Brooklyn College
Department of Computer and Information Sciences

CISC 3343 [49.1] Telecommunications

3 hours; 3 credits

Introduction to telecommunications. Data transmission fundamentals. Data encoding. Modems. Digital subscriber lines. Data compression. Physical layer interfaces. Transmission error control. Telephony signaling. Wireless and cellular communications. Asynchronous Transfer Mode (ATM) Networks. Integrated Services Digital Networks (ISDN). (Not open to students who are enrolled in or have completed CISC 3340 [Computer and Information Science 49].)

Syllabus:

1. Introduction to Telecommunications
    - Telecommunications Basics
    - Data, Signals, and Transmission
    - Analog vs. Digital
    - Channel Types: Simplex, Half-Duplex, Full-Duplex
    - Parallel vs. Serial Transmission
    - Asynchronous vs. Synchronous Transmission

2. Data Transmission Fundamentals
    - Time Domain Concepts
    - Frequency Domain Representation of Signals
    - Bandwidth
    - Filters
    - Transmission Impairments: Attenuation, Delay Distortion, Noise, Echo
    - Channel Capacity

3. Data Encoding
    - Digital Data <---> Digital Signals
    - Digital Data <---> Analog Signals
    - Modems
    - Analog Data <---> Digital Signals
    - Speech Encoding: PCM, ADPCM
    - Analog Data <---> Analog Signals
    - Muliplexing: FDM & TDM
    - DSL Lines: T-1, E-1, ISDN, ADSL, xDSL
    - SONET/SDH

4. Data Compression
    - Lossless vs. Lossy Compression
    - Text Compression: Huffman Coding, LZ Coding
    - Image Compression: GIF, TIFF, JPEG

- Fax Compression: MH, MR, MMR
- Audio Compression: ADPCM, LPC, CELP, MPEG Audio, Dolby Audio
- Video Compression: H.261, H.263, MPEG-1, MPEG-2, MPEG-4

5. Physical Layer Interfaces:
    - Physical Layer Protocols
    - EIA-232 Interface
    - Modem Operation
    - Null Modems

6. Transmission Error Control:
    - Transmission Error Sources
    - Error Detection Techniques: Parity Checks, Block Codes, CRCs
    - Error Correction Coding: Hamming Codes
    - ARQ Techniques

7. Telephony Signaling
    - Architecture of a Public Telephone Network
    - The Local (Subscriber) Loop
    - Making a Phone Call: Control Signaling
    - In-Channel vs. Common Channel Signaling
    - Loop Signaling: On-Hook Off-Hook Signaling
    - Analog Telephony Signaling
    - Digital Telephony Signaling: T-1, E-1
    - DID, DNIS, and ANI Services
    - Interoffice Signaling
    - Signaling System No. 7 (SS7)
    - SS7 Protocol Architecture: MTP, SCCP, TUP, ISUP

8. Wireless and Cellular Communications:
    - Cellular Telephony
    - The Mobile Telephone Switching Office (MTSO)
    - Advanced Mobile Phone System (AMPS)
    - Cellular and Cordless Network Reference Models
    - IS-41 North American Cellular Signaling Protocol
    - The Global System for Mobile Communications (GSM)
    - IS-54 North American Digital TDMA Cellular Standard
    - IS-95 North American Digital CDMA Cellular Standard

9. Asynchronous Transfer Mode (ATM) Networks:
    - ATM Protocol Architecture
    - ATM Logical Connections
    - ATM Cells
    - Transmission of ATM Cells
    - ATM Services
    - ATM Adaptation Layer (AAL)
    - ATM Traffic Management
    - ATM LANs

10. Intergrated Services Digital Networks (ISDN):
   - ITU-T Standards for ISDN
   - ISDN Channel Types (B, D, etc.)
   - The Basic Rate Interface (BRI)
   - The Primary Rate Interface (PRI)
   - ISDN Call Control Architecture: LAPD, Q.931
   - ISDN Services

Bibliography:

1. Networks, 2nd ed. By: Timothy Ramteke, Prentice Hall, 2001.

2. Data and Computer Communications, 6th ed. By: William Stallings, Prentice-Hall, 2000.

3. Fundamentals of Telcommunications. By: Roger Freeman, Wiley-Interscience, 1999.

4. Multimedia Communications: Applications, Networks, Protocols and Standards. by: Fred Halsall, Addison Wesley, 2001.