Course Handout (2023-24 ODD SEMESTER)

Subject Name/Code : Computer Networks(BTCS-T-PC-013) Branch/Sem/Batch :

Name of Faculty : Kasturi Dhal , Amarjeet Mohanty , Ranjit Kumar Behera , SASMITA PARIDA , KAILASH CHANDRA MISHRA , MILAN SAMANTARAY

Scope & Objective -:

The objective of this course is to study the fundamental concepts of computer networks and develop an understanding of modern network architectures from design & performance perspective.

Pre-Requisite -:

Detailed Syllabus:

Module#	CO	Topics	Hours
Module-1	CO1	Introduction: 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; Digital Transmission: Digital-to-Digital & Analog-to- Digital conversion, Transmission Modes; Analog Transmission: Digital-to-Analog & Analogto-Analog conversion; Multiplexing: FDM, TDM; Transmission Media: Guided Media, Unguided media; Switching: Circuit Switched, Datagram, and Virtual-Circuit Networks.	8
Module-2	CO2	Error Detection & Correction: Types of Errors, Error Detection mechanisms (Linear codes, Hamming codes, CRC, Checksum); Data Link Control and Protocols: Flow and Error Control, Stop-and-Wait ARQ, Go-Back- N ARQ, Selective Repeat ARQ; Introduction to HDLC and Point-to- Point Protocol; Multiple Access Mechanisms: Random Access - CSMA, CSMA/CD, CSMA/CA; Channelization: FDMA, TDMA, CDMA; Wired LANs (Ethernet): Traditional, Fast, and Gigabit Ethernet standards; Wireless LANs: IEEE802.11 Standards; Connecting Devices: Repeaters, Switches, Routers, Bridges, Modems, Hubs.	10
Module-3	CO3	Network Layer: IPV4 & IPV6 addresses, Subnets; Internet Protocol: Internetworking, IPV4 & IPV6 datagram format; Network Layer Protocols: ARP, RARP, ICMP working principles and datagram format; Routing: Unicast and Multicast Routing Protocols.	10
Module-4	CO4	Transport Layer: Process to Process Delivery, User Datagram Protocol (UDP) and Transmission Control Protocol (TCP), TCP and UDP segments and Flow Control.	8
Module-5	CO5	Domain Name System (DNS): Name Space, Domain Name Space and Distribution; Resolution: Recursive and Iterative DNS Queries; FTP, SMTP, HTTP.	6
		Total	42 Hours

#	Topic	Module	Chapter	Course Coverage	No of Classes
1	Overview of Data Communication Networks, Protocols and standards	Module-1		TRUE	1
2	OSI Reference model	Module-1		TRUE	1
3	TCP/IP Protocol	Module-1		TRUE	1
4	Physical Layer: Analog Signals and Digital Signals	Module-1		TRUE	1
5	Transmission Impairment, Data rate limit, Performance	Module-1		TRUE	1
6	Digital Transmission: Digital-to-Digital conversion	Module-1		TRUE	1

7	Line coding schemes	Module-1		TRUE	1
8	Block coding, Scrambling	Module-1		TRUE	1
9	Analog-to-Digital conversion	Module-1		TRUE	1
10	Transmission modes	Module-1		TRUE	1
11	Analog Transmission: Digital-to-Analog conversion	Module-1		TRUE	1
12	Analog-to-Analog conversion	Module-1		TRUE	1
13	Multiplexing: Frequency Division Multiplexing (FDM), Wave Division Multiplexing (WDM)	Module-1		TRUE	1
14	Time Division Multiplexing (TDM)	Module-1		TRUE	1
15	Transmission Media: Guided Media (Twisted-Pair Cable, Coaxial Cable and Fiber-Optic Cable) and unguided media (wireless)	Module-1		TRUE	1
16	Switching: Circuit Switched Network, Datagram Network, Virtual-Circuit Network	Module-1		TRUE	1
17	Preparation for Class Test-I			FALSE	1
18	Discussion of Q-A of class test-I and showing answer script to students	Module-1		FALSE	1
19	Error Detection and correction: Types of Errors, Error Detection mechanism:Linear codes	Module-2		TRUE	1
20	CRC, Checksum	Module-2		TRUE	1
21	Error Correction mechanism: Hamming Encoding	Module-2		TRUE	1
22	Data Link Control and Protocols: Flow and Error Control, Stop-and-Wait ARQ	Module-2		TRUE	1
23	Go-Back-N ARQ, Selective Repeat ARQ	Module-2		TRUE	1
24	HDLC, Point-to-Point Protocol			TRUE	1
25	Multiple Access: Random Access :ALOHA	Module-2		TRUE	1
26	CSMA, CSMA/CD, CSMA/CA	Module-2		TRUE	1
27	Controlled Access (Polling, Reservation, Token Passing)	Module-2		TRUE	1
28	Channelization (FDMA, TDMA, CDMA)	Module-2		TRUE	1
29	Wired LANs (Ethernet): Traditional Ethernet, Fast Ethernet, Gigabit Ethernet	Module-2		TRUE	1
30	Wireless LANs: IEEE 802.11 and Bluetooth	Module-2		TRUE	1
31	Connecting Devices: Passive Hub, Repeater, Active Hub, Bridge, Two layers Switch, Router, Three layers Switch, Gateway.	Module-2		TRUE	1
32	Virtual Circuit Networks: Frame Relay, Architecture & layers	Module-2		TRUE	1
33	Preparation for Class Test-II	Module-2		FALSE	1
34	Discussion of Q-A of class test-II and showing answer script to students	Module-2		FALSE	1
35	Network Layer: IPV4 addresses, IPV6 addresses	Module-3		TRUE	1
36	IPV4 datagram, IPV6 packet format and advantages	Module-3		TRUE	1
37	38 Network Layer Protocols: ARP, RARP, IGMP and ICMP	Module-3		TRUE	1
38	Routing: Unicast and multicast Routing Protocols	Module-3		TRUE	1
39	Transport Layer: Process to Process Delivery, User Datagram Protocol (UDP) and Transmission Control Protocol (TCP).	Module-4		TRUE	1
40	Domain Name System (DNS): Name Space, Domain Name Space, DNS in Internet, Resolution and Dynamic Domain Name System (DDNS)	Module-5		TRUE	1
41	Remote logging, FTP, Electronic Mail (SMTP)	Module-5		TRUE	1
42	WWW: Architecture & Web document, HTTP: Transaction & Persistent vs. Non persistent connection, Introduction to Wi-Fi and Li-Fi Technology	Module-5	*	TRUE	1

Total no. of classes : 42

Text Book

B. A. Forouzan, Data Communication and Networking, 5th Edition, Tata McGraw-Hill, 2017, ., .
A. S. Tannenbum and D. Wetherall, Computer Networks, 5th Edition, Prentice Hall, Imprint of Pearson, 2016, ., .

Reference Book

L. L. Peterson and B. S. Davie, Computer Networks: A System Approach, 5th Edition, Elsevier, 2011, ., .
W. Stallings, Data and Computer Communications, 10th Edition, Pearson Education, 2017, ., .
B. A. Forouzan and F. Mosharraf, Computer Networks: A Top-Down Approach, McGraw-Hill Education, 2017, ., .

Online Reference Material(s):

1. https://nptel.ac.in/courses/106/105/106105183/: by Prof. S. Chakraborty and Prof. S. K. Ghosh, IIT Kharagpur
2. https://nptel.ac.in/courses/106/106/106106091/: by Prof. H. A. Murthy, IIT Madras
3. https://nptel.ac.in/courses/106/105/106105080/: by Prof. A. Pal, IIT Kharagpur
4. https://nptel.ac.in/courses/106/105/106105081/: by Prof. S. Ghosh, IIT Kharagpur
5. http://intronetworks.cs.luc.edu/current/ComputerNetworks.pdf: eBook by Prof. P. L. Dordal, Loyola University, Chicago, USA

Course Outcome:

CO1	Describe the basics of computer networks, topology, TCP/IP, and OSI reference models and various techniques and modes of transmission (Analog and Digital).
CO2	Compare various Data Link protocols, Error detecting mechanisms, Multi-Channel Access protocols and IEEE 802.xx standards for LAN.
CO3	Describe IPv4 & IPv6 addressing schemes, subnets, routing principles and algorithms used in the network layer.
CO4	Explain the protocols of Transport & Application layers and understand the working principles of Internet & theWorld WideWeb.
CO5	Explain the principles of DNS hierarchy and working principles of various Application layer protocols.

Program Outcomes Relevent to the Course:

PO1	Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems
PO2	Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4	Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO6	The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7	Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10	Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one’s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12	Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Mapping of CO's to PO's: (1: Low, 2: Medium, 3: High)

	PO1	**PO2**	**PO3**	**PO4**	**PO6**	**PO12**
CO1	3	3	3	3		1
CO2	2	3	2	3		1
CO3	3	2	2	3		1
CO4	3	2	2	2	1	1
CO5	2	2	2	2	2	1