Course Title: Computer Networking (3 Cr.)
Course Code: CACS303
Year/Semester: III/V
Class Load: 5 Hrs. / Week (Theory: 3Hrs. Practical: 2 Hrs.)
Course Description

This course offers detailed concept and structure of networking standards and principles. It includes introduction, functioning and significance of Physical Layer, Data Link Layer, Network Layer, Transport Layer, Application layer and some security mechanisms. It does not entirely focus on theoretical concept but also strongly focuses on practical skill based learning.

Course objectives

The general objectives of this course are to provide theoretical as well as practical knowledge of computer networking to make students capable of implementing, managing and troubleshooting the issues of computer network in their personal as well professional life.

Course Contents

Unit 1: Introduction   6 Hrs.
    1.1 Network as an infrastructure for data communication
    1.2 Applications of Computer network
    1.3 Network Architecture
    1.4 Types of computer Networks
    1.5 Protocols and Standards
    1.6 The OSI Reference Model
    1.7 The TCP/IP Protocol Suite
    1.8 Comparison between OSI and TCP/IP Reference model
    1.9 Critiques of OSI and TCP/IP Reference model

Unit 2: The Physical Layer   6 Hrs.
    2.1 Functions of Physical Layer
    2.2 Data and Signals: Analog and Digital signals, Transmission
        Impairment, Data Rate Limits, Performance
    2.3 Data Transmission Media: Guided Media, Unguided Media and
        Satellites
    2.4 Bandwidth Utilization: Multiplexing and Spreading
    2.5 Switching: Circuit switching, Message switching & Packet
        switching
    2.6 Telephone, Mobile and Cable network for data Communication

Unit 3: The Data Link Layer   8 Hrs.
    3.1 Functions of Data Link Layer
    3.2 Data Link Control: Framing, Flow and Error Control
    3.3 Error Detection and Correction
    3.4 High-Level Data Link Control(HDLC) & Point – to – Point
        protocol(PPP)
    3.5 Channel Allocation Problem

3.6 Multiple Access: Radom Access(ALOHA, CSMA, CSMA/CD, CSMA/CA), Controlled Access(Reservation, Polling, Token Passing), Channelization(FDMA, TDMA, CDMA)

3.7 Wired LAN: Ethernet Standards and FDDI

3.8 Wireless LAN: IEEE 802.11x and Bluetooth Standards

3.9 Token Bus, Token Ring and Virtual LAN

Unit 4: The Network Layer   8 Hrs.

4.1 Functions of Network Layer

4.2 Virtual circuits and Datagram Subnets

4.3 IPv4 Addresses: Address Space, Notations, Classful addressing, Classless addressing, Subnetting and Network Address Translation(NAT)

4.4 IPv4 Datagram format and fragmentation

4.5 IPv6 Address Structure and advantages over IPv4

4.6 Routing Algorithms: Distance Vector Routing, Link State Routing

4.7 Internet Control Protocols: ARP, RARP, ICMP

4.8 Routing protocols: OSPF, BGP, Unicast, Multicast and Broadcast

Unit 5: The Transport Layer   7 Hrs.

5.1 Functions of Transport Layer

5.2 Elements of Transport Protocols: Addressing, Establishing and Releasing Connection, Flow Control & Buffering, Error Control, Multiplexing & Demultiplexing, Crash Recovery

5.3 User Datagram Protocol(UDP): User Datagram, UDP Operations, Uses of UDP, RPC

5.4 Principles of Reliable Data Transfer: Building a Reliable Data Transfer Protocol, Pipelined Reliable Data Transfer Protocol, Go-Back-N(GBN), Selective Repeat(SR)

5.5 Transmission Control Protocol(TCP): TCP Services, TCP Features, TCP Segment Header

5.6 Principle of Congestion Control

Unit 6: The Application Layer   5 Hrs.

6.1 Functions of Application layer

6.2 Application Layer Protocols: DNS, DHCP, WWW, HTTP, HTTPs, TELNET, FTP, SMTP, POP, IMAP

6.3 Concept of traffic analyzer: MRTG, PRTG, SNMP, Packet tracer, Wireshark.

Unit 7: Network Security   5 Hrs.

7.1 A Model for Network Security

7.2 Principles of cryptography: Symmetric Key and Public Key

7.3 Public Key Algorithm – RSA

7.4 Digital Signature Algorithm

7.5 Communication Security: IPSec, VPN, Firewalls, Wireless Security.

Practical

1. Prepare hardware and software specification for basic computer system.
2. Determine the appropriate placement of networking devices on a network.
3. Identify networking cable standards. Create and test cross – over and straight cables.
4. Configure the IP address of the computer.
5. Create a basic network and share file and folders.
6. Install and configure windows server: Active Directory, User and Group Policy Management.
7. Set the file access permissions and quota in windows server.
8. Configure basic DNS and DHCP services in windows server.
9. Install Linux based OS and practice on basic Linux and networking commands.
10. Configure IP address and subnet in Linux Machine.
11. Install packet tracer and identify the features of packet tracer.
12. Implement the LAN topologies.
13. Demonstrate the use of VLAN.
14. Implement the both static and dynamic router configurations.
15. Install and configure DNS, DHCP, FTP and Web Servers in Linux machine.
16. Capture some packets and analyze the header using Wireshark.
17. Implement the firewall.

Teaching Methods

The teaching faculties are expected to create environment where students can update and upgrade themselves with the current scenario of computing and information technology with the help of topics listed in the syllabus. The general teaching pedagogy that can be followed by teaching faculties for this course includes class lectures, laboratory activity, group discussions, case studies, guest lectures, research work, project work, assignments (Theoretical and Practical), and written and verbal examinations.

Evaluation

Examination Scheme				
Internal Assessment		External Assessment		Total
Theory	Practical	Theory	Practical	
20	20 (3 Hrs.)	60 (3 Hrs.)	-	

Reference Book

1. Andrew S. Tanenbaum, David J. Wetherall, "Computer Networks, 5/e", Prentice Hall, 2011.
2. Behrouz A. Forouzan, "Data Communications and networking" Tata McGraw-Hill.
3. Kurose, Ross, "Computer Networking: A Top-Down Approach", Pearson Education Limited, 2017.
4. Larry L. Peterson and Bruce S. Davie, "Computer Network: A System Approach", Morgan Kaufmann, 5/e, 2012.
5. Matthew Helmke, Andrew Hudson, Paul Hudson "Ubuntu Unleashed 2019 Edition_ Covering 18.04, 18.10, 19.04", 13/e, SAMS _ Pearson Education, 2019.