Network and Data Communications

Course Title: Network and Data Communications   **Full Marks:** 60 + 20 + 20
Course No: BIT254   **Pass Marks:** 24 + 8 + 8
Nature of the Course: Theory + Lab   **Credit Hrs:** 3
Semester: IV

Course Description:
The course covers fundamental concepts about Data communication, Data Transmission and Computer Network with their functionalities at Physical, Data, Network, Transport and Application Layer respectively.

Course Objective:
The main objective of this course to introduce analog and digital signals with their conversion and transmission; Protocols: OSI, TCP/IP; Medium of transmission; Multiplexing Techniques; Switching Techniques; Error Detection and Correction; Data Link Control; Routing Algorithms; Transport Protocols; Congestion Control; Domain Name System, Electronic Mail, File Transfer.

Course Contents:
Unit 1: Fundamental of Data Communication (6 Hrs.)
Components, Data Representation, Data Flow, Distributed Processing, Network Criteria, Physical Structures, Network Models, Categories of Networks; Basic Concepts about Bridge, Hub, Swtich, Router, NIC, MAC-address, Gateway; The Internet, Protocols and Standards, OSI, TCP/IP; Addressing.

Unit 2: Physical Layer and Media (12 Hrs.)
Analog and Digital; Periodic Analog Signals, Digital Signals; Basic Concepts about Noise, Distortion, Attenuation, Nyquist Bit Rat, Shannon Capacity, Bandwidth, Throughput, Latency; Conversion: Analog to Analog, Digital to Digital, Analog to Digital , Digital to Analog; Transmission modes; Multiplexing: Time Division Multiplexing, Frequency Division Multiplexing, Wavelength Division Multiplexing; Guided Media, Unguided Media; Switching: Circuit Switching and Packet Switching.

Unit 3: Data link layer (8 Hrs.)
Functionality of Data link Layer; Error detection and Correction: Introduction, Block Coding, Linear Block Codes, Cyclic codes, Checksum; Data Link Control: Framing, Flow and Error Control, Protocols, Noiseless Channels, Noisy Channels; Multiple Access: Random Access. ALOHA, Controlled Access; Basic concepts about Cellular telephony and Satellite network.

Unit 4: Network layer (8 Hrs.)
Functionality of Network Layer; Internetworking; IPv4, IPv6; Directing; Forwarding; Routing: Static vs. Dynamic Routing; Routing Algorithms: Shortest-path, Flooding, Flow-based, Distance-vector, Link-state; Congestion control and prevention: Leaky-bucket algorithm, Token-bucket algorithm; Network layer protocols: IP, NAT, ICMP, IGMP, RIP, ARP, RARP, OSPF, IGRP, EIGRP, BGP.

Unit 5: Transport layer (6 Hrs.)
Functionality of Transport layer; Client Server Paradigm, Multiplexing and De-multiplexing, Connectionless vs. Connection Oriented Service, Reliable vs. Unreliable; Basic Overview of TCP and UDP; Congestion Control and Quality of Service: Network Performance; Congestion Control: Open-loop and Closed loop.

Unit 6: Application layer (5 Hrs.)
Functionality of Application Layer; Domain Name System: Namespace, Domain Name Space, Distribution of Name Space, DNS in the Internet: Generic Domains, Country Domains, Inverse Domain, Resolution: Resolver, Mapping Names to Addresses, Address to Names, Recursive Resolution, Caching; Electronic mail: SMTP, POP, IMAP; File transfer: FTP, Telnet; Dynamic host configuration protocol (DHCP), HTTP, WWW, SNMP.

Laboratory Works:
Students should be able to configure network hardware and software; should be able to design and set up networks by using simulators and devices.

Text Book:
1. Behrouz A. Forouzan; "Data Communications and Networking", 4th Edition, McGraw Hill.

Reference Books:
1. William Stallings; "Data And Computer Communications", 8th Edition Prentice Hall of India, New Delhi.
2. A.S. Tanenbaum; "Computer Network", 4th Edition, Pearson Education International.