A. Course Handout (Version 1.1)

Institute/School Name	Chitkara University Institute of Engineering and Technology		
Department Name	Department of Computer Science & Engineering		
Programme Name	Bachelor of Engineering (B.E.), Computer Science & Engineering		
Course Name	Computer Networks	Session	2024-2025
Course Code	22CS008	Semester/Batch	3rd /2023
L-T-P (Per Week)	3-0-2	Course Credits	04
Course Coordinator	Dr. Amanpreet Kaur		

CLO01	Define the hardware, software, components of a network and the interrelations.
CLO02	Explain the role of reference models and the hierarchical relationship of their respective layers.
CLO03	Classify the networking protocols and select the appropriate protocol for a particular design.
CLO04	Examine the concepts and theories of networking with the real-world scenarios.
CLO05	Design an enterprise network including topologies, protocols, management, and security.

1. Objectives of the Course

The scope of the course is to provides the foundation for understanding the key aspects of computer network organization and implementation obtaining a theoretical understanding of data communication and computer networks. Students will be introduced to computer communication, network design and its operations will be ready for Industry Certifications such as CCNA, CCNP etc. The objectives of the course are:

- to build an understanding of the fundamental concepts of computer networking.
- to inculcate the skill in students to construct and debug computer networks.
- to develop, implement and manage computer networking systems within an organization.
- to familiarize with current topics such as network management, security and/or other topics.

2. Course Learning Outcomes

After completion of the course, student should be able to:

	Course Learning Outcome	*POs	**CL	***KC	Sessions
CLO01	Define the hardware, software, components of a network and the interrelations.	PO1, PO2, PO3, PO5, PO12	K2	Factual Conceptual	**12**
CLO02	Explain the role of reference models and the hierarchical relationship of their respective layers	PO1, PO3, PO4, PO5	K3	Conceptual Procedural	**12**
CLO03	Classify the networking protocols and select the appropriate protocol for a particular design.	PO1, PO2, PO3, PO4, PO5, PO7, PO11	K3	Conceptual Procedural	**12**

CLO04	Examine the concepts and theories of networking with the real-world scenarios.	PO3, PO4, PO5	K4	Procedural	**10**
CLO05	Design an enterprise network including topologies, protocols, management and security.	PO4, PO5	K3	Conceptual Procedural	**12**
Total Contact Hours					**58**

Revised Bloom's Taxonomy Terminology

* PO's available at (shorturl.at/cryzF)

**Cognitive Level =CL

***Knowledge Categories = KC

Course Learning Outcomes	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CLO01		H		H		M						H
CLO02	H	H	H	M	M	M					H	H
CLO03	H	M		H	M	M					M	M
CLO04	H	H		H		H						
CLO05	H	H	H		M	M	M				M	H

H=High, M=Medium, L=Low

3. ERISE Grid Mapping

Feature Enablement	**Level (1-5, 5 being highest)**
Entrepreneurship	1
Research	3
Innovation	2
Skills	5
Employability	4

4. Recommended Books:

Text Books:

B01: Data Communications and Networking' by Forouzan, 5th Edition, 2013.

B02: Computer Networks' By Andrew S. Tanenbaum 5th Edition, Pearson Education,2013.

B03: Data and Computer Communications' by William Stallings, 8th Edition, Pearson,2007.

B04: CCNA Cisco Certified Network Associate Study Guide', by Todd Lammle, Wiley, 7th Edition,2011.

B05: Security Engineering: A Guide to Building Dependable Distributed Systems, 2nd Edition by Ross J. Anderson

Reference Books:

B05: Computer Networking: A Top-Down Approach', by Kurose and Ross, Pearson Education, 6th Edition,2013.

E-Resources:

- https://library.chitkara.edu.in/subscribed-books.php

5. Other readings and relevant websites:

Serial No	Link of Journals, Magazines, websites and Research Papers
1.	https://nptel.ac.in/courses/106105183
2.	https://nptel.ac.in/courses/106106091
3.	https://nptel.ac.in/courses/106105081
4.	http://www.brainbell.com/tutorials/Networking/
5.	https://learningnetwork.cisco.com/index.jspa?ciscoHome=true
6.	http://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-263j-data-communication-networks-fall-2002/lecture-notes/

6. Recommended Tools and Platforms

Cisco Packet Tracer-7.3 or above versions, GNS3

7. Course Plan:

Lecture Number	Topics	Text Book
1	**Detail Discussion of Course Handout (CHO)**	B01-Chpater-1
2-3	**Introduction:** Uses of Computer Networks, Network Hardware Topologies, Collision Domain, Broadcast Domain	B01-Chapter-1
4-5	**Reference Models:** Seven-Layer OSI architecture, Concepts of Layers, Protocols and Layer interfaces and PDU, TCP/IP Reference Model, Comparison of OSI and TCP/IP reference models	B01-Chapter-2
6-7	**Physical Layer:** Transmission Media (Cable Media), Wireless Media (Cellular Telephone, Satellite Networks) Types of Connecting Devices (Hubs, Switches, Routers)	B01-Chapter-7
8-9	**Ethernet Frames,** Ethernet and the OSI Model, Ethernet Frame Fields, Ethernet MAC Address, Frame Processing, Multicast MAC Address, Broadcast MAC Address, Unicast MAC Address, ARP and RARP	B01-Chapter-13 B01-Chapter-13
10-11	**Network Security**: Security Services, Security Threats, and Vulnerabilities, Network Attacks: Types of Malwares, Reconnaissance Attacks, Access Attacks, Denial of Service Attacks	B01-Chapter-30 B01-Chapter-31 B05-Chapter-21
12-13	**Network Attack Mitigations**: The Défense-in-Depth Approach Keep Backups, Firewalls, Types of Firewalls, Authentication, Authorization, and Accounting	B05-Chapter-21
14-15	**VLAN concept,** Configuration, Trunks, Trunking Protocol, WLAN concepts, Configuration, Wireless Network	B01-Chapter-15 B04-Chapter-1
16-17	**Network Layer:** Concept of IP packet and addresses, IPv4 protocol format, Routing Algorithm-Distance Vector Routing, Link State Routing	B01-Chapter-19
18-19	ICMP, IGMP, IPV6, Transition from IPv4 to IPv6(format)	B01-Chapter-20
20-21	Network Classes (A, B, C, D) and Subnetting, Troubleshooting	B01-Chapter-21

22-23	**Static and Dynamic routing algorithms**: Shortest Path Routing, Routing Protocols (Static and Dynamic)	B01-Chapter-22
24-25	**Routing Protocols:** OSPF, EIGRP, Introduction to BGP, Routing Information Protocol (v1 & v2)	B01-Chapter-22
26-27	**Data Link Layer:** Types of Errors, Redundancy, Error Detection and Correction, CRC, Check Sum, Hamming code & Distance	B01-Chapter-10 B01-Chapter-11
28-29	**Multiple Access Protocols**: - **Random Access Protocols**–ALOHA, CSMA, CSMA/CA, CSMA/CD	B01-Chapter-11 B01-Chapter-12
30-31	**Channelization Protocols:** FDMA, TDMA, CDMA, **Controlled Access Protocols:** Reservation, Polling, Token Passing, Piggybacking	B01-Chapter-11
32-33	**Noisy Channel:** Stop and Wait, Automatic Repeat Request, go-back-n, selective repeat	B01-Chapter-12
34-35	**Noiseless Channels:** Elementary data link protocols, Simplex, Stop and Wait Protocol, **Transport layer:** Services, Connection Less and Connection Oriented protocol	B01-Chapter-11 B01-Chapter-23
ST-1 Syllabus (Lecture number 2-30)		
36-37	Transport Layer Protocols, TCP Connection, Transmission Control Protocol with Three-Way Handshaking, TCP / UDP Message Format, Congestion Control and Quality of Service	B01-Chapter-23
38-40	**Application Layer:** Domain Name System, Remote Logging, Electronic Mail, Introduction to FTP and WWW, Introduction to HTTP, SMTP and SNMP	B01-Chapter-25
ETE (Syllabus = Lecture number 1-40)		

8. Delivery/Instructional Resources

Lecture Number	Topics		Text Book
1	**Detail Discussion of Course Handout (CHO)**		
2-3	**Introduction:** Uses of Computer Networks, Network Hardware Topologies, Collision Domain, Broadcast Domain	https://www.cisco.com/c/en/us/solutions/automation/network-topology.html	https://www.youtube.com/watch?v=uDulBxDb7GM
4-5	**Reference Models:** Seven-Layer OSI architecture, Concepts of Layers, Protocols and Layer interfaces and PDU, TCP/IP Reference Model, Comparison of OSI and TCP/IP reference models	http://www.ics.uci.edu/%7Emagda/Courses/netsys270/ch2_v1.ppt https://slideplayer.com/slide/254123/ https://www.slideshare.net/ankurkumar983/tcp-ip-model	https://www.youtube.com/watch?v=vv4y_uOneC0 https://www.youtube.com/watch?v=2QGgEk20RXM
6-7	**Physical Layer:** Transmission Media (Cable Media), Wireless Media (Cellular Telephone, Satellite Networks) Types of Connecting Devices (Hubs, Switches, Routers)	http://www.ics.uci.edu/%7Emagda/Courses/netsys270/ch1_v1.ppt	https://www.youtube.com/watch?v=BJ7f-HcttyE https://www.youtube.com/watch?v=8ONuDQF7gOY

8-9	**Ethernet Frames,** Ethernet and the OSI Model, Ethernet Frame Fields, Ethernet MAC Address, Frame Processing, Multicast MAC Address, Broadcast MAC Address, Unicast MAC Address, ARP and RARP	https://www.geeksforgeeks.org/ethernet-frame-format/ https://www.javatpoint.com/ethernet-frame-format https://help.stonesoft.com/onlinehelp/StoneGate/SMC/6.5.0/GUID-74D81A6F-9EE0-433E-904F-5BC4722B1202.html#:~:text=In%20Ethernet%20(as%20defined%20in,%3Afe%3Afe%20are%20not. https://networklessons.com/multicast/multicast-ip-address-to-mac-address-mapping	https://www.youtube.com/watch?v=ewpq3qxx5Ls https://www.youtube.com/watch?v=GK_uF6cvrOY https://www.youtube.com/watch?v=TIiQiw7fpsU https://www.youtube.com/watch?v=q2U7Rg9KNG8 https://www.youtube.com/watch?v=IUSyV2BVh4A https://www.youtube.com/watch?v=3YcKrtVo2Ro
10-11	**Network Security**: Security Services, Security Threats, and Vulnerabilities, Network Attacks: Types of Malwares, Reconnaissance Attacks, Access Attacks, Denial of Service Attacks	https://www.slideshare.net/gichelleamon/network-security-12322065 https://www.scaler.com/topics/computer-network/cryptography-and-network-security/	https://www.youtube.com/watch?v=1plMO7ChXMU&list=PLJ5C_6qdAvBFAuGoLC2wFGruY_E2gYtev https://www.youtube.com/watch?v=yUeI4nqvNs8
12-13	**Network Attack Mitigations**: The Défense-in-Depth Approach Keep Backups, Firewalls, Types of Firewalls, Authentication, Authorization, and Accounting	https://www.cl.cam.ac.uk/~rja14/Papers/SEv2-c21.pdf	https://www.youtube.com/watch?v=o_vyfo3Hw0Y
14-15	**VLAN concept,** Configuration, Trunks, Trunking Protocol, WLAN concepts, Configuration, Wireless Network	https://www.geeksforgeeks.org/virtual-lan-vlan/ https://www.cisco.com/c/en/us/products/wireless/wireless-lan.html#:~:text=A%20wireless%20local%2Darea%20network,webpage%20is%20using%20a%20WLAN.	https://www.youtube.com/watch?v=ez24W5oTU3U https://www.youtube.com/watch?v=RBc7MyE9RTQ
16-17	**Network Layer:** Concept of IP packet and addresses, IPv4 protocol format, Routing Algorithm-Distance Vector Routing, Link State Routing	https://www.baeldung.com/cs/ipv4-datagram https://slideplayer.com/slide/4905255/	https://www.youtube.com/watch?v=STJhn9gKF2g https://www.youtube.com/watch?v=5ZuP5qjbKSI
18-19	ICMP, IGMP, IPV6, Transition from IPv4 to IPv6(format)	https://www.slideshare.net/asimnawaz54/internet-control-message-protocol	https://www.youtube.com/watch?v=xTqtm7-k25o

		https://www.slideshare.net/satish486/ipv6-17005017 https://www.slideshare.net/raghavendrahamilpure/igmp-35557007	https://www.youtube.com/watch?v=eBHwkyWgVaM https://www.youtube.com/watch?v=aor29pGhlFE
20-21	Network Classes (A, B, C, D) and Subnetting, Troubleshooting	https://www.slideshare.net/adkpcte/ip-address https://www.slideshare.net/gichelleamon/subnetting-12046383	https://www.youtube.com/watch?v=0qRcYFGK_60&t=1134s https://www.indiabix.com/networking/subnetting/
22-23	**Static and Dynamic routing algorithms**: Shortest Path Routing, Routing Protocols (Static and Dynamic)	https://www.cisco.com/c/en/us/td/docs/ios-xml/ios/iproute_rip/configuration/15-mt/irr-15-mt-book/irr-cfg-info-prot.html	https://www.youtube.com/watch?v=NdjcgVreDDU
24-25	**Routing Protocols:** OSPF, EIGRP, Introduction to BGP, Routing Information Protocol (v1 & v2)	https://www.slideshare.net/escrimag/ospfppt-35277878 https://www.cisco.com/c/en/us/td/docs/ios-xml/ios/iproute_rip/configuration/15-mt/irr-15-mt-book/irr-cfg-info-prot.html	https://www.youtube.com/watch?v=Zsf9f26rH8U https://www.youtube.com/watch?v=NdjcgVreDDU https://www.youtube.com/watch?v=_Z29ZzKeZHc
26-27	**Data Link Layer:** Types of Errors, Redundancy, Error Detection and Correction, CRC, Check Sum, Hamming code & Distance	http://www.engppt.com/2009/12/networking-fourozan-ppt-slides.html	https://www.youtube.com/watch?v=eQgRDdBD5Os
28-29	**Multiple Access Protocols**: - **Random Access Protocols**–ALOHA, CSMA, CSMA/CA, CSMA/CD	https://www.slideshare.net/amogha7/random-access-protocol-in-communication-251294924	https://www.youtube.com/watch?v=YAjfUc7Tt24
30-31	**Channelization Protocols:** FDMA, TDMA, CDMA, **Controlled Access Protocols:** Reservation, Polling, Token Passing, Piggybacking	https://www.slideshare.net/SammarKhan2/fdmatdmacdma	https://www.youtube.com/watch?v=KviHyRss-dE
32-33	**Noisy Channel:** Stop and Wait, Automatic Repeat Request, go-back-n, selective repeat	https://www.slideshare.net/Vishal061/unit-2-data-link-control	https://www.youtube.com/watch?v=YdkksvhkQGQ
34-35	**Noiseless Channels:** Elementary data link protocols, Simplex, Stop and Wait Protocol, **Transport layer:** Services, Connection Less and Connection Oriented protocol	https://www.geeksforgeeks.org/noiseless-channel-protocol/ https://www.slideshare.net/ahdkhalid/tcp-and-udp	https://www.youtube.com/watch?v=n09DfvemnTQ https://www.youtube.com/watch?v=MMDhvHYAF7E
ST-1 Syllabus (Lecture number 2-30)			

36-37	Transport Layer Protocols, TCP Connection, Transmission Control Protocol with Three-Way Handshaking, TCP / UDP Message Format, Congestion Control and Quality of Service	https://www.slideshare.net/AlokTripathi40/tcpip-3way-handshake https://www.slideshare.net/tmavroidis/tcpudpicmpandthetransportlayer?qid=d2cf871d-baca-48bf-a3d8-bd1381325b54&v=&b=&from_search=14 https://www.slideshare.net/AmanJaiswal32/congestion-control-68607381	https://www.youtube.com/watch?v=LyDqA-dAPW4 https://www.youtube.com/watch?v=uwoD5YsGACg
38-40	**Application Layer:** Domain Name System, Remote Logging, Electronic Mail, Introduction to FTP and WWW, Introduction to HTTP, SMTP and SNMP	https://www.slideshare.net/siddiqueibrahim37/domain-name-system-29792343 https://www.slideshare.net/BirminghamPublicLIbrary/basic-email https://www.slideshare.net/vinhnguyen509/file-transfer-protocol-36928060 https://www.slideshare.net/hetaljadav/snmp-26639208 https://www.slideshare.net/ToushikPaul/httpprotocol	https://www.youtube.com/watch?v=JkEYOt08-rU https://www.youtube.com/watch?v=pnoWCK82apU https://www.youtube.com/watch?v=GeDhsBRigro https://www.youtube.com/watch?v=pnoWCK82apU
ETE (Syllabus = Lecture number 1-40)			

9. Lab Plan

Sr. No.	Lab Number	Experiments	Learning Resource
1	1-2	Introduction of Cables, Network devices: Hub, Switches, Router etc. Installation and Introduction to Packet Tracer	https://www.tutorialspoint.com/network-devices-hub-repeater-bridge-switch-router-gateways-and-brouter https://www.netacad.com/courses/packet-tracer
2	3-4	Simulation of Network Devices (HUB, Switches, Router) and connect more than two computers using Switch to Topologies like Star, Mesh, Ring, BUS, Hybrid etc…	https://www.geeksforgeeks.org/implementing-star-topology-using-cisco-packet-tracer/
3	5-6	Basic commands of Routers: hostname, password, Show Run, Show IP int brief, Assigning IP addresses to interfaces	https://www.cisco.com/c/en/us/td/docs/routers/access/800M/software/800MSCG/routconf.html
4	7-8	To do peer to peer connectivity, assign the IP address and share the resources	https://crocotime.com/en/configuration-of-peer-to-peer-network/

5	9-10	Subnetting with Class A, B, C with different IP addresses	https://t4tutorials.com/ip-subnetting-techniques-and-class-a-b-c-d-and-e/
6	11-12	Subnetting of Class A, B and C using FLSM and VLSM	https://www.techtarget.com/searchnetworking/definition/fixed-length-subnet-mask https://www.geeksforgeeks.org/introduction-of-variable-length-subnet-mask-vlsm/
7	13-14	To Perform Static Routing, Default Routing by using 2 and 3 routers	https://www.geeksforgeeks.org/implementation-of-static-routing-in-cisco-2-router-connections/
8	15-16	To Perform Dynamic Routing using RIP (RIP-V1 and RIP-V2)	https://www.geeksforgeeks.org/routing-interface-protocol-rip-v1-v2/
9	17-18	To Perform Dynamic Routing using EIGRP	https://www.cisco.com/c/en/us/support/docs/ip/enhanced-interior-gateway-routing-protocol-eigrp/16406-eigrp-toc.html
10	19-20	To Perform Dynamic Routing using OSPF with Single area concept and Multiple Area Concept	https://www.learncisco.net/courses/icnd-1/ip-routing-technologies/single-area-ospf.html

10. Action plan for different types of learners

Slow Learners	Average Learners	Fast Learners
• Remedial Classes on Saturdays • Encouragement for improvement using Peer Tutoring • Use of Audio and Visual Materials • Use of Real-Life Examples	• Workshops • Formative Exercises used to highlight concepts and notions • E-notes and E-exercises to read ahead of the pedagogic material.	• Engaging students to hold hands of slow learners by creating a Peer Tutoring Group • Design solutions for complex problems • Design solutions for complex problems • Presentation on topics beyond those covered in CHO

11. Evaluation Scheme & Components:

Evaluation Component	Type of Component	No. of Assessments	Weightage of Component	Mode of Assessment
Component 2	Subjective Test/ Sessional Tests (STs)	02*	60%	ST-1 = Online Mode ST-2 = Certificate submission
Component 3	End Term Examinations	01**	40%	Online exam
Total		**100%**		

* Students will have to appear in all Sessional Tests.
* For successful completion of ST-1, Students needs to appear in Online Examination that having 20% of weightage.
* For successful completion of ST-2, Students needs to complete the course CCNA-1 (Introduction to Network) and CCNA-2 (Switching, Routing and Wireless) from www.netacad.com each course having 20% of weightage.
* Students are required to submit CCNA (1 and 2) completion Certificates.
**As per Academic Guidelines, a minimum of 75% attendance is required to become eligible for appearing in the End Semester Examination.

12. Syllabus of the Course:

Subject: Computer Networks / 22CS008	

S. No.	Topic (s)	No. of Sessions	Weightage %
1	**Introduction:** Uses of Computer Networks, Network Hardware Topologies, Collision Domain, Broadcast Domain, **Reference Models:** Seven-Layer OSI architecture, Concepts of Layers, Protocols and Layer interfaces and PDU, TCP/IP Reference Model, Comparison of OSI and TCP/IP reference models, **Physical Layer:** Transmission Media (Cable Media), Wireless Media (Cellular Telephone, Satellite Networks) Types of Connecting Devices (Hubs, Switches, Routers), **Ethernet Frames,** Ethernet and the OSI Model, Ethernet Frame Fields, Ethernet MAC Address, Frame Processing, Multicast MAC Address, Broadcast MAC Address, Unicast MAC Address, ARP and RARP, **Network Security**: Security Services, Security Threats, and Vulnerabilities, Network Attacks: Types of Malwares, Reconnaissance Attacks, Access Attacks, Denial of Service Attacks, **Network Attack Mitigations**: The Défense-in-Depth Approach Keep Backups, Firewalls, Types of Firewalls, Authentication, Authorization, and Accounting, **VLAN concept,** Configuration, Trunks, Trunking Protocol, WLAN concepts, Configuration, Wireless Network, **Network Layer:** Concept of IP packet and addresses,IPv4 protocol format, Routing Algorithm-Distance Vector Routing, Link State Routing, ICMP, IGMP, IPV6, Transition from IPv4 to IPv6(format), Network Classes (A, B, C, D) and Subnetting, Troubleshooting, **Static and Dynamic routing algorithms**: Shortest Path Routing, Routing Protocols (Static and Dynamic), **Routing Protocols:** OSPF, EIGRP, Introduction to BGP, Routing Information Protocol (v1 & v2), **Data Link Layer:** Types of Errors, Redundancy, Error Detection and Correction, CRC, Check Sum, Hamming code & Distance, **Multiple Access Protocols**: - **Random Access Protocols**–ALOHA, CSMA, CSMA/CA, CSMA/CD, **Channelization Protocols:** FDMA, TDMA, CDMA,	**30**	**50%**
ST-1 (Covering 50% syllabus)			
2	**Controlled Access Protocols:** Reservation, Polling, Token Passing, Piggybacking, **Noisy Channel:** Stop and Wait, Automatic Repeat Request, go-back-n, selective repeat, **Noiseless Channels:** Elementary data link protocols, Simplex, Stop and Wait Protocol, **Transport layer:** Services, Connection Less and Connection Oriented protocol, Transport Layer Protocols, TCP Connection, Transmission Control Protocol with Three-Way Handshaking, TCP / UDP Message Format, Congestion Control and Quality of Service, **Application Layer:** Domain Name System, Remote Logging, Electronic Mail, Introduction to FTP and WWW, Introduction to HTTP, SMTP and SNMP	**40**	**100%**
End Term 100% syllabus			

This Document is approved by:

Designation	Name	Signature
Course Coordinator	Dr. Amanpreet Kaur	
Head-Academic Delivery	Dr. Mrinal Paliwal	
Dean	Dr. Rishu Chhabra	
Dean Academics	Dr. Monit Kapoor	
Date	11.07.2024	