A. Course Handout

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	2022-2023
Course Code	22CS008	Semester/Batch	2nd/2022
L-T-P (Per Week)	4-0-2	Course Credits	06
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.

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/
7.	https://www.slideshare.net/VidhuBaggan1/mpls-by-vidhu

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	B01-Chapter-2
6-7	TCP/IP Reference Model, Comparison of OSI and TCP/IP reference models	B01-Chapter-2
8-9	**Physical Layer:** Transmission Media (Cable Media), Wireless Media (Cellular Telephone, Satellite Networks) Types of Connecting Devices (Hubs, Switches, Routers)	B01-Chapter-7
10-11	**Data Link Layer:** Types of Errors, Redundancy, Error Detection and Correction, CRC, Check Sum, Hamming code & Distance	B01-Chapter-10 B01-Chapter-11
12-14	**Multiple Access Protocols**: - **Random Access Protocols**–ALOHA, CSMA, CSMA/CA, CSMA/CD	B01-Chapter-11
15-16	**Channelization Protocols:** FDMA, TDMA, CDMA	B01-Chapter-12
17-18	**Controlled Access Protocols:** Reservation, Polling, Token Passing, Piggybacking	B01-Chapter-12
19	**Noiseless Channels:** Elementary data link protocols: Stop and Wait	B01-Chapter-11
20-22	**Noisy Channel:** Stop and Wait, Automatic Repeat Request, go-back-n, selective repeat	B01-Chapter-11
ST-1 (Syllabus = (Lecture number 1-22)		
23-25	**Network Layer:** Concept of IP packet and addresses, IPv4 protocol format, Routing Algorithm-Distance Vector Routing, Link State Routing	B01-Chapter-19
26-27	ICMP, IGMP, IPV6, Transition from IPv4 to IPv6(format)	B01-Chapter-20
28-30	Network Classes (A, B, C, D) and Subnetting	B01-Chapter-21

31-33	**Static and Dynamic routing algorithms**: Shortest Path Routing, Routing Protocols (Static and Dynamic)	B01-Chapter-22
34-36	Routing Information Protocol (v1 & v2)	B01-Chapter-22
37-39	**Routing Protocols:** OSPF, EIGRP, Introduction to BGP	B01-Chapter-22
40-42	**Transport layer:** Services, Connection Less and Connection Oriented protocol, Transport Layer Protocols, TCP Connection	B01-Chapter-10
43	Transmission Control Protocol with Three Way Handshaking	B01-Chapter-23
ST-2 (Syllabus = (Lecture number 23-43)		
44-45	TCP / UDP Message Format	B01-Chapter-23
46-47	Congestion Control and Quality of Service	B01-Chapter-24
48-50	**Application Layer:** Domain Name System, Remote Logging, Electronic Mail	B01-Chapter-25
51-52	Introduction to FTP and WWW	B01-Chapter-27
53-55	Introduction to HTTP, SMTP and SNMP	B01-Chapter-27 B01-Chapter-28
56-57	**Network Security**: Security Services, Cryptography	B01-Chapter-30 B01-Chapter-31
58	Digital Signature	B01-Chapter-31
ETE (Syllabus = (Lecture number 1-58)		

8. Delivery/Instructional Resources

Lecture No.	Topics	Web References	Audio-Video
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	http://www.ics.uci.edu/%7Emagda/Courses/netsys270/ch2_v1.ppt https://slideplayer.com/slide/254123/	https://www.youtube.com/watch?v=vv4y_uOneC0
6-7	TCP/IP Reference Model, Comparison of OSI and TCP/IP reference models	https://www.slideshare.net/ankurkumar983/tcp-ip-model	https://www.youtube.com/watch?v=2QGgEk20RXM
8-9	**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
10-11	**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
12-14	**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

15-16	**Channelization Protocols:** FDMA, TDMA, CDMA	https://www.slideshare.net/SammarKhan2/fdmatdmacdma	https://www.youtube.com/watch?v=KviHyRss-dE
17-18	**Controlled Access Protocols:** Reservation, Polling, Token Passing, Piggybacking	https://www.slideshare.net/konupruthviraj/controlled-access-protocols	https://www.youtube.com/watch?v=4x0oT7AeNYs
19	**Noiseless Channels:** Elementary data link protocols: Stop and Wait	https://www.geeksforgeeks.org/noiseless-channel-protocol/	https://www.youtube.com/watch?v=n09DfvemnTQ
20-22	**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
23-25	**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
26-27	ICMP, IGMP, IPV6, Transition from IPv4 to IPv6(format)	https://www.slideshare.net/asimnawaz54/internet-control-message-protocol https://www.slideshare.net/satish486/ipv6-17005017 https://www.slideshare.net/raghavendrahamilpure/igmp-35557007	https://www.youtube.com/watch?v=xTqtm7-k25o https://www.youtube.com/watch?v=eBHwkyWgVaM https://www.youtube.com/watch?v=aor29pGhlFE
28-30	Network Classes (A, B, C, D) and Subnetting	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/
31-33	**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
34-36	Routing Information Protocol (v1 & v2)	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
37-39	**Routing Protocols:** OSPF, EIGRP, Introduction to BGP	https://www.slideshare.net/escrimag/ospfppt-35277878	https://www.youtube.com/watch?v=Zsf9f26rH8U https://www.youtube.com/watch?v=_Z29ZzKeZHc
40-42	**Transport layer:** Services, Connection Less and Connection Oriented protocol, Transport Layer Protocols, TCP Connection	https://www.slideshare.net/ahdkhalid/tcp-and-udp	https://www.youtube.com/watch?v=MMDhvHYAF7E
43	Transmission Control Protocol with Three Way Handshaking	https://www.slideshare.net/AlokTripathi40/tcpip-3way-handshake	https://www.youtube.com/watch?v=LyDqA-dAPW4
44-45	TCP / UDP Message Format	https://www.slideshare.net/tmavroidis/tcpudpicmpandthetransportlayer?qid=d2cf871d-baca-48bf-a3d8-	https://www.youtube.com/watch?v=uwoD5YsGACg

		bd1381325b54&v=&b=&from_search=14	
46-47	Congestion Control and Quality of Service	https://www.slideshare.net/AmanJaiswal32/congestion-control-68607381	https://www.youtube.com/watch?v=zjfPh7sar_Y
48-50	**Application Layer:** Domain Name System, Remote Logging, Electronic Mail	https://www.slideshare.net/siddiqueibrahim37/domain-name-system-29792343 https://www.slideshare.net/BirminghamPublicLIbrary/basic-email	https://www.youtube.com/watch?v=JkEYOt08-rU https://www.youtube.com/watch?v=pnoWCK82apU
51-52	Introduction to FTP and WWW	https://www.slideshare.net/vinhnguyen509/file-transfer-protocol-36928060	https://www.youtube.com/watch?v=GeDhsBRiqro
53-55	Introduction to HTTP, SMTP and SNMP	https://www.slideshare.net/hetaljadav/snmp-26639208 https://www.slideshare.net/ToushikPaul/httpprotocol	https://www.youtube.com/watch?v=pnoWCK82apU
56-57	**Network Security**: Security Services, Cryptography	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
58	Digital Signature	https://www.techtarget.com/searchsecurity/definition/digital-signature	https://www.youtube.com/watch?v=yUeI4nqvNs8

9. Lab Plan

Sr. No.	Lab Number	Experiments	Learning Resource
1	1-2	Introduction of Cables, Network devices: Hub, Switches, Router etc.	https://www.tutorialspoint.com/network-devices-hub-repeater-bridge-switch-router-gateways-and-brouter
2	3-4	Installation and Introduction to Packet Tracer	https://www.netacad.com/courses/packet-tracer
3	5-6	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/
4	7-8	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
5	9-10	To do peer to peer connectivity, assign the IP address and share the resources	https://crocotime.com/en/configuration-of-peer-to-peer-network/

6	11-12	Subnetting with Class A, B, C with different IP addresses	https://t4tutorials.com/ip-subnetting-techniques-and-class-a-b-c-d-and-e/
7	13-14	Subnetting of Class A, B and C using FLSM	https://www.techtarget.com/searchnetworking/definition/fixed-length-subnet-mask
8	15-16	Subnetting of Class A, B and C using VLSM	https://www.geeksforgeeks.org/introduction-of-variable-length-subnet-mask-vlsm/
9	17-18	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/
10	19-20	To Perform Dynamic Routing using RIP (RIP-V1 and RIP-V2)	https://www.geeksforgeeks.org/routing-interface-protocol-rip-v1-v2/
11	21-22	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
12	23-24	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
13	25-26	To Create and Apply ACL: Standard and Extended	https://www.geeksforgeeks.org/standard-access-list/
14	27-28	Creating and Managing Communication through VLAN	https://www.comparitech.com/net-admin/how-to-set-up-a-vlan/
15	29-30	To Apply NAT (Network Address Translation): Static	https://www.geeksforgeeks.org/network-address-translation-nat/ https://www.cisco.com/c/en/us/support/docs/ip/network-address-translation-nat/13772-12.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 1	Practical Lab / Formative Assessments (FAs)	03*	10%	Offline (Practical Viva)
Component 2	Subjective Test/Sessional Tests (STs)	02*	40%	Offline
Component 3	End Term Examinations	01	50%	Offline

Total	**100%**	

* Out of 03FAs, the ERP system will automatically pick marks of the best 02 FAs for final marks evaluation of FAs.
* Out of 02 STs, the ERP system automatically picks the average of best 01 ST marks for evaluation of the STs as final marks.

12. Syllabus of the Course:

Subject: Computer Networks	

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) **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, **Controlled Access Protocols:-**Reservation, Polling, Token Passing, Piggybacking, **Noiseless Channels:** Elementary data link protocols: Stop and Wait, **Noisy Channel:** Stop and Wait, Automatic Repeat Request, go-back-n, selective repeat	**24**	**40%**
ST-1 (Covering 40% syllabus)			
2	**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), **Static and Dynamic routing algorithms**: Shortest Path Routing, Routing Protocols (Static and Dynamic): RIPv1 & v2, Network Classes (A,B,C,D) and Subnetting, Routing Protocols: OSPF, EIGRP, Introduction to BGP, **Transport layer:** Services, Connection Less and Connection Oriented protocol, Transport Layer Protocols, TCP Connection, Three Way Handshaking	**20**	**35%**
ST-2 (Covering 75% syllabus)			
3	TCP / UDP Message Format, Congestion Control and Quality of Service, **Application Layer:** Domain Name System, Remote Logging, Electronic Mail, FTP, WWW, HTTP,SNMP, **Network Security:** Security Services, Digital Signature, Cryptography	**16**	**25%**
End Term (Covering (40%+ 35%+ 25%=)100% syllabus)			

*As per Academic Guidelines minimum 85% attendance is required to become eligible for appearing in the End Semester Examination.

Course Plan

This Document is approved by:

Designation	Name	Signature
Course Coordinator	Dr. Amanpreet Kaur	
Head-Academic Delivery	Dr. Vikas Khullar	
Dean	Dr. Rishu Chhabra	
Date (DD/MM/YYYY)	04-07-2023	