

EEEN3005J

Communication Theory
(Introduction &
course outline)

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Course Description

This module provides an introduction to the theory of physical layer communications from a signals and systems viewpoint. Analog and digital modulation and detection are treated from a mathematical perspective as is the characterisation of channels and noise.



Course Contents

- Review of Fourier Transforms
- Analog & digital modulation schemes
 - Definitions
 - Implementation circuits
 - Mathematical analysis
- Channels
 - Definitions
 - Mathematical analysis
- On successful completion of this module, students will be able to:
 - 1. Give mathematical descriptions of communication signals and systems in both time and frequency domains
 - 2. Characterise noise from a probabilistic standpoint
 - 3. Explain the principles underlying the main analog and digital modulation schemes.

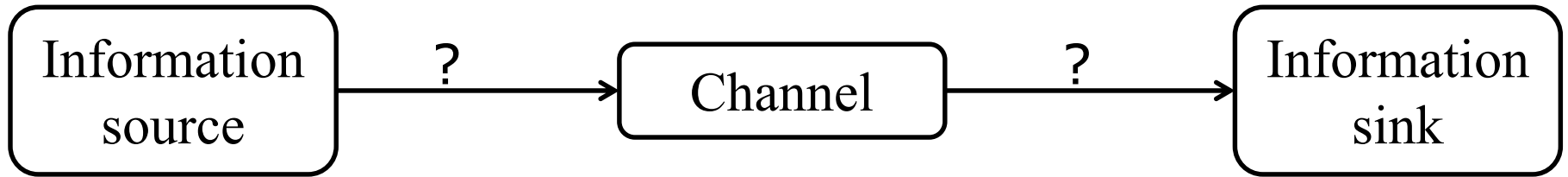


How will I be assessed ?

Labs: Standard laboratory reports:	15%
Examination: Quiz(s)	25%
Examination: Final Examination:	60%



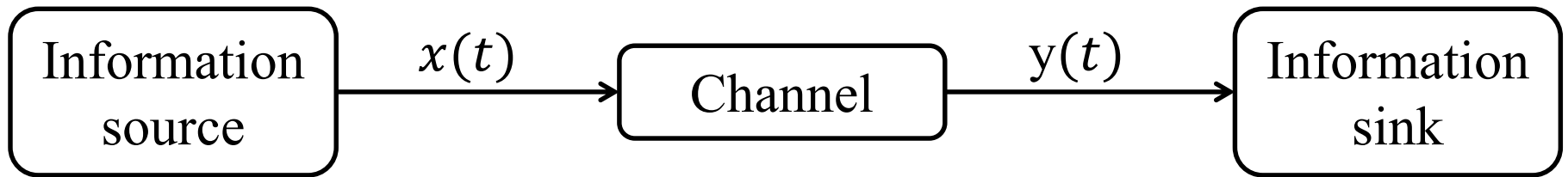
What is communications?



- Information source
 - E.g. microphone, camera, CD, computer file...
- Channel
 - E.g. telephone line, air interface (wireless), optical fiber...
- Information sink
 - E.g. loud speaker, TV screen, computer ...
- Engineering task:
 - Use channel to get information from the source to the sink.



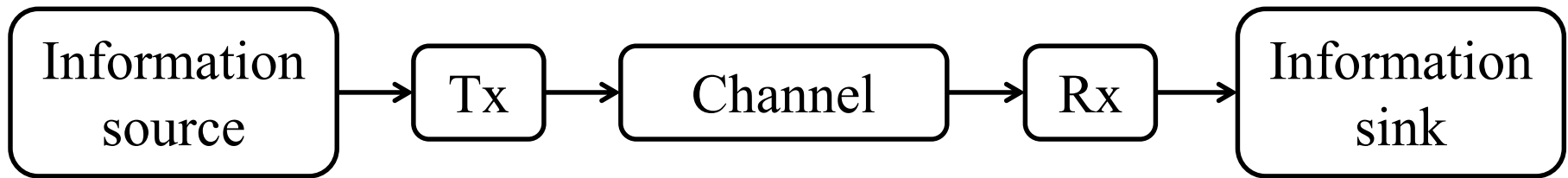
Channel



- Only certain types of signals are supported
 - Wireless: high frequency radio waves
 - Optical fiber: light signals
 - Telephone line: low frequency electrical signals
- Channel input and output are not equal!
 - $x(t) \neq y(t)$
 - Loss: $y(t) = \lambda \cdot x(t)$
 - Distortion: $y(t) = h(x(t))$
 - May or may not be linear and invertible.
 - Noise: $y(t) = h(x(t)) + n(t)$
 - May or may not be Gaussian and white



Generic communication system.



- Transmitter (Tx)

- Performs modulation: vary some aspect of the transmit signal so as to convey information.

- Receiver (Rx)

- Performs detection: Attempts to recovery the transmitted information based on the received signal $y(t)$.

Goal of a communication system

To transmit information **efficiently** and **reliably** from source to destination using a communication resource within some allowable (design) constraint.

- Communication resource
 - Anything you are allowed to use to achieve the communication, e.g. a specified time interval or a specified frequency range
- Design constraint
 - Transmit power (standards limit this)
 - Also:
 - Device power consumption (user requirement)
 - Tolerable delay
 - Cost of system
 - Security



Recommended texts

- Communication systems
 - Simon Haykin
- Digital & Analog communication systems
 - Leon W. Couch II

