BOS	Computer Science
Class	F Y. B.C.A
Semester	I
Course Name	Networking Fundamentals
Course Code	PUSCA204
Type of course	Skill Enhancement Course
Level of the Subject	Medium
Credit points	2

Course Objectives:

1. Understand Networking Fundamentals and Protocol Models.
2. Master Transmission and Error Control Techniques and Explore Network Layer and Transport Layer Protocols.

Unit No.	Name of Unit	Topic No.	Contents	Hours
1	Introduction and Protocol Layering Data & Signals Transmission Impairments	1.1	Definition of Computer Network, Nodes, Communication Link, Data Flow, Network Topology, Network types. Protocol Layering: Network Models: OSI Layered Architecture, TCP/IP Protocol Suite	10
		1.2	Signals: Data and Signals, Analog and Digital Data, Analog and Digital Signals, Sine Wave Phase, Wavelength, Time and Frequency Domains, Bandwidth, Digital Signal, Bit Rate, Bit Length	
		1.3	Transmission of Digital Signals, Transmission Impairments, Attenuation, Distortion, Noise, Data Rate Limits, Performance, Bandwidth, Throughput, Latency (Delay)	
2	Physical Layer Transmission Media Data Link Layer	2.1	Transmission Modes, Parallel Transmission, Serial Transmission.Multiplexing, Frequency Division Multiplexing, Wavelength-Division Multiplexing, Time-Division Multiplexing.	10
		2.2	Transmission Media, Guided Media, Twisted- Pair Cable, Coaxial Cable, Fiber-Optic Cable.	
		2.3	Introduction to Data-Link Layer: Services, Two Sub-layers: MAC, LLC Three Types of addresses, Address Resolution Protocol (ARP) Error Detection and Correction: Introduction, Types of Errors, Redundancy, Detection versus Correction, Simple parity check code, Hamming distance, Hamming code, CRC, Checksum, Media Access Control (MAC)	
3	Connecting Devices and Network Layer	3.2	Connecting Devices and Addressing: Virtual LANs, connecting devices, Hubs, Link-Layer Switches, Routers,	10

	Routing Transport Layer		Introduction to Network Layer, Routing and Forwarding, IPv4 addresses, Address Space, Classful Addressing.	
		3.3	Routing: Unicast Routing, Least- Cost Routing, Routing Algorithms: Distance Vector Routing, Link-State Routing, Path Vector Routing	
		3.4	Introduction to Transport Layer, Transport- Layer Services, Connectionless and Connection- Oriented Protocols. UDP: Service, Port Numbers, User Datagram Protocol User Datagram TCP: Service, Port Numbers, TCP Features, Segment format, TCP connections,	
			Total Hours	**30**

Course Outcomes:

1. Explain the fundamentals of computer networks, including types, topologies, protocols, and OSI/TCP-IP models.
2. Analyze analog and digital signals, their properties, impairments, and impact on communication performance.
3. Apply knowledge of multiplexing techniques and guided transmission media to design efficient data communication systems.
4. Evaluate different error detection and correction mechanisms such as parity checks, Hamming codes, and CRC for reliable data communication
5. Design IP addressing schemes, analyze routing algorithms, and assess their role in efficient data packet forwarding within a network
6. Compare TCP and UDP protocols: services, features, and port management

References:

1. "Computer Networking: A Top-Down Approach" by James Kurose and Keith Ross
2. "Data and Computer Communications" by William Stallings
3. "Computer Networks" by Andrew S. Tanenbaum and David J. Wetherall
4. "TCP/IP Illustrated, Volume 1: The Protocols" by W. Richard Stevens
5. "Network+ Guide to Managing and Troubleshooting Networks" by Mike Meyers
6. Data Communications and Networking – Behrouz A. Forouzan

Practical List

Practical No	Details
1	Understanding the working of NIC cards, Switches, Hub, Gateway router
2	IP Addressing and Subnetting Perform subnetting and IP address allocation in a network. ● Given an IP address range, calculate subnets and allocate IP addresses for multiple devices.

	● Configure subnets using subnet masks and verify connectivity between devices. ● Use ping and traceroute to test connectivity.
3	Basic Networking Setup and Configuration Set up a small local area wired network (LAN) and configure basic networking components (routers, switches, and computers). ● Assign static IP addresses and configure network interfaces on PCs. ● Set up a basic network with a router and multiple devices. ● Test network connectivity using ping and traceroute.
4	Using Packet Tracer, create a wireless network of multiple PCs using appropriate access point to block/unblock wireless connection
5	Using Packet Tracer, Configure the network with static routing using protocol.
6	Using linux-terminal or Windows-cmd, execute the following networking commands and note the output: ping, traceroute, netstat, arp, ipconfig.
7	Using Packet Tracer, Configure the network with dynamic routing using RIP, OSPF protocol.
8	OSI and TCP/IP Model Analysis using Wireshark:Capture and analyze network traffic at different layers of the OSI and TCP/IP models. ● Capture packets using Wireshark and analyze the flow through various layers (e.g., IP, TCP, UDP, HTTP). ● Identify the protocols operating at each layer. ● Compare the packet structure for different protocols (e.g., TCP vs. UDP).
9	Using Packet Tracer, create a wireless network of multiple PCs using appropriate access point to block/unblock wireless connection
10	Create and simulate a network connecting two different networks with the help of two routers.