Lectures for the course: Communication Systems and Networking (IT 60103)

Week 1

Lecture 1 – 22/07/2013

• Introduction to the course
• Evaluation Guidelines

Lecture 2 – 23/07/2013

• Data communication and networking introductory notes

Lecture 3 – 24/07/2013

• ISO OSI model and its significance
• Physical layer, data link layer and network layer functionality

Week 2

Lecture 4+5 – 29/07/2013

• Transport Layer, Session, Presentation and Application layer functionality
• TCP/IP layers and their relation with ISO OSI
• Some TCP/IP protocols at each layer
• Impact of TCP/IP and reasons for its success

Lecture 6 – 30/07/2013

• Introduction to physical layer
• Types of data and signals (analog and digital)
• Time and frequency domain representations
• Periodic and aperiodic signals
• Frequency, Time period, wavelength
• Bit rate
• Composite signal – bandwidth
• Baseband transmission of digital signal through low-pass channel

Lecture 7 – 31/07/2013

• Broadband transmission of digital signal
• Transmission impairment – attenuation, distortion, noise
• Data rate limits: Nyquist bit rate and Shannon channel capacity
• Performance – bandwidth, throughput, delay
Week 3

Lecture 8+9 – 05/08/2013

- Digital transmission
- Various types of line coding
- Characteristics
- Unipolar, polar and bipolar approaches
- Multilevel
- Multitransition

Lecture 10 – 06/08/2013

- Block coding
- Scrambling
- Pulse code modulation
- Nyquist theorem
- Delta modulation
- Transmission modes – asynchronous, synchronous, isochronous

Lecture 11 – 07/08/2013

- Analog transmission
- ASK, FSK, PSK, QAM
- AM, FM, PM

Week 4

Lecture 12+13 – 12/08/2013

- Modulation
- Spread spectrum

Lecture 14 – 13/08/2013

- Transmission media
- Guided and unguided media
- Switching
- Circuit switching

Lecture 15 – 14/08/2013

- Packet switching
- Datagram and virtual circuit
Switch construction
Banyan switch

**Week 5**

**Lecture 16+17 – 19/08/2013**

- Class Test 1 held

**Lecture 18 – 20/08/2013**

- Error detection and correction
- Block code
- Linear block code
- Hamming distance
- Parity check

**Lecture 19 – 21/08/2013**

- Hamming Code
- Error correction using Hamming code
- Burst error correction using Hamming code
- Cyclic codes
- CRC
- Hardware implementation of CRC

**Week 6**

**Lecture 20+21 – 26/08/2013**

- Class test 1 script shown and feedback given
- Polynomial representation of CRC coding
- Choice of generator polynomial
- Checksum
- Data Link Control
- Framing
- Flow and error control
- Simple protocols
- Stop-and-Wait ARQ

**Lecture 22 – 27/08/2013**

- Go-Back-N ARQ
- Selective Repeat ARQ
- Piggybacking
Lecture 23 – 28/08/2013

• HDLC
• PPP

Lecture 24 – 28/08/2013

• Practice problems

Week 7

Lecture 25+26 – 02/09/2013

• Multiple Access
• Random access protocols
• ALOHA, CSMA, CSMA/CD and CSMA/CA
• Controlled access protocols
• Reservation, Polling and Token passing

Lecture 27 – 03/09/2013

• Channelization protocols
• Wired LANs- Ethernet
• LLC and MAC
• MAC Frame format
• Minimum frame size and maximum network length
• Ethernet address

Lecture 28 – 04/09/2013

• Fast Ethernet
• Gigabit Ethernet
• 10GB Ethernet

Lecture 29 – 04/09/2013

• Practice problems

Week 8

Lecture 30+31 – 09/09/2013

• Wireless LAN
• IEEE 802.11
• DCF and PCF
• Frame format and addressing
• Hidden and Exposed Station problems
• Physical layer for IEEE 802.11

Lecture 32 – 10/09/2013

• Connecting Devices, backbone network, VLAN
• Hubs and repeater
• Bridges and Layer 2 switches
• Spanning tree algorithm for bridges
• VLAN

Lecture 33 – 11/09/2013

• Practical demonstration of networking in the department and the building

Lecture 34 – 11/09/2013

• Practice problems

Week 9

Lecture 35+36 – 16/09/2013

• Random variables
• Discrete and continuous random variables
• Probability distribution and probability density functions
• Moments
• Expectations of various distributions

Lecture 37 – 17/09/2013

• Joint distribution
• Conditional probability
• Memoryless nature of exponential and geometric distribution
• Random processes
• Time parameter and state space
• Continuous parameter and discrete parameter processes
• Chains
• First order and joint distributions
• Stationary processes

Lecture 38 – 18/09/2013

• Markov process and Markov chain
• Time homogeneity
• DTMC and CTMC
• Details of DTMC
• Chapman-Kolmogorov equation
• One step and n-step transition probabilities of homogeneous DTMCs
• Transient probabilities
• State sojourn time

Lecture 39 – 18/09/2013

• Practice problems

Week 10

Mid-sem exams held

Week 11

Lecture 40 – 01/10/2013

• CTMC
  • Birth death process
  • Mid-sem scripts shown and feedback given

Week 12

Lecture 41+42 – 07/10/2013

• Queuing theory
• Kendall's notation
• Various types of queues
• Little's theorem
• Performance measures

Lecture 43 – 08/10/2013

• Practice problems on queuing theory

Week 13

Lecture 44+45 – 21/10/2013

• IP Addressing
• IPv4 addressing
• Classful and Classless addressing
• NAT
• IPv6 addressing

Lecture 46 – 22/10/2013

• Internet Protocol Ver. 4
• Internet Protocol Ver. 6
• Transition from IPv4 to IPv6

Lecture 47 – 23/10/2013

• ARP
• ICMP error and query messages
• Ping and Traceroute

Lecture 48 – 23/10/2013

• Practice problems on network layer

Week 14

Lecture 49+50 – 28/10/2013

• Class test 2 held
• IGMP
• ICMPv6

Lecture 51 – 29/10/2013

• Delivery
• Forwarding

Lecture 52 – 30/10/2013

• Unicast routing protocols

Lecture 53 – 30/10/2013

• Class test 2 scripts shown and feedback given

Week 15

Lecture 54+55 – 04/11/2013

• Multicast routing
• Introduction to Transport Layer

**Lecture 56 – 06/11/2013**

• UDP
• TCP Header
• TCP Connection setup, data transfer and connection release

**Week 16**

**Lecture 57+58 – 11/11/2013**

• Flow Control
• Error Control
• Congestion Control
• Traffic Shaping

**Lecture 59 – 12/11/2013**

• Course Summary