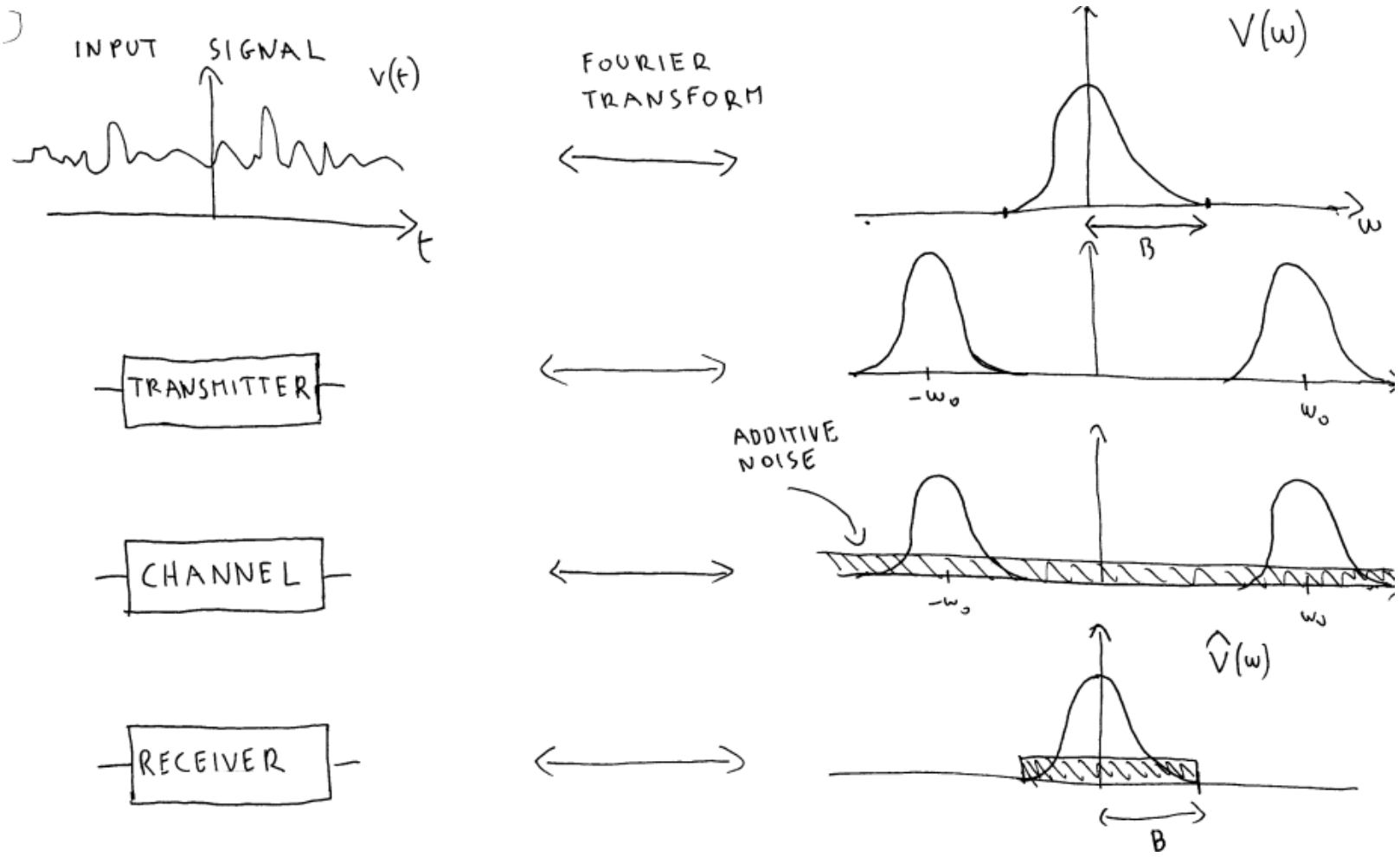
Examples of Communication Systems

Communication Systems

- **Information source:** to initiate a message, e.g., human speech, a picture, or a text message.
- **Message:** converted by an input transducer into an electrical waveform (baseband signal).
- **Input transmitter:** to process the baseband signal for efficient transmission.
- **Channel:** the medium through which the signal propagates, e.g., coaxial cable, optical fiber, or wireless link.
- **Receiver:** to process the received signal to undo the modifications introduced by the transmitter and the channel.
- **Output transducer:** to convert the signal back into its original form.

Communication System Model



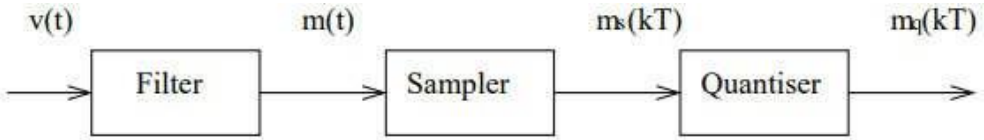

INPUT SIGNAL
v(t)
t
FOURIER TRANSFORM
V(w)
w
B
TRANSMITTER
$-w_0$
w_0
ADDITIVE NOISE
CHANNEL
$-w_0$
w_0
$\hat{V}(w)$
RECEIVER
B

Digital vs. Analog Messages

- A message can be in **digital** or **analog** form.
- **Digital messages** are built from a finite number of symbols.
  - Example: Morse code telegraphy.
- **Analog messages** are characterized by continuously varying data.
  - Example: the temperature at a certain location.

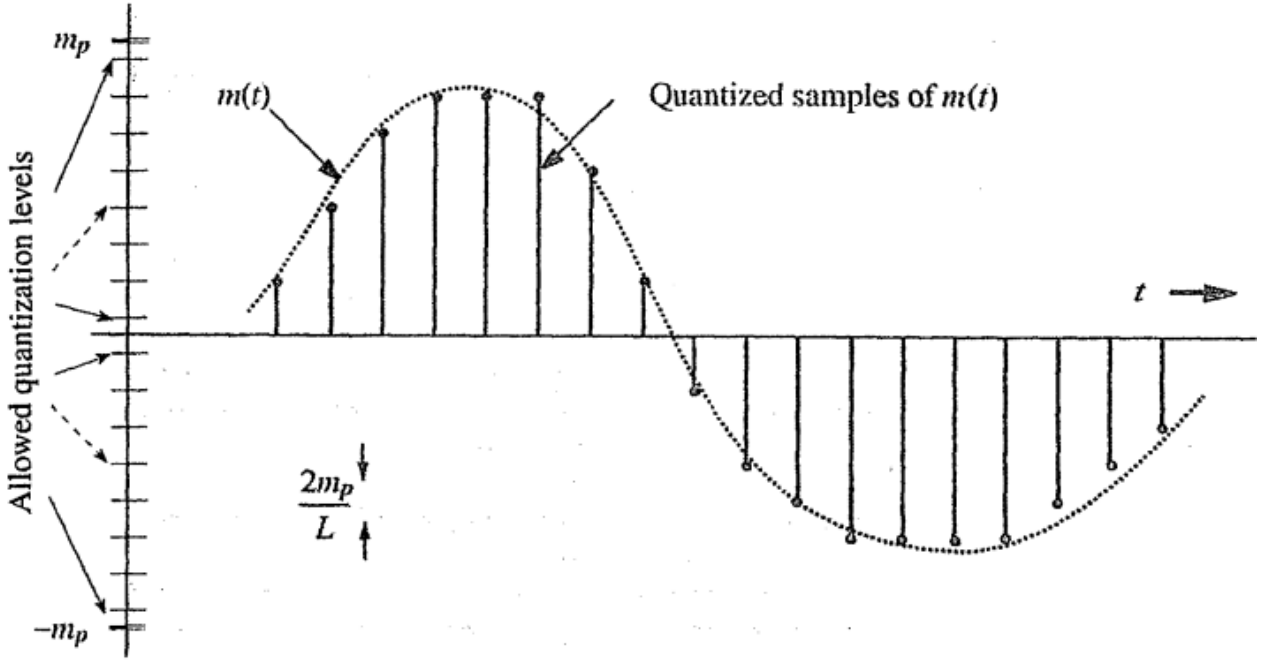
Digital Communications

- **Digital signals** are more robust to noise compared to analog signals.
- **Analog signals** can be converted into digital signals using Analog-to-Digital Converters (ADC).



Sampling of Signals

- Lấy mẫu tín hiệu



- First, the signal **m(t)** is sampled in the time domain.
- The amplitude of the signal samples $\mathbf{m_s(kT)}$ is then quantized into a finite number of levels.

Key Parameters of ADCs

- Resolution
- Conversion time (μs ~ ms)
- Sampling frequency
- Quantization error

Sampling Theorem

The Sampling Theorem states:

*If the **highest frequency** in a signal spectrum is **B**, then the signal **can be reconstructed** from its samples taken at a **sampling frequency not less than 2B**.*