Name of the Course: Computer Networks

Sr. No.	Heading	Particulars
1	**Description the course:**	**Introduction:** The Computer Networks course provides a foundational understanding of how computers and other devices communicate over various types of networks. It introduces key networking models like OSI and TCP/IP, explores the structure and functionality of different layers such as physical, data link, network, transport, and application, and dives into real-world protocols such as Ethernet, IP, TCP, HTTP, and DNS. The course also addresses modern developments like IPv6, Quality of Service (QoS), and secure communication practices. **Relevance:** n an era where connectivity drives innovation, understanding computer networks is essential for any computer science graduate. This course aligns with the growing need for professionals who can design, troubleshoot, and manage complex networked systems, including those used in cloud computing, data centers, mobile communications, and IoT environments. **Usefulness:** The course is highly useful for learners as it equips them with the theoretical background and practical insights needed to understand how data moves through networks. This knowledge is critical not only for roles in networking but also in software development, cybersecurity, systems administration, and IT infrastructure management. **Application:** Concepts learned in this course have direct application in configuring LANs and WANs, managing IP addresses, analyzing packet data, securing communications, and developing network-based applications. Students will be able to apply their knowledge in creating efficient, scalable, and secure communication systems. **Interest:** Students often find this course interesting due to its hands-on nature and immediate relevance to everyday technologies such as the internet, mobile phones, social media, and streaming services. Simulations and practical case studies help visualize how theoretical concepts apply

		in real-world network scenarios. **Connection with Other Courses:** This course connects closely with subjects such as Operating Systems, Database Management Systems, Web Programming, Cloud Computing, and Cybersecurity. A good understanding of networking is essential for understanding how distributed systems work, how servers handle requests, and how secure communication is maintained. **Demand in the Industry:** There is a consistent demand in the industry for professionals who understand networking principles and can manage network operations. Roles involving cloud platforms (like AWS, Azure), DevOps, and IT support all value networking skills. Knowledge of protocols and architectures is especially important for careers in network engineering, cybersecurity, and system integration. **Job Prospects:** Completing the Computer Networks course equips students for roles like network administrator, support technician, and system engineer. It builds a strong foundation for careers in cybersecurity, cloud computing, and IT infrastructure. The knowledge gained is valuable for industry certifications and in-demand across tech-driven sectors.
2	**Vertical:**	Major
3	**Type:**	Theory
4	**Credits:**	2 credits (1 credit = 15 Hours for Theory or 30 Hours of Practical work in a semester)
5	**Hours Allotted:**	30 Hours
6	**Marks Allotted:**	50 Marks
7	**Course Objectives (CO):** **CO 1.** To introduce students to fundamental concepts of computer networks, network types, architecture, and models including OSI and TCP/IP. **CO 2.** To explain data transmission techniques, bandwidth utilization, switching methods, and transmission media used in modern networks. **CO 3.** To provide an understanding of data link layer functions including MAC, error detection/correction, and LAN protocols. **CO 4.** To equip learners with knowledge of network layer operations such as IP addressing, routing, and protocol analysis including IPv4 and IPv6.	

	CO 5. To introduce transport and application layer protocols and their real-world applications such as web communication, email, and DNS. **CO 6.** To make students aware of modern network trends, QoS mechanisms, and the transition to IPv6 and secure communications.
8	**Course Outcomes (OC):** After successful completion of this course, students would be able to - **OC 1.** Describe network architectures, types, models, and the layered approach in data communication. **OC 2.** Analyze the working of physical and data link layers including signal transmission, media, error detection, and MAC protocols. **OC 3.** Explain the role of switching techniques and multiplexing in efficient communication. **OC 4.** Configure and evaluate IPv4/IPv6 addressing schemes and understand packet forwarding and routing algorithms. **OC 5.** Compare and contrast TCP, UDP, and SCTP protocols and apply them to real-time applications. **OC 6.** Use knowledge of application layer protocols (HTTP, FTP, Email, DNS, etc.) to understand client-server interactions. **OC 7.** Assess Quality of Service (QoS) requirements and identify modern network challenges and solutions like 5G, satellite, and secure communication.
9	**Modules:-** **Module 1 (15 hours):**
	Introduction to Computer Networks: Networking standards and organizations (ISO, IEEE, IETF), Types of Networks: LAN, MAN, WAN, Network topologies and basic hardware **Network Models:** OSI Reference Model – layers, functions, TCP/IP Protocol Suite – layers and comparison with OSI **Physical Layer Concepts:** Data and signals: analog & digital, Signal impairments: attenuation, noise, distortion, Data transmission: bandwidth, throughput, latency, Digital transmission: line coding, analog-to-digital conversion, Transmission modes: simplex, half-duplex, full-duplex **Bandwidth Utilization & Transmission Media:** Multiplexing: FDM, TDM, WDM, Spread Spectrum techniques: DSSS, FHSS, Transmission Media: Guided (Twisted Pair, Coaxial, Fiber Optics) & Unguided Media (Radio, Microwave, Infrared) **Switching Techniques:** Circuit Switching, Packet Switching (connectionless and connection-oriented) **Data Link Layer and Error Handling:** Link layer addressing (MAC), framing concepts, Error detection: Parity, CRC, Checksum, Error correction: Hamming Code, Data link protocols: Stop-and-Wait, Go-Back-N, HDLC, Introduction to MAC: CSMA/CD, CSMA/CA

	Wired & Wireless LANs: Ethernet (standard, fast, gigabit). IEEE 802.11 Wi-Fi, Bluetooth, WiMAX, Cellular telephony: Generations overview (2G–5G), Satellite networks: types and applications	
	Module 2 (15 hours):	
	Network Layer Fundamentals: Packet Switching Concepts, IPv4 Addressing, Subnetting, IP Packet forwarding & routing, Overview of ICMPv4, Basics of Mobile IP **Routing Techniques:** Routing algorithms: Concepts of Distance Vector & Link State Routing, Unicast Routing Protocols: Basic overview of RIP & OSPF **IPv6:** IPv6 Addressing format, comparison with IPv4, ICMPv6, Transition strategies **Transport Layer Protocols,** Transport layer services, User Datagram Protocol (UDP), Transmission Control Protocol (TCP): Features, 3-way handshake **Application Layer & Protocols:** Client-Server architecture: Iterative vs Concurrent Servers, Standard Protocols: HTTP (with HTTPS), FTP, Email (SMTP, POP3, IMAP), TELNET, SSH (modern replacement), DNS **Quality of Service (QoS):** Concepts of Delay, Jitter, Bandwidth, Flow control techniques, Integrated Services (IntServ) and Differentiated Services (DiffServ), Current trends: QoS in video streaming and VoIP	
10	**Text Books** 1. Data Communications and Networking, Behrouz A. Forouzan, Fifth Edition, TMH, 2018. 2. Computer Network, Andrew S. Tanenbaum, David J. Wetherall, Fifth Edition, Pearson Education, 2018.	
11	**Reference Books** 1. Computer Network, Bhushan Trivedi, Oxford University Press, 2016 2. Data and Computer Communication, William Stallings, PHI, 2017	
12	**Internal Continuous Assessment: 40%**	**Semester End Examination: 60%**