

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

### **Week 1**

#### **Lecture 1 – 22/07/2015**

- Introduction to the course
- Evaluation Guidelines

#### **Lecture 2 – 23/07/2015**

- Basic components of communication systems and networks
- Topologies
- LAN, WAN

#### **Lecture 3+4 – 24/07/2015**

- Basics of OSI model
- Physical, data link, network and transport layer functionality
- Session, presentation and application layer functionality
- Overview of TCP/IP
- Layers of TCP/IP vis-à-vis OSI

### **Week 2**

#### **Lecture 5 – 29/07/2015**

- 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 6 – 30/07/2015**

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

### **Lecture 7+8 – 31/07/2015**

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

### **Week 3**

#### **Lecture 9 – 06/08/2015**

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

#### **Lecture 10 – 07/08/2015**

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

### **Week 4**

#### **Lecture 11 – 12/08/2015**

- Multiplexing
- FDM, WDM and TDM
- Synchronous and statistical TDM

#### **Lecture 12 – 13/08/2015**

- Spread Spectrum
- FHSS and DSSS
- Transmission media
- Guided and unguided media
- UTP, Coax

#### **Lecture 13+14 – 14/08/2015**

- Fiber
- Radio wave characteristics and propagation
- Switching
- Circuit switching and packet switching
- Virtual circuit networks
- Space-division switching
- TSI

## **Week 5**

### **Lecture 15 – 19/08/2015**

- Space-time switching
- Banyan tree switch structure
- Synchronous and statistical TDM

### **Lecture 16 – 20/08/2015**

- Introduction to data link layer
- Error detection and correction
- Block codes and convolutional codes
- Linear block codes
- Error detection and correction capabilities
- Hamming codes
- Error correction using Hamming codes

### **Lecture 17+18 – 21/08/2015**

- Cyclic codes
- CRC
- Impact of generator polynomial of error detection capability of CRC
- Checksum
- Tutorial on physical layer

## **Week 6**

### **Lecture 19+20 (evening) – 26/08/2015**

- Framing
- Flow and error control
- Stop-and-wait, Go-back-N, Selective Repeat
- Tutorial on physical layer

### **Lecture 21 – 27/08/2015**

- HDLC
- PPP

### **Lecture 22+23 – 28/08/2015**

- Class test 1 held
- PPP (contd.)

### **Week 7**

### **Lecture 24 – 02/09/2015**

- Multiple access
- Random access protocols
- CSMA/CD
- Class test scripts shown and feedback given

### **Lecture 25 – 03/09/2015**

- Controlled-access protocols
- Introduction to channelization protocols
- CDMA
- Wired LAN

### **Lecture 26+27 – 04/09/2015**

- Ethernet – Standard, 100MBPS, Gigabit Ethernet, 10GB Ethernet
- Wireless LAN

### **Week 8**

### **Lecture 28 – 09/09/2015**

- Wireless LAN

### **Lecture 29 – 09/09/2015 (evening)**

- Tutorial on data link layer

### **Lecture 30 – 10/09/2015**

- Connecting devices, backbone network
- VLAN

### **Lecture 31+32 – 11/09/2015**

- Summary of topics covered before mid-sem
- Practical demonstration of the institute network connections

### **Week 9**

- Mid-sem exam held

### **Week 10**

#### **Lecture 33 – 23/09/2015**

- Random variable
- Discrete and continuous random variables
- Various types of discrete random variables

#### **Lecture 34 – 24/09/2015**

- Moments
- Conditional probability
- Memoryless property of geometric distribution

### **Week 11**

#### **Lecture 35 – 30/09/2015**

- Continuous random variables
- Normal and exponential distribution
- Memoryless property of exponential distribution
- Random processes
- Chains

#### **Lecture 36 – 01/10/2015**

- Markov processes and Markov chains
- DTMC and CTMC
- Time homogeneous Markov processes
- DTMC details
- Finite state DTMCs
- Single step transition probabilities
- Chapman-Kolmogorov equation for DTMC

## Week 12

### **Lecture 37 – 07/10/2015**

- One step and multiple step transition probabilities
- State sojourn time
- Continuous time Markov chain

### **Lecture 38 – 08/10/2015 (evening)**

- Chapman-Kolmogorov equation for CTMC
- Generator matrix
- Birth death process
- Kendall's notation

### **Lecture 39 – 09/10/2015**

- M/M/1 queue
- M/M/ $\infty$  queue

### **Lecture 40+41 – 10/10/2015**

- M/M/m queue
- M/M/1/K finite buffer queue
- M/M/m/m m-server loss system

## Week 13

### **Lecture 42 – 14/10/2015**

- Network Layer
- IP addressing
- Classful and classless addressing in IPV4
- Private addresses and NAT

### **Lecture 43 – 15/10/2015**

- IPv6 addressing
- Internet Protocol (IPv4)

### **Lecture 44+45 – 16/10/2015**

- Fragmentation in IPv4
- Checksum
- Options

- IPv6
- Base header and extension headers
- Flow label
- Transition from IPv4 to IPv6
- ARP

## **Week 14**

### **Lecture 46 – 28/10/2015**

- ARP
- ICMP

### **Lecture 47+48 – 29/10/2015**

- IGMP
- ICMP v6
- Tutorial problems on queuing theory
- Packet delivery
- Packet forwarding

### **Lecture 49+50 – 30/10/2015**

- Class test 2 held
- Packet forwarding

## **Week 15**

### **Lecture 51 – 04/11/2015**

- Intra-domain and inter-domain routing
- Distance vector routing
- Class test 2 scripts shown and feedback given

### **Lecture 52 – 05/11/2015**

- RIP
- Link state routing
- Dijkstra's algorithm
- OSPF

### **Lecture 53 – 05/10/2015 (evening)**

- Practical demonstration of campus IP network

**Lecture 54+55 – 06/10/2015**

- Inter-domain routing
- Transport layer
- UDP
- TCP

**Lecture 56 – 06/10/2015 (evening)**

- Tutorial on network layer

**Week 16**

**Lecture 57 – 12/11/2015**

- TCP

**Lecture 58 – 12/11/2015**

- Congestion control
- Quality of service

**Lecture 59 – 13/11/2015**

- Course summary