Semester: 5	
Programme : B.Sc. Computer Science (Major)	
Course : DATA COMMUNICATIONS AND COMPUTER NETWORKS	
Paper code: C3CS230531T	**Credits: 4**
Hours/week : Theory: 4	
Category: Core/MDC/SEC/VAC : Core	
Theory / Practical / Composite : Theory	
No of Modules : 1	

Course Overview: Data Communications and Computer Networks is a 4-credit theoretical course designed to provide a comprehensive foundation in the principles, architectures, and protocols governing modern digital communication systems. Structured around a layered, bottom-up pedagogical approach, the course begins with fundamental concepts of signal representation, transmission impairments, and channel capacity (Nyquist and Shannon theorems), then systematically progresses through the OSI and TCP/IP reference models—covering Physical layer media and multiplexing, Data Link layer framing and error control (ARQ protocols), Network layer IP addressing and routing fundamentals, Transport layer end-to-end reliability and congestion management (TCP/UDP), and Application layer services such as DNS, HTTP, and email. Supplementary modules introduce multiple access techniques (IEEE 802.X), mobile communications, and cloud networking paradigms, ensuring relevance to contemporary distributed systems. By integrating theoretical analysis with practical protocol design considerations, the course equips students with the analytical skills to evaluate network performance, troubleshoot communication challenges, and prepare for advanced study or professional roles in network engineering, cybersecurity, and cloud infrastructure.

Course Outcome:

1. **Analyse** analog and digital signal characteristics and evaluate transmission impairments using time and frequency domain analysis, including Nyquist and Shannon theorems.
2. **Explain** fundamental concepts of computer networks, including network classifications, topologies, protocols, and layered architectures such as the OSI reference model and TCP/IP protocol suite.
3. **Apply** physical and data link layer concepts to analyse transmission media, multiplexing and switching techniques, encoding methods, framing, flow control, and error detection and correction mechanisms.
4. **Evaluate** multiple access protocols and local area network technologies based on IEEE 802 standards, including Ethernet and Token Ring architectures.
5. **Analyze** network and transport layer functionalities, including IP addressing, packet delivery, TCP and UDP operations, flow and congestion control, window management, and quality of service.
6. **Describe** application layer protocols and emerging networking concepts, including DNS, HTTP, FTP, electronic mail, network management, mobile communications, cloud networking, data compression, and basic cryptography.

SYLLABUS

UNIT/Module	CONTENT	HOURS or NUMBER OF CLASSES	CO Mapping	COGNITIVE LEVEL
	GROUP A			
I.	Data Communications: Analog & Digital Signals, Periodic and Non Periodic	7	**CO1**	**K4**

	Signals, Time and frequency Domain Analysis. Transmission Impairments: Nyquist and Shanon's Theorem.			
II.	Introduction to Computer Networks Network definition; network topologies; network classifications; network protocol; layered network architecture; overview of OSI reference model; overview of TCP/IP protocol suite.	6	**CO2**	**K2**
III.	Physical Layer Functionalities Transmission Media. Multiplexing: FDM, TDM and Applications. Switching Techniques: Circuit, Message and Packet Switching. Encoding Techniques.	6	**CO3**	**K3**
IV.	Data Link Layer Functions and Protocol Error detection and error correction techniques; data-link control- framing and flow control; error recovery protocols: Stop and wait ARQ, Go-back-n ARQ, Selective repeat ARQ.	7	**CO3**	**K3**
GROUP B				
V.	Multiple Access Protocol and Networks Carrier and non-carrier sense protocols; IEEE 802.X – Introduction, architecture, protocol and management of Ethernet and token ring.	6	**CO4**	**K5**
VI.	Networks Layer Functions and Protocols; IP addressing Concepts.	5	**CO5**	**K4**
VII.	Transport Layer Process-to-process delivery, Transport layer protocols (UDP and TCP), Multiplexing, Connection management, Flow control and retransmission, Window management, TCP Congestion control, Quality of service.	6	**CO5**	**K4**
VIII.	Application Layer: Domain Name System, World Wide Web and Hyper Text Transfer Protocol, Electronic mail, File Transfer Protocol, Remote login, Network management, Data compression, Cryptography – basic concepts	5	**CO6**	**K6**
IX.	Overview of Mobile Communications, Introduction to Cloud networking	4	**CO6**	**K6**

Text Books

1. **Behrouz A. Forouzan –** *Data Communications and Networking with TCP/IP Protocol Suite 6th Edition*, **McGraw-Hill Education (International)**, 2021.
2. **William Stallings –** *Data and Computer Communications 10th Edition*, **Pearson Education**, 2021/2022

3. **Andrew S. Tanenbaum, Nick Feamster & David J. Wetherall –** *Computer Networks 6th Edition*, **Pearson Education**, 2021/2022
Suggested Reading: 1. **James F. Kurose & Keith W. Ross –** *Computer Networking: A Top-Down Approach Latest Edition (typically 7th/8th)*, **Pearson Education** 2. Douglas E. Comer – Internetworking with TCP/IP, Volume 1: Principles, Protocols and Architecture Latest Edition, Pearson/Prentice Hall
Evaluation
Theory CIA: 25 Attendance: 5 Semester Exam: 70
Paper Structure for Theory Semester Exam Module: Group A: Answer 5 out of 7 of 7 marks each Group B: Answer 5 out of 7 of 7 marks each

Course outcomes (COs) and Cognitive Level Mapping

COs	CO Description	Cognitive levels
CO1	**Recall** and explain basic concepts of analog and digital signals, signal types, and transmission media	Remember (K1)
CO2	**Explain** network fundamentals, classifications, topologies, protocols, OSI model, and TCP/IP architecture	Understand (K2)
CO3	**Apply** physical and data link layer concepts such as multiplexing, switching, framing, flow control, and error control	Apply (K3)
CO4	**Analyze** multiple access protocols and IEEE 802 based LAN technologies such as Ethernet and Token Ring	Analyze (K4)
CO5	**Evaluate** network and transport layer operations including IP addressing, TCP/UDP, congestion and flow control	Evaluate (K5)
C06	**Design** conceptual solutions using application layer services and emerging networking concepts such as cloud and mobile networking	Create (K6)