

**MANIPAL UNIVERSITY JAIPUR**  
Department of Artificial Intelligence and Machine Learning  
Course Hand-out

**A. Basic Details:**

Programme Name:	B. Tech. CSE (AIML)
Course Name:	Computer Networks
Course Code:	AI3103
LTPC ( <i>Lecture Tutorial Practical Credits</i> ):	3 1 0 4
Session:	Aug 2025– Nov 2025
Class:	V
Course Coordinator:	Dr. Amit Kumar Bairwa
Course Instructor(s):	Dr. Deepak Panwar; Dr. Uddalak Chatterjee; Dr. Hemlata Parmar; Dr. Varun Tiwari; Dr. Kanwal Preet Kour; Dr. Amit Kumar Bairwa ; Dr. Noopur Tyagi
Additional Practitioner(s) – if any ( <i>Industry Fellow/ Visiting Faculty/ Adjunct Faculty, etc.</i> ):	To be identified and appointed later/ or at the beginning of the semester

**B. Introduction:** The main objective of this course is to familiarize students with computer networks of today which are based on the TCP/IP model and its layered structure.

**C. Course Outcomes:** At the end of the course, students will be able to

CO Statement	CO	Bloom's Level	Target Attainment %	Target Attainment level
<b>Explain</b> basic concepts, OSI reference model, services and role of each layer of OSI model and TCP/IP, networks devices and transmission media, Analog and digital data transmission.	1	2	100%	3
<b>Develop</b> skills for error detection and correction techniques in the data transmission. Identify Data	2	3	100%	3

framing, flow, and error control protocols at Data Link Layer				
<b>Apply</b> the Internet control protocols – IPv4, IPV6, class full addressing, sub netting and classless addressing.	<b>3</b>	3	100%	3
<b>Analyze</b> the Transport Layer and Its protocols.	<b>4</b>	4	100%	3
<b>Explain</b> the Application Layer, its protocols.	<b>5</b>	2	100%	3

Here, the level indicates the cognitive level of Revised Bloom's Taxonomy.

Information about attainment levels:

Attainment (%)	Level
< 60 %	0
≥ 60% < 70%	1
≥ 70% < 80%	2
≥ 80	3

**D. Program Outcomes and Program Specific Outcomes:** Mention program outcomes and program specific outcomes of the program.

**E. Assessment Plan:** Clearly write the criteria, its description, and associated marks for assessment of student achievements. In addition, the attendance requirements, assignments need to be mentioned in this section.

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Sessional Exam I	30
	1 Quiz (05 Marks), 1 Attendance (5 Marks), 2 Assignment (5+5 Marks) +Viva, 1 CISCO Certificate (10 Marks) (Accumulated and Averaged)  <b>CISCO Certificate</b>  CCNAv7: Introduction to Networks	30
End Term Exam (Summative)	End Term Exam (Close Book)	40
	Total	100

## F. Syllabus:

**Introduction to Computer Networking Concepts:** Data Communications and Networking For Today's Enterprise, Layered Network Protocol Architectures OSI and TCP.

**Physical Layer:** Data Transmission: Concepts and Terminology, Analog and Digital Data Transmission, Channel capacity.

**Transmission Media:** Guided and Wireless Transmission, Wireless Propagation, Line-of-Sight Transmission. Signal Encoding Techniques: Analog and Digital Signals.

**Digital-To-Digital Conversion:** Line Coding Schemes, Block Coding, Scrambling, Analog-To-Digital Conversion: Pulse Code Modulation, Delta Modulation.

**Data Link Layer and Logical Link Control (LLC) sub-layer:** Asynchronous and Synchronous Transmission, types of Errors. Error Detection Error Correction, Framing for Reliable transmission and Automatic Repeat Request: (ARQ), Stop-and-Wait Protocol, Go-back-N, Selective Repeat. Performance analysis of ARQ protocols. Example protocols such as HDLC and PPP.

**Medium Access Control (MAC) sub-layer:** Shared media systems: Bus, Star and Ring topologies; TDMA, FDMA, CSMA, CSMA/CD, Ethernet, CSMA/CA protocols; Shared and Switched Ethernet; Related protocols such as ICMP, NAT, ARP and RARP.

**Network Layer:** IPv4 Addresses and Header, Classfull addressing, Classless addressing, Subnetting, CIDR—Classless Interdomain Routing, VLSM, IPv6 addressing and headers; Routing protocols including distance-vector and link-state approaches.

**Transport Layer:** Reliable end-to-end transmission protocols; UDP header; Details of TCP header and operation including options headers and congestion control.

**Application Layer:** Socket Interface and Socket programming; Example protocols such as DNS, SMTP, FTP, and HTTP.

### TEXTBOOKS:

1. W. Stallings, Data & Computer Communications (9e), Pearson Education Inc., Noida, 2017.
2. A S Tanenbaum, Computer Networks, 5<sup>th</sup> Ed., Pearson, 2010.
3. B.A. Forouzan, TCP/IP Protocol Suite, 4<sup>th</sup> Ed., TMH, 2010.

### REFERENCES:

1. J.F. Kurose and K.W. Ross, Computer Networking - A top-down approach, (7e), Pearson, 2017.
2. A. S. Tanenbaum, Computer Networks, (5e), Pearson Education India, 2013.
3. L. L. Peterson and B.S. Davie, Computer Networks- A Systems approach, (5e), Elsevier, 2016
4. B. A. Forouzan and F.Mosharraf, Computer Networks A Top-Down Approach, Mc-Graw Hill, 2017
5. NPTEL Course: NOC: Computer Networks and Internet Protocol, IIT Kharagpur

## G. Lecture Plan:

Le ct.	Topics	Session Outcome	Corresp onding CO	Mode of delivery	Mode of Assessing CO
1	Introduction to Course, Course Outcome. <b>Introduction to Computer Networking Concepts:</b> Data Communications and Networking For Today's Enterprise,	To acquaint and clear teacher's expectations and understand students' expectations.	AI3103.1	Lecture	NA
2	Layered Network Protocol Architectures OSI	Recognize layering architecture and OSI model in Internet	AI3103.1	Lecture	MTE, Quiz & ETE
3	TCP/IP – Layers and Functioning	Illustrate TCP/IP model	AI3103.1	Lecture	MTE, Quiz & ETE
4	<b>Physical Layer:</b> Data Transmission: Concepts and Terminology, Composite signal, Bandwidth, Digital Signal: Bit Rate, Bit Length, Digital signal as a composite, Analog Signal, <b>Tutorial</b>	Analyze composite signal	AI3103.1	Lecture	MTE, Quiz & ETE
5	Transmission Impairment: Attenuation, Distortion, Noise	Identify transmission impairment	AI3103.1	Lecture	MTE, Quiz & ETE
6	Performance: Bandwidth, Throughput, Latency, Delay, Jitter	Analyze performance in communication	AI3103.1	Lecture	MTE, Quiz & ETE
7	<b>Transmission Media:</b> Guided and Wireless Transmission, Wireless Propagation, Line- of-Sight Transmission. Introduction, Twisted Pair Cable, Coaxial Cable, Fiber Optic Cable	Identify transmission media	AI3103.1	Lecture	MTE, Quiz & ETE
8	Digital-to- Analog Conversion: Line Coding Schemes, Block Coding, <b>Tutorial</b>	Illustrate ASK	AI3103.1	Lecture	MTE, Quiz & ETE
9	Scrambling		AI3103.1	Lecture	MTE, Quiz & ETE
10	Digital-to- Analog Conversion: Digital to Digital		AI3103.1	Lecture	MTE, Quiz & ETE

11	Analog-To- Digital Conversion: Pulse Code Modulation, Delta Modulation.	Framing, Error detection and Correction, Switching	AI3103.1	Lecture	MTE, Quiz & ETE
12	<b>Error Detection And Correction:</b> Introduction, Types of Errors, Redundancy, Detection versus correction, Coding, <b>Tutorial</b>	Illustrate MAC protocol ALOHA	AI3103.2	Lecture	MTE, Quiz & ETE
13	Cyclic Redundancy Check, Polynomials	Illustrate MAC protocol – CSMA, CSMA/CD	AI3103.2	Lecture	MTE, Quiz & ETE
14	<b>Error Correction:</b> Block Code Principles	Illustrate MAC protocol – CSMA/CA	AI3103.2	Lecture	MTE, Quiz & ETE
15	Flow Control: Stop-and-Wait Protocol, Piggybacking, Sliding Window	Analyze error types	AI3103.2	Lecture	MTE, Quiz & ETE
16	Error Control: Stop-and-wait ARQ, Go-back- N ARQ, SR ARQ, <b>Tutorial</b>	Apply CRC and error correction mechanism	AI3103.2	Lecture	MTE, Quiz & ETE
17	HDLC, Configurations and Transfer Modes, Framing	Apply checksum	AI3103.2	Lecture	MTE, Quiz & ETE
18	<b>Medium Access Control (MAC) sub-layer:</b> Shared media systems: Bus, Star and Ring topologies; ALOHA	Identify flow control in data link layer	AI3103.2	Lecture	MTE, Quiz & ETE
19	CSMA, CSMA/CD	Identify error control in data link layer	AI3103.2	Lecture	MTE, Quiz & ETE
20	CSMA/CA, <b>Tutorial</b>	Summarize HDLC and framing	AI3103.2	Lecture	MTE, Quiz & ETE
21	<b>Network Layer:</b> Store-and-Forward Packet Switching, Services Provided to the Transport Layer	Understanding of packet switching and services provided to transport layer	AI3103.3	Lecture	MTE, Quiz & ETE
22	Implementation of Connectionless Service, Implementation of Connection-Oriented Service	learn implementation of connectionless and connection-oriented service	AI3103.3	Lecture	MTE, Quiz & ETE
23	<b>Network Layer:</b> IPv4 Addresses and Header, Classfull addressing, Classless addressing, Subnetting	Knowledge of IP Address, Understanding of need of subnetting	AI3103.3	Lecture	MTE, Quiz & ETE

24	CIDR—Classless Interdomain Routing, <b>Tutorial</b>	Understanding of CIDR	AI3103.3	Lecture	MTE, Quiz & ETE
25	VLSM, IPv6 addressing and headers;	Understanding of VLSM	AI3103.3	Lecture	MTE, Quiz & ETE
26	<b>Routing:</b> Shortest Path Routing, Flooding	Understanding of shortest path routing algorithm	AI3103.3	Lecture	MTE, Quiz & ETE
27	Distance Vector Routing,	Understanding of distance vector routing algorithm	AI3103.3	Lecture	MTE, Quiz & ETE
28	Link State Routing, Hierarchical Routing, <b>Tutorial</b>	Understanding of link state routing protocol and Hierarchical routing	AI3103.3	Lecture	MTE, Quiz & ETE
29	CIDR—Classless Interdomain Routing	Understanding of CIDR	AI3103.3	Lecture	MTE, Quiz & ETE
30	Related Protocols: NAT, DHCP	Learn Network address translation and network protocols	AI3103.3	Lecture	MTE, Quiz & ETE
31	ARP, RARP	Understanding of network protocols	AI3103.3	Lecture	MTE, Quiz & ETE
32	ICMP, IPV4 header format, <b>Tutorial</b>	Understanding of network protocols	AI3103.3	Lecture	MTE, Quiz & ETE
33	Fragmentation	Learn concept of fragmentation	AI3103.3	Lecture	MTE, Quiz & ETE
34	RIP, OSPF, BGP	Understanding of dynamic routing protocols	AI3103.3	Lecture	MTE, Quiz & ETE
<b>Mid Term Examination – I</b>					
35	General Principles of Congestion Control,	Understanding of congestion principles and prevention	AI3103.4	Lecture	Quiz & ETE
36	Techniques for Achieving Good Quality of Service, <b>Tutorial</b>	Understanding of Techniques for achieving good QoS	AI3103.4	Lecture	Quiz & ETE
37	Introduction to Transport Layer, Transport Service Primitives	Understanding of transport layer and service primitives	AI3103.4	Lecture	Quiz & ETE
38	Elements of Transport Protocols, Addressing,	Understanding of elements of transport protocols	AI3103.4	Lecture	Quiz & ETE
39	Connection Establishment, Connection Release	Understanding of connection	AI3103.4	Lecture	Quiz & ETE

		establishment and release process			
40	Flow Control and Buffering, <b>Tutorial</b>	Understanding of flow control and buffering in transport layer	AI3103.4	Lecture	Quiz & ETE
41	UDP, UDP Header	Understanding of UDP	AI3103.4	Lecture	Quiz & ETE
42	TCP Service Model, TCP Protocol	Understanding of TCP	AI3103.4	Lecture	Quiz & ETE
43	TCP Segment Header,	Understanding of TCP segment header	AI3103.4	Lecture	Quiz & ETE
44	Connection Control and Time Control, <b>Tutorial</b>	Understanding of Connection control	AI3103.4	Lecture	Quiz & ETE
45	Introduction to Application Layer	Understanding of application layer	AI3103.5	Lecture	Quiz & ETE
46	DNS—The Domain Name System	Understanding of DNS	AI3103.5	Lecture	Quiz & ETE
47	SMTP, POP	Understanding of email	AI3103.5	Lecture	Quiz & ETE
48	IMAP, MIME, <b>Tutorial</b>	understanding of email	AI3103.5	Lecture	Quiz & ETE
49	HTTP	Understanding of web and protocol	AI3103.5	Lecture	Quiz & ETE
50	SNMP	Understanding of network management protocol	AI3103.5	Lecture	Quiz & ETE
35	General Principles of Congestion Control,	Understanding of congestion principles and prevention	AI3103.4	Lecture	Quiz & ETE
36 *	Techniques for Achieving Good Quality of Service, <b>Tutorial</b>	Understanding of Techniques for achieving good QoS	AI3103.4	Lecture	Quiz & ETE
37 *	Introduction to Transport Layer, Transport Service Primitives	Understanding of transport layer and service primitives	AI3103.4	Lecture	Quiz & ETE
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48 *	IMAP, MIME, <b>Tutorial</b>	understanding of email	AI3103.5	Lecture	Quiz & ETE
49 *	HTTP	Understanding of web and protocol	AI3103.5	Lecture	Quiz & ETE
50 *	SNMP	Understanding of network management protocol	AI3103.5	Lecture	Quiz & ETE
<b>End Term Examination</b>					

### Important Update:

1. As per NAAC Reforms 2024- Binary Accreditation Stakeholder Consultation (University), the mode of delivery should include the followings:

- |   |                                      |
|---|--------------------------------------|
| 1. <b>Lecture based teaching-learning</b> | 7. Expeditionary learning            |
| 2. Group- teaching and learning           | 8. <b>Technology based learning</b>  |
| 3. <b>Individual learning/ self-study</b> | 9. <b>Peer teaching</b>              |
| 4. Inquiry based learning                 | 10. Learning through problem-solving |
| 5. Kinaesthetic learning                  | 11. <b>Flipped Classroom, etc.</b>   |
| 6. Game Based learning                    |                                      |

*Course coordinators should include at least 5 pedagogical approaches from the pedagogical approaches as specified above and mention the same in respective lecture types / Mode of delivery.*

2. In addition, some lectures should be marked as \* that indicates the lectures to be covered by additional practitioners (Industry Fellow/ Visiting Faculty/ Adjunct Faculty, etc.)



## H. Course Articulation Matrix:

CO	Statement	Correlation with Program Outcomes														
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	Explain basic concepts, OSI reference model, services and role of each layer of OSI model and TCP/IP, networks devices and transmission media, Analog and digital data transmission.	3	3	1	3	2				1		3	3	1	2	X
2	Develop skills for error detection and correction techniques in the data transmission. Identify Data framing, flow, and error control protocols at Data Link Layer	3	3	3	3							2	3	1	1	X
3	Apply the Internet control protocols – IPv4, IPV6, class full addressing, sub netting and classless addressing.	3	3	3	3	3				2	2	3	3	1	3	X
4	Analyze the Transport Layer and Its protocols.	3	2	2	3	3				2	2	3	3	1	2	X
5	Explain the Application Layer, its protocols.	3	1	2	1	3			3		2	3	3	1	3	X

1: Low Correlation    2: Moderate Correlation    3: Substantial Correlation