Subject Code	Subject Name	Period per Week		Credit
28554	Data Communication	T	P	C
		3	3	4

Rationale	Data communication is the most significant area of diploma in Computer Science & Technology. To work with data communication and networking should have the knowledge, skills and attitude of Data Communication and Transmission Basics, Transmission Media, Analog and Digital Modulation, Multiplexing Techniques, Flow control, Error detection and correction, Network model and standard, Data link layer and switching technique, Communication Devices and Protocols, Network Addressing, Wireless Communication.
Learning Outcome (Theoretical)	After Completing the subject, students will be able to: ▪ Interpret Data Communication, Transmission and Media. ▪ Explain different Modulation Techniques. ▪ Describe different Multiplexing and Switching Techniques. ▪ State Flow control, Error detection and correction. ▪ Illustrate Communication Devices, Network Protocols and Models. ▪ Discuss Network Addressing. ▪ Describe wireless Communication.
Learning Outcome (Practical)	After undergoing the subject, students will be able to: ▪ Identify Analog and Digital signals. ▪ Perform the Pulse Code Modulation signal. ▪ Identify the Network equipment and tools. ▪ Prepare Co-axial and Ethernet Cable. ▪ Perform Fiber-Optic cable Connection. ▪ Perform One-to-one connection. ▪ Observe Network Protocols and Ports. ▪ Perform Wireless Connection. ▪ Perform Local and Internet Bandwidth Testing.

Detailed Syllabus (Theory)

Unit	Topics with contents	Class (1 Period)	Final Marks
1	**DATA COMMUNICATION BASICS** 1.1 Define Communication. 1.2 Describe Communication Terminology. 1.3 Mention the basic elements of a Communication System. 1.4 Describe Communication System with a simple block diagram. 1.5 Define Data and Signal. 1.6 Describe different types of data signal. 1.7 Define Data communication. 1.8 Discuss importance of Data communication.	3	6
2	**DATA TRANSMISSION CONCEPTS** 2.1 Discuss Components of Data Communication. 2.2 Describe the Typical Data Communication System. 2.3 State Frequency, Wavelength, Spectrum, Bandwidth, Throughput, Propagation Speed, Propagation Time, Noise and SNR. 2.4 Differentiate between bandwidth and data rate. 2.5 Mention the different Communication Models. 2.6 Describe Unicast, Multicast and Broadcast communication models. 2.7 Describe Simplex, Half-duplex and Full duplex modes of communication. 2.8 Describe Synchronous and Asynchronous communication techniques.	4	8
3	**TRANSMISSION MEDIA AND CONNECTORS** 3.1 Define Transmission Media. 3.2 Mention the categories of transmission media. 3.3 Describe the construction of STP, UTP, Co-axial and Fiber-optic cable. 3.4 State the characteristics of STP, UTP, Co-axial and Fiber-optic cable. 3.5 State the advantages and disadvantages of STP, UTP, Co-axial and Fiber-optic cable. 3.6 Define Connectors. 3.7 Discuss connectors for different types of media.	3	6
4	**ANALOG COMMUNICATION SYSTEMS** 4.1 Define Modulation and Demodulation. 4.2 State the necessity of Modulation. 4.3 Mention the types of Modulation. 4.4 Describe AM, FM and PM with necessary waveform. 4.5 State the advantages and disadvantages of ASK, FSK, PSK and BPSK.	3	6

5	**DIGITAL COMMUNICATION SYSTEMS** 5.1 Define Digital Modulation. 5.2 Describe PCM, DM and DPCM. 5.3 Define Line Coding and Block Coding. 5.4 Mention the Line Coding Schemes. 5.5 Differentiate between Analog and Digital Modulation.	**3**	**6**
6	**MULTIPLEXING TECHNIQUES** 6.1 Define Multiplexing and De-multiplexing. 6.2 Mention the categories of multiplexing. 6.3 Define FDM, WDM, TDM and CDM. 6.4 Describe Frequency Division Multiplexing and De-multiplexing technique with block diagram. 6.5 Describe Wave Division Multiplexing and De-multiplexing technique with block diagram. 6.6 Describe Time Division Multiplexing and De-multiplexing technique with block diagram. 6.7 Compare between baseband and broadband transmission.	**5**	**9**
7	**DATA FLOW CONTROL** 7.1 Define data flow control. 7.2 Discuss the necessity of flow control. 7.3 Describe the method of flow control. 7.4 Discuss Sliding Window protocol. 7.5 Discuss Stop and Wait protocol.	**3**	**6**
8	**ERROR DETECTION AND CORRECTION** 8.1 Define Error and Error Detection in data communication. 8.2 Describe types of errors in data communication. 8.3 Describe different types of error detection techniques. 8.4 Define Error Correction. 8.5 Describe different types of error correction techniques.	**4**	**8**
9	**NETWORK MODEL AND STANDARDS** 9.1 Define OSI and TCP/IP Model. 9.2 Describe the OSI Model. 9.3 List the network devices of OSI model layer. 9.4 Describe the TCP/IP Model. 9.5 Describe the interconnection model of OSI and TCP/IP model.	**3**	**7**
10	**DATA LINK LAYER AND SWITCHING TECHNIQUE** 10.1 Define Data Link Layer. 10.2 Describe the function of data link layer. 10.3 Discuss Data Link Control protocols. 10.4 Define Switching. 10.5 Mention the types of Switching. 10.6 Describe Circuit switching, Message switching and Packet switching. 10.7 Describe advantages and disadvantages of Circuit switching, Message switching and Packet switching.	**6**	**9**

11	**COMMUNICATION DEVICES AND PROTOCOLS** 11.1 Define Communication Devices. 11.2 Describe different types of Communication Devices. 11.3 Define Protocols and Ports. 11.4 List different types of Communication Protocols and Ports. 11.5 Describe TCP, UDP, SNMP, SMTP, FTP, SFTP, HTTP, MQTT, CoAP, I2C and ARP. 11.6 Define IoT and IoT Devices with example.	**4**	**7**
12	**NETWORK ADDRESSING** 12.1 Define Network Addressing and IP Addressing. 12.2 Define MAC Address. 12.3 Define IPv4 and IPv6. 12.4 Describe the IPv4 address format of Class A, B, C, D and E with example. 12.5 Discuss Public and Private IP address. 12.6 Describe Subnet and Subnet Mask. 12.7 Describe the Subnetting for IPv4.	**4**	**6**
13	**WIRELESS COMMUNICATION** 13.1 Define Wireless Communication. 13.2 Mention the types of Wireless Communication. 13.3 Discuss the necessity of wireless communication. 13.4 Describe Radio, Microwave, Satellite, Infrared and Mobile/Cellular communication systems. 13.5 Define WiFi and LiFi. 13.6 Define CDMA and GSM. 13.7 Describe 2G, 3G, 4G and 5G.	**3**	**6**
	TOTAL	**48**	**90**

DETAILED SYLLABUS (PRACTICAL)

SL.	EXPERIMENT NAME	Class (3 Period)	Marks (Continuous)
1	**IDENTIFY THE ANALOG AND DIGITAL SIGNALS** 1.1 Identify the equipment. 1.2 Observe analog signals using oscilloscope. 1.3 Observe digital signal using logic analyzer. 1.4 Identify and record characteristics of both types of signals, such as waveform shapes and amplitude. 1.5 Maintain the record of performed task.	**1**	**2**
2	**PERFORM MODULATION AND DEMODULATION** 2.1 Use a signal generator to produce modulated signals (e.g., AM, FM). 2.2 Use a demodulator to retrieve the original signal. 2.3 Maintain the record of performed task.	**1**	**2**
3	**PERFORM PULSE CODE MODULATION SIGNAL** 3.1 Prepare the equipment and trainer board list. 3.2 Connect the equipment according to diagram. 3.3 Observe the PCM signals. 3.4 Maintain the record of performed task.	**1**	**2**

4	**IDENTIFY THE NETWORK EQUIPMENTS AND TOOLS** 4.1 Prepare the equipment list. 4.2 Identify the equipment and tools. 4.3 Recognize the characteristics chart of each equipment. 4.4 Maintain the record of performed task.	**1**	**2**
5	**PREPARE STRAIGHT-THROUGH CABLE** 5.1 Collect the necessary equipment, including Ethernet cables, RJ-45 connectors, a cable crimper, a cable tester, and a wire stripper. 5.2 Follow the T-568B wiring standard for straight-through cables. 5.3 Follow the specific steps for crimping RJ-45 connectors onto Ethernet cables. 5.4 Practice crimping Ethernet cables. 5.5 Prepare straight through cable. 5.6 Test the crimped Ethernet cables for connectivity with Cable Tester.	**2**	**2**
6	**PREPARE CROSSOVER CABLE** 6.1 Collect the necessary equipment, including Ethernet cables, RJ-45 connectors, a cable crimper, a cable tester, and a wire stripper. 6.2 Follow the T-568A wiring standard for one end and T-568B for the other. 6.3 Follow the specific steps for crimping RJ-45 connectors onto Ethernet cables. 6.4 Test the crimped Ethernet cables for connectivity with Cable Tester. 6.5 Label the cables.	**1**	**2**
7	**PREPARE COAXIAL CABLE** 7.1 Collect necessary materials, including coaxial cables and connectors. 7.2 Apply the techniques for crimping BNC or F-Type connectors onto coaxial cables. 7.3 Apply the techniques through hands-on practice. 7.4 Test the crimped cables for connectivity with "Cable Continuity Tester" or "Coaxial Cable Tester".	**1**	**2**
8	**PERFORM FIBER OPTIC CABLE CONNECTION** 8.1 Collect equipment, including fiber optic connectors, a fusion splicer, and cleaver. 8.2 Clean Fiber and free from contaminants. 8.3 Strip the protective coating from the fiber ends using a precision stripping tool. 8.4 Use a cleaver to create a flat and clean end face for each fiber. 8.5 Perform positioning the cleaved fibers in a fusion splicer and align them precisely. 8.6 Activate the fusion splicer to melt and fuse the fibers together. 8.7 Inspect the fused fiber connection for quality and cleanliness. 8.8 Check the connectivity of the fiber optic cable by transmitting a light signal through it.	**2**	**3**

9	**PERFORM ONE-TO-ONE CONNECTION** 9.1 Collect Equipment. 9.2 Identify Ethernet Ports. 9.3 Prepare Ethernet Cables. 9.4 Connect Computers with the cable. 9.5 Configure Network Settings. 9.6 Test Connectivity.	**1**	**2**
10	**OBSERVE NETWORK PROTOCOLS AND PORTS** 10.1 Use network diagnostic tools to inspect network traffic. 10.2 Identify and analyze packets transmitted using Wireshark. 10.3 Identify different application layer protocols with associated ports (e.g., TCP, UDP).	**1**	**2**
11	**CONFIGURE WIRELESS NETWORK CONNECTION** 11.1 Configure a basic wireless router with default configuration. 11.2 Connect devices (e.g., laptops, smartphones) to the wireless network. 11.3 Protect wireless network by encryption and passwords. 11.4 Test wireless connectivity and signal strength.	**1**	**2**
12	**TEST THE LOCAL AND INTERNET BANDWIDTH** 12.1 Connect computers to the local network (LAN). 12.2 Use Local Bandwidth Testing Software. 12.3 Run the local bandwidth test using the software to measure the speed of data transfer within the local network. 12.4 Connect computers to the Internet. 12.5 Identify Online Bandwidth Testing Tool. 12.6 Run the Internet Bandwidth Test. 12.7 Observe local and internet bandwidth results. 12.8 Identify affecting factors of LAN and WAN bandwidth 12.9 Observe different bandwidth testing for local network (e.g., file transfers) and on the internet (e.g., streaming, online gaming).	**1**	**2**
	Total	**16**	**25**

NECESSARY RESOURCES (TOOLS, EQUIPMENT AND MACHINERY):

SL	Item Name	Quantity
1	Oscilloscope	05 Nos
2	Function Signal Generator	05 Nos
3	Network tool box	10 Nos
4	Ethernet Cable	01 box (305 m)
5	RJ 45 connector	300 Nos
6	Wire Stripper	10 Nos
7	Screwdriver (if needed to open computer cases)	10 Nos
8	Crimping tool	10 Nos
9	Cable tester	10 Nos
10	Router (Wireless)	05 Nos
11	Network Switch	05 Nos
12	Desktop PC	25 Nos
13	Internet connection	
14	LAN Connection	
15	Web Browser	
16	Network speed testing software (e.g., Speed test, LAN Speed Test)	
17	Wireshark /Packet Tracer Software	