



ADDIS ABABA UNIVERSITY

College of Natural and Computational Sciences

Department of Computer Science

Course title: Data Communication and Computer Networks

Course code: CoSc2032

Credit hours: 3 ECTS: 5

Contact hours: **Lecture Hrs:** 2 **Lab hrs:** 3 **Tutorial hrs:** 2

Prerequisite: None

Course category: Compulsory

Year: II

Semester: I

Course description

This course will explore the various types of data communication systems, networks and their applications. Concepts & terminologies like computer networks, layered architecture (OSI & TCP/IP), network hardware, network software, standardization, network medium, and IP addressing will be explored. The practical aspect will deal with building small to medium level networks including Cabling, Configuring TCP/IP, Peer to Peer Networking, Sharing resources, Client Server Networking.

Course objectives

By the end of this course, students will be able to:

- Understand the concepts and principles of data communications and computer networks
- Understand data transmission and transmission media
- Understand Protocols and various networking components
- Understand TCP/IP & OSI Reference Model
- Understand LAN and WAN technologies
- Understand and implement IP addressing.
- Build small to medium level Computer networks
- Understand subnets
- Design simple local area network for a corporate
- Practically implement various Networking protocols

Course Outline

Chapter 1: Data Communication and Computer Networking Basics (5 hours)

1.1 Data Communication

- 1.1.1 Definition of Data Communication
- 1.1.2 Communication Basics
- 1.1.3 Data Representation techniques
- 1.1.4 Digital Data Transmission formats
- 1.1.5 Transmission Impairments
- 1.1.6 Modes of Data transmission
- 1.1.7 Elements of Data Communication
- 1.1.8 Protocols and standards
- 1.1.9 Circuit switching and Packet switching,

1.2 Computer Network

- 1.2.1 Network Definition
- 1.2.2 Network Applications
- 1.2.3 Network Types
 - 1.2.3.1 Geographical Area
 - 1.2.3.1.1 PAN
 - 1.2.3.1.2 LAN
 - 1.2.3.1.3 MAN
 - 1.2.3.1.4 WAN
 - 1.2.3.2 Architecture
 - 1.2.3.2.1 Peer-to-Peer
 - 1.2.3.2.2 Client/server
- 1.2.4 Network Components
 - 1.2.4.1 Hardware Components
 - 1.2.4.2 Software Components
- 1.2.5 Network Topology
 - 1.2.5.1 Physical
 - 1.2.5.2 Logical
- 1.2.6 Network Models
 - 1.2.6.1 OSI Reference Model
 - 1.2.6.2 TCP/IP Protocol Suite

1.3 Transmission Media

- 1.3.1 Guided
 - 1.3.1.1 Twisted Pair Cable
 - 1.3.1.2 Coaxial Cable
 - 1.3.1.3 Fiber Optics/Optical Fiber Cable
- 1.3.2 Unguided
 - 1.3.2.1 Wireless LAN
 - 1.3.2.2 Radio Communication
 - 1.3.2.3 Microwave Communication
 - 1.3.2.4 Infrared Communication
 - 1.3.2.5 Wi-Fi

- 1.3.2.6 Bluetooth Technology
- 1.3.2.7 Satellite communication

Chapter 2: Application, Session and Presentation Layers (5 hours)

- 1.1. Application Layer Introduction
- 1.2. Client-Server Model
- 1.3. Application Protocols
- 1.4. Network Services
- 1.5. Session Layer
- 1.6. Presentation Layer

Chapter 3: Transport Layer (6 hours)

- 1.1. Segmentation
- 1.2. Addressing
- 1.3. Multiplexing and DE-multiplexing
- 1.4. Connectionless/Connection-Oriented
- 1.5. Unreliable/ Reliable
- 1.6. Protocols in Transport Layer
 - 1.6.1. UDP
 - 1.6.2. TCP
 - 1.6.2.1. Flow control
 - 1.6.2.2. Error Control
 - 1.6.2.3. Congestion control
 - 1.6.2.4. TCP Variants

Chapter 4: Network Layer Addressing and Routing (8 hours)

- 4.1. NIC addressing
- 4.2. Packetizing
- 4.3. IP addressing
 - 4.3.1. IPv4
- 4.4. Sub-netting,
 - 4.4.1. Classfull Addressing
 - 4.4.2. Classless Inter Domain Routing(CIDR)
 - 4.4.3. Private and Public IP addresses
 - 4.4.4. NAT
 - 4.4.5. PAT
- 4.5. Address Mapping
 - 4.5.1. Logical to Physical Address Mapping –ARP
 - 4.5.2. Physical to Logical Address Mapping –RARP
- 4.6. ICMP:
 - 4.6.1. Types of Messages
 - 4.6.2. Message Format
 - 4.1.1. Error Reporting and Query
 - 4.1.2. ICMPv6
- 4.7. IGMP:
 - 4.7.1. Group Management

- 4.7.2. IGMP Messages
- 4.7.3. Message Format
- 4.7.4. IGMP Operation
- 4.7.5. Encapsulation
- 4.7.6. Netstat
- 4.8. Routing and forwarding
 - 4.1.3. Routing algorithms
 - 4.1.4. Routing in the Internet
 - 4.1.5. Unicasting, Multicasting and Broadcasting
- 4.9. IPv6
 - 4.9.1. structure
 - 4.9.2. Address space

Chapter 5: Link Layer and Physical Layer (8 hours)

- 5.1. Link layer services
 - 5.1.1. Framing
 - 5.1.2. Multiple Access Protocols
 - 5.1.2.1. CSMA/CD and CSMA/CA
 - 5.1.3. Link layer addressing
 - 5.1.3.1. MAC address
 - 5.1.4. Data Link Sub Layers
 - 5.1.4.1. Logical Link Control (LLC) and Data Link Control
 - 5.1.5. Data Link and its responsibilities
 - 5.1.5.1. Data Link Control,
 - 5.1.5.2. Error detection and correction
 - 5.1.5.3. Data Link Layer Protocols
- 5.2. Physical Layer Services
 - 5.2.1. Bits
 - 5.2.2. Ethernet,
 - 5.2.3. Point-to-Point Protocol
 - 5.2.4. LAN Devices: Repeaters, Hubs, Bridges and switches
 - 5.2.5. WAN Devices Routers, Layer 3 Switches and Gateways
 - 5.2.6. Signaling and encoding
 - 5.2.6.1. Signal Encoding Techniques
 - 5.2.7. Physical Layer and its responsibilities

Teaching-learning methods

Two contact hours of lectures, three contact hours of lab and two hours of tutorials per week.

Assessment methods

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| ➤ Assignments and quizzes | 15% |
| ➤ Lab Assessments | 10% |
| ➤ Mid semester examination | 25% |
| ➤ Final examination | 50% |

Textbooks:

1. Data Communications and Networking, 5th Edition, Behrouz A. Forouzan

Reference Books:

1. Andrew S. Tanenbaum, David J. Wetherall, Computer Networks (5th Edition), Pearson; 2010.
2. William Stallings, Data and Computer Communications, 10th Edition, Pearson, 2014

Laboratory Outline

Week 1: Designing cables

- 1.1. Crossover cable
- 1.2. Straight-through cable
- 1.3. Rollover cable

Week 2: Creating Peer to Peer network

- 2.1. Building a Switched based network
- 2.2. Sharing Files and Printers between Windows OSs
- 2.3. Sharing Files between Windows OSs

Week 3: Study of IPv4 Address

- 3.1. Classification of IP Addresses
- 3.2. Subnetting
- 3.3. Supernetting
- 3.4. NIC addressing

Week 4: Study of Basic Network Configuration commands

- 4.1.ping
- 4.2.tracert/traceroute
- 4.3.ifconfig/ipconfig
- 4.4.netstat
- 4.5.telnet
- 4.6.ssh
- 4.7.ftp
- 4.8.nslookup
- 4.9.pathping

Week 5: Configuring a Switch

Week 6: Configuring a VLAN

Week 7: Configuring a Router

Week 8: Configuring NAT

Week 9: Configuring Routing Information Protocol (RIPv2)

Week 10: Configuring Interior Gateway Protocol (IGRP)

Week 11: Configuring Open Shortest Path First (OSPF)

Week 12: Configuring Enhanced Interior Gateway Routing Protocol (EIGRP)

Week 13: Configuring Border Gateway Protocol (BGP)

Week 14: Configuring Intermediate System-to-Intermediate System (IS-IS)