

Telecommunication Network Systems (SRT)

Official program:

=====

Sistemas e Redes de Telecomunicações/ Systems and Telecommunication Networks

=====

1. Introduction to telecommunication networks: evolution and standardization; fundamental concepts and topologies; network architectures.
2. Services and service networks: present and emerging applications.
3. Traffic in circuit switched networks.
4. Guided transmission media: twisted pair of wires, coaxial cable, optical fiber.
5. Fiber optic technology: basic components, wavelength division multiplexing (WDM) technology, network applications.
6. Telecommunications transport network. Plesiochronous technologies; synchronous digital hierarchy; network planning and performance analyses. Optical transport networks.
7. Access networks: wired access network infrastructure; broadband access over copper pairs (xDSL). Optical access networks: FTTx and PONs.

Lecture structure:

Chapter 0: Introduction

- What is communication?
- Levels of the communication activity
- Types of channels
- Nyquist rate
- Channel capacity (of Shannon and Hartley)
- Standards
- Network topologies
- (A)synchronous

Chapter 1: Information Theory

- information is uncertainty reduction
- Entropy of information of a scheme
- Dependent events
- Markov chains
- Encoding/decoding
- Example: 7.4 Hamming coder/decoder
- Shannon Theorem

Chapter 2: The Physical Channel

- Unipolar/bipolar
- Modulation
- Drift/wander
- Manchester coding
- Long distance effects
- Coax cables
- Transmission line
- Lossy cables
- Waveguides

- Fiber optics
- Optical amplification
- Noise

Chapter 3: Access Networks

- IDN
- ISDN
- xDSL
- optical networks

Chapter 4: Transport Networks

- Time-division multiplexing
- Plesiosynchronous
- Synchronous digital heirarchy

Appendix A; Modulation

- Amplitude shift keying / on/off keying
- Frequency shift keying
- (Binary) phase shift keying
- Quadrature phase shit keying
- Quadrature amplitude modulation
- Trellis code modulation
- Pulse amplitude modulation
- Pulse code modulation
- Pulse width modulation

Bibliography

The lecture notes are based on the following books (as indicated in the lecture notes):

Khinchin, "Mathematical foundations of information theory"

Pierce, "An introduction to information theory. Symbols, signals and noise"

MacKay, "Information theory, inference and learning algorithms"

Proakis, "Communication system engineering"

Benvenuto, "Principles of communications networks and systems"

Duck & Read, "Data communications and computer networks"

Grades

The final note is based on 70% the final exam and 30% the home works and lab works handed in. A minimum of '9' has to be obtained in both these parts. In case the weighted average is larger than 9.5, but this criterion is not met, a "9 reprovado" will be given.

Peter Stallinga, responsible professor,
9 March 2015