Government of Karnataka

DEPARTMENT OF COLLEGIATE AND TECHNICAL EDUCATION

Programme	Computer Science and Engineering	**Semester**	III
Course Code	20CS33P	**Type of Course**	Programme Core
Course Name	Computer Networks	**Contact Hours**	8 hours/week 104 hours/semester
Teaching Scheme	L:T:P :: 3:1:4	**Credits**	6
CIE Marks	60	**SEE Marks**	40

1.Rationale

The computer networking skills are essential in today's information and communication technology driven world. It enables students with essential skills and knowledge to explore the world of communication and networking for further study and career.

2. Course Outcomes: At the end of the course, the student will be able to:

CO-01	Select an appropriate communication technology for a given network and ensure optimal performance by addressing issues arising from transmission impairments.
CO-02	Design a network for a given specification by using the right network components, devices, topologies, protocols and software.
CO-03	Design, build, test and troubleshoot a SOHO network for a given premises.
CO-04	Demonstrate the configuration of IP address, routing, subnetting, client-server interaction (TCP, UDP) and DNS for a given WAN network using a network simulator and troubleshoot common network issues

3. Course Content

Week	CO	PO	Lecture (Knowledge Criteria)	Tutorial (Activity Criteria)	Practice (Performance Criteria)
			3 hours/week	1 hour/week	4 hours/week(2 hours/batch twice in a week)
1	01	1, 2	**Electromagnetic waves** - Generation of electromagnetic waves and their properties **Electromagnetic spectrum** - classification and its applications **Communication Systems** - Basic elements of communication systems with block diagram, List commonly used terms in electronic communication systems, Data representation, Data flow, Modulation, Demodulation Analog and Digital Signals, Periodic and Non-Periodic Signals, Sine Wave, Phase, Wavelength, Digital Signals, Bit-rate, Bit-length.	**Refer Table 1**	1.Build a circuit to Generate and detect of BASK signal and BFSK signal using communication kit.
2	01	1,2	**Transmission Impairment** – Attenuation, Distortion and Noise,		1. Explore all ISP in your area/locality and select best internet ISP/plan

			Performance - Bandwidth, Throughput, Latency, Jitter (Basic concepts only). **Transmission Modes** – Parallel and Serial Transmission. Asynchronous and Synchronous Transmission. **Satellite communication**- Introduction, advantages and disadvantages		based on cost and performance. 2. Test the download/upload speed in your computer/mobile phone also check type, bandwidth and ISP. 3. Explore Bluethooth, Wifi, NFC in your smartphone and note their key technical attributes (Radio spectrum band, range, pathloss, throughput, mode etc)
3	01, 02	1, 2, 3	**Perspectives on Networking** – End user perspectives on Networking and Internet, Overview of Networking. Categories of networks - LAN, MAN, WAN, Internetworking (Illustrate Network from LAN connected using a HUB to Internetwork). The communication rules (Method, language, Confirmation) – Protocols, the Internet. The Network Standard Organizations, Protocol Stack. **OSI Model** : OSI Layers and Their Functions, OSI Layering Concepts and Benefits, OSI Encapsulation Terminology.		1. My Protocol Rules Objectives a) Relate computer network protocols to the rules that you use every day for various forms of communication. b) Define the rules that govern how to communicate in a group of students. c) Play the communication game. d) List what would happen if the sender and receiver did not agree on the details of the protocol. 2. Manual and Automatic address assignment (Windows) a) IPv4 address b) Subnet mask c) DNS 3. Manual and Automatic address assignment (Android) a) IPv4 address b) Subnet mask c) DNS
4	01, 02	1, 2, 3	**TCP/IP Networking Model** - History Leading to TCP/IP, Overview of the TCP/IP Networking Model. TCP/IP Application Layer, HTTP Overview, HTTP Protocol Mechanisms. TCP/IP Transport Layer, TCP Error Recovery Basics, Same-Layer and Adjacent-Layer Interactions. TCP/IP Network Layer, Internet Protocol and the Postal Service, Internet Protocol Addressing Basics, IP Routing Basics. TCP/IP Link Layer (Data Link Plus Physical), TCP/IP Model and Terminology, Data		1. Organize and play games to understand working of TCP/IP like: Create 2 group of students, each playing role of a layers of TCP/IP (intermediate network devices roles can also be considered). Start the communication between two with a sender and receiver. 2. Determine the IP Address Configuration of a

			Encapsulation Terminology. Names of TCP/IP Messages.		Computer (Windows) and Test the Network Interface TCP/IP Stack (Ping).
5	02, 03	1, 2, 4,	**Hardware and Software components of Network** - Common network devices - Computers, Access points, Hub, Switch, Router, repeaters, NIC, Modem. LAN Cables – Co-axial, twisted pair, optical fibre, LAN connectors- co-axial cable, and twisted pair cable, optical fibre, Connectors, Firewall, Firm wares, ISPs.		1. Demonstrate working of common network devices. 2. Demonstrate different network cables and connectors. 3. Install and configure NIC. 4. Crimping of RJ45: Straight and Cross. a) Punching Cat 6 cable to I/O Box. Use punching tool. b) Check connectivity using LAN tester
6	01, 02	1, 2, 3, 4,	**Overview of network topologies** - Basic topologies- bus, ring, star, mesh and hybrid. **Network Simulator**: Network simulator like Packet Tracer, Installation, User Interface. Deploy devices and cables GUI and CLI Configuration. Configure end Devices		1. Install Network simulator like Cisco packet tracer. 2. Create simple network in simulator. 3. Create and Demonstrate all possible network topologies using simulator.
7	02, 03	1, 2, 3, 4,	**An Overview of LANs** - Typical SOHO LANs, Typical Enterprise LANs, The Variety of Ethernet Physical Layer Standards, Consistent Behaviour over All Links Using the Ethernet Data Link Layer. Building Physical Ethernet Networks with UTP - Transmitting Data Using Twisted Pairs, Breaking Down a UTP Ethernet Link, UTP Cabling Pinouts for 10BASE-T and 100BASE-T, Straight-Through Cable Pinout, Crossover Cable Pinout, Choosing the Right Cable Pinouts, UTP Cabling Pinouts for 1000BASE-T, Sending Data in Ethernet Networks.		1. Build a physical Ethernet LAN Network and demonstrate file sharing, printer sharing. 2. Install and configure wireless access point over the LAN. 3. Use pathping command to find actual path between source to destination with information about network latency/delay & network loss.
8	02, 03	1, 2, 3, 4,	**Ethernet Data Link Protocols** – The Rise of Ethernet, The Ethernet MAC address and Ethernet Addressing, Identifying Network Layer Protocols with the Ethernet Type Field, Error Detection with FCS. Encapsulation, Ethernet Frame. **Hierarchical Network Design** – Physical and logical addresses, Benefits of a Hierarchical Design, Access, Distribution, and Core layers Sending Ethernet Frames with Switches and Hubs, Sending in Modern Ethernet LANs Using Full-Duplex, Using Half-Duplex with LAN Hubs. **Ethernet access layer devices** – Hub, Switch, The MAC address table,		1. Determine the MAC Address of a Host(PC and Phone). 2. View Wireless and Wired NIC Information and make a table explaining each. 3. Configure and install a ethernet switch/Hub (Use simulator if hardware devices are not available) 4. Create/model a simple Ethernet network using 3 hosts and a switch, Observe traffic behavior on the network and Observer

			Ethernet Broadcast and Broadcast domain, ARP.		data flow of ARP broadcasts and pings.
9	02, 03, 04	1, 2, 3, 4,	**Routing:** The Need for Routing - Criteria for Dividing the Local Network - Now We Need Routing **Overview of Network Layer Functions** - Network Layer Routing (Forwarding) Logic, Host Forwarding Logic: Send the Packet to the Default Router, Routing Data Across the Network, Delivering Data to the End Destination, How Network Layer Routing Uses LANs and WANs, IP Addressing and How Addressing Helps IP Routing, Routing Protocols. **IPv4 Addressing** - Rules for IP Addresses, Rules for Grouping IP Addresses, Class A, B, and C IP Networks, The Actual Class A, B, and C IP Networks, IP Subnetting, How to create subnets, Subnet mask, CIDR, variable length subnet mask.		1. Build a simple peer-to-peer network and verify physical connectivity and Assign various IPv4 addresses to hosts and observe the effects on network communication 2. Configure IP addresses of a network (real or simulated) and ping across to test and troubleshoot. 3. Subnetting of a network (either using real network or in Simulator). 4. Connect to web server using simulator, Observe how packets are sent across the Internet using IP addresses.
10	02, 03, 04	1, 2, 3, 4, 7	**IPv4 Routing** - IPv4 Host Routing, Router, Forwarding Decisions and the IP Routing Table, The default gateway, A Summary of Router Forwarding Logic, A Detailed Routing Example. **Routing Protocols** - IPv4 Routing Protocols – static and dynamic. **Other Network Layer Features** - Using Names and the Domain Name System, The Address Resolution Protocol, ICMP Echo and the ping Command. **DHCP** – Static address assignment, Dynamic address assignment, DHCP servers.		1. Implement simple static routing. 2. Troubleshooting of IP Addressing- a) Change a routing table entry b) Wrong address c) incorrect subnet mask 3. Configure and test DHCP on a wireless router (real or simulated)
11	02, 03, 04	1, 2, 3, 4,	**Pv4 and IPv6 Address Management** - Network Boundaries -Gateways to Other Networks, Routers as Gateways. **Network Address Translation** - Introduction, NAT operation. **IPv4 Issues** - Need of IPv6, Ipv4 vs IPv6, IPv4 and IPv6 Coexistence. **IPv6 features** - IPv6 Address Representation. **Concept of Virtual LAN's**(VLAN's)		1. Packet Tracer - Examine NAT on a Wireless Router 2. Identify IPv6 Addresses a) Identify the different types of IPv6 addresses. b) Examine a host IPv6 network interface and address. c) Practice IPv6 address abbreviation. 3. Setup, configure and test VPN in your smartphone.
12	02, 03, 04	1, 2, 3, 4,	**The Client Server relationship –** Client Server interaction. URI, URN, URL **TCP/IP Layer 4 Protocols**: TCP and UDP - Transmission Control Protocol, Multiplexing Using TCP Port Numbers, Popular TCP/IP Applications, Connection Establishment and Termination, User Datagram Protocol.		1. Create a client – server model in simulator and observe the client interaction between the server and PC using packet tracer. 2. Observe DNS Name Resolution

			Port Numbers – TCP and UDP. Socket pairs, the netstat command. **Application Layer Services** - Common Network Application Services, Domain Name System, Domain Name Translation, DNS Servers, HTTP, Web Clients and Servers, FTP, Virtual Terminals, Remote Access with Telnet or SSH, Telnet, Security Issues with Telnet, SSH, Email- Email protocols, Simple Mail Transfer Protocol (SMTP), Post Office Protocol (POP3), Internet Message Access Protocol (IMAP4).		a) Observe the conversion of a URL to an IP address. b) Observe DNS lookup using the nslookup command. 3. Use simulator to demonstrate Telnet and SSH
13	02, 03, 04	1, 2, 3, 4,	**Troubleshoot Common Network Problems** - The Troubleshooting Process, Network Troubleshooting Overview, Gather Information - Nature of problem, Equipment, Configuration and Topology, Previous Troubleshooting. **Structured Troubleshooting Methods** - Bottom-Up, Top-Down, Divide-and-Conquer, Follow-the-Path, Substitution, Comparison, Educated Guess. Guidelines for Selecting a Troubleshooting Method **Troubleshoot Wireless Issues** - Causes of Wireless Issues, Authentication and Association Errors.		1. Demonstrate troubleshooting Commands with a scenario- ipconfig, ping , netstat, tracert, nslookup. 2. Interpret the output of commonly used network command line utilities and Determine which network utility can provide the necessary information to perform troubleshooting activities in a bottom-up troubleshooting strategy 3. Physical Layer Problems - Common Layer 1 Problems, how to use the five senses to troubleshoot, Wireless Router LEDs, Cabling Problems 4. Common Internet Connectivity Issues - DHCP Server Configuration Errors, Check Internet Configuration, Check Firewall Settings.
Total in hours			**39**	**13**	**52**

***PO = Program outcome as listed and defined in year 1 curriculum**

Table 1: Suggestive activities for tutorials (the list is only shared as an example and not inclusive of all possible activities for that course. Student and faculty are encouraged to choose activities that are relevant to the topic and the availability of such resources at their institution)

Sl. No	Activity
1	Prepare a report on advanced communication systems and suggest best way to connect remote villages of India.
2	Prepare a report on Communication satellites of Indian Space Research Organization.
3	Prepare a presentation on 5 networking protocols being used in your smart phone.
4	My Protocol Rules Objectives a) Relate computer network protocols to the rules that you use every day for various forms of communication. b) Define the rules that govern how you send and interpret text messages.

	c) Explain what would happen if the sender and receiver did not agree on the details of the protocol.
5	My Local Network a) Record all the different network-attached devices in your home or classroom. b) Investigate how each device connects to the network to send and receive information. c) Create a diagram showing the topology of your network. d) Label each device with its function within the network.
6	Detailed study of Packet tracer and present the same.
7	Trace a Route a) Determine network connectivity to a destination host b) Trace a route to a remote server using tracert
8	Presentation on wireless Ethernet protocols
9	1. Calculate whether destination address is local or remote using IP address. 2. Calculate whether destination address is local or remote using mask. 3. Use logical AND to determine network address
10	Identify IPv6 Addresses a) Identify the different types of IPv6 addresses. b) Examine a host IPv6 network interface and address. c) Practice IPv6 address abbreviation.
11	Prepare a report on ICANN List the popular port numbers with their use.
12	Prepare e report on popular application layer protocols and present the same.
13	Identify and correct any misconfiguration of a wireless device (Scenario : A small business owner learns that a wireless user is unable to access the network. All the PCs are configured with static IP addressing. Identify and resolve the issue)

4. CIE and SEE Assessment Methodologies

Sl. No	Assessment	Test Week	Duration In minutes	Max marks	Conversion
1.	CIE-1 Written Test	5	80	30	Average of three tests 30
2.	CIE-2Written Test	9	80	30	
3	CIE-3Written Test	13	80	30	
4.	CIE-4 Skill Test-Practice	6	180	100	Average of two skill tests reduced to 20
5	CIE-5 Skill Test-Practice	12	180	100	
6	CIE-6 Portfolio continuous evaluation of Activity through Rubrics	1-13		10	10
				Total CIE Marks	60
	Semester End Examination (Practice)		180	100	40
				Total Marks	**100**

5. Format for CIE written Test

Course Name	**Computer Network**	Test	I/II/III	Sem	III/IV
Course Code	20CS33P	Duration	80 Min	Marks	30
Note: Answer any one full question from each section. Each full question carries 10 marks.					

Section	Assessment Questions	Cognitive Levels	Course Outcome	Marks
I	1			
	2			
II	3			

	4			
III	5			
	6			
Note for the Course coordinator: Each question may have one, two or three subdivisions. Optional questions in each section carry the same weightage of marks, Cognitive level and course outcomes.				

6. Rubrics for Assessment of Activity (Qualitative Assessment)

Sl. No.	Dimension	Beginner	Intermediate	Good	Advanced	Expert	Students Score
		2	4	6	8	10	
1		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	8
2		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	6
3		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	2
4		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	2
	Average Marks=(8+6+2+2)/4=4.5						**5**

Note: Dimension and Descriptor shall be defined by the respective course coordinator as per the activities

7. Reference:

Sl. No.	Description
1	www.netcad.com
2	Computer Networks - Behrouz A. Forouzan
3	www.howtonetwork.com
4	vlab.co.in

8. CIE Skill Test and SEE Scheme of Evaluation

SL. No.	**Particulars/Dimension**	**Marks**
1	Identify the network devices, cables, Connectors, software and other tools required as per the given specification and write their technical details.	20
2	Design/Create/Configure the given network as per the specification given.	25
3	Configure and troubleshoot the network (devices, address, port, software, tools, protocol).	25
4	Demonstrate the solution. In the event of, a student fails to get the desired result, the examiner shall use viva voce to assess the student's understanding of computer networks.	20
5	Portfolio evaluation based on aggregate of all practice sessions.	10
	Total Marks	**100**

9. Equipment/software list with Specification for a batch of 20 students

Sl. No.	**Particulars**	**Specification**	**Quantity**

1	Computer		20
2	Lan cable		20
3	Crimping tool		20
4	Networking Switch, Modem		2
5	Network simulator like packet tracer		20
6	Communication trainer kit		10