

Title: Telecommunication Engineering

Lecturer: Assist. Prof. Dr. Iztok Humar (VSP)

Aim of the course:

To acquire fundamental knowledge on design, planning, modeling and management of telecommunications networks to avoid congestions and provide quality.

Required (pre)knowledge:

Telecommunications Networks, Network Services, Telecommunication Protocols, Mathematics (Probability & Statistics).

Contents:

Introduction to design, planning, modeling and management of telecommunication systems. Telecommunication system design. Elastic and non-elastic applications. Traffic theory and queuing. Design in circuit switched networks (Erl B, Erl C model). Design in packet switched networks (M/M/1). Network bottlenecks and Congestion control. Efficiency and performance evaluation. Network simulation and emulation. Quality of Service (QoS): statistical multiplexing, overprovisioning, resource reservation, admission control, service differentiation. QoS mechanisms and protocols in contemporary networks. User perceived quality, Quality of Experience (QoE). QoE evaluation and measurements. Mean opinion score (MOS). Network traffic characterization and measurements, performance evaluation and conformance testing. Management and control of telecommunication networks and systems. Management models (TM, eTOM, ITIL), protocols and information models (CMIP, SNMP, CIM, MIB). Accounting and Billing.

Selected references:

Villy B. Iversen: *Teletraffic Engineering and Network Planning*, Technical University of Denmark, 2007.

Alexander Clemm: *Network management Fundamentals*, Cisco System, 2007.

Alberto Leon-Garcia, Indra Widjaja: *Communication Networks, Fundamental Concepts and Key Architectures*, McGraw-Hill, 2000.

Haojin Wang: *Telecommunications Network Management*, McGraw Hill, 2000.

Papers on state-of-the-art technologies in *IEEE Communications Surveys & Tutorials*: <http://www.comsoc.org/livepubs/surveys/index.html>