IT 240: Business Data Communication and Networking

BIM 4th Semester

Credits:3
Lecture Hours: 48

Course Objectives

The main objective of this course is to introduce different concepts of business data communication and computer networking. Special focus will be given to layers of networking model, wired and wireless LAN, WAN, backbone network, Internet and network design and management.

Course Description

This course is designed to provide students with a comprehensive understanding of business data communication and networking concepts. The course covers different aspects of data communications and computer networking, including fundamental concepts, different layers of networking model, LAN, WAN, backbone network, Internet, and network design and management.

Course Details

Unit 1: Introduction to Data Communications **3 LHs**

Introduction; Data Communications Networks (Components of a Network, Types of Networks); Network Models (Open Systems Interconnection Reference Model, Internet Model, Message Transmission Using Layers); Network Standards (The Importance of Standards, The Standards-Making Process, Common Standards); Future Trends (Wireless LAN and BYOD, The Internet of Things, Massively Online).

Unit 2: Application Layer **4 LHs**

Introduction; Application Architectures (Host-Based Architectures, Client-Based Architectures, Client-Server Architectures, Cloud Computing Architectures, Peer-to-Peer Architectures, Choosing Architectures); World Wide Web (Working of WWW, HTTP Request and Response); Electronic Mail (Working of Email, SMTP Packet, Multipurpose Internet Mail Extension); Other Applications (Telnet, Instant Messaging, Videoconferencing).

Unit 3: Physical Layer **7 LHs**

Introduction; Circuits (Circuit Configuration, Data Flow, Multiplexing); Communication Media (Twisted Pair Cable, Coaxial Cable, Fiber-Optic Cable, Radio, Microwave, Satellite, Media Selection); Digital Transmission of Digital Data (Coding, Transmission Modes, Digital Transmission, How Ethernet Transmits Data); Analog Transmission of Digital Data (Modulation, Capacity of a Circuit, How Modems Transmit Data); Digital Transmission of Analog Data (Translating from Analog to Digital, How Telephones Transmit Voice Data, How Instant Messenger Transmits Voice Data, Voice over Internet Protocol).

Unit 4: Data Link Layer **5 LHs**

Introduction; Media Access Control (Contention, Controlled Access, Relative Performance); Error Control (Sources of Errors, Error Prevention, Error Detection, Error Correction via Retransmission, Forward Error Correction, Error Control in Practice); Data Link Protocols (Asynchronous Transmission, Synchronous Transmission); Transmission Efficiency.

Unit 5: Network and Transport Layers **7 LHs**

Introduction; Transport and Network Layer Protocols (Transmission Control Protocol, Internet Protocol); Transport Layer Functions (Linking to the Application Layer, Segmenting, Session Management); Addressing (Assigning Addresses, Address Resolution); Routing (Types of Routing, Routing Protocols, Multicasting, The Anatomy of a Router); TCP/IP Example (Known Addresses, Unknown Addresses, TCP Connections, TCP/IP and Network Layers).

Unit 6: Wired and Wireless Local Area Networks **6 LHs**

Introduction; LAN Components (Network Interface Cards, Network Circuits, Network Hubs, Switches, and Access Points, Network Operating Systems); Wired Ethernet (Topology, Media Access Control, Types of Ethernet); Wireless Ethernet (Topology, Media Access Control, Wireless Ethernet Frame Layout, Types of Wireless Ethernet, Security); The Best Practice LAN Design (Designing User Access with Wired Ethernet, Designing User Access with Wireless Ethernet, Designing the Data Center, Designing the e-Commerce Edge, Designing the SOHO Environment); Improving LAN Performance (Improving Server Performance, Improving Circuit Capacity, Reducing Network Demand).

Unit 7: Backbone Networks **4 LHs**

Introduction; Switched Backbones; Routed Backbones; Virtual LANs (Benefits of VLANs, How VLANs Work); The Best Practice Backbone Design; Improving Backbone Performance (Improving Device Performance, Improving Circuit Capacity, Reducing Network Demand).

Unit 8: Wide Area Networks **4 LHs**

Introduction; Dedicated-Circuit Networks (Basic Architecture, T-Carrier Services, SONET Services); Packet-Switched Networks (Basic Architecture, Frame Relay Services, IP Services, Ethernet Services); Virtual Private Networks (Basic Architecture, VPN Types, How VPNs Work); The Best Practice WAN Design; Improving WAN Performance (Improving Device Performance, Improving Circuit Capacity, Reducing Network Demand).

Unit 9: The Internet **2 LHs**

Introduction; How the Internet Works (Basic Architecture, Connecting to an ISP, The Internet Today); Internet Access Technologies (Digital Subscriber Line, Cable Modem, Fiber to the Home, WiMax); The Future of the Internet (Internet Governance, Building the Future).

Unit 10: Network Design and Management **6 LHs**

Introduction to Network Design (Network Architecture Components, The Traditional Network Design Process, The Building-Block Network Design Process); Needs Analysis (Network Architecture Component, Application Systems, Network Users, Categorizing Network Needs, Deliverables); Technology Design (Designing Clients and Servers, Designing Circuits, Network Design Tools, Deliverables); Cost Assessment (Request for Proposal, Selling the Proposal to Management, Deliverables). Introduction to Network Management; Designing for Network Performance (Managed Networks, Managing Network Traffic, Reducing Network Traffic); Configuration Management (Configuring the Network and Client Computers, Documenting the Configuration); Performance and Fault Management (Network Monitoring, Failure Control Function, Performance and Failure Statistics, Improving Performance); End User Support (Resolving Problems, Providing End User Training); Cost Management (Sources of Costs, Reducing Costs).

Laboratory Works:

The laboratory work consists of:

- Understanding of Network equipment and wiring
- Using basic Networking commands
- Working with IP addressing and subnetting Linux/windows machine
- Learning to use Packet Tracer, creating and testing LAN, working with VLANs
- Learning basic Router Configuration and routing
- Implementing firewall, router access control list
- Learning packet capture and header analysis of TCP, UDP, and IP
- Configuring DNS, Web, and FTP server

Suggested Readings:

Jerry FitzGerald, Alan Dennis, and Alexandra Durcikova, "Business Data Communications and Networking", 13th Edition, Wiley, 2017

Behrouz A. Forouzan, "Data Communications and Networking", 5th Edition, McGraw-Hill, 2013

Andrew S. Tanenbaum, Nick Feamster, and David Wetherall, "Computer Networks", 6th Edition, Pearson, 2021

William Stallings and Thomas Case, "Business Data Communications: Infrastructure, Networking and Security", 7th Edition, Pearson, 2013