EOPE3009 DATA COMMUNICATION AND NETWORK 3-0-0

Course Objectives:

The objectives of this course are to:

1. Provide a foundational understanding of data communication principles, transmission media, and network models, including the OSI and TCP/IP reference architectures.
2. Introduce various transmission techniques, multiplexing methods, switching mechanisms, and physical-layer concepts essential for communication networks.
3. Develop knowledge of error detection and correction techniques, data link control mechanisms, medium access control strategies, and wired LAN technologies.
4. Familiarize students with wireless LAN standards, internetworking devices, virtual circuit technologies, network layer protocols, routing mechanisms, and transport layer services.
5. Enable students to understand application-layer protocols such as DNS, SMTP, FTP, and HTTP, and gain insights into modern wireless communication technologies including Wi-Fi and Li-Fi.

Module – I (6 hours)

Overview of Data Communication Networks, Protocols and standards, OSI Reference model, TCP/IP Protocol. Physical Layer: Analog Signals, Digital Signals, Data Rate Limits, Transmission Impairment, Data rate limit, Digital Transmission: Digital-to-Digital conversion, Analog-to-Digital conversion, Digital-to-analog conversion, Analog Transmission: Digital-to-analog conversion, Analog-to-Analog conversion.

Module – II (6 hours)

Multiplexing: Frequency Division Multiplexing (FDM), Wave Division Multiplexing (WDM), Time Division Multiplexing (TDM), Transmission Media: Guided Media (Twisted-Pair Cable, Coaxial Cable and Fiber-Optic Cable) and unguided media (wireless). Switching: Circuit Switched Network, Datagram Network, Virtual-Circuit Network, Telephone Network, Dial-up Modems and Digital Subscriber Lines.

Module – III (6 hours)

Error detection and correction: Types of Errors, Error Detection mechanism (Linear codes, CRC, Checksum). Error Correction mechanism: Hamming distance, Data Link Control and connection control: Flow and Error control: Stop-and-Wait ARQ, Go-Back-N ARQ, Selective Repeat ARQ, HDLC and Point-to-Point Protocol. Access Control: Random Access (ALOHA, CSMA, CSMA/CD, CSMA/CA), Controlled Access (Polling, Reservation, Token Passing), Channelization (FDMA, TDMA, CDMA). Wired LANs (Ethernet): Traditional Ethernet, Fast Ethernet, Gigabit Ethernet.

Module – IV (6 hours)

Wireless LANs: IEEE 802.11 and Bluetooth. Connecting Devices: Passive Hub, Repeater, Active Hub, Bridge, Two layers Switch, Router, Three layers Switch, Gateway. Virtual Circuit Networks: Frame Relay, Architecture & Layers; ATM: Design goals, Architecture & Protocols, IP: IPv4 and IPv6 addressing, IPv6 Header format and advantages. Network Layer Protocols: ARP, RARP, IGMP and ICMP. Routing: Unicast Routing Protocols and Multicast Routing Protocols. Transport Layer: Process to Process Delivery, User Datagram Protocol (UDP) and Transmission Control Protocol (TCP).

Module – V (6 hours)

Domain Name System (DNS): Name Space, Domain Name Space, DNS in Internet, Resolution and Dynamic Domain Name System (DDNS), Remote logging, Electronic Mail (SMTP) and file transfer (FTP).

WWW: Architecture & Web document, HTTP: Transaction & Persistent vs. Non-persistent connection. Introduction to Wi-Fi and Li-Fi Technology.

Course Outcomes (COs)

After successful completion of this course, students will be able to:

CO1 Describe the fundamental concepts of data communication, network models, and various signal transmission techniques.

CO2 Compare different multiplexing methods, switching techniques, and transmission media used in communication networks.

CO3 Analyze error detection/correction schemes, data link control mechanisms, medium access techniques, and wired LAN protocols.

CO4 Explain wireless LAN technologies, internetworking devices, network layer addressing, routing algorithms, and transport layer protocols.

CO5 Apply knowledge of application-layer protocols (DNS, SMTP, FTP, HTTP) and emerging wireless technologies such as Wi-Fi and Li-Fi in modern communication networks.

Books:

1. Data Communications and Networking, Behrouz A. Forouzan, Tata McGraw-Hill.
2. Computer Networks, A. S. Tannenbum, D. Wetherall, Prentice Hall, Pearson.
3. Computer Networks: A System Approach, Larry L. Peterson and Bruce S. Davie, Elsevier.
4. Computer Networks, Natalia Olifer, Victor Olifer, Willey India.
5. Data and Computer Communications, William Stallings, Prentice Hall, Pearson.

Digital Learning Resources:

Course Name: Data Communication
Course Link: https://nptel.ac.in/courses/106/105/106105082/
Course Instructor: Prof. A. Pal, IIT Kharagpur

Course Name: Computer Networks
Course Link: https://nptel.ac.in/courses/106/105/106105080/
Course Instructor: Prof. A. Pal, IIT Kharagpur