I

Name _____

Roll No. _____ Year 20 ____ 20 ____

Exam Seat No. _____

ELECTRONICS GROUP | SEMESTER - VI | DIPLOMA IN ENGINEERING AND TECHNOLOGY

A LABORATORY MANUAL

FOR

Computer Networking and Data Communication (22634)

(EJ/DE)



MAHARASHTRA STATE BOARD OF TECHNICAL EDUCATION, MUMBAI

(Autonomous) (ISO 9001 : 2015) (ISO / IEC 27001 : 2013)

A Laboratory Manual for

Computer Networking and Data Communication

(22634)

Semester-VI

(EJ, DE)

Maharashtra State
Board of Technical Education, Mumbai
(Autonomous) (ISO-9001-2015) (ISO/IEC 27001:2013)

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4th Floor, Government Polytechnic Building, 49, Kherwadi,
Bandra (East), Mumbai – 400051.
(Printed on November 2019)

Maharashtra State
Board of Technical Education

Certificate

This is to certify that Mr. / Ms ……. Roll No…….of …… Semester of Diploma in ……..…… of Institute ……..…… (Code……..) has attained pre-defined practical outcomes(PROs) satisfactorily in course **Computer Networking and Data Communication (22634)** for the academic year 20…….to 20…..... as prescribed in the curriculum.

Place ……. Enrollment No……
Date:…..... Exam Seat No. …….....

Course Teacher **Head of the Department** **Principal**

Seal of the Institute

Preface

The primary focus of any engineering laboratory/ field work in the technical education system is to develop the much needed industry relevant competencies and skills. With this in view, MSBTE embarked on this innovative 'I' Scheme curricula for engineering diploma programmes with outcome-base education as the focus and accordingly, relatively large amount of time is allotted for the practical work. This displays the great importance of laboratory work making each teacher; instructor and student to realize that every minute of the laboratory time need to be effectively utilized to develop these outcomes, rather than doing other mundane activities. Therefore, for the successful implementation of this outcome-based curriculum, every practical has been designed to serve as a ***'vehicle'*** to develop this industry identified competency in every student. The practical skills are difficult to develop through 'chalk and duster' activity in the classroom situation. Accordingly, the 'I' scheme laboratory manual development team designed the practicals to ***focus*** on the ***outcomes***, rather than the traditional age old practice of conducting practicals to 'verify the theory' (which may become a byproduct along the way).

This laboratory manual is designed to help all stakeholders, especially the students, teachers and instructors to develop in the student the pre-determined outcomes. It is expected from each student that at least a day in advance, they have to thoroughly read through the concerned practical procedure that they will do the next day and understand the minimum theoretical background associated with the practical. Every practical in this manual begins by identifying the competency, industry relevant skills, course outcomes and practical outcomes which serve as a key focal point for doing the practical. The students will then become aware about the skills they will achieve through procedure shown there and necessary precautions to be taken, which will help them to apply in solving real-world problems in their professional life.

This manual also provides guidelines to teachers and instructors to effectively facilitate student-centered lab activities through each practical exercise by arranging and managing necessary resources in order that the students follow the procedures and precautions systematically ensuring the achievement of outcomes in the students.

Data communication deals with the transmission of digital data through a network. Many applications like Airline Reservations, Railway reservations, e-banking, e-governance, Online Shopping, e-learning can be managed by a single click. Diploma Engineers should be able to select, classify, install, troubleshoot and maintain different industrial data communication networks. This course gives the important concepts and techniques related to data communication and enable students to maintain and troubleshoot computer networks.

Although all care has been taken to check for mistakes in this laboratory manual, yet it is impossible to claim perfection especially as this is the first edition. Any such errors and suggestions for improvement can be brought to our notice and are highly welcome.

Programme Outcomes (POs) to be achieved through Practical of this Course

Following programme outcomes are expected to be achieved through the practical of the course

PO1. **Basic knowledge:** Apply knowledge of basic mathematics, sciences and basic engineering to solve the broad-based Electronics and Telecommunication engineering problems.

PO2. **Discipline knowledge:** Apply Electronics and Telecommunication engineering knowledge to solve broad-based Electronics and Telecommunications engineering related problems.

PO3. **Experiments and practice:** Experiments and practice: Plan to perform experiments and practices to use the results to solve broad-based Electronics and Telecommunication engineering problems.

PO4. **Engineering tools:** Apply relevant Electronics and Telecommunications technologies and tools with an understanding of the limitations

PO5. **The engineer and society:** Assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to practice in field of Electronics and Telecommunication engineering.

PO6. **Environment and sustainability:** Apply Electronics and Telecommunication engineering solutions also for sustainable development practices in societal and environmental contexts.

PO7. **Ethics:** Apply ethical principles for commitment to professional ethics, responsibilities and norms of the practice also in the field of Electronics and Telecommunication engineering.

PO8. **Individual and team work:** Function effectively as a leader and team member in diverse/ multidisciplinary teams.

PO9. **Communication:** Communicate effectively in oral and written form.

PO10. **Life-long learning:** Engage in independent and life-long learning activities in the context of technological changes also in the Electronics and Telecommunication engineering and allied industry.

Program Specific Outcomes (PSO) (What s/he will be able to do in the Electronics and Telecommunication engineering specific industry soon after the diploma programme).

PSO1. Electronics and Telecommunication Systems: Maintain various types of Electronics and Telecommunication systems.
PSO2. EDA Tools Usage: Use EDA tools to develop simple Electronics and Telecommunication engineering related circuits.

List of Industry Relevant Skills

The following industry relevant skills of the competency **'Maintain computer network systems'** are expected to be developed in students by undertaking the practicals of this laboratory manual**.**

1. Identify the network and communication component.
2. Test network and communication component
3. Suggest the network and communication component of proper specification as per the requirement.
4. Test the performance of the network device.
5. Troubleshoot computer network.
6. Connect computers network devices as per requirement.
7. Use the tool effectively.

Practical- Course Outcome matrix

Course Outcomes (COs)

a. Maintain wired computer network topologies.
b. Use the relevant network model for the specified data communication system.
c. Maintain relevant transmission medium and modem for data transmission**.**
d. Analyze error detection/correction and flow control of data in the data network.
e. Configure the network component and assign IP address.

Pro. No.	Practical Outcomes (PrO)	CO a.	CO b.	CO c.	CO d.	CO e.
1.	Analyze the type of network topology used in your lab and prepare technical specifications for it.	✓	-	-	-	-
2.	Connect computers in bus topology and transfer the data.	✓	-	-	-	-
3.	Connect computers in star topology and test the performance.	✓	-	-	-	-
4.	Install/configure/Test Peer to Peer LAN and sharing of resources.	✓	✓	-	-	-
5.	Configure Point to Point network in laboratory.	✓	✓	-	-	-
6.	Prepare patch cord and cross connection cables, use to connect the devices on the LAN.	-	-	✓	-	-
7.	Using a Hub/ Switch Install a LAN network consisting of 6 computers.	-	✓	✓	-	-
8.	Locate the error bit in the given data stream by applying the different error detection methods.	-	-	-	✓	-
9.	Correct the error in a given data stream by applying the different error correction methods.	-	✓	-	✓	-
10.	Use route command to test the performance of the given network.	-	-	-	-	✓
11.	Install and test Router, Repeater and Bridge	-	✓	-	-	✓
12.	Assign IP address to the PC connected to the internet.	-	✓	-	-	✓
13.	Configure/Test Internet connectivity.	-	✓	-	-	✓
14.	Use FTP protocol to transfer file from one system to another system.	-	✓	-	-	✓
15.	Install and configure a Firewall for the network security.	-	✓	-	-	✓
16.	Interconnect two PCs using RS232 cable and transfer data as null modem configuration.	-	-	-	-	✓

Guidelines to Teachers

1. Teacher is expected to refer complete curriculum document and follow guidelines for implementation
2. Teacher should provide the guideline with demonstration of practical to the students with all features.
3. Teacher shall explain prior concepts to the students before starting of each practical
4. Involve students in performance of each practical.
5. Teacher should ensure that the respective skills and competencies are developed in the students after the completion of the practical exercise.
6. Teachers should give opportunity to students for hands on experience after the demonstration.
7. Teacher is expected to share the skills and competencies to be developed in the students.
8. Teacher may provide additional knowledge and skills to the students even though not covered in the manual but are expected the students by the industry.
9. Give practical assignment and assess the performance of students based on task assigned to check whether it is as per the instructions.
10. Assess the skill achievement of the students and COs of each unit.
11. At the beginning Teacher should make the students acquainted with any of the simulation software environment as few practical are based on simulation.
12. It is desirable to paste the photo of actual practical setup or draw block diagram of experimental setup.
13. Teachers shall make the students perform all networking based experiments using PCs or Laptop.

Instructions for Students

1. Listen carefully to the lecture given by teacher about course, curriculum, curriculum map, skills to be developed.
2. Before performing the practical student shall read lab manual of related practical to be conducted.
3. For incidental writing on the day of each practical session every student should maintain a ***dated log book*** for the whole semester, apart from this laboratory manual which s/he has to ***submit for assessment to the teacher***.
4. Organize the work in the group and make record of all observations.
5. Students shall develop maintenance skill as expected by industries.
6. Student shall attempt to develop related hands-on skills and gain confidence.
7. Student shall develop the habits of evolving more ideas, innovations, skills etc. those included in scope of manual
8. Student shall refer technical magazines, IS codes and data books.
9. Student should develop habit to submit the practical on date and time.
10. Student should be well prepared while submitting write-up of exercise.
11. Student may watch YouTube videos relevant to the experiment in the lab manual.
12. Students shall perform all networking based experiments using PCs or Laptop.

Content Page

List of Practicals and Progressive Assessment Sheet

- *The practical marked as '*' are compulsory,*
- *Column* 6th marks to be transferred to Performa of CIAAN-2017.

Practical No.1: Analyse the type of network topology used in your lab and prepare technical specifications for it.

I Practical Significance

Internet-based communication is assuming an increasingly important role in the developing world. It is thus crucial that students be exposed to contemporary networking equipment in a realistic setting, in order to connect theoretical concepts taught in lecture courses with the realities of physical hardware. This practical will enable the student to identify the various networking devices available in the lab and the way they are connected in the network

II Relevant Program Outcomes (POs)

- **Discipline knowledge**: Apply Electronics and Telecommunication engineering knowledge to solve broad-based Electronics and Telecommunications engineering related problems.
- **Experiments and practice:** Plan to perform experiments and practices to use the results to solve broad-based Electronics and Telecommunication engineering problems.
- **Individual and team work:** Function effectively as a leader and team member in diverse/ multidisciplinary teams.

III Competency and Practical skills

This practical is expected to develop the following skills for the industry identified competency

Maintain Computer Network systems

Identify the various networking devices and connect them in a network.

IV Relevant Course Outcome

Maintain wired computer network topologies.

V Practical Outcome

Analyze the type of network topology used in your lab and prepare technical specifications for it**.**

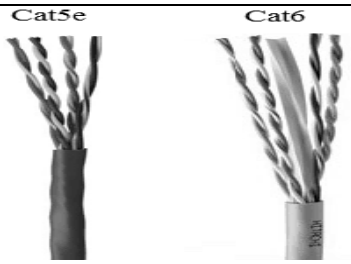
VI Relevant Affective domain related Outcomes

- Follow ethical practices.
- Handle equipment carefully.
- Follow safety practices.

VII Minimum Theoretical Background

A network refers to two or more connected computers that can share resources such as data, a printer, an Internet connection, applications, or a combination of these resources. To enable computers to get connected, different network controlled devices and transmission media are used. The following network accessories and control devices are required for performing the various functions of a computer network.

Table 1.1: Network Accessories

Name of the device/ Accessory	Image	Use/ Purpose
Cable		A twisted pair cable used as a communication medium that allows data to flow through it
Connector		RJ45 is a type of connector commonly used or Ethernet networking. RJ refers to Registered Jack. Ethernet is the standard way to connect computers on a network over a wired connection.
Network Interface Card (NIC)		NIC is an expansion board that can be inserted into a computer so the computer can be connected to a network. Most NICs are designed for a particular type of network, protocol, and media, although some can serve multiple networks.
Hub/ Switch		**Hub** is a common connection point for devices in a network. A hub contains multiple ports. **Switch** is a device that filters and forwards packets between LAN segments.
Router		**Router** is a device that forwards data packets along networks. A router is connected to at least two networks .
Repeater		A repeater is a device that receives a signal and retransmits it. Repeaters are used to extend transmissions so that the signal can cover longer distances or be received on the other side of an obstruction.

Name of the device/ Accessory	Image	Use/ Purpose
Bridge		A device that connects two local-area networks (LANs), or two segments of the same LAN that use the same protocol

VIII a) Network Diagram for Lab.:

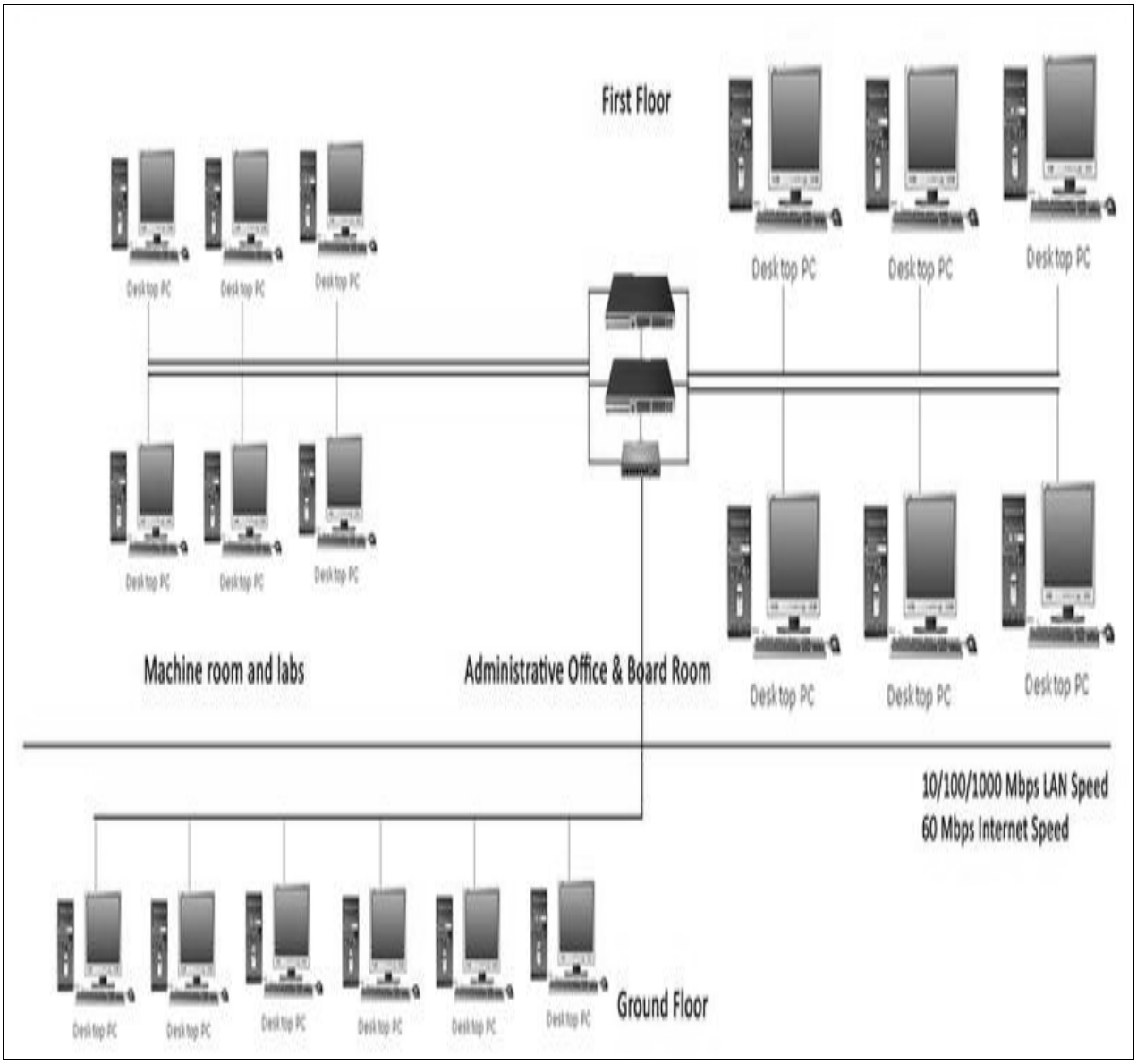


Fig 1.1: Block schematic showing the networked devices

(b) Actual Network used in laboratory

IX Resources required

Sr. No.	Instrument /Components	Specification	Quantity
1.	Desktop computers	Computers in the lab	Min 3 No.s
2.	Networking devices (Switch, Hub, Router etc..)	Available in the lab	1 No. each
3.	Connecting Cables and connectors	Unshielded twisted Pair cable, Network tool kit, RJ 45 Connectors	

X Precautions to be followed

- Try to locate the various ports on the computer before making connections
- Use the network tools with care

XI Procedure

1. Check the configuration of the computers being used in the lab by using the following procedure.
   i) Switch ON the Computer.
   ii) Right Click on "My Computer". Select " Properties"
   iii) The following screen appears. Note down the specifications of the computer in the table

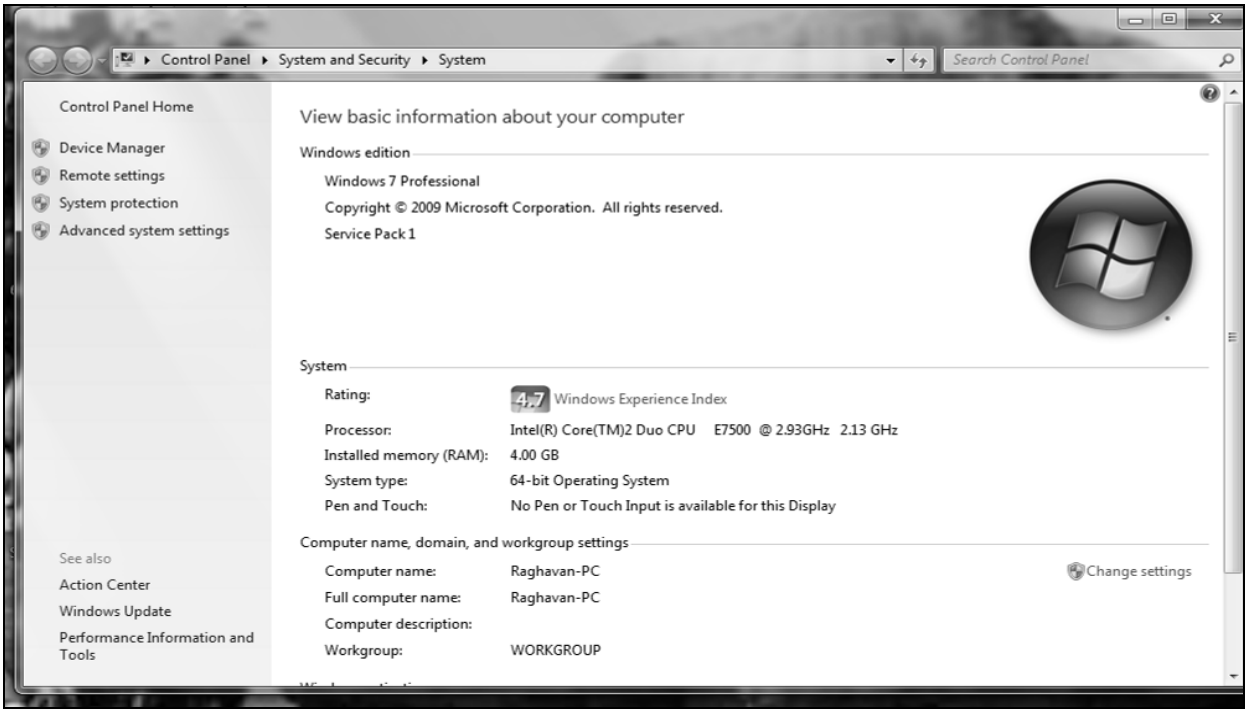


Fig 1.2: Information about the computer (Right Click on my computer ► properties

1. Observe and understand various components of networking with its purpose
2. Use the network toolkit to understand the use of various tools
3. Observe the lab Network. Draw the positioning of various devices in the network in the lab. And note its specification.

XII Resources used

Sr. No.	Instrument /Components	Specification	Quantity
1.			
2.			
3.			

XIII Actual procedure followed

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XIV Precautions followed (use blank sheet provided if space not sufficient)

1. Do not change other settings in IP addresses without intimating subject teacher.
2. Use proper cables wherever applicable (Cross-over , Straight).

XV Observations (use blank sheet provided if space not sufficient)

Computer Configuration		
Component / Part	**Name of Manufacturer**	**Specification**
Processor		
Hard Disk		
Operating System		
RAM		
Component / Part	**Name of Manufacturer**	**Specification**
Network Components		
Component	**Name of Manufacturer**	**Specification**
Switch/Hub		Number of Ports : Speed :
Cable		Speed
Connector		Type:
Router		
Any Other		
Note: Refer instruction manual for above observation		

XVI Conclusions and Recommendations

(Actions/decisions to be taken based on the interpretation of results).

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XVII Practical Related Questions

Note: Below given are few sample questions for reference. Teacher must design more such questions so as to ensure the achievement of identified CO.

1. State the different ports available on the computer. Give their functions.
2. State the position of the Switch in the connected Network
3. State the number of computers and network control devices connected in network.

[Space for Answers]

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XVIII References / Suggestions for further Reading

1. https://www.youtube.com/watch?v=aHJElrgj6UA
2. https://www.youtube.com/watch?v=_VRToy-9SD0

XIX Assessment Scheme

Performance indicators		Weightage
Process related: (15 Marks)		**60%**
1	Proper handling of the equipment	20%
2	Identifying the various Network components	20%
3	Identifying the various ports of computer	20%
Product related: (10 Marks)		**40%**
4	Results	20%
5	Practical related questions	10%
6	Submission of report in time	10%
	Total (25 Marks)	**100 %**

Name of Team Members

1. ……..
2. ……..
3. ……..
4. ……..

Marks Obtained			Dated signature of Teacher
Process Related (15)	**Product Related (10)**	**Total (25)**	

Practical No.2: Connect computers in bus topology and transfer the data.

I Practical Significance

Network topology is the physical layout in which computers of a small area are connected to each other. There are 2 types of topologies – Physical and Logical topology. Physical topology refers to the positioning of the various network components and cable installation. Logical topology shows how the data flows within a network. There are different types of topologies like Bus, Star, Ring, Mesh, Tree and Hybrid to connect computers with each other. In this practical, the student will be able to connect computer in bus topology.

II Relevant Program Outcomes (POs)

- **Discipline knowledge**: Apply Electronics and Telecommunication engineering knowledge to solve broad-based Electronics and Telecommunications engineering related problems.
- **Experiments and practice:** Plan to perform experiments and practices to use the results to solve broad-based Electronics and Telecommunication engineering problems.
- **Individual and team work:** Function effectively as a leader and team member in diverse/ multidisciplinary teams.

III Competency and Practical skills

This practical is expected to develop the following skills for the industry identified competency

Maintain Computer Network systems

Connecting computers in Bus topology

IV Relevant Course Outcome

Maintain wired computer network topologies.

V Practical Outcome

Connect computers in bus topology and transfer the data.

VI Relevant Affective domain related Outcome(s)

- Follow ethical practices.
- Handle equipment carefully.
- Follow safety practices.

VII Minimum Theoretical Background

Bus topology refers to a network setup where nodes or devices are interconnected using a single cable. It is because of this setup why bus topology is often referred to as line topology or backbone. Depending on the nodes or devices that need to be connected, a coaxial cable or an RJ45 cable is typically used to connect the devices. Bus topology usually consists of two ends and signals travel from one end to another. Bus topology is unidirectional and data is transferred from one end to another in a single direction. A device wanting to communicate with another device on the network sends a broadcast message onto the wire that all other devices see, but only the intended recipient actually accepts and processes the message.

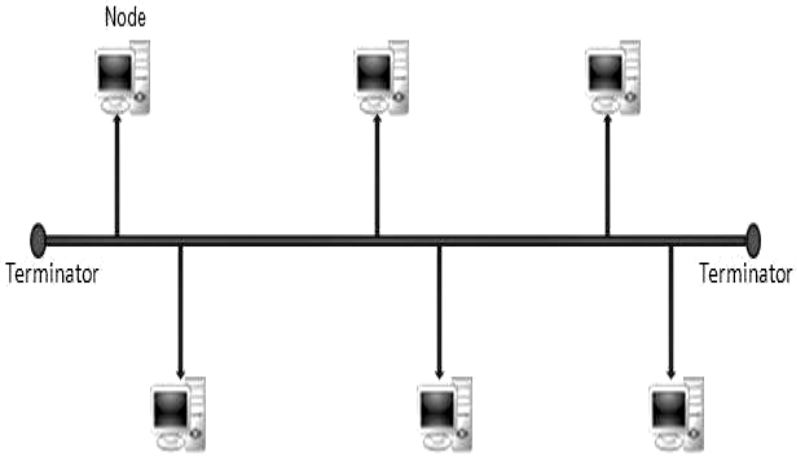

Fig 2.1: Bus Topology

VIII a) Block Diagram

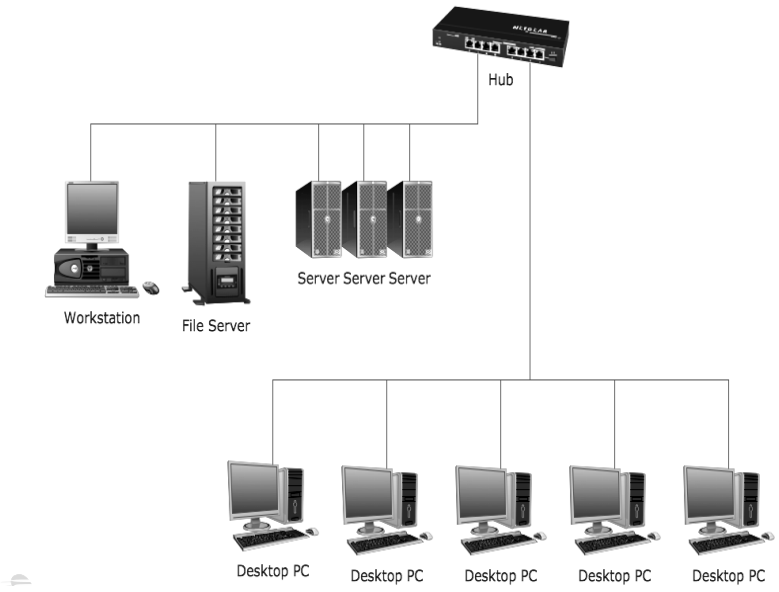

Fig 2.2: Typical topology network

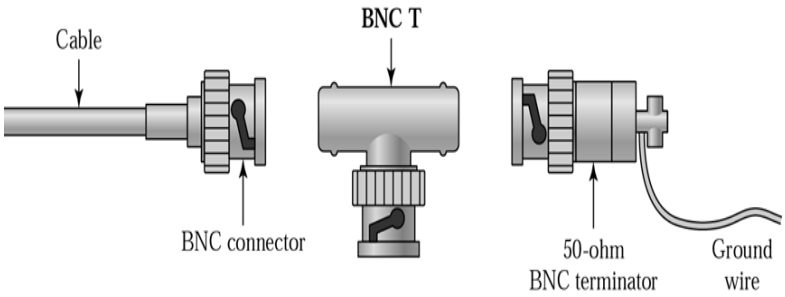

Fig 2.3: Connectors (BNC, BNC-T, Terminator)

(b) Actual Network used in laboratory

IX Resources required

Sr. No.	Instrument /Components	Specification	Quantity
1.	Desktop computers	Computers in the lab	3
2.	Connecting Cables and connectors	Connectors with one end BNC and other end RJ 45 Connectors,(Or a linker between BNC connector and RJ 45), co axial cable, BNC connectors, BNC-T Connector and Terminator	
3.	Network toolkit	Standard	01

X Precautions to be Followed

- Handle computers with care.
- Use the network tools with care

XI Procedure

Physical formation of Bus Topology

1. Take a coaxial Cable of length 1.5 m. Take a terminator connector and connect to One end of the cable.

Fig 2.4 BNC terminator

2. To the other end of coaxial cable connect a BNC-T connector.(One end)

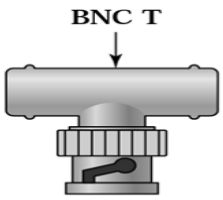

Fig 2.5 BNC-T Connector

3. Take Ethernet cables and connect one end of the cable to port-RJ 45 to connect to the NIC of the Computer. The other end is connected to BNC connector which in turn is connected to the BNC –T Connector

Fig 2.6 BNC Connector

Fig 2.7 One end of cable connected to BNC connector and the other end to RJ 45

4. The compter1 is now connected one end of the BNC- T connector and then to the terminator. Repeat step 3 to connect more computers/ networking devices.
5. After connecting 3 computers, connect BNC terminator to the BNC-T open end.
6. Now switch "ON" the computers. The computers are connected in Bus topology
7. Share file or folder between two computers.

XII Resources used

Sr. No.	Instrument /Components	Specification	Quantity
1.			
2.			
3.			

XIII Actual procedure followed

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XIV Precautions followed (use blank sheet provided if space not sufficient)

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XV Observations (use blank sheet provided if space not sufficient)

Remove the BNC connection and the RJ 45 connection and re connect to check the rigidity of the connection established.

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XVI Result

The number of Cables required to connect 4 computers in Bus topology is ----------

The number of BNC-T connectors required for connecting 3 computers is ----------

The number of BNC connectors required for connecting 3 computers is ---------

XVII Interpretation of Results

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XVIII Conclusions and Recommendations (Actions/decisions to be taken based on the interpretation of results).

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XIX Practical Related Questions

Note: Below given are few sample questions for reference. Teacher must design more such questions so as to ensure the achievement of identified CO.

1. State the limitations of the bus topology
2. State one situation where bus topology can be implemented.
3. Name the different tools available in the tool kit.

[Space for Answers]

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XX References / Suggestions for further Reading

1. https://www.youtube.com/watch?v=EQ3rW22-Py0
2. https://www.youtube.com/watch?v=6ogqMji-_NA
3. https://www.youtube.com/watch?v=5b5d0CJed1k
4. https://youtu.be/vjbfw5TG4JA

XXI Assessment Scheme

Performance indicators		Weightage
Process related: (15 Marks)		**60%**
1	Proper handling of the equipment	20%
2	Identifying the various Network components	20%
3	Identifying the various ports of computer	20%
Product related: (10 Marks)		**40%**
4	Results	20%
5	Practical related questions	10%
6	Submission of report in time	10%
	Total (25 Marks)	**100 %**

Name of Team Members

1. ……..
2. ……..
3. ……..
4. ……..

Marks Obtained			Dated signature of Teacher
Process Related (15)	**Product Related (10)**	**Total (25)**	

Practical No.3: Connect computers in star topology and test the performance.

I Practical Significance

Network topology is the physical layout in which computers of a small area are connected to each other. There are two types of topologies – Physical and Logical topology. Physical topology refers to the positioning of the various network components and cable installation. Logical topology shows how the data flows within a network. There are different types of topologies like Bus, Star, Ring, Mesh, Tree and Hybrid to connect computers with each other. In this practical, the student will be able to connect computer in star topology and test its performance.

II Relevant Program Outcomes (POs)

- **Discipline knowledge**: Apply Electronics and Telecommunication engineering knowledge to solve broad-based Electronics and Telecommunications engineering related problems.
- **Experiments and practice:** Plan to perform experiments and practices to use the results to solve broad-based Electronics and Telecommunication engineering problems.
- **Individual and team work:** Function effectively as a leader and team m
- Remember in diverse/ multidisciplinary teams.

III Competency and Practical skills

This practical is expected to develop the following skills for the industry identified competency**:**

Maintain computer network systems

Connecting computers in Star topology

Preparing CAT 6 cable patch cord of given length with RJ 45 connector on both sides

IV Relevant Course Outcome

Maintain wired computer network topologies.

V Practical Outcome

Connect computers in star topology and test the performance.

VI Relevant Affective domain related Outcomes

- Follow ethical practices.
- Handle equipment carefully.
- Follow safety practices.

VII Minimum Theoretical Background

In star topology, every node (computer, workstation or any other peripheral) is connected to the central node or a device called Hub or Switch. All the data on the star topology passes through the central device before reaching the intended destination. A hub forwards data packets to all the ports . A switch is intelligent. It recognizes which computer is connected to which port based on the MAC address and saves this information in a table format. When a switch receives the data packet, it determines the recipient and forwards the packet to the correct computer. An advantage of the star

topology is the simplicity of adding additional nodes. The main disadvantage of star topology is that the central device represents a single point of failure.

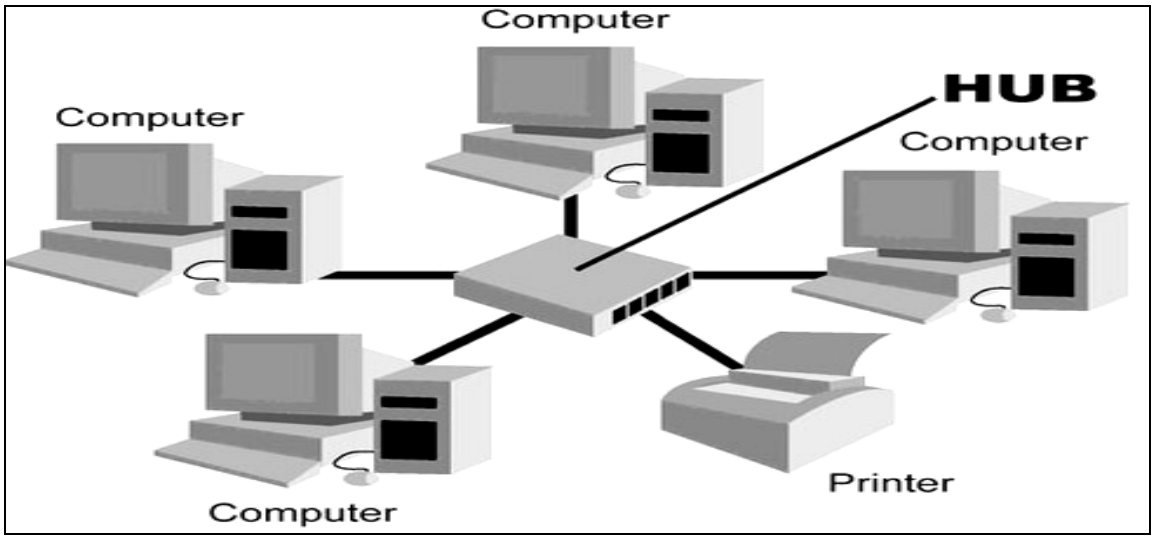

Fig 3.1: Star Topology

Packet Tracer

Packet Tracer is a powerful network simulator that can be utilized to create networks with an almost unlimited number of devices and to experience troubleshooting without having to buy real Cisco routers or switches. The tool is created by Cisco Systems. The purpose of Packet Tracer is to provide a tool to learn the principles of networking. Packet tracer allows us to create network by just dragging and dropping devices and connection to specific port of the devices so that necessary configuration shall be performed on each device and test as per the requirement. Group of computers are connected to switch and are assigned IP addresses of same network in which each computer in the network are directly reachable.

Packet Tracer is a protocol simulator developed by Dennis Frezzo and his team at Cisco Systems. Packet Tracer (PT) is a powerful and dynamic tool that displays the various protocols used in networking, in either Real Time or Simulation mode. This includes layer 2 protocols such as Ethernet and PPP, layer 3 protocols such as IP, ICMP, and ARP, and layer 4 protocols such as TCP and UDP. Routing protocols can also be traced.

VIII a) Block Diagram

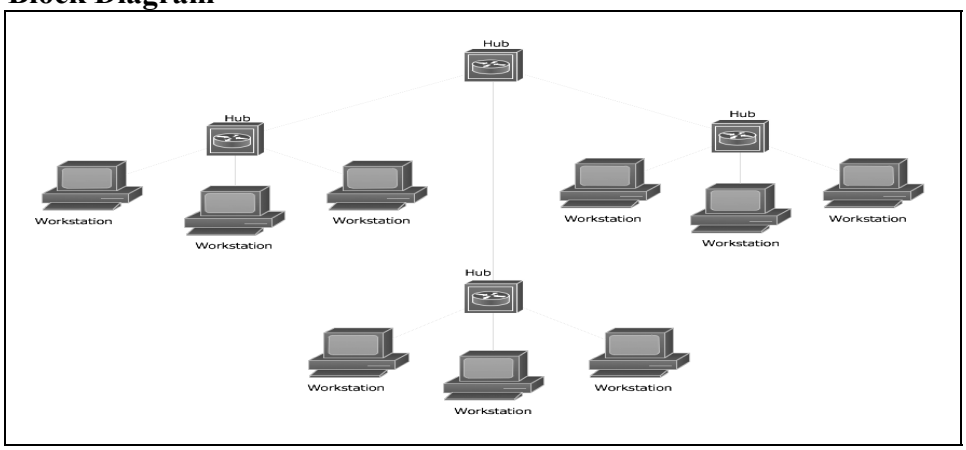

Fig 3.2: Typical topology network

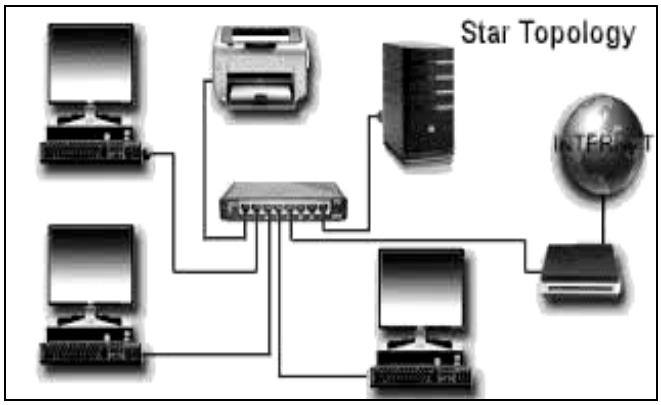

Fig 3.3 Star Topology physical connections

(b) Actual Network used in laboratory

IX Resources required

Sr. No.	Instrument /Components	Specification	Quantity
1.	Desktop computers	Computers in the lab	10
2.	Networking devices (Switch, Hub)	8, or 16 or 24 port switch	1 No. each
3.	Connecting Cables (CAT 5 0r CAT 6) and RJ 45 connectors	Unshielded twisted Pair cable, Network tool kit, RJ 45 Connectors	As per no. of PCs to be connected in LAN plus one for server
4.	Packet Tracer	Packet Tracer 5.1 or higher version (Optional)	

X Precautions to be Followed

- Handle computers with care.
- Use the network tools with care

XI Procedure

Physical formation of Star Topology

1. Power ON the computers that are to be connected in Star topology and confirm whether operating system is installed and NIC card is connected
2. Consider a central device such as a switch or hub for the above connection.
3. Take Ethernet cables and connect one end of the cable to port of the switch or hub and connect to computer's NIC port.
4. The lights of the switch or hub and computer's NIC port should turn on.
5. This is the physical formation of star topology.

To check the performance:

1. Check workgroup of computer under which all computers are connected to each other.
2. Assign IP Address to computer using TCP/IP configuration.
3. The computers should be connected to switch or Hub must come under same workgroup.
4. IP address of each computer must be unique.
5. Use ping command to check whether computers are connected in network.
6. Once whole network is formed, then go to network and check whether all computers are connected in network or not.

OR

Alternative procedure (Simulation based):

(Download link for CISCO Packet Tracer Version 6.1.1)-suggested

- https://agetintopc.com/cisco-packet-tracer-6-1-free-download

Star Topology can also be formed by using Cisco Packet Tracer

Step 1: Start Packet Tracer

Step 2: Choosing Devices and Connections

Build network topology by selecting devices and the media in which to connect them. Several types of devices and network connections can be used.
Single click on each group of devices and connections to display the various choices.

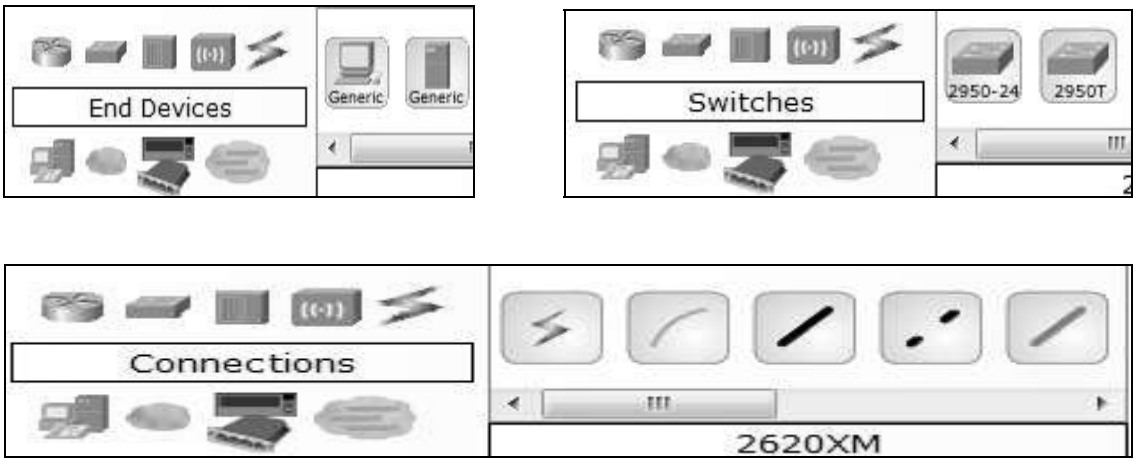

Fig. 3.4 Components in CISCO Packet Tracer Simulator

Step 3: Building the Topology –
Adding Hosts

- Single click on the **End Devices**.
- Single click on the **Generic** host.
- Move the cursor into topology area. Notice it turns into a plus "+" sign.
- Single click in the topology area and it copies the device.
- Add three more hosts.

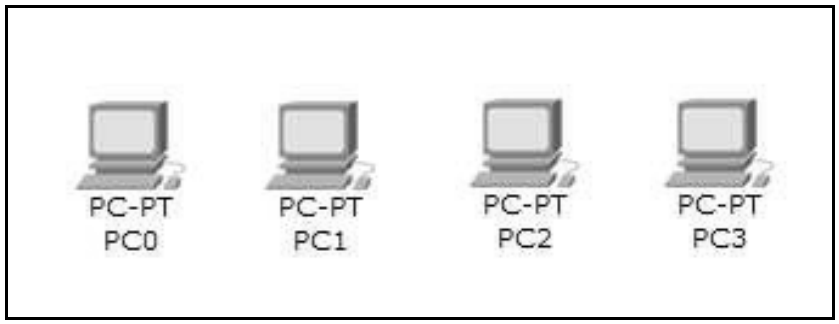

Fig. 3.5 Component (End Terminal/ PC) in CISCO Packet Tracer Simulator

Step 4: Building the Topology – Connecting the Hosts to Hubs and Switches
Adding a Switch

1. Select a switch, by clicking once on **Switches** and once on a **2950-24** switch.
2. Add the switch by moving the plus sign "+" below PC2 and PC3 and click once.
3. Connect PC2 to Hub0 by first choosing Connections.
4. Click once on the Copper Straight-through cable.

Perform the following steps to connect **PC2** to **Switch0**:

1. Click once on **PC2**
2. Choose **FastEthernet**
3. Drag the cursor to **Switch0**
4. Click once on **Switch0** and choose **FastEthernet0/1**

5. Notice the green link lights on **PC2** Ethernet NIC and amber light **Switch0 FastEthernet0/1 port**. The switch port is temporarily not forwarding frames, while it goes through the stages for the Spanning TreeProtocol (STP) process.
6. After about 30 seconds the amber light will change to green indicating that the port has entered the forwarding stage. Frames can now forwarded out the switch port.
7. Repeat the steps above for **PC3** connecting it to **Port 3** on **Switch0** on port **FastEtherent0/2**. (The actual switch port you choose does not matter.)
8. Move the cursor over the link light to view the port number. **Fa** means Fast Ethernet, 100 Mbps Ethernet.

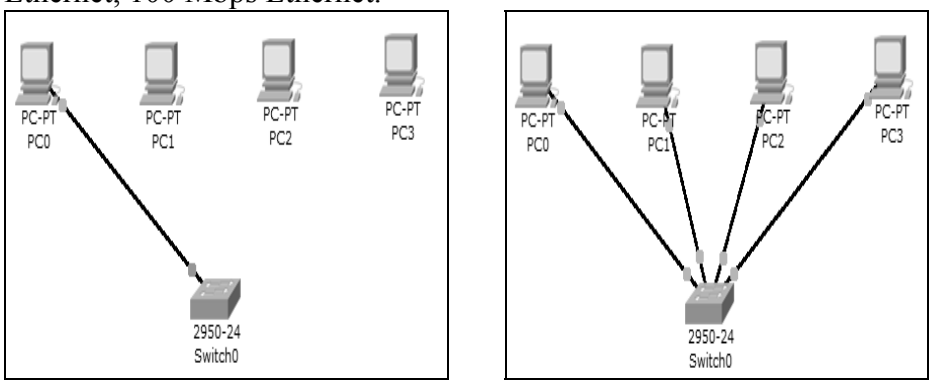

Fig 3.6: Connection between switch and PCs

Step 5: Connect and Configuring IP Addresses and Subnet Masks on the Hosts

Before we can communicate between the hosts we need to configure IP Addresses and Subnet Masks on the devices. Click once on PC0.

Choose the **Config** tab and click on **Settings**. It is here that name of PC0 can be changed.

Click on **Interface** and then **FastEthernet**. Add the IP Address to 172.16.1.10. Click once in the Subnet Mask field to enter the default Subnet Mask.

Also, notice this is where the Bandwidth (speed) and Duplex of the Ethernet NIC (Network Interface Card) can be changed. The default is Auto (auto-negotiation), which means the NIC will negotiate with the hub or switch. The bandwidth and/or duplex can be manually set by removing the check from the **Auto** box and choosing the specific option.

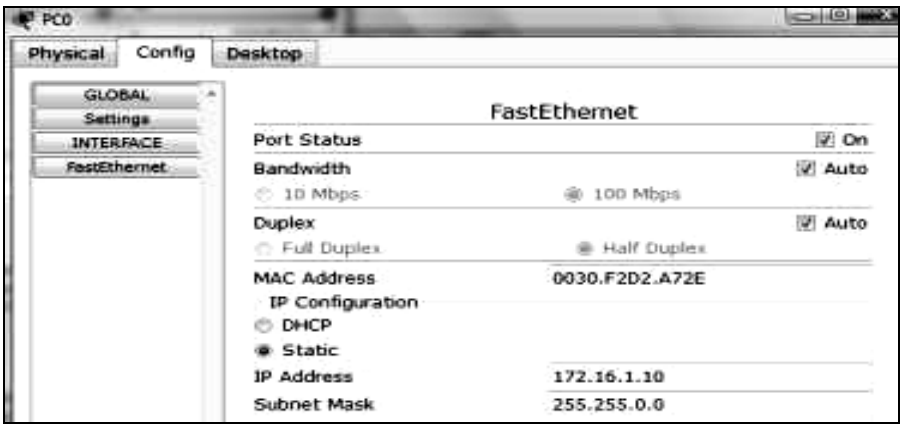

Fig. 3.7: Configuring PC0

To close this dialog box, click the "**X**" in the upper right.

Repeat these steps for the other hosts. Use the information below for IP Addresses and Subnet Masks.

Host IP Address Subnet Mask
PC0 172.16.1.10 255.255.0.0
PC1 172.16.1.11 255.255.0.0
PC2 172.16.1.12 255.255.0.0
PC3 172.16.1.13 255.255.0.0
Verify the information
To verify the information that you entered, move the Select tool (arrow) over each host.

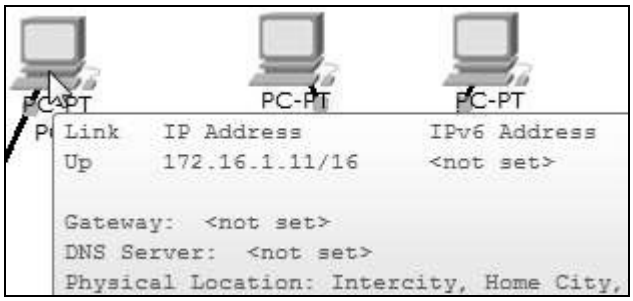

Fig. 3.8: Verification of information of PCs

Deleting a Device or Link
To delete a device or link, choose the **Delete** tool and click on the item you wish to delete.
Step **6: Verifying Connectivity in Real-time Mode**
Be sure you are in **Real-time** mode.
Select the **Add Simple PDU** tool used to ping devices..
Click once on PC0, then once on PC3.
The PDU **Last Status** should show as **Successful**.

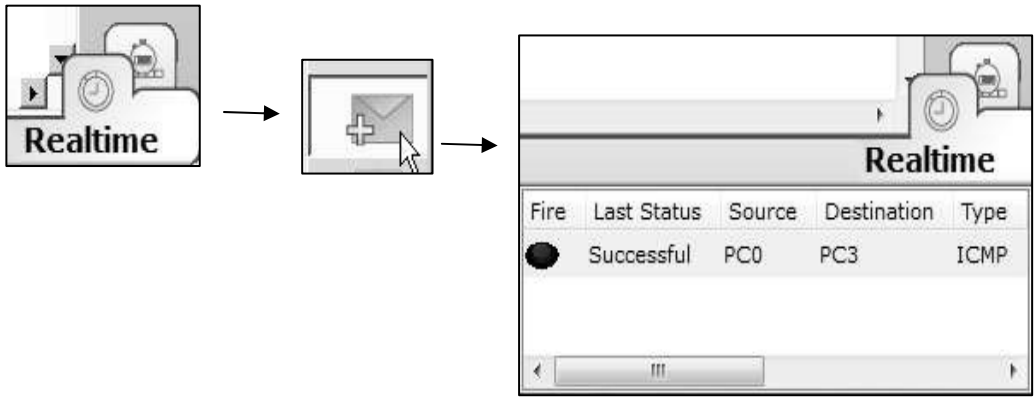

Fig. 3.9: Real-time mode

Resetting the Network
At this point we will want to reset the network, whenever you want to reset the network and begin the simulation again, perform the following tasks:
Click **Delete** in the PDU area.
Step 8: Verifying Connectivity in Simulation Mode
Be in **Simulation** mode.
Deselect all filters (All/None) and select only **ICMP**.
Select the **Add Simple PDU** tool used to ping devices..
Click once on PC0, then once on PC3.

Continue clicking **Capture/Forward** button until the ICMP ping is completed. The ICMP messages move between the hosts, hub and switch. The PDU **Last Status** shows as **Successful**.

XII Resources used

Sr. No.	Instrument /Components	Specification	Quantity
1.			
2.			
3.			

XIII Actual procedure followed (use blank sheet provided if space not sufficient)

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XIV Precautions followed (use blank sheet provided if space not sufficient)

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XV Observations (use blank sheet provided if space not sufficient)

Name of Computer	
MAC address	
IP Address	
Name of Workgroup	
Port number of switch/ hub where one end of the computer's NIC port is connected	
Total number of computers connected in Star topology	

XVI Result

The number of Patch Cables required to connect 4 computers in Star topology is ……

The arrangement of components in above network topology is done in (physical/ Logical) ……..

XVII Interpretation of Results

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XVIII Conclusions and Recommendations (Actions/decisions to be taken based on the interpretation of results).

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XIX Practical Related Questions

Note: Below given are few sample questions for reference. Teacher must design more such questions so as to ensure the achievement of identified CO.

1. Give the method to check whether the physical formation of star topology is completed or not?
2. State the difference between Hub and Switch
3. State the number of ports in the switch/ Hub that is used in the lab

[Space for Answers]

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XX References / Suggestions for further Reading

1. https://www.youtube.com/watch?v=EQ3rW22-Py0
2. https://www.youtube.com/watch?v=6ogqMji-_NA
3. https://www.youtube.com/watch?v=5b5d0CJed1k
4. https://youtu.be/vjbfw5TG4JA

XXI Assessment Scheme

Performance indicators		Weightage
Process related: (15 Marks)		**60%**
1	Proper handling of the equipment	20%
2	Identifying the various Network components	20%
3	Identifying the various ports of computer	20%
Product related: (10 Marks)		**40%**
4	Results	20%
5	Practical related questions	10%
6	Submission of report in time	10%
	Total (25 Marks)	**100 %**

Name of Team Members

1. ……..
2. ……..
3. ……..
4. ……..

Marks Obtained			Dated signature of Teacher
Process Related (15)	**Product Related (10)**	**Total (25)**	

Practical No.4: Install/configure/Test Peer to Peer LAN and sharing of resources.

I Practical Significance

Peer to Peer networks are used to connect two or more computers together to share data and resources. Peer to peer computer network model uses the same Workgroup for all the computers and a unique name for each computer in a computer network. There is no master or controller or central server in this computer network and computers join hands to share files, printers and Internet access. Software for peer-to-peer network is included with most modern desktop operating systems such as Windows and Mac OS. Peer to peer relationship is suitable for small networks having less than 10 computers on a single LAN. The student will be able to configure computers in peer to peer network also share data and printer.

II Relevant Program Outcomes (POs)

- **Discipline knowledge**: Apply Electronics and Telecommunication engineering knowledge to solve broad-based Electronics and Telecommunications engineering related problems.
- **Experiments and practice:** Plan to perform experiments and practices to use the results to solve broad-based Electronics and Telecommunication engineering problems.
- **Individual and team work:** Function effectively as a leader and team member in diverse/ multidisciplinary teams.

III Competency and Practical skills

This practical is expected to develop the following skills for the industry identified competency

Maintain Computer Network systems

- Configure peer to peer LAN.
- Share resources using peer to peer.

IV Relevant Course Outcome

Maintain wired computer network topologies.
Use the relevant network model for the specified data communication system.

V Practical Outcome

Install/configure/Test Peer to Peer LAN and sharing of resources.

VI Relevant Affective domain related Outcome(s)

- Work in team
- Handle equipment carefully.
- Follow safety practices.

VII Minimum Theoretical Background

A peer to peer network is a type of decentralized and distributed network architecture in which the individual nodes (computers, printers) act in the networks act as both suppliers and consumers of resources. It differs from the client server networking model where certain devices have the responsibility of providing all serving data and other devices consumes or act as a client. Computers in peer to peer network run the

same networking protocol and software. These networks are usually situated physically close to each other. P2P networks are robust. If one attached device goes down, the network continues. It is possible to configure computers in peer-to-peer workgroups to allow sharing of files, printers, and other resources across all the devices. Peer networks allow data to be shared easily in both directions, whether for downloads to a computer or uploads from the same computer. Since each device participates in routing traffic through the network, hackers can easily launch denial of service attacks. P2P software acts as server and client, which makes peer-to-peer networks more vulnerable to remote attacks than client-server networks. Data that is corrupt can be shared on P2P networks by modifying files that are already on the network to introduce malicious code.

VIII a) Block Diagram

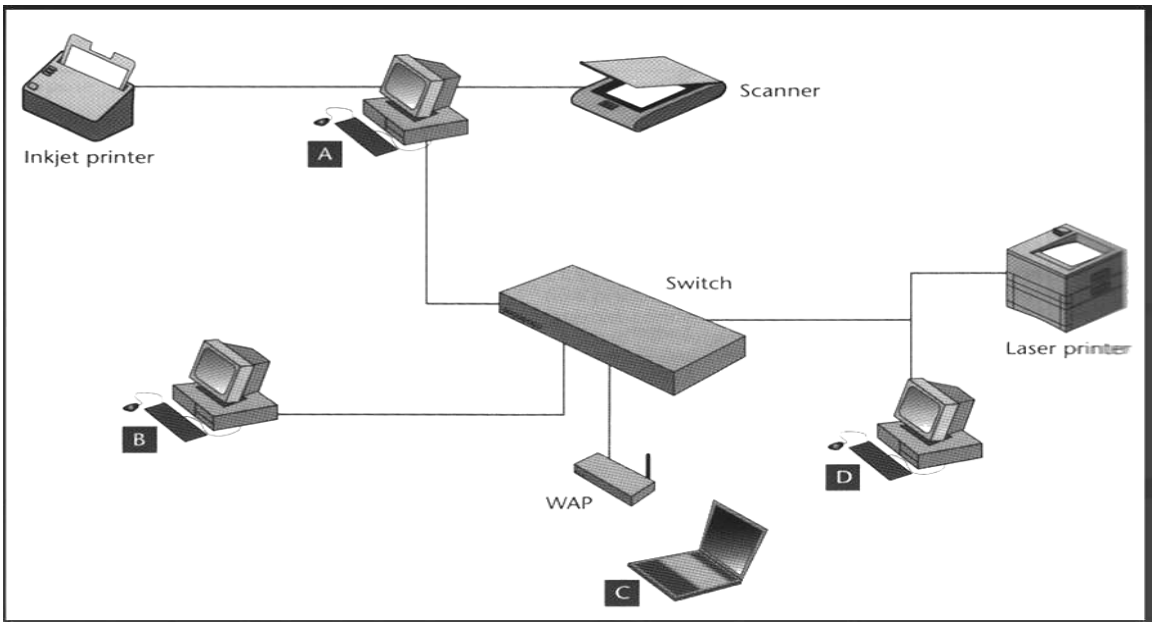

Fig 4.1: Peer to Peer Network

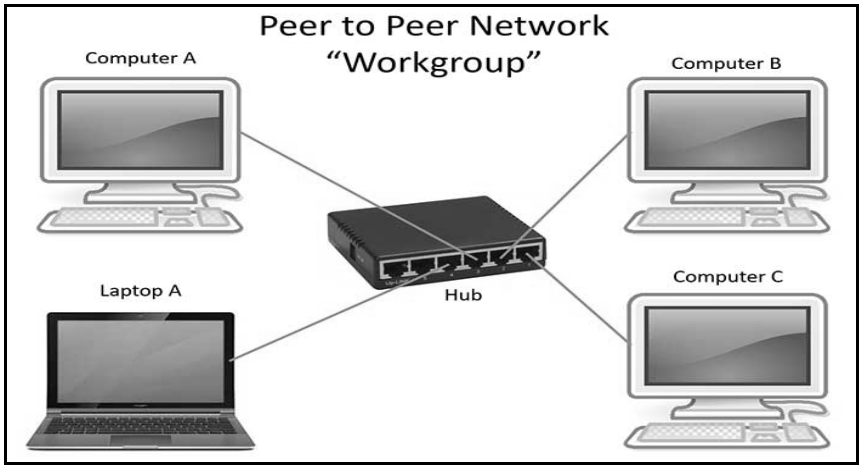

Fig 4.2: Block diagram showing Peer to peer network

(b) Actual Network used in laboratory

IX Resources required

Sr. No.	Instrument /Components	Specification	Quantity
1.	Personal computers	Standard computers with NIC card	2
2.	Connecting Cables and connectors	UTP CAT5 Cable (crossover cable) with RJ-45 connectors	4

X Precautions to be Followed

- Locate the various ports on the computer before making connections
- Make the connections with care
- Handle equipment with care
- Configure settings carefully to avoid conflict.

XI Procedure

1. The two computers are connected to each other using UTP cables as shown in the block schematic.
2. Name the two computers as Computer-A & Computer-B

- Check the computer name settings for each PC and make adjustments as necessary. For each Computer/PC, select **Start** and **Control Panel.**
- Double-click the **System** icon, and then click the **Computer Name** tab.
- Write the name of the computers as Compute-A, Computer-B on respective machines

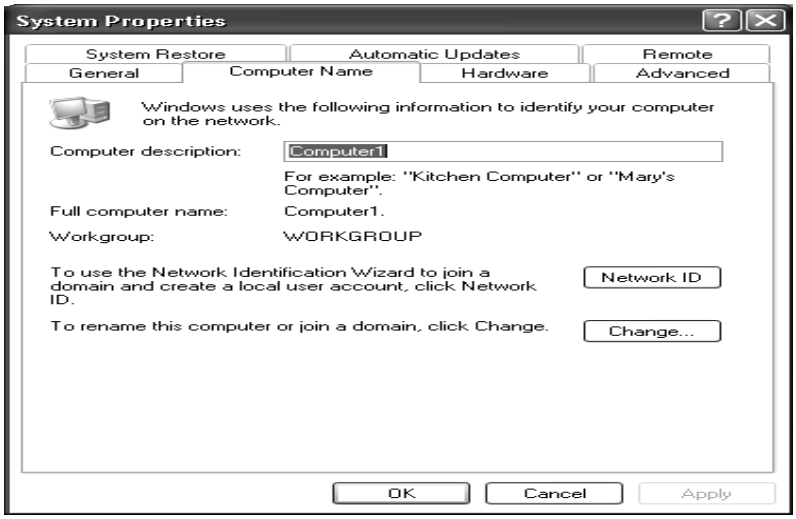

Fig.4.3: System Properties Window

- Click **OK** to close the **System Properties** window.

3. Connect the Ethernet cable

- Use the Ethernet crossover cable provided. Plug one end of the cable into the Ethernet NIC of Compute-A. Plug the other end of the cable into the Ethernet NIC of Compute-B.

4. Verify physical connectivity

- After the Ethernet crossover cable is connected to both PCs, take a close look at each Ethernet port. A light (usually green or amber) indicates that physical connectivity has been established between the two NICs. Try unplugging the cable from one PC then reconnecting it to verify that the light goes off then back on.
- Go to the **Control Panel**, double click the **Network Connections** icon, and confirm that the local area connection is established. The following figure shows an active local area connection. If physical connectivity problems exist, you will see a red **X** over the Local Area Connection icon with the words "**Network cable unplugged**."

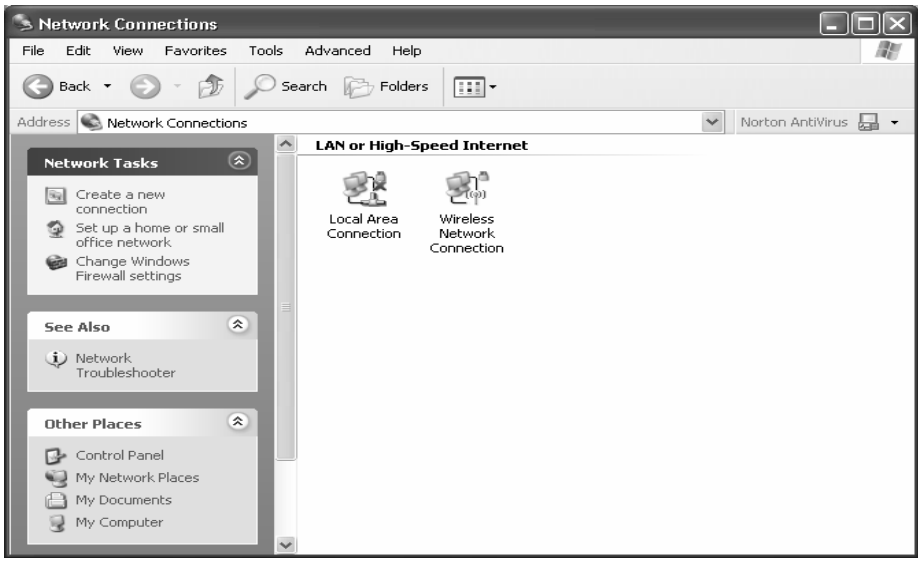

Fig.4.4: Network Connection Window

5. Configure IP settings

- Configure the logical addresses for the two PCs so that they are able to communicate using TCP/IP. On one of the PCs, go to the Control Panel, double click the Network Connections icon, and then right click the connected Local Area Connection icon. Choose Properties from the pull-down menu.
- Using the scroll bar in the **Local Area Connection Properties** window, scroll down to highlight

Internet Protocol (TCP/IP). Click the **Properties** button.

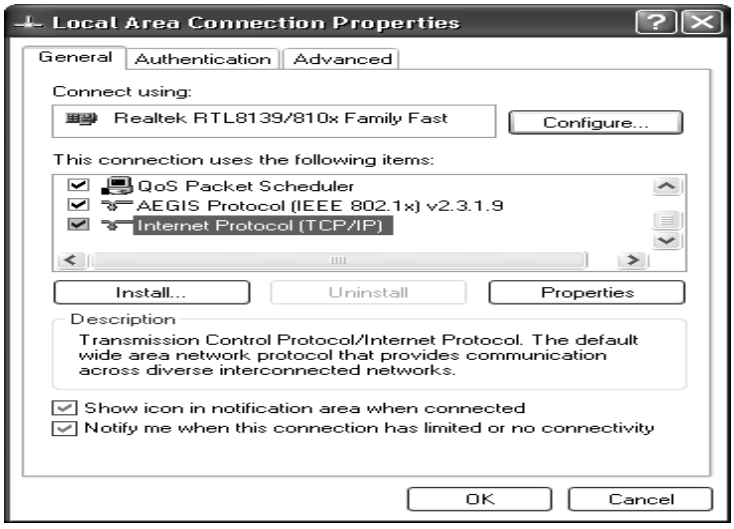

Fig.4.5: Local Area Connection Properties Window

- Select the **Use the following IP address** radio button and enter the following information:

Change the properties of the TCP/IP v4 connection as follows

For Computer-A:	
IP Address	192. 168.1.1 (Based on the allocation of IP address)
Subnet Mask	255.255.255.0

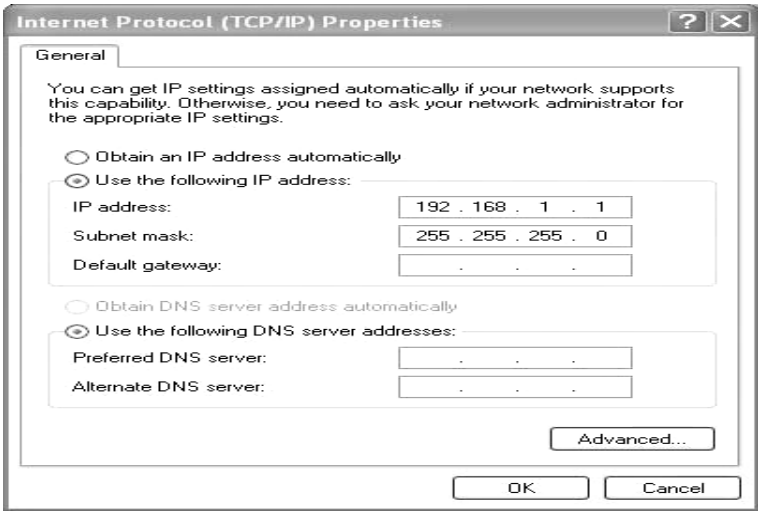

Fig.4.6: Internet Protocol Properties Window

- Click **OK**, which will close the **Internet Protocol (TCP/IP) Properties** window. Click the **Close** button to exit the **Local Area Connection Properties** window.
- Repeat steps 5 for the second PC using the following information:

For **Computer-B:**	
IP Address	192. 168.1.2 (Based on the allocation of IP address)
Subnet Mask	255.255.255.0

Step 6: Verify IP connectivity between the two PCs

NOTE: To test TCP/IP connectivity between the PCs, Windows Firewall must be disabled temporarily on both PCs.

- On Compute-A, on the Windows desktop, click **Start**. From the Start menu, select **Control Panel**, and double-click **Network Connections**.
- Right-click the Local Area Connection icon and select **Properties**. Click the **Advanced** tab. Locate and click the **Settings** button.
- The **ping** command is a simple way to accomplish this task. The **ping** command is included with the Windows operating system.
- On Compute-A, go to **Start**, then **Run**. Type **cmd**, and then click **OK**. A Windows command prompt window will appear as shown in the figure below.

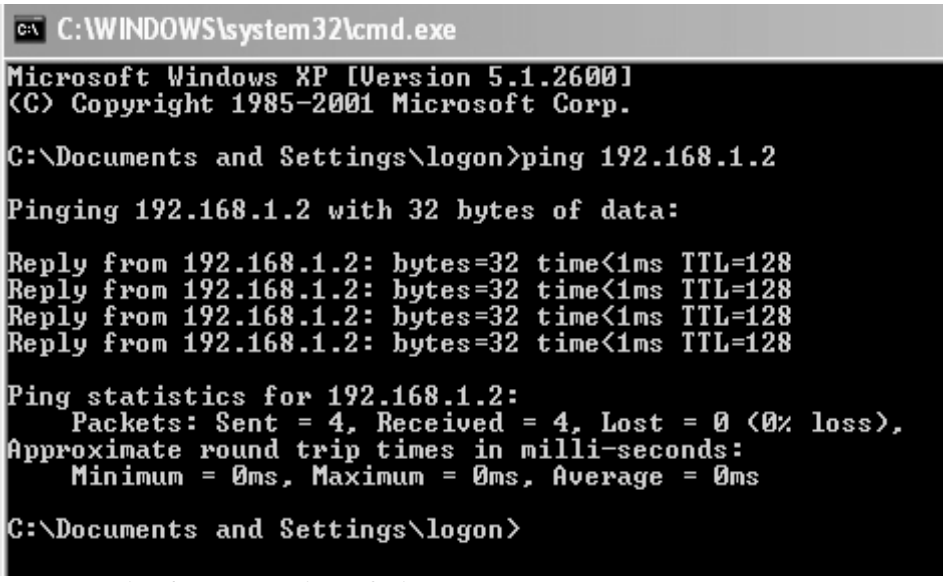

Fig. 4.7: Execution of Ping command at command prompt

- At the > prompt, type **ping** 192. 168.1.2 and press **Enter**. A successful **ping** will verify the IP connectivity. It should produce results similar to those shown
- Repeat Steps 6 on Compute-B. The second PC will **ping** 192. 168.1.1
- Close the Windows command prompt window on both PCs.

Step 7: Verify connectivity using My Network Places

- A PC can share its resources with other PCs on the network. PCs with shared resources should be visible through **My Network Places**. On PC1, go to **Start**, click **My Network Places**, and then click **View workgroup computers** in the left panel. Close any open window.

- Share file between Computer-A and Computer-B and confirm the data transfer among the computers.
- Share printer between both computers and try to get access of printer.

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XII Resources used

Sr. No.	Instrument /Components	Specification	Quantity
1.			
2.			

XIII Actual procedure followed

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XIV Precautions followed (use blank sheet provided if space not sufficient)

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XV Observations (use blank sheet provided if space not sufficient):

Make the following observations after step 7

a. Check the icon for the other PC in given peer-to-peer network
b. Is it the same name of computer you recorded in Step 2?

   _____

c. Perform Step 7 on the second PC.

XVI Result

1. The packets/file sent by…….. are received by the Computer-B
2. Folders can be shared from Computer-B to ……..
3. It is possible to share Printers, scanners, connected to Computer-A by……..

XVII Interpretation of Results

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XVIII Conclusions and Recommendations

(Actions/decisions to be taken based on the interpretation of results).

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XIX Practical Related Questions

Note: Below given are few sample questions for reference. Teacher must design more such questions so as to ensure the achievement of identified CO.

State the actual IP settings of computers used in the lab.

1. State the steps to add one more computer to the peer to peer network formed
2. State the advantages of the peer to peer model in comparison to the client server model.
3. Name type of networks shown in fig 4.8 and fig 4.9 following diagram:

Fig 4.8

Fig 4.9

[Space for Answers]

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XX References / Suggestions for further Reading

1. https://youtu.be/yJZ-iKOBOuw
2. https://youtu.be/7W5QXyl8FFc
3. https://youtu.be/hthfdP_lSWI

XXI Assessment Scheme

Performance indicators		Weightage
Process related: (15 Marks)		**60%**
1	Proper handling of the equipment and making proper connections	20%
2	Use of various commands	20%
3	Assigning proper IP addresses	20%
Product related: (10 Marks)		**40%**
4	Results	20%
5	Practical related questions	10%
6	Submission of report in time	10%
	Total (25 Marks)	**100 %**

Name of Team Members

1. ……..
2. ……..
3. ……..
4. ……..

Marks Obtained			Dated signature of Teacher
Process Related (15)	**Product Related (10)**	**Total (25)**	

Practical No.5: Configure Point to Point network in laboratory.

I Practical Significance

In telecommunications, a point-to-point connection refers to a communications connection between two communication endpoints or nodes. An example is a telephone call, in which one telephone is connected with another, and what is said by one caller can only be heard by the other. This is contrasted with a point-to-multipoint or broadcast connection, in which many nodes can receive information transmitted by one node. Other examples of point-to-point communications links are leased lines, microwave radio relay and two-way radio.

Point-to-Point (PPP) protocol is useful in the WAN. PPP is configured with its options like quality and load balancing on numerous links; PPP is also configured in authentication and concluded with verification and troubleshooting of PPP.

The student will be able to connect computers in point to point network and configure.

II Relevant Program Outcomes (POs)

- **Discipline knowledge**: Apply Electronics and Telecommunication engineering knowledge to solve broad-based Electronics and Telecommunications engineering related problems.
- **Experiments and practice:** Plan to perform experiments and practices to use the results to solve broad-based Electronics and Telecommunication engineering problems.
- **Individual and team work:** Function effectively as a leader and team member in diverse/ multidisciplinary teams.

III Competency and Practical skills

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences**:**

Maintain computer network systems.

Able to Configure and test point to point connectivity in network.

IV Relevant Course Outcome

Maintain wired computer network topologies.

Use the relevant network model for the specified data communication system.

V Practical Outcome

Configure Point to Point network in laboratory**.**

VI Relevant Affective domain related Outcomes

- Demonstrate working as a leader/a team member. .
- Follow ethical practices.
- Handle equipment carefully.
- Follow safety practices.

VII Minimum Theoretical Background

PPP is used in computer networking and computer architecture refer to a wire or any other connection that links only two computers or circuits, as opposed to

other network topologies such as buses or crossbar switches which can connect many communications devices.
Point-to-point (telecommunications) PPP provides router-to-router and host-to-network connections over both synchronous and asynchronous circuits

- **Asynchronous Transmission:**
  1. Transmitting & Receiving devices maintain their own internal clocks. They do not synchronize their clocks.
  2. Each frame is sent separately.
  3. Each frame begins with a start bit & ends with a stop bit. A extra bit called parity bit maybe added for error detection

- **Synchronous Transmission:**
  1. Transmitting device provides clocking
  2. May use separate channel that is dedicated to the clock
  3. Resists timing errors better than Asynchronous because the transmitter & receiver use the same clock Can transmit large blocks of data

PPP Layer Function: In order to move data between any two nodes or routers, a data path must be established, and flow control procedures must be in place to ensure delivery of data. This is also true in the WAN environment and is accomplished by using WAN protocols such as Point-to-Point Protocol

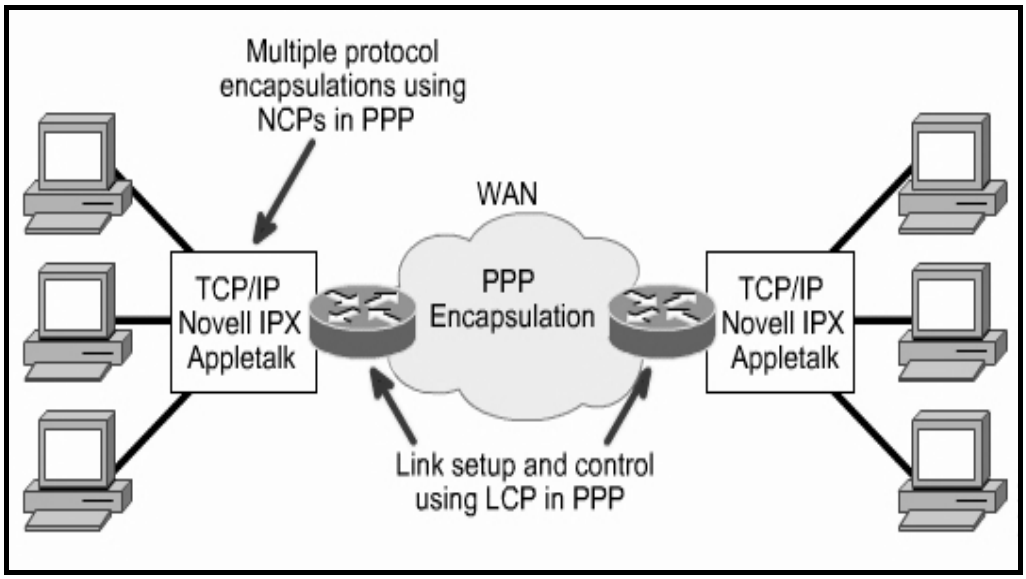

Fig.5.1: PPP Encapsulation

Functions of PPP:

- Control of data link setup
- Provides for dynamic assignment of IP addresses
- Network protocol multiplexing
- Link configuration and link quality testing
- Error detection
- Negotiation options for capabilities such as network-layer address negotiation and data compression negotiations

PPP Components

1. Encapsulating datagrams over serial links. (Point-to-point links)
2. A Link Control Protocol (LCP) for establishing, configuring, and testing the data-link connection.
3. A family of Network Control Protocols (NCPs) for establishing and configuring different network-layer protocols. (TCP/IP, IPX AND APPLETALK

VIII a) Block /Connection Diagram

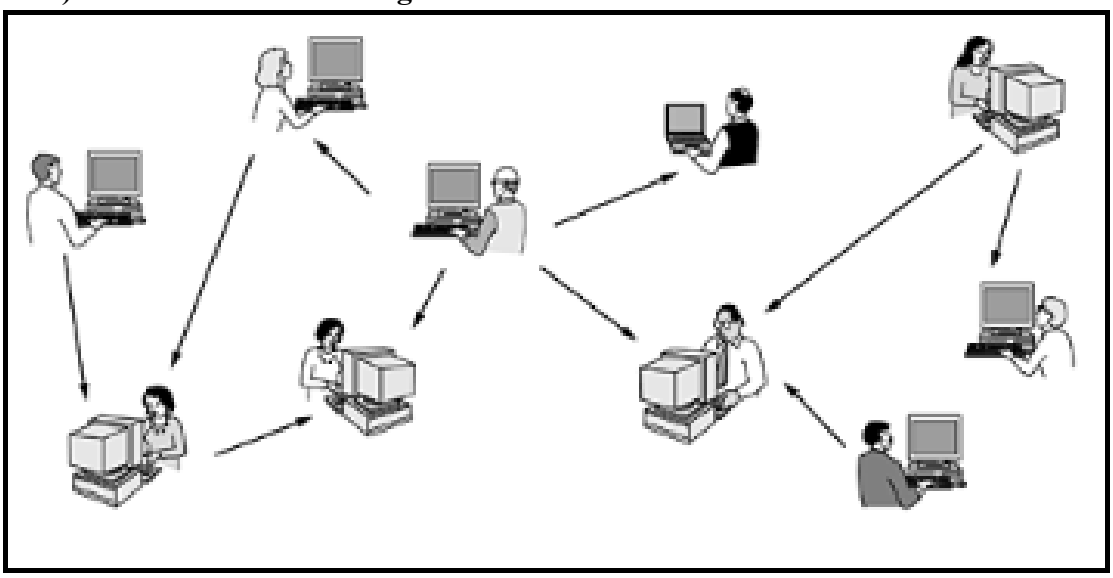

Fig. 5.2: Point to Point system Connection

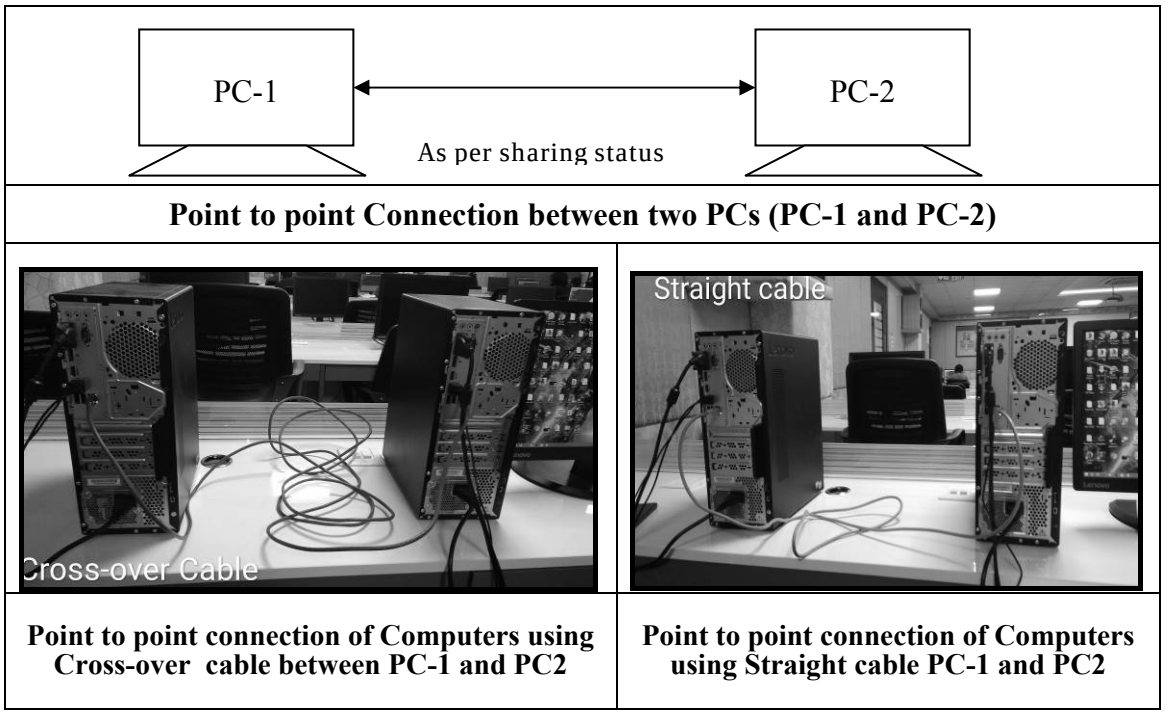

Fig. 5.3: Activities for PPP

(b) Actual Circuit used in laboratory

IX Resources required

Sr. No.	Instrument /Components	Specification	Quantity
1.	Personal computer with basic configuration	Windows 7 onwards..	Minimum 2
2.	Network cable (Straight)	CAT-5/CAT-6 (minimum 1 meter length with RJ-45 connectors on both ends	1
3.	Network cable (Cross-Over)	CAT-5/CAT-6 (minimum 1 meter length with RJ-45 connectors on both ends	1

X Precautions to be Followed

- Cables shall be properly crimped to avoid error and trouble in establishing connection.
- Check physical connection and settings of IP addresses of networking before starting the troubleshooting and using in network.

XI Procedure

Procedure for point to point (PPP) connection of two computers using Cross cable:

1. Get one LAN cable (CAT-5/CAT6) having standard colour coding having RJ-45 connectors at both the ends
2. Connect two personal computers (PC) using this cable at network patch cord socket on back panel of PC.
3. Switch ON both PCs. (PC-1 and PC-2)

For PC-1

1. Go to start Menu--- Setting in windows -- Network /Internet options and click on Change adaptor Option.
2. Select Ethernet – make it enabled Then right-click on the ICON and select Properties.
3. Then in that select (Double click) on IPV4 (TCP/IP) and click on Properties

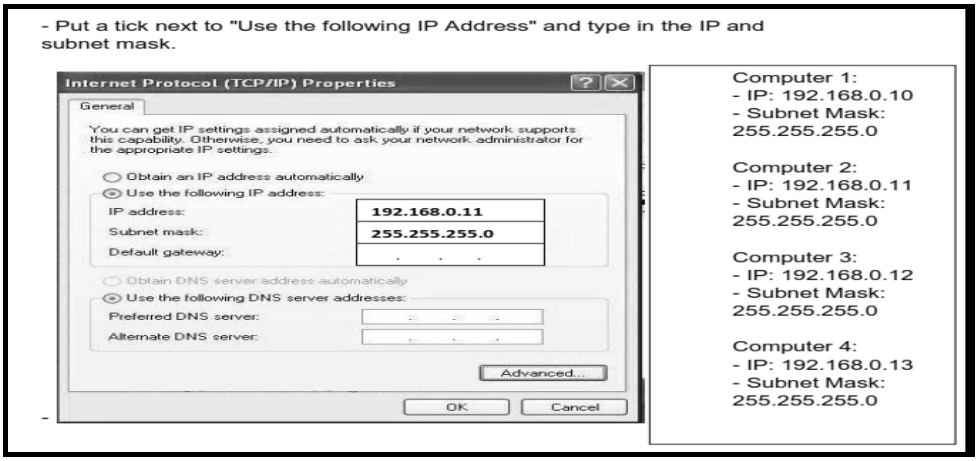

Fig.5.4: Internet Protocol (TCP/IP) P:roperties - setting IP address.

4. Automatic setting of IP:
5. Use Manual IP Address:
   (Student may select PC IP address of their choice as per available IP addresses**)**
   Remove all other options Or set following sample addresses as follows.
   i.e.

IP address	**192.168.10.71**
Subnet Mask	**255.255.255.0**
Default Gateway	**192.168.10.1 of Router.**

Now share one document or folder from Desktop of PC-1.

1. Select one document from desktop of PC-1
2. Select File/Folder go to share option.
3. Set/ use Give access to option then right click on file/folder and select specific people------select Everyone and press ADD button.
4. That IP is available.
5. We can change permission levels as (Read--Read/Write—Remove)
6. Now press Share.
7. Click on Next.
8. Do you want to Turn on network discovery & file . Show for all public network.
9. Select YES to SHARE.
   And NO to restrict.
   That will appear the document in the new list.
10. Press DONE.

Establish similar setting in PC-2 also. Need to confirm changes reflected for PC-2

1. Now go to PC-2.
2. It will ask for User Id and Password.
3. Now select PC-1 and go to Control panel and select Network and Internet
4. Then select Network sharing Center – HomeGroup / Home/ Workgroup..
5. Select Advance Sharing Setting option.(for Windows-7 Select Public folder share Turn ON sharing of EVERYONE -(For Windows-7 select Read-Write)
6. Turn off password prefetched setting
7. Then SAVE changes
8. Now PC-1 will get Access of the PC-2 now.

To check connectivity of PC-1 and PC-2. By using PING command.
At Run command prompt in start menu.

On command prompt: Give the following command
C:\ PING 192.168.10.71
Or \\ 192.168.10.71
User shows USER and DESKTOP .By double clicking on file

Alternative procedure to understand Point to Point configuration
Using CISCO Packet Tracer-Version 5 onwards (Freeware). OPTIONAL

1. After downloading and installing the setup file automatically opens on PC.
2. Icon appeared /launched on desktop.

Procedure to create connection of different computer network topologies using Cisco Packet Tracer.

1. After opening Cisco Packet Tracer we obtain network component menu such as Switch, routers, hubs, wireless devices, connections END devices like PC security components etc.
2. Now start creating actual networking of components and specification.

Network-1: Peer to Peer connection using two computers.

1. Select/drop Two PCs / END devices connect.
2. Draw connection between these two PCs using connector.
3. Select PC-1 , double-click on it IPV4 setting appears on screen.
4. Set IP address(i.e. 192.168.10.2)
5. Select PC-2 , double-click on it IPV4 setting appears on screen.
6. Set its different IP address. (i.e. 192.168.10.3) Take care that the IP address shall be from same range only.

To Test the connectivity of network(using CISCO) on screen

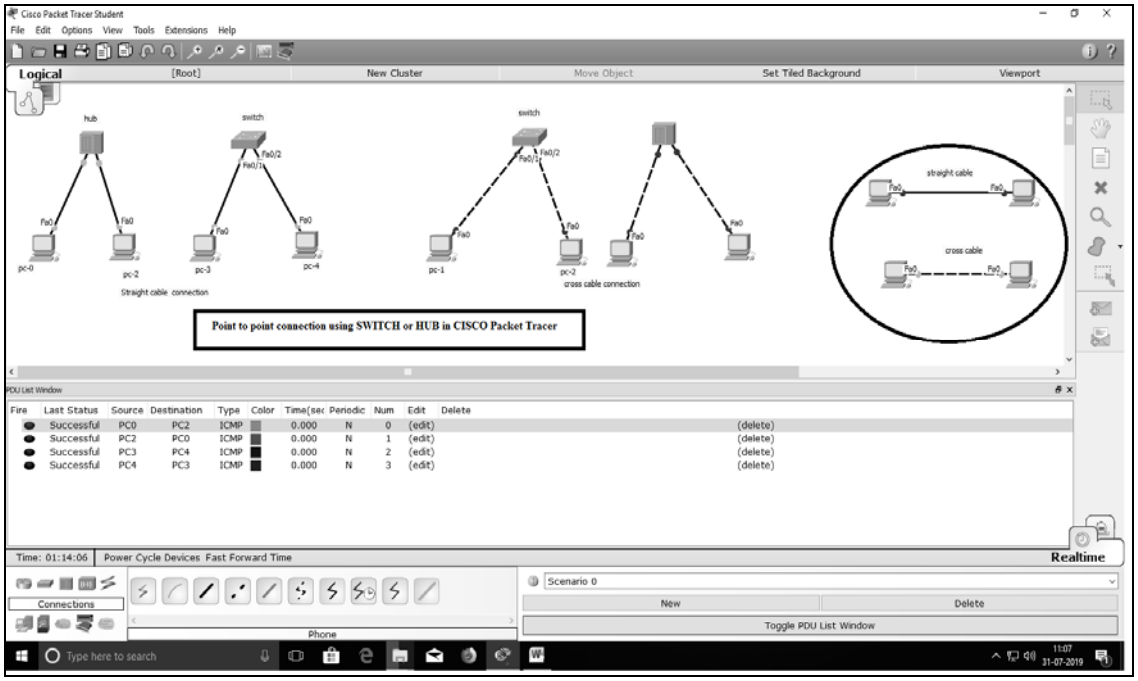

Fig.5.5: Diagram of Pont to point connection using CISCO Packet Tracer
(It indicates links as RED when NO connection or and GREEN when Connection established)

XII Resources used

Sr. No.	Instrument /Components	Specification	Quantity
1.			
2.			
3.			

XIII Actual procedure followed

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XIV Precautions followed (use blank sheet provided if space not sufficient)

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XV Observations (use blank sheet provided if space not sufficient)

1. Both PCs PC-1 and PC2 shall be switched ON /OFF before configuring.
2. Test cable before establishing connection green colour LED glows on Back panel or on Laptop.
3. Check sharing setting of PCs before sharing files/folder.

XVI Result

1. The File share from PC-1: ……...
2. The File available at PC-2: ……..
3. Whether Packet sent from PC-1 to PC-2? : ……
4. Whether Packet reached to PC-2? (Yes/No): ……..
5. Networking Verified (Yes/No): ……...

XVII Interpretation of Results

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XVIII Conclusions and Recommendations (Actions/decisions to be taken based on the interpretation of results).

Different ports available in PC :

1. Back panel…….
2. Front Panel……..……..

XIX Practical Related Questions

Note: Below given are few sample questions for reference. Teacher must design more such questions so as to ensure the achievement of identified CO.

Teacher shall allocate (Q.___ ,Q.____, Q.____, Q._____) to students.

1. State three parameters used in point to point operation.
2. Write steps to configure PCs IP address of PC-1.
3. Record specifications of network components used in point to point connection
4. Given probable reasons if point to point connection may establish between PC-1 and PC-2.
5. Record observations if cross-over cable is replaced with straight cable?

.[Space for Answers]

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XX References / Suggestions for further Reading

1. http://ecomputernotes.com/computernetworkingnotes/switching/point-to-point-protocol As on 28 July 2019
2. http://ecomputernotes.com/computernetworkingnotes/switching/ppp-phases as on 28 July 2019

XXI Assessment Scheme

Performance indicators		Weightage
Process related: (15 Marks)		**60%**
1	Proper handling of the network components	20%
2	Identifying and rectifying the various errors in connection.	20%
3	Configuring network as per PPP need.	20%
Product related: (10 Marks)		**40%**
4	Results	20%
5	Practical related questions	10%
6	Submission of report in time	10%
	Total (25 Marks)	**100 %**

Name of Team Members

1. ……..
2. ……..
3. ……..
4. ……..

Marks Obtained			Dated signature of Teacher
Process Related (15)	**Product Related (10)**	**Total (25)**	

Practical No.6: Prepare patch cord and cross connection cables, use to connect the devices on the LAN.

I Practical Significance

Transmission media is a medium over which information travels from the sender to receiver. Different media have different properties and used in different environments for different purpose. The purpose of physical layer is to transport a raw bit stream from one computer to other.Ethernet cables can be wired as straight through or crossover. The straight through is the most common type and is used to connect computers to hubs or switches. Patch cords are the short lengths of modular, plug-ended cable that connect personal computers to wall outlets and cross-connects to hubs.

The practical will enable students to prepare patch chords (Straight and crossover).

II Relevant Program Outcomes (POs)

- **Discipline knowledge**: Apply Electronics and Telecommunication engineering knowledge to solve broad-based Electronics and Telecommunications engineering related problems.
- **Experiments and practice:** Plan to perform experiments and practices to use the results to solve broad-based Electronics and Telecommunication engineering problems.
- **Engineering tools:** Apply relevant Electronics and Telecommunications technologies and tools with an understanding of the limitations
- **Individual and team work:** Function effectively as a leader and team member in diverse/ multidisciplinary teams.

III Competency and Practical skills

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences**:**

Maintain computer network systems.

Able to prepare patch chords useful for computer networking

Establish network connectivity and troubleshoot fault in computer networking.

IV Relevant Course Outcome

Maintain relevant transmission medium and modem for data transmission**.**

V Practical Outcome

Prepare patch cord and cross connection cables, use to connect the devices on the LAN.

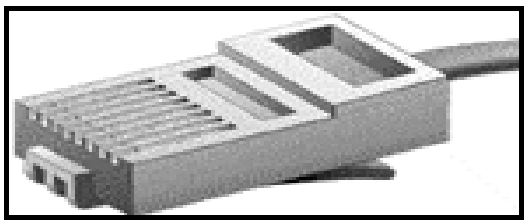
VI Relevant Affective domain related Outcomes

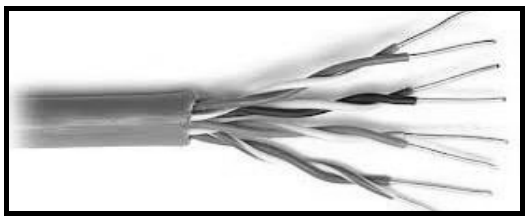
- Demonstrate working as a leader/a team member. .
- Follow ethical practices.
- Handle equipment carefully.
- Follow safety practices.

VII Minimum Theoretical Background

Cables and Connectors:

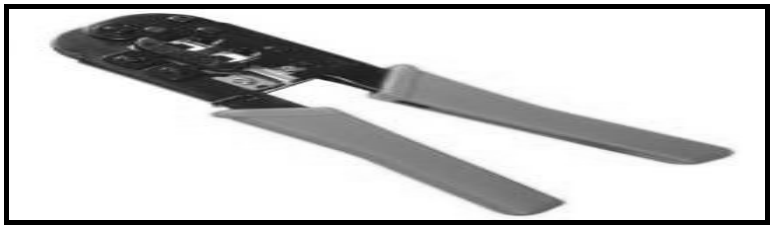
- **Cable** is one way of transmission media which can transmit communication signals and data. The wired network typology uses special type of cable to connect computers on a network.
  There are several types of cables as below:
  Unshielded Twisted Pair (UTP) Cable
  - ✓ Shielded Twisted Pair (STP) Cable
  - ✓ Coaxial Cable
  - ✓ Fiber Optic Cable
- **Shielded Twisted Pair Cable (STP)** Shielded twisted pair cable has a metal foil or braided-mesh covering that encases each pair of insulated conductors. The metal casing prevents the penetration of electromagnetic noise.





Cables and Connectors (RJ = Registered Jack)
(RJ-45 Connector = Category-5 (CAT5) Connector 8 position 8 Contact Connector (8 Pin)) RJ – 45 connectors are used for networking.

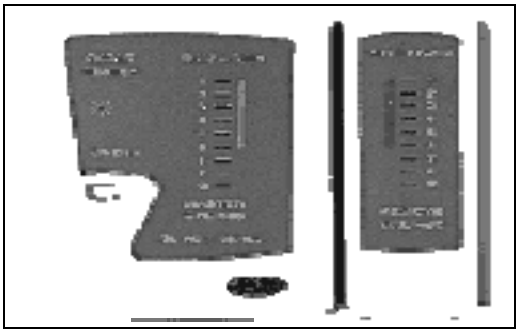
Fig.6.1: RJ connector and Cable



Crimping Tool: A crimping (Mean /Type / Method / type of solder less connection) tool is a tool designed to crimp or connect a connector to the end of a cable in a specific way.

Fig.6.2: Crimping Tool

- **LAN Tester: Testers** helps / assist in the installation and control of networks. LAN testers can determine IP addresses; identify polarity, connected port and link connectivity. Even they can test fiber optic cables. They also show cable break points, incorrect connections in fiber optic lines.



- Network Cable / LAN Tester for RJ-12, RJ-11, RJ-45, Cat 5e, Cat 5, Cat 6, 10/100 Base-T, AT&T 258 A, TIA-568A/568B etc.
- Test correspondingly double-twisted cables 1, 2, 3, 4, 5, 6, 7, 8 and Ground.
- 9 LED lights to indicated wiring connection on both remote and master unit Grounding Test.
- Easy read LED display which indicates problems. Power: 9V battery (Battery not Included)
- Keep network running smoothly by testing wrong connection, short circuit and open circuit
- Suitable for network cable with RJ-45 connector and ADSL cable with RJ-11 connect
- Suitable for cat-5 and cat5e cable with 8p8c, 6p6c and 4p4c plugs
- For network installations up to 100 mbps 10base-t Ethernet and token ring
- Battery included

Fig. 6.3: LAN / Network cable Tester

- **Essential Components for Computer Networking:**
  i. Network Interface Card (NIC)
  ii. Hub
  iii. Switches
  iv. Cables and connectors
  v. Crimping Tool
  vi. LAN tester
  vii. Router
  viii. Modem
  ix. Bridge

Use straight through Ethernet cable for the following cabling:

- Switch to router
- Switch to PC or server
- Hub to PC or server

Use crossover cables for the following cabling:

- Switch to switch
- Switch to hub
- Hub to hub
- Router to router
- Router Ethernet port to PC NIC
- PC to PC

VIII a) Ethernet Cable Color Coding Diagram for Straight and Crossover cables:

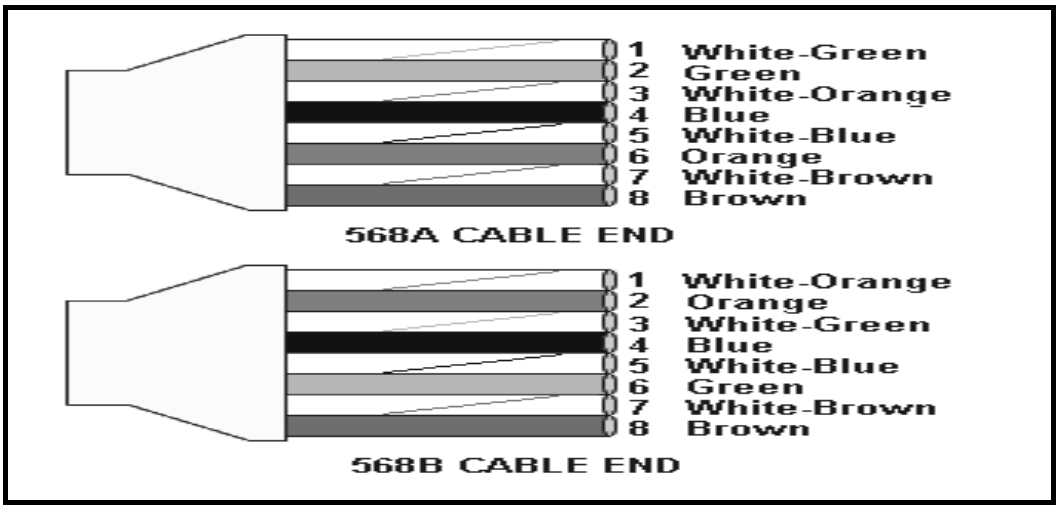


Fig.6.4: T568A or T568B Wiring Standard (RJ-45 Specification)

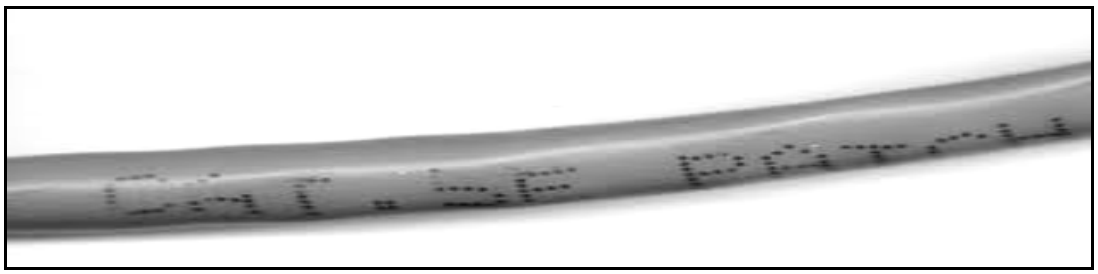


Fig. 6.5: Identification mark printed on CAT-5E cable

Some of CAT cables are:

- Category-5 cables
- Category-5E cables
- Category-6 cables
- Category-6E cables

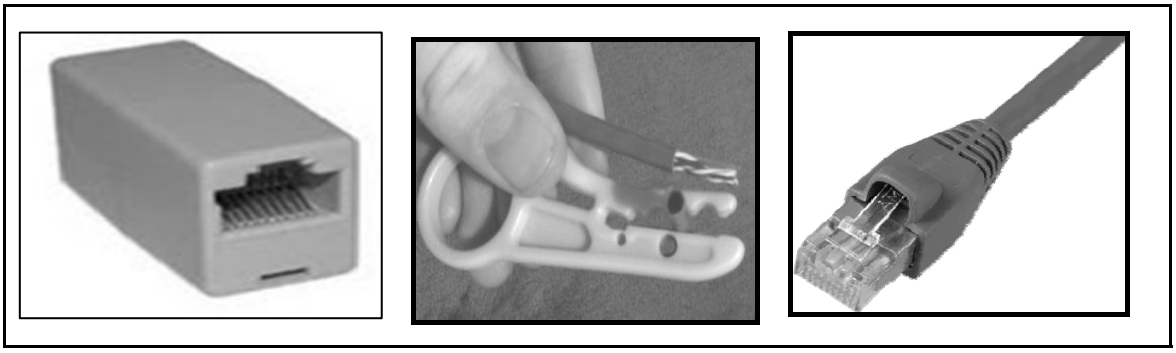
Ethernet Cable Tips:

Straight-through cable has both ends identical.

- A crossover cable has different ends.
- A straight-through cable is used as a patch cord in Ethernet connections.
- A crossover is used to connect two Ethernet devices without a hub or for connecting two hubs.

Crossover cable has both ends different**:** has one end with the Orange set of wires switched with the Green set. Odd numbered pins are always striped, even numbered pins are always solid colored.

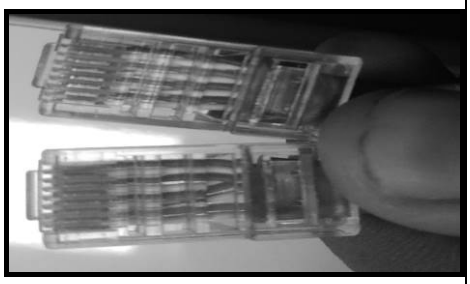
- Looking at the RJ-45 with the clip facing away from student, Brown is always on the right, and pin 1 is on the left.



Crossover Cable Changer **Cable Stripper** **Ready Ethernet cable**

Fig.6.6: Components of Cables

b) Crimped cables used for connecting computers to networking components.

	
Straight cable with RJ-45 connectors	**Cross-over cable with RJ-45 connectors**
Fig. 6.7: Crimped CAT-5 Cable with RJ-45 connectors	

- Student shall draw straight and cross-over cables wires sequence with **coloured sketch-pens or Pencils** shown in Fig 6.4

Draw Straight Cable wire sequence	**Draw Cross-over Cable wire sequence**

IX Resources required

Sr. No.	Instrument /Components	Specification	Quantity
1	Cable	Digi-Link CAT-5/5E/6 / 1Gbps, Support up to 100 meter, 4-Core Cable Used for connecting PC to network	1 No.
2	Crimping tool	Standard Crimper for RJ-45/ RJ-11 cable	1 No.
3	Connector	RJ-45type	8-10 No.s
4	LAN/Network cable Tester		1 No.
5	Caesar / Cutter / Stripper		1 No.

X Precautions to be Followed

- Select proper specification of cables and connectors as per networking parameters need.
- Use a good quality crimping tool along with quality connectors.
- Arrange colour codes properly straightened neatly, fully pressed to connect to connectors for correct connection (properly crimped) to avoid error n trouble in establishing connection.
  There's a reason you need eye-protection: when cutting the copper wires, they can go flying and potentially get your eye! Be smart, be safe!
- No more than 1/2″ of the Ethernet cable should be untwisted otherwise it will be susceptible to crosstalk.
- Do not deform, do not bend, do not stretch, do not staple, do not run parallel with power cables, and do not run Ethernet cables near noise inducing components**.**

XI Procedure

For Straight Cable:

1. Inspect available cable segment as per Straight cable sequence shown in Fig.6.4
2. Strip one end of Cable using cable stripper
3. Arrange the sequence of wires as Given in Fig. 6.4 for Straight Cable
4. Push the Wires carefully in the RJ-Connector, Take precaution these shall not be bend
5. Align the connector with crimping tool proper and Crimp/Press the Connector with wire.
6. Follow this for other end as per cable type.
7. Test the cable using LAN tester.
8. Patch chord is ready

For Cross-over Cable:

1. Inspect available cable segment as per Cross-over cable sequence shown in Fig.6.4
2. Strip one end of Cable using cable stripper
3. Arrange the sequence of wires as Given in Fig. 6.4 for Straight Cable

4. Push the Wires carefully in the RJ-Connector, Take precaution these shall not be bend
5. Align the connector with crimping tool proper and Crimp/Press the Connector with wire.
6. Follow this for other end as per cable type.
7. Test the cable using LAN tester.
8. Patch chord is ready

XII Resources used

Sr. No.	Instrument /Components	Specification	Quantity
1			
2			
3			
4			
5			

XIII Actual procedure followed
Student shall write procedure:
For preparing straight cable:

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For Cross-over cable: (At a Glance)

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XIV Precautions followed (use blank sheet provided if space not sufficient)

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XV Observations (use blank sheet provided if space not sufficient)

Features	Availability in lab.
Personal Computer	
Switch/Hub	
CISCO Packet Tracer (OPTIONAL)	
Network Cable Tester	

XVI Result

1. CAT stands for……..
2. Cable consists of …… (RJ-45/RJ-11 / Both of these) connector as part of patch chord.
3. Computer Laboratory / Internet Café is example of …… (LAN/MAN/WAN).
4. Network inside the University is ……..type of network. (LAN/MAN/WAN).
5. Hub to hub and Router to router connection is made by ……(Crossover/Straight Cable)

XVII Interpretation of Results

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XVIII Conclusions and Recommendations (Actions/decisions to be taken based on the Interpretation of results).

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XIX Practical Related Questions

Note: Below given are few sample questions for reference. Teacher must design more such questions so as to ensure the achievement of identified CO.

1. The most popular type of twisted-pair cable is …….. **(**UTP/ STP).
2. UTP cable for data transmissions up to 100 Mbps is category **……** (5/3).
3. Telephone wire uses a**……** (RJ-45/ RJ-11) connector.
4. **……** (HUB/ Switch) is a device that splits a network connection into multiple computers.
5. **……** (RJ-45/ RJ-11) connectors are used for computer networking.
6. Enlist the network components in your lab and give use of four).
7. Name type of cable is used in networking of laboratory?
8. State the type of topology used in laboratory?.....….

[Space for Answers]

XX References / Suggestions for further Reading

1. www.cisco.com/c/en/us/td/docs/cable/cmts/ubr10012/installation/.../u10kcbl.pdf
2. https://www.wikihow.com/Create-an-Ethernet-Cable
3. https://www.wikihow.com/Create-an-Ethernet-Cable (Video link)
4. https://www.youtube.com/watch?v=lullzS740wI (Video link)
5. https://www.lanshack.com/make-cat5E.aspx

XXI Assessment Scheme

Performance indicators		Weightage
Process related: (15 Marks)		**60%**
1	Preparation of properly as per specification	20%
2	Sequencing and crimping of straight and crossover cable properly	20%
3	Testing of cable using LAN Tester	20%
Product related: (10 Marks)		**40%**
4	Results	20%
5	Practical related questions	10%
6	Submission of report in time	10%
	Total (25 Marks)	**100 %**

Name of Team Members

1. ……..
2. ……..
3. ……..
4. ……..

Marks Obtained			Dated signature of Teacher
Process Related (15)	**Product Related (10)**	**Total (25)**	

Practical No.7: Using a Hub/ Switch Install a LAN network consisting of 6 computers.

I Practical Significance

Local Area Network is connection of different computer in network. It helps to share resources. Connecting devices like Hub, Switch are required in networking. A hub is the most basic networking device that connects multiple computers or other network devices together. Switch is a Data Link layer device; it is able to examine the packets that pass through of data Link layer. A switch is a hardware device that filters and forwards network packets from one networking device to another. A network switch is a multiport network bridge that uses hardware addresses to process and forward data at the data link layer (layer 2) of the OSI model.

In this practical students will be able to connect computers in the network using connecting devices such as Hub and Switch.

II Relevant Program Outcomes (POs)

- **Discipline knowledge**: Apply Electronics and Telecommunication engineering knowledge to solve broad-based Electronics and Telecommunications engineering related problems.
- **Experiments and practice:** Plan to perform experiments and practices to use the results to solve broad-based Electronics and Telecommunication engineering problems.
- **Engineering tools:** Apply relevant Electronics and Telecommunications technologies and tools with an understanding of the limitations.
- **Individual and team work:** Function effectively as a leader and team member in diverse/ multidisciplinary teams.

III Competency and Practical skills

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences**:**

Maintain computer network systems.

Identify Switch and hub

Set up LAN using computers

IV Relevant Course Outcome

Use the relevant network model for the specified data communication system.

Maintain relevant transmission medium and modem for data transmission**.**

V Practical Outcome

Using a Hub/ Switch Install a LAN network with 6 computers.

VI Relevant Affective domain related Outcomes

- Demonstrate working as a leader/a team member. .
- Follow ethical practices.
- Handle equipment carefully.
- Follow safety practices.

VII Minimum Theoretical Background

There are also multiple devices or mediums which helps in the communication between two different devices which are known as **Network devices**. Ex: Router, Switch, Hub, Bridge.

. **Fig.7.1: Hub and Switch**

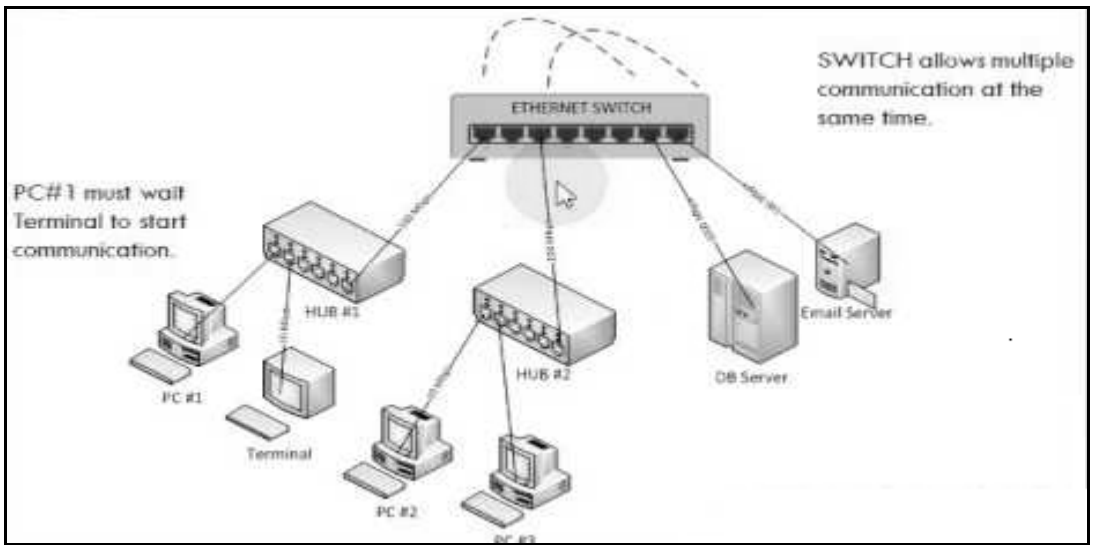

Fig. 7.2: Computer network using Hubs and Switch.

A **network hub** is a central connection point for devices in a local area network, or LAN.
There's a limit to the amount of bandwidth users can share on a hub-based network. The more devices are added to the network hub, the longer it takes data to reach its destination.

A switch avoids these and other limitations of network hubs.
A large network may include multiple switches, which connect different groups of computer systems together.
These switches are typically connected to a router that allows connected devices to access the Internet.

Table 7.1: Colour codes for cables used to connect PCs, Hub and switches

For PC 2 PC Communication without HUB (Cross Cable Connection)

Sl. No.	One Site	Second Site	Pin Configuration
01	Orange White	Green White	Transmit
02	Orange	Green	Transmit
03	Green White	Orange White	Receive
04	Blue	Blue	Not Use
05	Blue White	Blue White	Ground
06	Green	Green	Receive
07	Brown White	Brown White	DTR
08	Brown	Brown	DTS

For PC 2 PC Communication with HUB (Simple Cable Connection)

Sl. No.	One Site	Second Site	Pin Configuration
01	Orange White	Orange White	Transmit
02	Orange	Green	Transmit
03	Green White	Orange White	Receive
04	Blue	Blue	Not Use
05	Blue White	Blue White	Ground
06	Green	Green	Receive
07	Brown White	Brown White	DTR
08	Brown	Brown	DTS

For One Cable in Two PC Communication through HUB (Simple Cable Connection)

First Connection

Sl. No.	One Site	Second Site	Pin Configuration
01	Orange White	Green White	Transmit
02	Orange	Orange	Transmit
03	Green White	Green White	Receive
04	Green	Green	Receive

Second Connection:

Sl. No.	One Site	Second Site	Pin Configuration
01	Blue	Green White	Transmit
02	Blue White	Orange	Transmit
03	Brown White e	Green White	Receive
04	Brown	Green	Receive

VIII a) Block Diagram

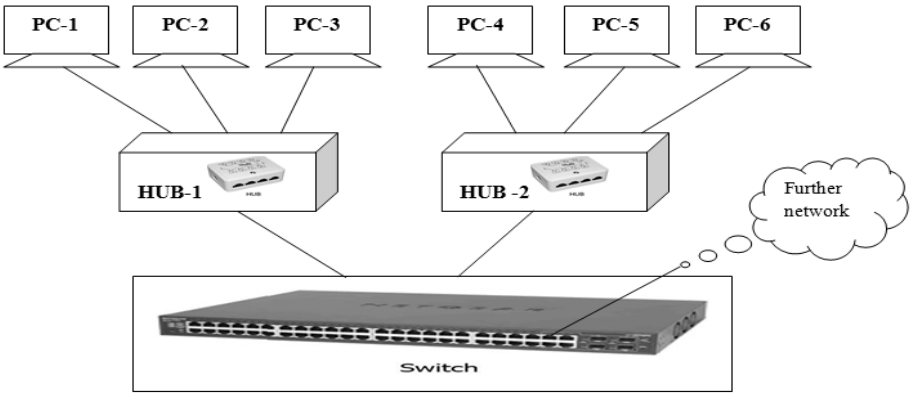

Fig. 7.3: Computers in star connected through wires

b) Actual Circuit used in laboratory

IX Resources required

Sr. No.	Instrument /Components	Specification	Quantity
1.	Personal Computers (For additional Terminals)	Intel P-IV , 2Gbyte , DDR2 , 500Gbyte HDD, Keyboard onswards Installed with Windows 7 onwards and internet connectivity	01
2.	Personal Computers (For End Terminals)	Available computers in Laboratory	06
3.	Hub	Minimum 4 port Hub	03
4.	Switch	Minimum 8 port switch	01
5.	Cables	Cross-over cable (with RJ-45 connector)	01
6.	Cables	Straight cable (with RJ-45 connector)	01

X Precautions to be Followed

- Network Design parameters shall be planned earlier
- IP addresses shall be predetermined to avoid IP conflict.
- Selection and connection of proper patch cables (Straight / Cross-over) at appropriate situations shall be used as per selected topology of network.
- Printer shall be installed on PC where it is connected

XI Procedure

Connect the computers in Local Area Network

1. Connect all computers and network devices as shown if Fig. 7.4 using standard network cable (CAT -5).
2. Connect Three computers (PC-1 to PC-3) to the Hub-1 using straight cables. (one end to each cable to Computers and other to Hub-1)
3. Connect other Three computers (PC-4 to PC-6) to the Hub-2 straight cables. (one end to each cable to Computers and other to Hub-2)
4. Then connect both Hub-1 and Hub-2 to Switch.
5. Using crossover cables connect Hub-1 and Hub-2. As one end to first hub wand other end to other Hub.
6. Assign IP addresses, subnet mask and Default gateway addresses to each.
7. For First Computer(PC-1)
   i.e IP address :192.168.7.1
   Subnet Mask :255.255.255.0
   Default Gateway :192.168.7.1
   For Second Computer(PC-2)
   i.e IP address :192.168.7.2
   Subnet Mask :255.255.255.0
   Default Gateway :192.168.7.1
8. To check connectivity use ping command as follows:
   Ping 192.168.7.1 from Second computer (PC-2) or
   Ping 192.168.7.2 from Second computer (PC-1)
9. Put all the computers in the same workgroup:
   On each computer, right-click "My Computer"- Click "Properties"
10. Go to the "Computer Name" tab -Click "Change" at the bottom
    -Type computer Name (name should be unique for each computer)
    - Under "Member of" put a tick on radio button named "Workgroup"
    - Type name for the workgroup.(name should be same for all computers)

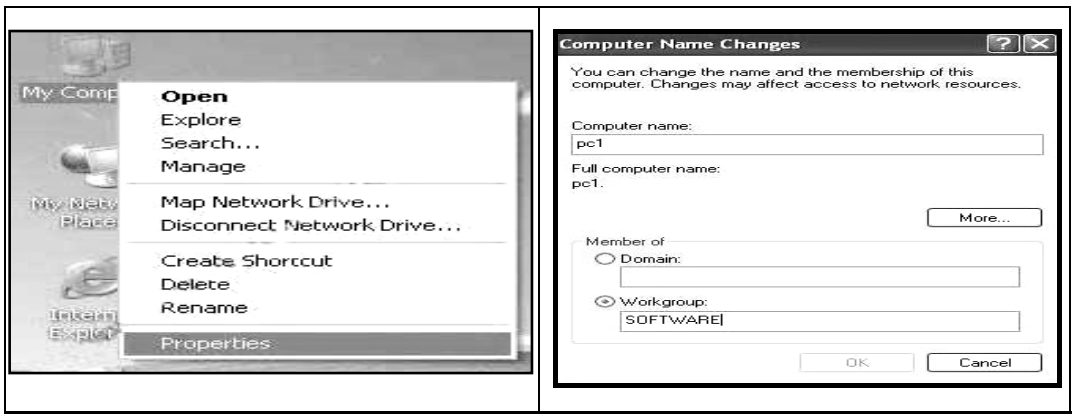

Fig.7.4: Computer Name Change options

11. Restart your machine by clicking on **Yes** to get effect of changed settings

Fig. 7.5 System Setting Change dialogbox

Give all the computers IP address in the same subnet mask.

Use the following guidelines:

Open Start > Control Panel > Network Connections

- Right-click "Local Area Connection"
- This connection uses the following items select "Internet Protocol (TCP/IP)" and click the "Properties" button
- Put a tick next to "Use the following IP Address" and type in the IP and subnet mask.

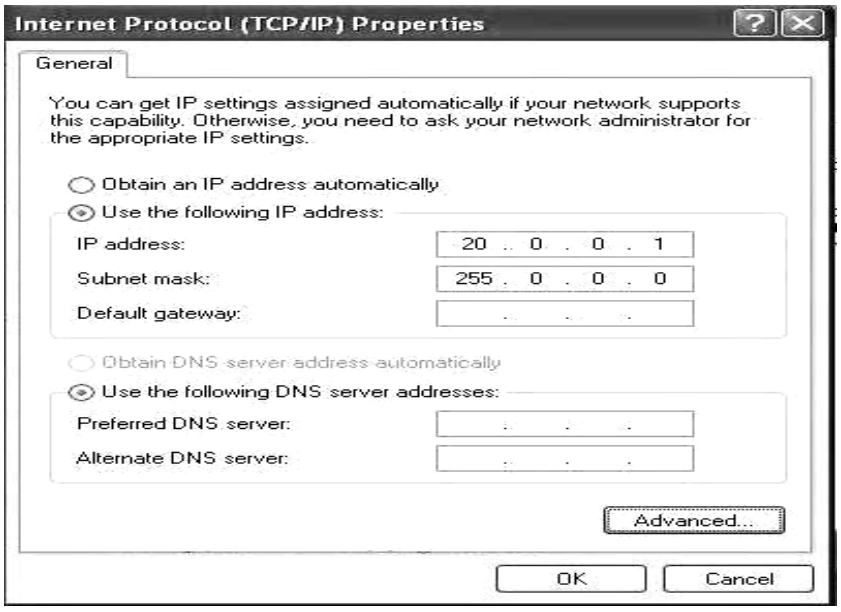

Fig. 7.6: Internet protocol properties

Table7.2: IP address, Subnet Mask and Default gateway assignment

Server:
- IP: 192.168.0.2 **- Subnet Mask:** **255.255.255.0**

Computer 1:	Computer 2:	Computer 3:
- IP: 192.168.0.3	- IP: 192.168.0.4	- IP: 192.168.0.5
- Subnet Mask: 255.255.255.0	- Subnet Mask: 255.255.255.0	- Subnet Mask: 255.255.255.0

Computer 4:	Computer 5:	Computer 6:
- IP: 192.168.0.6	- IP: 192.168.0.7	- IP: 192.168.0.8
- Subnet Mask: 255.255.255.0	- Subnet Mask: 255.255.255.0	- Subnet Mask: 255.255.255.0

5. Type **ping** command on command prompt of every computer to verify connections Repeat this process and observe the output of ping command for all PCs.

C:\Documents and Settings>ping 192.168.0.2
Pinging 192.168.0.2 with 32 bytes of data:
Reply from 192.168.0.3 bytes=32 time<1ms TTL=128
Reply from 192.168.0.4: bytes=32 time<1ms TTL=128
Reply from 192.168.0.5: bytes=32 time<1ms TTL=128
Reply from 192.168.0.6: bytes=32 time<1ms TTL=128
Reply from 192.168.0.7: bytes=32 time<1ms TTL=128
Reply from 192.168.0.8: bytes=32 time<1ms TTL=128

Ping statistics for 192.168.0.2:
Packets: Sent = 6, Received = 6, Lost = 0 (0% loss)

To Share file/Folders in LAN:
1. Open Network & Sharing Center
2. In all versions of Windows, the app is located in the Control Panel. .
3. In the Control Panel, click on the Network and Internet category and then click on Network and Sharing Center.

To Share Printer in LAN:
1. Click on Start in the bottom left corner of screen. A popup list will appear.
2. Click on Devices and **Printers** from the popup list.
3. Select Add a **printer**.
4. Click on Add a **network**, wireless or Bluetooth **printer**.
5. Click the **shared printer**.
6. Click Next.

XII Resources used

Sr. No.	Instrument /Components	Specification	Quantity
1.			
2.			
3.			
4.			
5.			

XIII Actual procedure followed

- **Steps in short for Connecting computers in LAN:**

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- **For sharing Files/Folders in LAN:**

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- **For sharing Printer in LAN:**

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XIV Precautions followed (use blank sheet provided if space not sufficient)

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XV Observations (use blank sheet provided if space not sufficient)

Features	Specification availability in lab.
Personal Computers (For Additional Computer)	
Personal Computers (For End Terminals)	
Hub /Switch	
Cables	

Note: Refer instruction manual / specification settings for above observation

XVI Result

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XVII Interpretation of Results

Replace/ Exchange crossover Patch cable with Straight cable between Hub-1 and Hub-2

- Record effect on pinging of other computers ……

XVIII Conclusions and Recommendations (Actions/decisions to be taken based on the interpretation of results).

- File/Folder are accessible after sharing from specific PC to other specific PC……..

XIX Practical Related Questions

Note: Below given are few sample questions for reference. Teacher must design more such questions so as to ensure the achievement of identified CO.

1. Check whether all PCs are pinging or not?.....…….
2. Unplug patch cable (straight Cable) of PC-3 to Hub-1
   - Record effect on pinging of other computer. ……
   - Record effect on pinging of PC4 to PC6……..
3. Remove cable (Cross-over Cable) between Hub-1 to Hub-2:
   - Identify computers on which the networks affect or effect on pinging to other computers. ……
4. Check whether printer is able to take print after sharing and status ……
   ……
5. Check the connectivity of computers is simplex or duplex after sharing and record the result…….……

[Space for Answers]

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XX References / Suggestions for further Reading

1. https://www.geeksforgeeks.org/network-devices-hub-repeater-bridge-switch-router-gateways/
2. https://www.slideshare.net/RAJESHSADHUKHA01/computer-networking-devices-16572482
3. https://www.youtube.com/watch?v=_VRToy-9SD0
4. https://www.youtube.com/watch?v=CGeAauny2fc
5. https://www.youtube.com/watch?v=teah142FGBc

XXI Assessment Scheme

Performance indicators		Weightage
Process related: (15 Marks)		**60%**
1	Proper handling of the equipment	20%
2	Identifying the various network components	20%
3	Testing of working of network	20%
Product related: (10 Marks)		**40%**
4	Results	20%
5	Practical related questions	10%
6	Submission of report in time	10%
	Total (25 Marks)	**100 %**

Name of Team Members

1. ……..
2. ……..
3. ……..
4. ……..

Marks Obtained			Dated signature of Teacher
Process Related (15)	**Product Related (10)**	**Total (25)**	

Practical No.8: Locate the error bit in the given data stream by applying the different error detection methods.

I Practical Significance

Error is a condition when the receiver's information does not match with the sender's information. During transmission, digital signals suffer from noise that can introduce errors in the binary bits travelling from sender to receiver. That means a 0 bit may change to 1 or a 1 bit may change to 0. To avoid this, error-detecting codes are used which are additional data added to a given digital message to detect any error that has occurred during transmission of the message. The student will be able to detect errors in a given data stream.

II Relevant Program Outcomes (POs)

- **Discipline knowledge**: Apply Electronics and Telecommunication engineering knowledge to solve broad-based Electronics and Telecommunications engineering related problems.
- **Experiments and practice:** Plan to perform experiments and practices to use the results to solve broad-based Electronics and Telecommunication engineering problems.
- **Individual and team work:** Function effectively as a leader and team member in diverse/ multidisciplinary teams.

III Competency and Practical skills

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences**:**
Maintain computer network systems.

IV Relevant Course Outcome

Analyze error detection/correction and flow control of data in the data network.

V Practical Outcome

Locate the error bit in the given data stream by applying the different error detection methods.

VI Relevant Affective domain related Outcomes

- Demonstrate working as a leader/a team member. .
- Follow ethical practices.

VII Minimum Theoretical Background

Whenever a message is transmitted, it may get scrambled by noise and the data may get corrupted. Basic approach used for error detection is the use of redundancy bits, where additional bits are added to facilitate detection of errors.

Some of the techniques for error detection are:

1. Parity check
2. Two-dimensional Parity check
3. Checksum
4. Cyclic redundancy check

Parity check

A parity bit or a check bit is added to blocks of data from the source. A parity bit of:

- 1 is added to the block if it contains odd number of 1's, and
- 0 is added if it contains even number of 1's

This scheme makes the total number of 1's even, that is why it is called even parity checking.

Two-dimensional Parity check

Parity check bits are calculated for each row, which is equivalent to a simple parity check bit. Parity check bits are also calculated for all columns, and then both are sent along with the data. At the receiving end these are compared with the parity bits calculated on the received data.

Checksum

In checksum error detection scheme, the data is divided into k segments each of m bits.

In the sender's end the segments are added using 1's complement arithmetic to get the sum. The sum is complemented to get the checksum. The checksum segment is sent along with the data segments. At the receiver's end, all received segments are added using 1's complement arithmetic to get the sum. The sum is complemented. If the result is zero, the received data is accepted; otherwise the received data is discarded.

Cyclic redundancy check (CRC)

CRC is based on binary division. In CRC, a sequence of redundant bits, called cyclic redundancy check bits, are appended to the end of data unit so that the resulting data unit becomes exactly divisible by a second, predetermined binary number. At the destination, the incoming data unit is divided by the same number. If at this step there is no remainder, the data unit is assumed to be correct and is therefore accepted.

A remainder indicates that the data unit has been damaged in transit and therefore must be rejected.

VIII a) Block Diagram

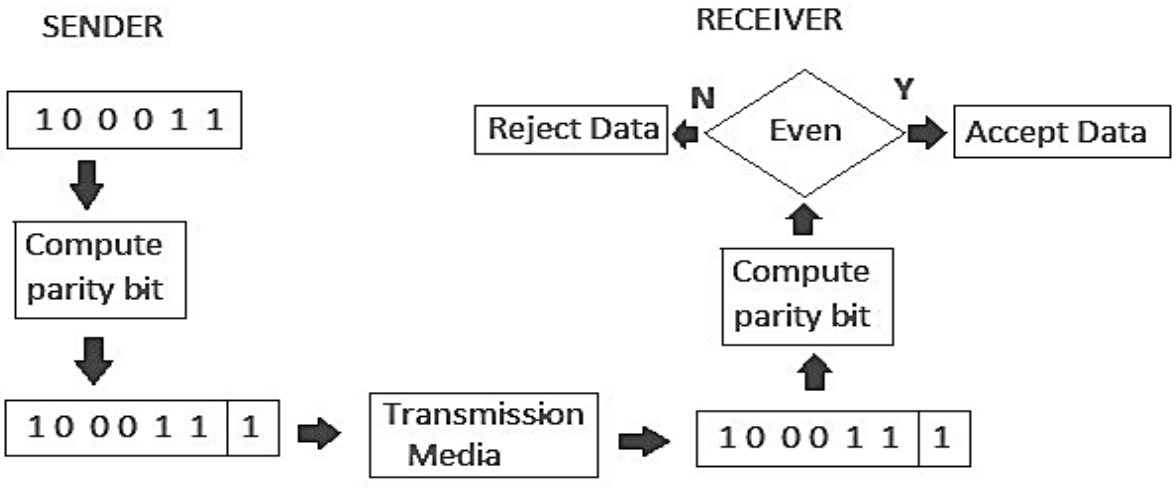

Fig 8.1 : Single Bit parity Check (Even Parity)

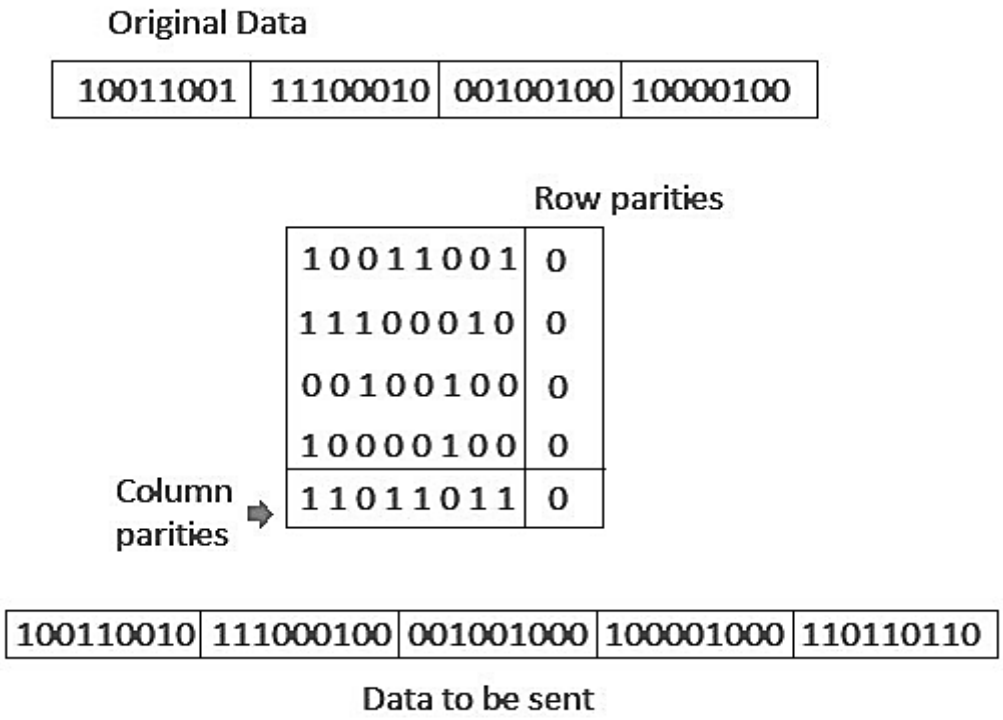

Fig 8.2 : Two-dimensional Parity check

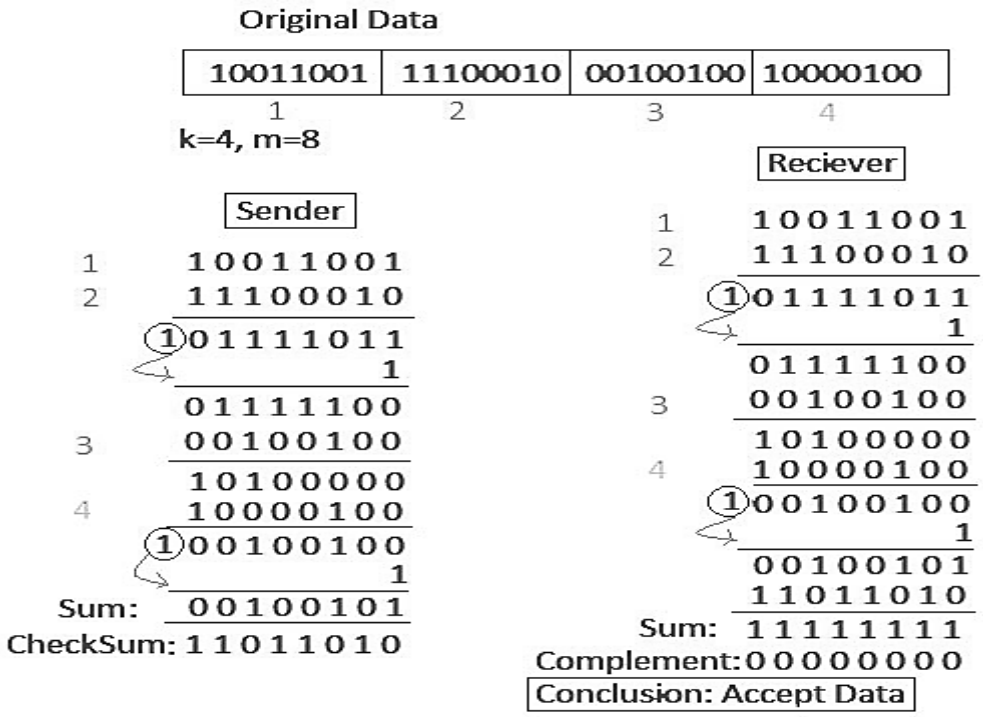

Fig 8.3: Checksum

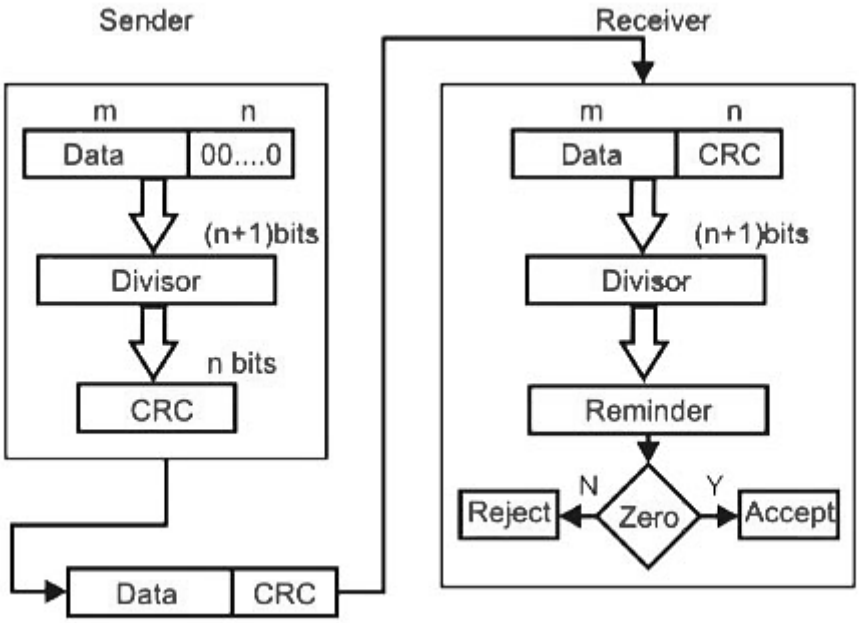

Fig 8.4: Cyclic Redundancy Check

1. **Sample code for Parity Check**

```
// C program to find parity
// of an integer
# include <stdio.h>
# define  bool int
 /* Function to get parity of number n. It returns 1
if n has odd parity, and returns 0 if n has even
parity */
bool getParity(unsigned int n)
{
bool parity = 0;
while (n)
{
parity = !parity;
n      = n & (n - 1);
}
return parity;
}
/* Driver program to test getParity() */
int main()
{
unsigned int n = 7;
printf("Parity of no %d = %s",  n,
(getParity(n)? "odd": "even"));
getchar();
 return 0;
}
```

2. Sample code for Cyclic Redundancy Check

```
#include <stdio.h>
#include <conio.h>
#include <string.h>
void main()
{
int i,j,keylen,msglen;
char input[100], key[30],temp[30],quot[100],rem[30],key1[30];
clrscr();
printf("Enter Data: ");
gets(input);
printf("Enter Key: ");
 gets(key);
keylen=strlen(key);
msglen=strlen(input);
strcpy(key1,key);
for(i=0;i<keylen-1;i++)
{
input[msglen+i]='0';
}
for(i=0;i<keylen;i++)
temp[i]=input[i];
for(i=0;i<msglen;i++)
{
quot[i]=temp[0];
if(quot[i]=='0')
for(j=0;j<keylen;j++)
key[j]='0';
else
for(j=0;j<keylen;j++)
key[j]=key1[j];
for(j=keylen-1;j>0;j--)
{
if(temp[j]==key[j])
rem[j-1]='0';
else
rem[j-1]='1';
}
rem[keylen-1]=input[i+keylen];
```

```
strcpy(temp,rem);
}
strcpy(rem,temp);
printf("\nQuotient is ");
for(i=0;i<msglen;i++)
printf("%c",quot[i]);
printf("\nRemainder is ");
for(i=0;i<keylen-1;i++)
printf("%c",rem[i]);
printf("\nFinal data is: ");
for(i=0;i<msglen;i++)
printf("%c",input[i]);
for(i=0;i<keylen-1;i++)
printf("%c",rem[i]);
getch();
}
```

Sample Output of the above C program:

```
Enter Data: 11110110101
Enter Key: 111010

Quotient is 10010010000
Remainder is 00000
Final data is: 11110110101000000
```

3. **Sample program for Detecting error by checksum Method**

```
#include<stdio.h>
#include<conio.h>
#include<math.h>
int sender(int b[10],int k)
{
int checksum,sum=0,i;
printf("\n****SENDER****\n");
for(i=0;i<k;i++)
sum+=b[i];
printf("SUM IS: %d",sum);
checksum=~sum;
printf("\nSENDER's CHECKSUM IS:%d",checksum);
return checksum;
}
int receiver(int c[10],int k,int scheck)
int checksum,sum=0,i;
printf("\n\n****RECEIVER****\n");
for(i=0;i<k;i++)
```

```
sum+=c[i];
printf(" RECEIVER SUM IS:%d",sum);
sum=sum+scheck;
checksum=~sum;
printf("\nRECEIVER's CHECKSUM IS:%d",checksum);
return checksum;
}
main()
{
int a[10],i,m,scheck,rcheck;
clrscr();
printf("\nENTER SIZE OF THE STRING:");
scanf("%d",&m);
printf("\nENTER THE ELEMENTS OF THE ARRAY:");
for(i=0;i<m;i++)
scanf("%d",&a[i]);
scheck=sender(a,m);
rcheck=receiver(a,m,scheck);
if(rcheck==0)
printf("\n\nNO ERROR IN TRANSMISSION\n\n");
else
printf("\n\nERROR DETECTED");
getch();
}
```

IX Resources required

Sr. No.	Instrument /Components	Specification	Quantity
1.	Personal Computer	Standard Specifications	01
2.	Turbo C/ Any simulation tool available in the lab	Free downloadable	

X Precautions to be Followed

- Ensure compatibility of computer system with software.
- Install the software for running C programming
- Compile and Execute the program without error

XI Procedure

1. Open the “C” software.
2. Create New file in “C”
3. Type the program code in command window.
4. Save the file with .C extension.
5. Compile the program code using Alt+C or Alt+F9 command and remove the errors if any.
6. Run the program codes using Alt+R or Ctrl+F9.
7. Enter the valid input.
8. Observe the output
9. After completion of practical shut down the PC and switch off the supply

Note: The sample code is given in C programming. The teacher may conduct this experiment in any other simulation tool.

XII Resources used

Sr. No.	Instrument /Components	Specification	Quantity
1.			
2.			

XIII Actual procedure followed

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XIV Precautions followed (use blank sheet provided if space not sufficient)

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XV Observations (use blank sheet provided if space not sufficient)

Actual simulation output observed
(Student should paste the simulation output / print out)

XVI Result

1. For the bit stream 1101101- Parity bit is ……..
2. For the bit stream 1101110, 1011010, 1111111, 0000000, arrange and determine row parity , column parity and data transmitted.

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XVII Interpretation of Results

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XVIII Conclusions and Recommendations

(Actions/decisions to be taken based on the interpretation of results).

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XIX Practical Related Questions

Note: Below given are few sample questions for reference. Teacher must design more such questions so as to ensure the achievement of identified CO.

1. For the bit sequence 101000 and the generator polynomial used is x^3+1, determine the data transmitted.
2. Consider the bit sequence 1101110, determine the parity bit for Odd Parity and for even Parity
3. For the bit sequence 110101, 101010, 100100, 111100, determine the checksum.

[Space for Answers]

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XX References / Suggestions for further Reading

1. www.nptel.ac.in/courses/106105080/pdf/M3L2.pdf
2. https://youtu.be/aNqiTCZ-nko
3. https://youtu.be/TPqSuqLQxVA

XXI Assessment Scheme

Performance indicators		Weightage
Process related: (15 Marks)		**60%**
1	Handling of simulation software	20 %
2	Program execution	20%
3	Solving problems related to Error detection	20%
Product related: (10 Marks)		**40%**
4	Results	20%
5	Practical related questions	10%
6	Submission of report in time	10%
Total (25 Marks)		**100 %**

Name of Team Members

1. ……..
2. ……..
3. ……..
4. ……..

Marks Obtained			Dated signature of Teacher
Process Related (15)	**Product Related (10)**	**Total (25)**	

Practical No.9: Correct the error in a given data stream by applying the different error correction methods.

I Practical Significance

Error is a condition when the receiver's information does not match with the sender's information. During transmission, digital signals suffer from noise that can introduce errors in the binary bits travelling from sender to receiver. That means a 0 bit may change to 1 or a 1 bit may change to 0. To avoid this, error-detecting codes are used which are additional data added to a given digital message to detect any error that has occurred during transmission of the message. At the receiver, the detected error is corrected .Error correction is the detection of errors and reconstruction of the original error free data. The student will be able to correct errors in a given data stream.

II Relevant Program Outcomes (POs)

- **Discipline knowledge**: Apply Electronics and Telecommunication engineering knowledge to solve broad-based Electronics and Telecommunications engineering related problems.
- **Experiments and practice:** Plan to perform experiments and practices to use the results to solve broad-based Electronics and Telecommunication engineering problems.
- **Individual and team work:** Function effectively as a leader and team member in diverse/ multidisciplinary teams.

III Competency and Practical skills

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences**:**

Maintain computer network systems.

IV Relevant Course Outcome

Use the relevant network model for the specified data communication system.

Analyze error detection/correction and flow control of data in the data network.

V Practical Outcome

Correct the error in a given data stream by applying the different error correction methods.

VI Relevant Affective domain related Outcomes

- Demonstrate working as a leader/a team member. .
- Follow ethical practices.

VII Minimum Theoretical Background

Whenever a message is transmitted, it may get scrambled by noise and the data may get corrupted. Two methods of error correction are-

1. Reverse error correction (REC).
2. Forward error correction (FEC)

In Reverse error correction, the receiver requests for the retransmission of the code word whenever it detects an error after that the receiver locates the error by analyzing the received code and reverses the erroneous bits.

In Forward Error correction the code set is so designed that it is possible for the receiver to detect and correct error as well by itself.
Hamming code is a set of error-correction codes that can be used to detect and correct the errors that can occur when the data is moved or stored from the sender to the receiver.
General Algorithm of Hamming code –
The Hamming Code is the use of extra parity bits to allow the identification of an error.

1. Write the bit positions starting from 1 in binary form (1, 10, 11, 100, etc).
2. All the bit positions that are a power of 2 are marked as parity bits (1, 2, 4, 8, etc).
3. All the other bit positions are marked as data bits.
4. Each data bit is included in a unique set of parity bits, as determined its bit position in binary form.

- Parity bit 1 covers all the bits positions whose binary representation includes a 1 in the least significant position (1, 3, 5, 7, 9, 11, etc).
- Parity bit 2 covers all the bits positions whose binary representation includes a 1 in the second position from the least significant bit (2, 3, 6, 7, 10, 11, etc).
- Parity bit 4 covers all the bits positions whose binary representation includes a 1 in the third position from the least significant bit (4–7, 12–15, 20–23, etc).
- Parity bit 8 covers all the bits positions whose binary representation includes a 1 in the fourth position from the least significant bit bits (8–15, 24–31, 40–47, etc).
- In general each parity bit covers all bits where the bitwise AND of the parity position and the bit position is non-zero. Parity check is done for even parity, hence set a parity bit to 1 if the total number of ones in the positions it checks is odd. Set a parity bit to 0 if the total number of ones in the positions it checks is even.

  Determining the position of redundant bits –
  These redundancy bits are placed at the positions which correspond to the power of 2.
  As in the above example:

1. The number of data bits = 7
2. The number of redundant bits = 4
3. The total number of bits = 11
4. The redundant bits are placed at positions corresponding to power of 2 ie.. 1, 2, 4, and 8

VIII a) Block Diagram

Sample code in C programming

```
#include<stdio.h>

#include<conio.h>

void main() {

int data[7],rec[7],i,c1,c2,c3,c;

printf("this works for message of 4bits in size \nenter message bit one by one:  ");

scanf("%d%d%d%d",&data[0],&data[1],&data[2],&data[4]);

data[6]=data[0]^data[2]^data[4];

data[5]=data[0]^data[1]^data[4];
```

```
data[3]=data[0]^data[1]^data[2];
printf("\nthe encoded bits are given below: \n");
for (i=0;i<7;i++) {
printf("%d ",data[i]);
}
printf("\nenter the received data bits one by one: ");
for (i=0;i<7;i++) {
scanf("%d",&rec[i]);
}
c1=rec[6]^rec[4]^rec[2]^rec[0];
c2=rec[5]^rec[4]^rec[1]^rec[0];
c3=rec[3]^rec[2]^rec[1]^rec[0];
c=c3*4+c2*2+c1 ;
if(c==0) {
printf("\ncongratulations there is no error: ");
} else {
printf("\nerron on the postion: %d\nthe correct message is \n",c);
if(rec[7-c]==0)
rec[7-c]=1; else
rec[7-c]=0;
for (i=0;i<7;i++) {
printf("%d ",rec[i]);
}
}
getch();
}
```

IX Resources required

Sr. No.	Instrument /Components	Specification	Quantity
1.	Personal Computer	Standard Specifications	01
2.	Turbo C/ Any simulation tool available in the lab	Free downloadable	

X Precautions to be Followed

- Ensure compatibility of computer system with software.
- Install the software for running C programming
- Compile and Execute the program without error

XI Procedure

1. Open the "C" software.
2. Create New file in "C"
3. Type the program code in command window.
4. Save the file with .C extension.
5. Compile the program code using Alt+C or Alt+F9 command and remove the errors if any.
6. Run the program codes using Alt+R or Ctrl+F9.
7. Enter the valid input.
8. Observe the output
9. After completion of practical shut down the PC and switch off the supply

Note: The sample code is given in C programming. The teacher may conduct this experiment in any other simulation tool.

XII Resources used

Sr. No.	Instrument /Components	Specification	Quantity
1.			
2.			

XIII Actual procedure followed

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.....

XIV Precautions followed (use blank sheet provided if space not sufficient)

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XV Observations (use blank sheet provided if space not sufficient)

Actual simulation output observed

(Student should paste the simulation output)

XVI Result

1. For the bit stream 1101101- state the parity bits R_1,R_2,R_3 and R_4 ……..
2. Name the other methods of error correction.
3. Execute the program for the bit stream 1010111. Write the output screen.

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XVII Interpretation of Results

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XVIII Conclusions and Recommendations

(**Actions/decisions to be taken based on the interpretation of results).**

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XIX Practical Related Questions

Note: Below given are few sample questions for reference. Teacher must design more such questions so as to ensure the achievement of identified CO.

1. Calculate the number of parity bits required for given data (1011).
2. Which is the most efficient error correction method.
   Name the forward error correction method and backword error correction method

[Space for Answers]

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XX References / Suggestions for further Reading

1. www.nptel.ac.in/courses/106105080/pdf/M3L2.pdf
2. https://youtu.be/aNqiTCZ-nko
3. https://youtu.be/TPqSuqLQxVA

XXI Assessment Scheme

Performance indicators		Weightage
Process related: (15 Marks)		**60%**
1	Handling of simulation software	20 %
2	Program execution	20%
3	Solving problems related to Error detection	20%
Product related: (10 Marks)		**40%**
4	Results	20%
5	Practical related questions	10%
6	Submission of report in time	10%
	Total (25 Marks)	**100 %**

Name of Team Members

1. ……..
2. ……..
3. ……..
4. ……..

Marks Obtained			Dated signature of Teacher
Process Related (15)	**Product Related (10)**	**Total (25)**	

Practical No.10: Use route command to test the performance of the given network.

I Practical Significance

The **tracert command** is a Command prompt command that shows several details about the path that a packet takes from the source computer to the destination computer. Student will be able to use route command or **traceroute** command.

II Relevant Program Outcomes (POs)

- **Discipline knowledge**: Apply Electronics and Telecommunication engineering knowledge to solve broad-based Electronics and Telecommunications engineering related problems.
- **Experiments and practice:** Plan to perform experiments and practices to use the results to solve broad-based Electronics and Telecommunication engineering problems.
- **Engineering tools:** Apply relevant Electronics and Telecommunications technologies and tools with an understanding of the limitations.
- **Individual and team work:** Function effectively as a leader and team member in diverse/ multidisciplinary teams.

III Competency and Practical skills

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences**:**

Maintain computer network systems.

Able to trace travelling route of transmitted message or data packet

Able to modify entries of routing table.

IV Relevant Course Outcome

Configure the network component and assign IP address.

V Practical Outcome

Use route command to test the performance of the given network..

VI Relevant Affective domain related Outcomes

- Demonstrate working as a leader/a team member. .
- Follow ethical practices.
- Handle equipment carefully.
- Follow safety practices.

VII Minimum Theoretical Background

Route command is only available if the TCP/IP protocol is installed as a component in the properties of a network adapter.

route command displays or modifies the computer's routing table information. For a typical computer that has a single network interface and is connected to a local area network (LAN) that has a router, the routing table is pretty simple. If user facing trouble in accessing other computers or other networks, user can use the route command to investigate bad entry that affect in the computer's routing table.

For a computer with more than one interface and that's configured to work as a router, the routing table is often a major source of trouble. Setting up the routing table properly is a key part of configuring a router to work.
Earlier tracert command is used to trace the travel of packet from source to destination over a network. This command is capable to modify routing table entries hence the route command is established. To display the routing table (both IPv4 and IPv6) in Windows, use the route print command.

Route command syntax finds and displays following information

For each entry in the routing table, five items of information are listed:

- The **destination IP address** , this is the address of the destination subnet, and must be interpreted in the context of the subnet mask.
- The **subnet mask** that must be applied to the destination address to determine the destination subnet
- The **IP address of the gateway** to which traffic intended for the destination subnet will be sent
- The **IP address of the interface** through which the traffic will be sent to the destination subnet
- The **metric,** which **indicates the number of hops required to reach destinations via the gateway**

Route command syntax

route [-f] [-p] [-4|-6] [Command [Destination] [mask Netmask] [Gateway] [metric Metric]] [if Interface]]

Most of the times this command syntax is used with print option like

Route print command syntax

route print [-f] [-p] [-4|-6] [Command [Destination] [mask Netmask] [Gateway] [metric Metric]] [if Interface]] >

This will create a text file with the name that user can observe following:

- Interface list:
- **IPv4 Route Table:**
- Active Routes:
- Persistent Routes:
- **IPv6 Route Table:**
- Active Routes:
- Persistent Routes:

- **Parameters** [edit]
- -f: Clears the routing table
- -p: The route is added to the Windows Registry and is used to initialize the IP routing table whenever the TCP/IP protocol is started (only when used with the add command)
- Command: The command to run (add, change, delete, print)
- -4: Force using IPv4
- -6: Force using IPv6
- Destination: Network destination of the route
- mask Netmask: The netmask (subnet mask) associated with the network destination

- Gateway: The forwarding or next hop IP address over which the set of addresses defined by the network destination and subnet mask are reachable
- metric Metric: Integer cost metric (ranging from 1 to 9999) for the route
- if Interface: The index of the interface over which the destination is reachable
- /?: Command help

Route Command syntax and Parameters

- **Some of the output screens shown below:**

Fig. 10.1 : output screen of command c:\>route –f –p -4

Fig. 10.2 : Output screen of command c:\>route –f –p -6

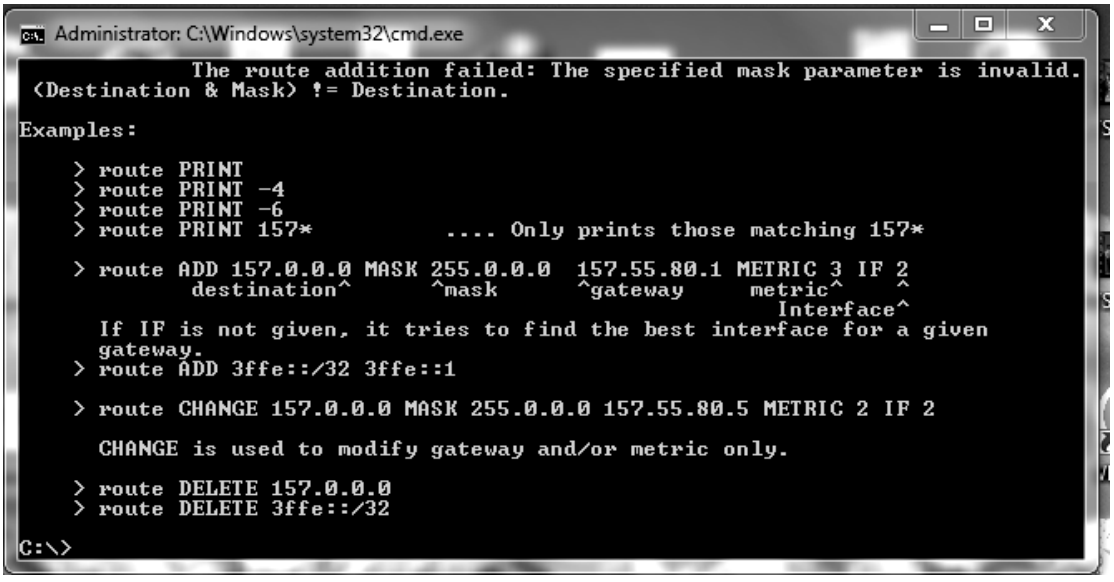

Fig.10.3 Output screen of command
c:\> Route –f –p command add - -4 destination 192.168.1.4 mask netmask 255.255.255.0

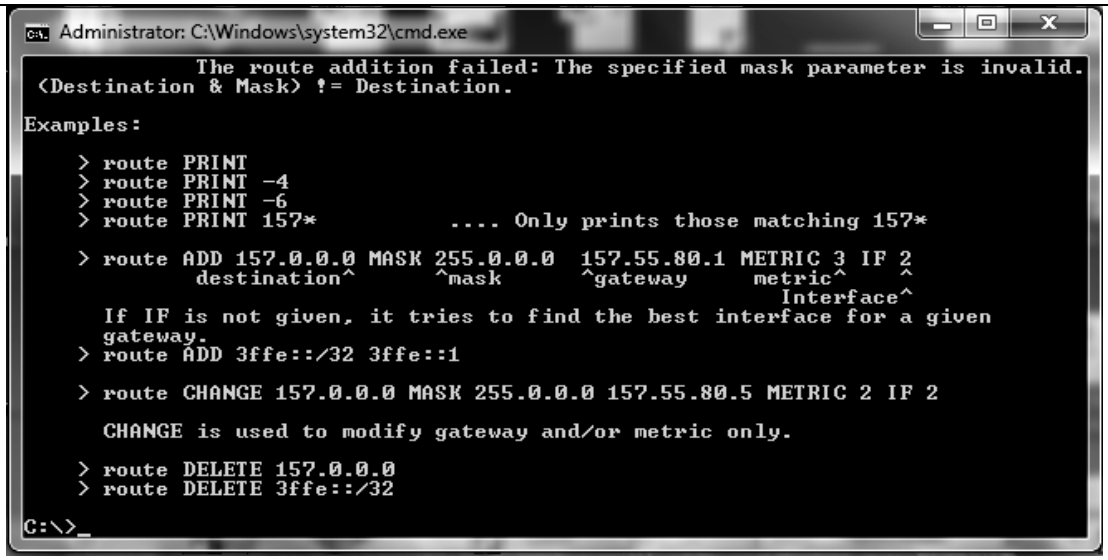

Fig. 10.4 Output screen of command
c:\> Route –f –p command add - -4 destination 192.168.1.4 mask netmask 255.255.255.0 if interface

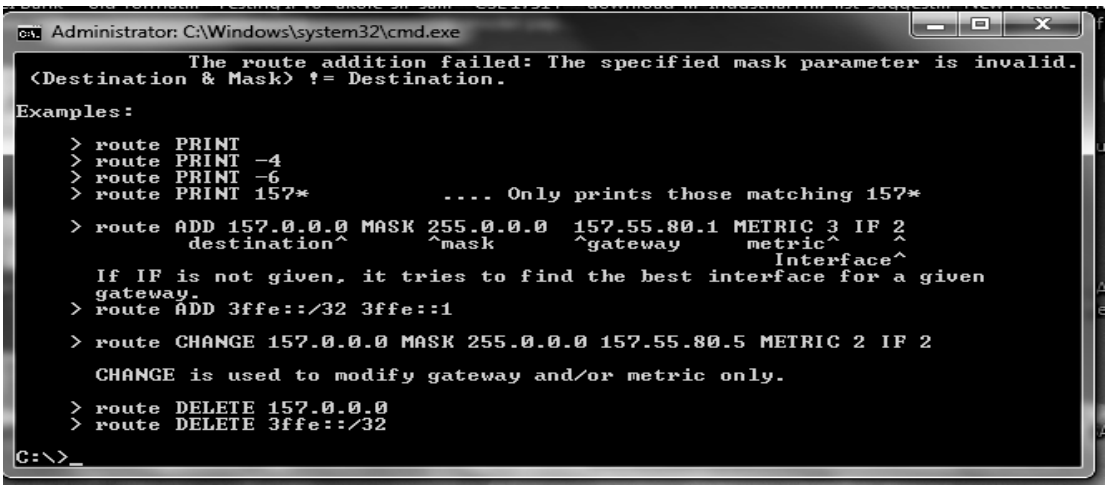

Fig. 10.5: Output screen of command
C:\>Route –p –f -4 command 192.168.1.25 mask netmask metric metric

```
===========================================================================
Interface List
 62...a4 17 31 e3 d6 fc ......Bluetooth Device (Personal Area Network) #2
 56...26 17 31 e3 d6 fb ......Microsoft Virtual WiFi Miniport Adapter
 55...a4 17 31 e3 d6 fb ......Qualcomm Atheros AR9485WB-EG Wireless Network
Adapter #2
 53...30 f9 ed ce 97 01 ......Realtek PCIe GBE Family Controller #2
  1...........................Software Loopback Interface 1
 95...00 00 00 00 00 00 00 e0 Microsoft ISATAP Adapter #4
 59...00 00 00 00 00 00 00 e0 Microsoft Teredo Tunneling Adapter
 83...00 00 00 00 00 00 00 e0 Microsoft ISATAP Adapter #49
===========================================================================
IPv4 Route Table
===========================================================================
Active Routes:
  None
Persistent Routes:
  None
===========================================================================
IPv6 Route Table
===========================================================================
Active Routes:
  None
Persistent Routes:
  None
```

Output screen of command C:\>Route print 198*

Tracert Command Syntax

tracert [**-d**] [**-h** *MaxHops*] [**-w** *TimeOut*] [**-4**] [**-6**] *target* [/**?**]

The availability of certain tracert command switches and other tracert command syntax may differ from operating system to operating system.

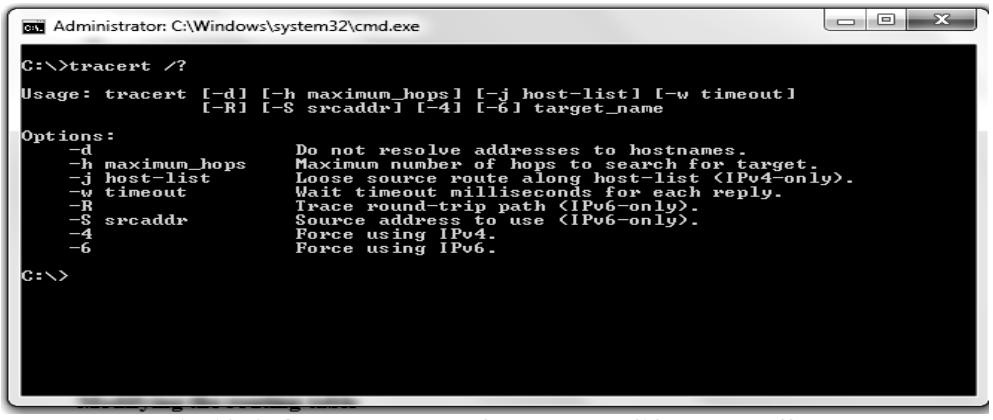

Fig.10.6: Output screen of command C:\>tracert /? Help

- Students can try following option as shown similar to route command except print

Fig. 10.7: Understanding The Tracert

Tracert Command Options

Item	Description
-d	This option prevents tracert from resolving IP addresses to hostnames, often resulting in much faster results.
-hMaxHops	This tracert option specifies the maximum number of hops in the search for the target. If you do not specify MaxHops, and a target has not been found by 30 hops, tracert will stop looking.

Item	Description
-w*TimeOut*	You can specify the time, in milliseconds, to allow each reply before timeout using this tracert option.
-4	This option forces tracert to use IPv4 only.
-6	This option forces tracert to use IPv6 only.
target	This is the destination, either an IP address or hostname.
/?	Use the help switch with the tracert command to show detailed help about the command's several options.

- **Following part of route command is only to bring awareness to students about the options for modification of routing table. (Suggested not to execute these commands as it may modify current table which create problem in accessing network.**

  Modifying the routing table
  Besides displaying the routing table, the route command also lets you modify it by adding, deleting, or changing entries.
  Warning: **User need to carefully use this command If you mess up the routing table, your computer may not be able to communicate with anyone.**
- The **command** option specifies one of the six commands in this table:

Table 10.1: Commands for modification of routing table

Command	Definition
print	Prints a route
add	Adds a route
delete	Deletes a route
change	Modifies an existing route
destination	Specifies the computer to send command
mask subnetmask	Specifies a subnet mask to be associated with this route entry (default subnet mask is 255.255.255.255)

Syntax for the route command for adding, deleting, or changing a route entry :
route [-p] command dest [mask subnet] gateway [-if interface]
The following list describes each of the route command's parameters:

- -p: Makes the entry persistent. If you omit -p, the entry will be deleted the next time you reboot. (Use this only with add commands.)
- command: Add, delete, or change.
- dest: The IP address of the destination subnet.
- mask subnet: The subnet mask. If you omit the subnet mask, the default is 255.255.255.255, meaning that the entry will apply only to a single host rather than a subnet. You usually want to include the mask.
- gateway: The IP address of the gateway to which packets will be sent.
- -if interface: The IP address of the interface through which packets will be sent. If your computer has only one network interface, you can omit this.

Suppose that your network has a second router that serves as a link to another private subnet, 192.168.2.0 (subnet mask 255.255.255.0). The interface on the local side of this router is at 192.168.1.200.

Examples

In order to view the entire contents of the IP routing table, issue the **route print** command.

In order to add a persistent route to the destination 10.19.0.0 with the subnet mask of 255.255.0.0 and the next hop address of 10.10.0.1, issue the **route -p add 10.19.0.0 mask 255.255.0.0 10.10.0.1** command.

In order to view the routes in the IP routing table that begin with "172.", issue the **route print 172.*** command.

In order to delete all routes in the IP routing table that begin with "172.", issue the **route delete 172.*** command.

Additional Commands for route:

- Syntax to ADD a static route entry
- C:\>route -p add 192.168.2.0 mask 255.255.255.0 192.168.1.200
- Syntax to CHANGE the IP address of the router to 192.168.1.222.
- C:\>route change 192.168.2.0 mask 255.255.255.0 192.168.1.222

- Syntax to DELETE the entry:
  C:\>route delete 192.168.2.0
  (If you omit the mask from a route change command, the command changes the mask to 255.255.255.255!)

VIII a) Commands need to type on Command Execution of command prompt

- Route command **command**
  route [-f] [-p] [-4|-6] [Command [Destination] [mask Netmask] [Gateway] [metric Metric]] [if Interface]]
- **Tracert** Command Syntax
  tracert *[-d] [-h* MaxHops*] [-w* TimeOut*] [-4] [-6]* target *[/?]*

The availability of certain tracert command switches and other tracert command syntax may differ from operating system to operating system.

b) Actual execution of commands used in laboratory

```
Examples:

    > route PRINT
    > route ADD 157.0.0.0 MASK 255.0.0.0  157.55.80.1 METRIC 3 IF 2
              destination^      ^mask      ^gateway     metric^    ^
                                                        Interface^
      If IF is not given, it tries to find the best interface for a given
      gateway.
    > route PRINT
    > route PRINT 157*            .... Only prints those matching 157*
    > route DELETE 157.0.0.0
    > route PRINT
```

Fig. 10.8 Execution of route print command

```
C:\WINNT\System32\cmd.exe
Microsoft(R) Windows NT(TM)
(C) Copyright 1985-1996 Microsoft Corp.

C:\>route print

Active Routes:

  Network Address          Netmask  Gateway Address       Interface  Metric
        0.0.0.0          0.0.0.0    199.98.126.2    199.98.126.16       1
     38.208.233.0    255.255.255.0    199.98.126.2    199.98.126.16       1
        127.0.0.0        255.0.0.0       127.0.0.1       127.0.0.1       1
     199.98.126.0    255.255.255.0  199.98.126.16    199.98.126.16       1
    199.98.126.16  255.255.255.255       127.0.0.1       127.0.0.1       1
   199.98.126.255  255.255.255.255  199.98.126.16    199.98.126.16       1
        224.0.0.0        224.0.0.0  199.98.126.16    199.98.126.16       1
  255.255.255.255  255.255.255.255  199.98.126.16    199.98.126.16       1

C:\>
```

Fig. 10.9

Execution of route print command (Win-NT Active routes)

Example -1:

Tracert Command Examples
tracert 192.168.1.1
In the above example, the tracert command is used to show the path from the networked computer on which the tracert command is being executed to a network device, in this case a router on a local network, that's assigned the 192.168.1.1 IP address.
The result displayed on screen will look something like this:
Tracing route to 192.168.1.1
over a maximum of 30 hops
1 <1 ms <1 ms <1 ms 192.168.1.254
2 <1 ms <1 ms <1 ms 192.168.1.1
Trace complete.
In this example, you can see that tracert found a network device using the IP address of192.168.1.254, let's say a network switch, followed by the destination, 192.168.1.1, the router.
tracert www.google.com

Example -2:

Using the tracert command as shown above, we're asking tracert to show us the path from the local computer all the way to the network device with the hostname www.google.com.
Tracing route to www.l.google.com [209.85.225.104]
over a maximum of 30 hops:
1 <1 ms <1 ms <1 ms 10.1.0.1
2 35 ms 19 ms 29 ms 98.245.140.1
3 11 ms 27 ms 9 ms te-0-3.dnv.comcast.net [68.85.105.201]
...
….
….
13 81 ms 76 ms 75 ms 209.85.241.37
14 84 ms 91 ms 87 ms 209.85.248.102
15 76 ms 112 ms 76 ms iy-f104.1e100.net [209.85.225.104]
Trace complete.

In above example tracert identified fifteen network devices including our router at 10.1.0.1 and all the way through to the target of www.google.com which we now know uses the public IP address of 209.85.225.104.
Note that: excluded hops 4 through 12 above just to keep the example simple. If you were executing a real tracert, those results would all show up on screen.

tracert -h 3 lifewire.com > z:\tracertresults.txt
In this last example of the tracert command in Windows, we're using ***-h* to limit the hop count to *3*,** but instead of displaying the results in Command Prompt, we'll use the > redirection operator to send it all to a TXT **tracert -h 3 lifewire.com > z:\tracertresults.txt**
file located on *Z:*, an external hard drive.
Here are some example results of this last command:
Tracing route to lifewire.com [151.101.66.114]
over a maximum of 3 hops:
1 <1 ms <1 ms <1 ms testwifi.here [192.168.86.1]
2 1 ms 1 ms <1 ms 192.168.1.1
3 17 ms 16 ms 17 ms giantwls-64-71-222-1.giantcomm.net [64.71.222.1]
Trace complete.
Tracert Related Commands

Fig. 10.5: Output of command c:>\ tracert -h 3 lifewire.com > c:\tracertresults.txt

IX Resources required

Sr. No.	Instrument /Components	Specification	Quantity
1.	Personal computers with Internet connectivity	Standard computers with Broad specifications with 32 bit with 2GB RAM	1

X Precautions to be Followed

1. Here's how the rules shown in this example are used. Notice that you have to read the entries from the bottom up:
2. The availability of certain tracert command switches and other tracert command syntax may differ from operating system to operating system.
3. If websites or IP address are Secured they may not respond successfully for the **route** and **tracert** command(s)

XI Procedure (Execution of commands)

Route or **route** command syntax
The command-syntax is:

route [-f] [-p] [-4|-6] [Command [Destination] [mask Netmask] [Gateway] [metric Metric]] [if Interface]]

Tracert or **tracert** Command Syntax
tracert [**-d**] [**-h** *MaxHops*] [**-w** *TimeOut*] [**-4**] [**-6**] *target* [/**?**]

XII Resources used

Sr. No.	Instrument /Components	Specification	Quantity
1.			

XIII Actual procedure followed

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XIV Precautions followed (use blank sheet provided if space not sufficient)

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XV Observations (use blank sheet provided if space not sufficient)

Record following Observations in space for answers.

1. Rewrite contents of IPV4 Route table Active routes from Fig 10.7
2. Rewrite output of command tracert from Fig. 10.3

XVI Result

1. Try any two web sites with their Website address for route command
2. Try any two popular web sites with their name for tracert command

XVII Interpretation of Results

Comment on output of route and tracert commands. In your own language.

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XVIII Conclusions and Recommendations

(Actions/decisions to be taken based on the interpretation of results).

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XIX Practical Related Questions

Note: Below given are few sample questions for reference. Teacher must design more such questions so as to ensure the achievement of identified CO.

1. Execute the syntax of Route command with any two options
2. Write contents of tracert command for www.amazon.comafter execution.
3. Give syntax of commands for adding , deleting IP addresses from routing table.

[Space for Answers]

XX References / Suggestions for further Reading

1. https://en.wikipedia.org/wiki/Route_(command)
2. https://sourcedaddy.com/networking/using-route-command.html
3. https://www.lifewire.com/tracert-command-2618101
4. https://sourcedaddy.com/networking/using-route-command.html
5. https://sourcedaddy.com/networking/using-tracert-command.html
6. Technical Support & Documentation - Cisco Systems

XXI Assessment Scheme

Performance indicators		Weightage
Process related: (15 Marks)		**60%**
1	Proper handling of the equipment	20%
2	Selection of Command with options	20%
3	Execution of commands and observation of output	20%
Product related: (10 Marks)		**40%**
4	Results	20%
5	Practical related questions	10%
6	Submission of report in time	10%
	Total (25 Marks)	**100 %**

Name of Team Members

1. ……..
2. ……..
3. ……..
4. ……..

Marks Obtained			Dated signature of Teacher
Process Related (15)	**Product Related (10)**	**Total (25)**	

Practical No.11: Install and test Router, Repeater and Bridge.

I Practical Significance

A **router** (even a wireless **router**) is a special networking device which is connected to two or more networks running software that allows the **router** to move data from one network to another. **Router** functions in an Internet protocol based network and operate at the network layer (OSI Model's layer 3).

A router is a networking device that forwards data packets between computer networks. Routers perform the traffic directing functions on the Internet. Data sent through the internet, such as a web page or email, is in the form of data packets.

A Repeater can be used to increase the length of network by eliminating the effect of attenuation on the signal. It forwards every frame and it has no filtering capability. A repeater is a regenerator, not an amplifier. It operates in physical layer. Repeaters are used in transmission systems to regenerate analog or digital signals distorted by transmission loss in a data **network**, a **repeater** can relay messages between sub-networks that use different protocols or cable types.

Network Bridge is used for connecting two or more LANs.

The student will be able to install router, repeater and bridge

II Relevant Program Outcomes (POs)

- **Discipline knowledge**: Apply Electronics and Telecommunication engineering knowledge to solve broad-based Electronics and Telecommunications engineering related problems.
- **Experiments and practice:** Plan to perform experiments and practices to use the results to solve broad-based Electronics and Telecommunication engineering problems.
- **Individual and team work:** Function effectively as a leader and team member in diverse/ multidisciplinary teams.
- **Life-long learning:** Engage in independent and life-long learning activities in the context of technological changes also in the Electronics and Telecommunication engineering and allied industry.

III Competency and Practical skills

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences**:**

Maintain computer network systems.

Establish and track computer network.

Installation and configuration of networking devices like Router, Repeater and Bridge.

IV Relevant Course Outcome

Use the relevant network model for the specified data communication system.

Configure the network component and assign IP address.

V Practical Outcome:

Install and test Router, Repeater and Bridge

VI Relevant Affective domain related Outcomes

- Demonstrate working as a leader/a team member. .
- Follow ethical practices.
- Handle equipment carefully.
- Follow safety practices.

VII Minimum Theoretical Background

- A **Router** (even a wireless **router**) is a special networking device which is connected to two or more networks running software that allows the **router** to move data from one network to another. **Router** functions in an Internet protocol based network operate at the network layer (OSI Model's layer 3).

  Router holds the home network together. It connects all the computers to one another, either through Ethernet cables or a wireless connection.

  The basic components of any Cisco router are :
  - Interfaces.
  - The Processor (CPU)
  - Internetwork Operating System (IOS)
  - RXBoot Image.
  - RAM.
  - NVRAM.
  - ROM.
  - Flash memory.

  Types of Routers

  Broadband Routers are used to connect computers or to connect to the Internet. If it is required to connect to the internet through phone and using Voice over IP technology (VOIP) it need broadband router. These are special type of modem (ADSL) that will have both Ethernet and phone jacks.

  Wireless Routers: create a wireless signal in your home or office. So, any PC within range of Wireless routers can connect it and use your Internet.

  To secure Wireless routers, use password or get IP address.

- **Repeater** is a **network** device used to regenerate or replicate a signal. **Repeaters** are used in transmission systems to regenerate analog or digital signals distorted by transmission loss. Analog **repeaters** frequently can regenerate the original signal while digital **repeaters can** reconstruct a signal to near its original quality.

  Bridges vs. Repeaters

  Bridges and network repeaters share a similar physical appearance. Sometimes, a single unit performs both functions. Unlike bridges, however, repeaters do not perform any traffic filtering and do not join two networks together. Instead, repeaters pass along the traffic they receive. Repeaters serve primarily to regenerate traffic signals so that a single network can reach a longer physical distance.

  Bridges vs. Switches and Routers

  In wired computer networks, bridges serve a similar function as network switches. Conventionally, wired bridges support one incoming and one outgoing

network connection, which is accessible through a hardware port, whereas switches usually offer four or more hardware ports. Switches are sometimes called multiport bridges for this reason.

Bridges lack the intelligence of network routers. Bridges do not understand the concept of remote networks and cannot redirect messages to different locations dynamically but instead support only one outside interface.

VIII a) Block Diagram

Fig 11.1: Router connectivity

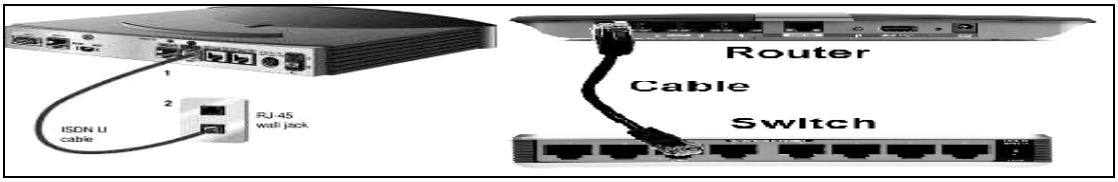

Fig. 11. 2 Router to Wall Jack and Switch Network Connection Connection

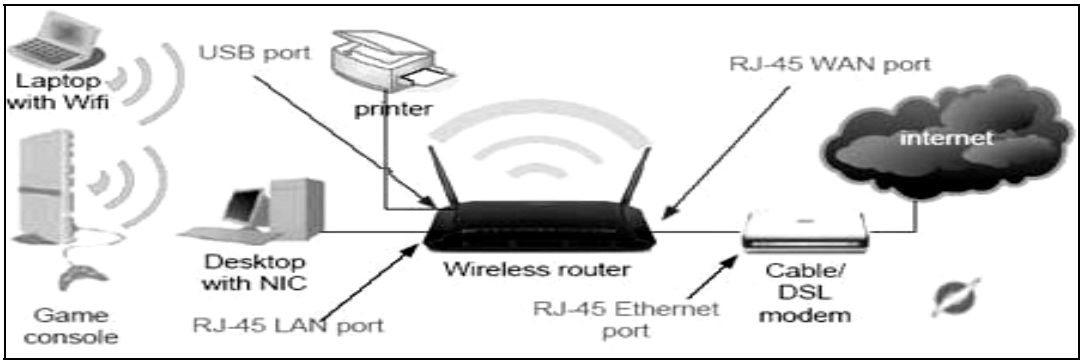

Fig. 11.3: Wired Router connection diagram.

Fig. 11.4: Wireless Router connection diagram.

r

Fig.11.5: Optic fiber Repeater

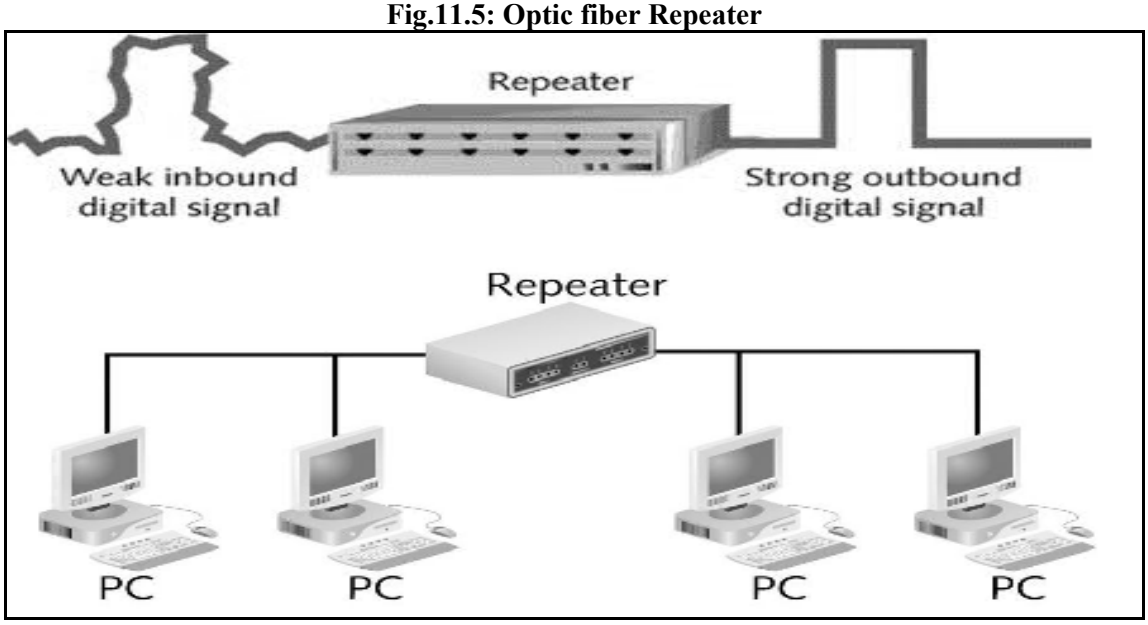

Fig.11.6: Repeater connection

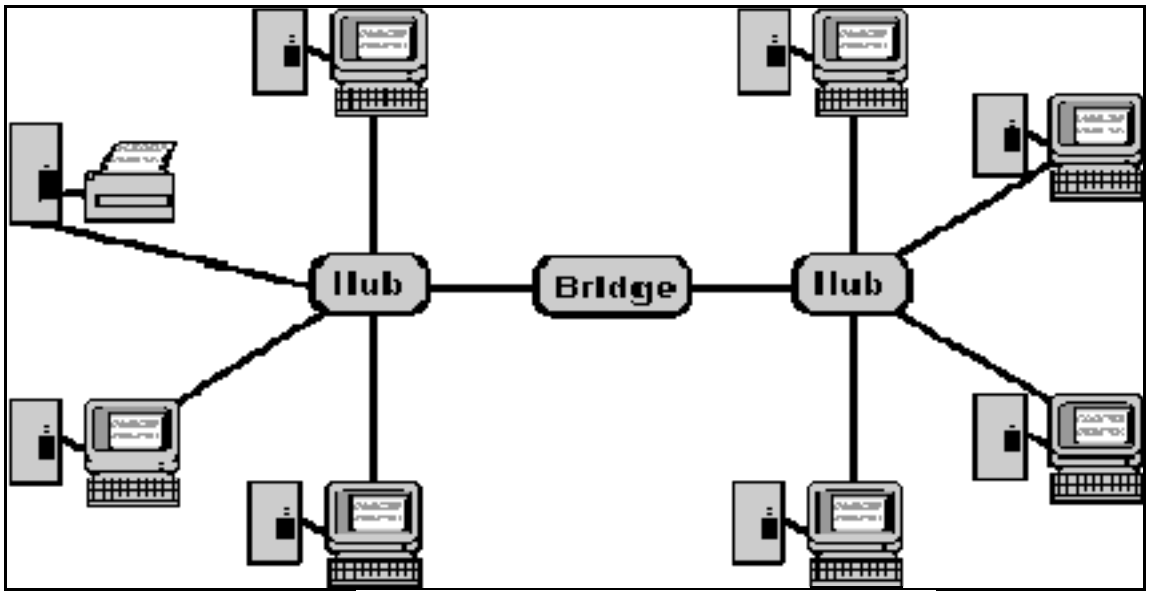

Fig 11.7: Connection diagram of Bridge in network

b) Actual Circuit used in laboratory

- **Router Connection Diagram:**

- **Repeater Connection Diagram:**

- **Bridge Connection Diagram:**

IX Resources required

Sr. No.	Instrument /Components	Specification	Quantity
1	Router	TP-Link standard router	1
2	Repeater	Outdoor Band Selective Mobile Signal Repeater suggested	1
3	Network Bridge	TP-Link standard bridge router	1
4	Personal Computers (For additional Terminals)	Intel P-IV , 2Gbyte , DDR2 , 500Gbyte HDD, Keyboard onwards Installed with Windows 7 onwards and internet connectivity	01
5	Hub	Minimum 4 port Hub	02
6	Switch	Minimum 8 port switch	01
7	Cables	Cross-over cable (with RJ-45 connector)	As per no. of connection to be made
8	Cables	Straight cable (with RJ-45 connector)	As per no. of connection to be made

X Precautions to be Followed

1. Default network name (SSID)
2. Apply Firewall default setting
3. Administration options for security shall be verified.
4. IP addresses can be dynamically assigned by the DHCP server as static only as a temporary solution. Preferably assign an IP address in the range that doesn't belong to the DHCP address pool on available router.

XI Procedure used

1) **To install a Router**
   a) Check Your Internet Connection
   b) Place the Router
   c) Connect to Power
   d) Connect to Your Internet Source
   e) Access the Router's Web Interface
   f) Connect Wired Devices
   g) Connect Your PC or Device to Wi-Fi

2) **To configure router for cable internet connection with Smart Wizard:**

a) Connect modem to the internet port of the router and computer to any of the four LAN ports.

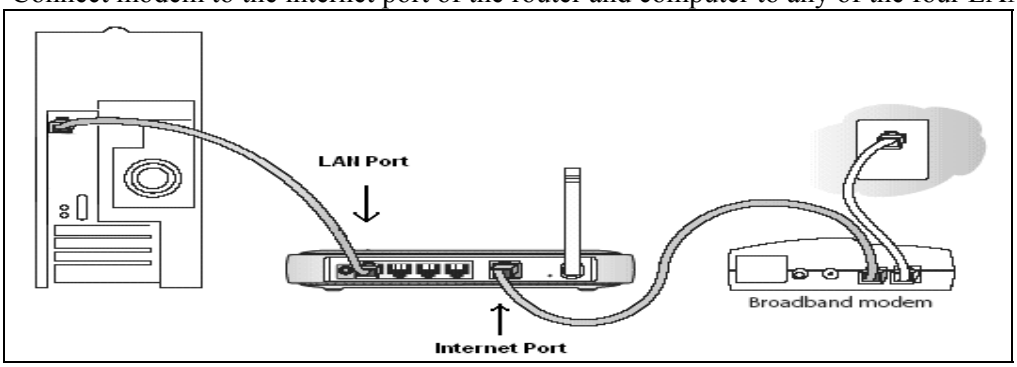

Fig. 11.8 Interconnection of Modem Router and PC

b) Switch the computer, router, and broadband/cable modem, off and on again. Wait for them all to finish booting up.

c) Open a web browser and type the router's IP address which would be either http://192.168.0.1 or http://192.168.1.1 in the address bar and press Enter.
   - User gets prompt to log into the router.
   - Default username is **admin** and the default password is **password**.
   - The username and password are case-sensitive.
   - If the default username and password is not working, user might have changed the password. Please try other passwords that you might have changed to. Otherwise, a factory reset is needed to restore the router to factory defaults setting.

3) Click Setup **Wizard**. The Setup Wizard screen displays.

4) Select **Yes** and click **Next**.

Fig. 11.9: Setup Wizard router

The Setup Wizard detects the type of internet connection. For cable internet connections, the Setup Wizard detects **Dynamic IP**.

5) Click **Next**. The router saves the settings.

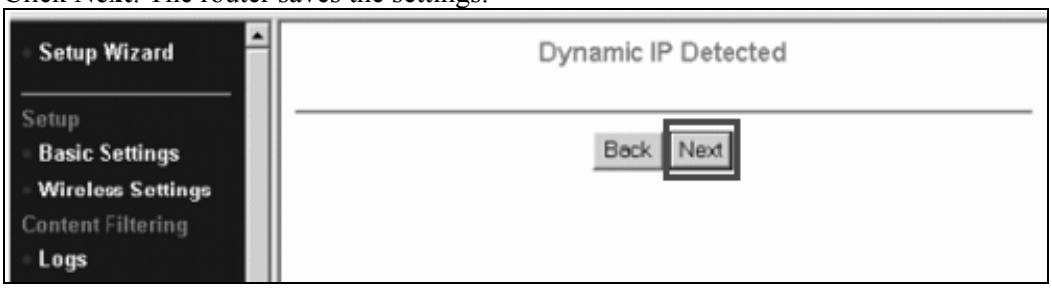

Fig. 11.10: Setup Wizard router to detect dynamic IP

Note: Do not change the default settings unless your internet service provider gave specific DNS information that must be configured.

6) (Optional) To check if connected to the internet, select **Router Status** under **Maintenance**.

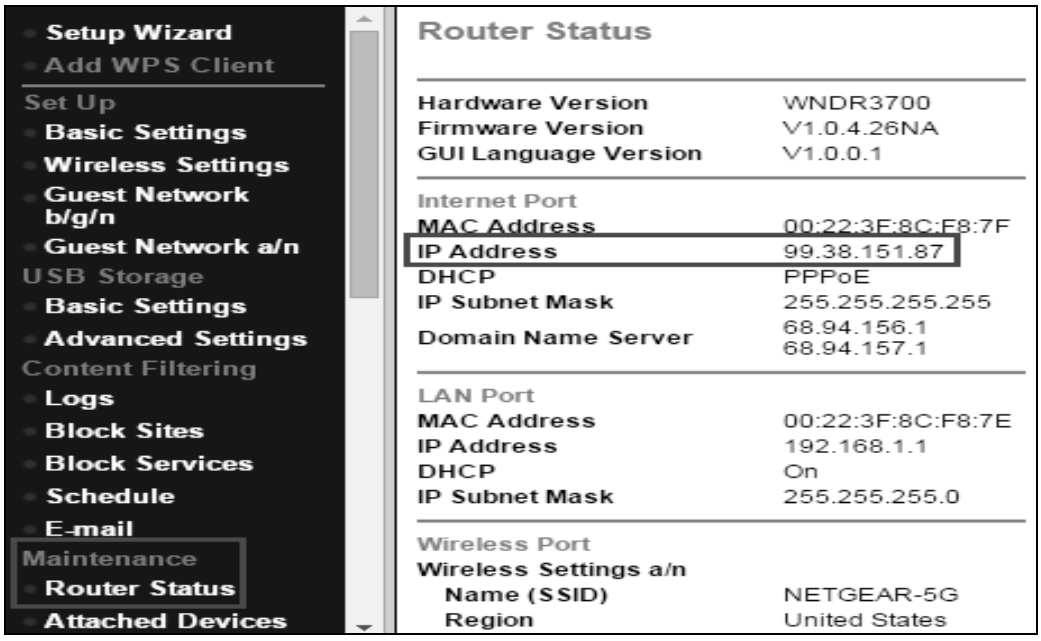

Fig.11.11: Router Status Maintenance Menu

Look at the **IP Address** field to see a valid IP address (that is, not blank or filled with zeroes, such as 0.0.0.0).

- **Install a Repeater Bridge:**

The Client Bridge allows only wired clients to connect to the secondary router. In order to allow wireless clients to connect to the secondary router, a Repeater Bridge is necessary.

A Repeater Bridge allows wireless and wired clients to connect to the secondary router. It also allows the secondary device to connect to the main device wirelessly.

- **Repeater Installation /setup Process**

1. Plug the repeater into a working AC power outlet in location within range of existing Wi-Fi coverage.
2. Using a nearby computer or laptop, connect the repeater.

3. Connect an Ethernet cable directly from the repeater to your PC, or by connecting to the repeater's wireless network, often called something like *Wi-Fi Repeater*
4. When they are connected, open computer's local area network properties. On Windows, select Start > Control Panel > View Network Status and Tasks > Manage Network Connections. Then, right-click Local Area Network and choose Properties, followed by Internet Protocol Version 4 and Properties again.
5. Check the repeater's instructions but the default IP address student need to enter in the respective blank field is usually 192.168.10.1. Also enter common number strings for the subnet mask (255.255.255.0) and default gateway (192.168.10.1).
6. Open a web browser and type http://192.168.10.1 in the address bar. It may ask to enter a DNS server address, leave the field blank. If asked for a username and password, try entering admin in both fields or admin in the username field and password in the password field. This brings you to the Setup Wizard.
7. Choose Wireless Repeater Mode and click Repeater – One Key Setting. When it appears, select the Wireless Network Selection button and click Refresh List.
8. Choose main router's wireless network to connect the repeater to the router and click Next.
9. Enter Wi-Fi network's password in the Pre-Shared Key field when prompted if the network is secured. Now click Apply and Reboot and OK.

- **Testing Repeater:**
  Now Wi-Fi repeater setup is complete, Student may verify that wireless signal has more range than earlier.

- **Install bridge connection**
  To gain access to the internet from the host computer do the following:

1. Use the **Windows key + X** to open the Power User menu and select Network Connections.
2. Right-click the bridge adapter and select **Properties**.

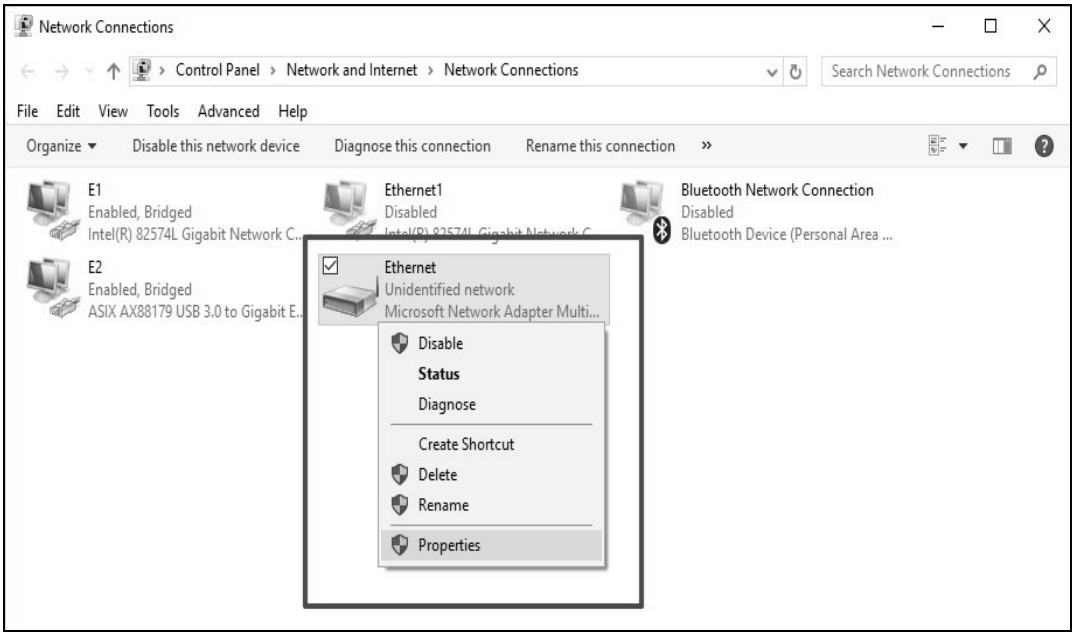

Fig.11.12: Network connection menu of windows control panel

3. Select the network adapter that connects to the internet.
4. Select **Internet Protocol Version 4 (TCP/IPv4)**.
5. Click **Properties.**

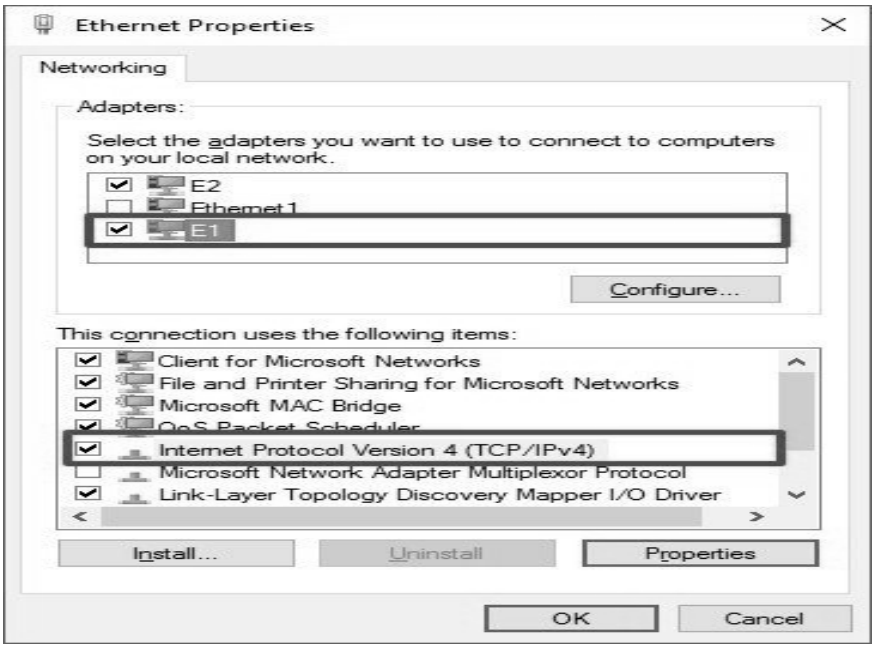

Fig.11.13: Ethernet properties

6. Select the **Use the following IP address** option.
7. Use the IP address information you collected at the beginning of this guide to assign a static IP address like is shown in the screenshot below.

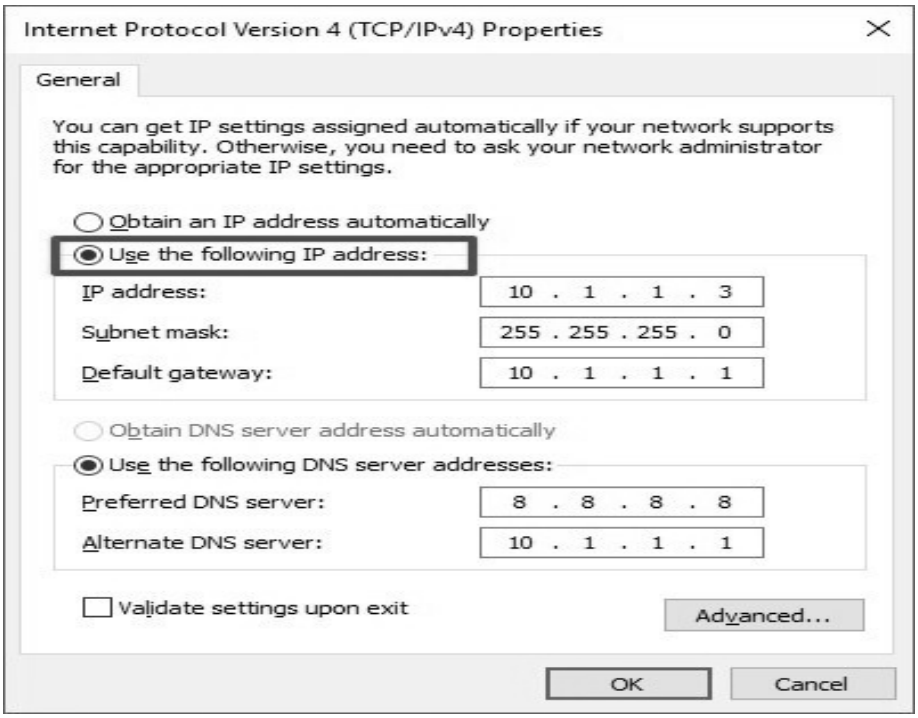

Fig.11.14: Internet protocol version 4 (TCP/IPv4) properties

8. Click **OK**.
9. Click **Close** to complete the task.

XII Resources used

Sr. No.	Instrument /Components	Specification	Quantity
1.	Router	TP-Link standard router	1
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			

XIII Actual procedure followed (use blank sheet provided if space not sufficient)

Write connection process for connecting router:
(Use blank sheet provided if space not sufficient)

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Write connection process for interfacing repeater:
(Use blank sheet provided if space not sufficient)

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Write connection process for interfacing bridge:
(use blank sheet provided if space not sufficient)

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XIV Precautions followed (use blank sheet provided if space not sufficient)

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XV Observations (use blank sheet provided if space not sufficient

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XVI Result

- Installation of Router is successful……. ……..
- Installation and Testing of Repeater is ……..
- Bridge is removed from the network……..

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XVII Interpretation of Results

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XVIII Conclusions and Recommendations

(Actions/decisions to be taken based on the interpretation of results).

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XIX Practical Related Questions

Note: Below given are few sample questions for reference. Teacher must design more such questions so as to ensure the achievement of identified CO.

Answer the following questions:

1. Test pinging between Host R1 to R2. Write status of pinging.
2. Can bridge be exchanged with repeater in connection?
3. Label all the network components used in given fig. 11.15

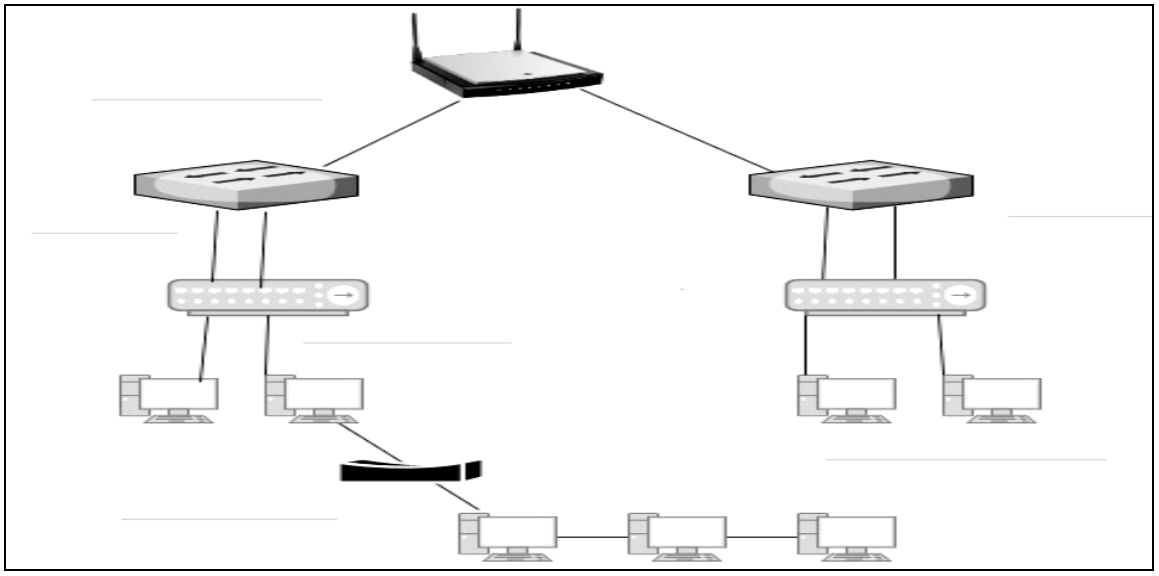

Fig. 11.15

[Space for Answers]

XX References / Suggestions for further Reading

1. https://en.wikipedia.org/wiki/Router
2. http://www.informit.com/articles/article.aspx?p=1151312&seqNum=5
3. https://sourcedaddy.com/networking/using-route-command.html
4. https://www.smallnetbuilder.com/basics/lanwan-basics/31442-how-to-add-ports-to-a-router
5. https://www.google.com/search?q=connecting+Repeater+in+computer+network&source=lnms&tbm=isch&sa=X&ved=0ahUKEwjm6M_PovLjAhXOZSsKHbQSC0YQ_AUIESgB&biw=1236&bih=524#imgrc=Xa4d7vIOnVkuFM:
6. https://askleo.com/whats_the_difference_between_a_hub_a_switch_and_a_router/

XXI Assessment Scheme

Performance indicators		Weightage
Process related: (15 Marks)		**60%**
1	Preparation of properly as per specification	20%
N 2	Installation and Configuration of router , Repeater, Bridge properly	20%
3	Testing of cable using LAN Tester	20%
Product related: (10 Marks)		**40%**
4	Results	20%
5	Practical related questions	10%
6	Submission of report in time	10%
	Total (25 Marks)	**100 %**

Name of Team Members

1. ……..
2. ……..
3. ……..
4. ……..

Marks Obtained			Dated signature of Teacher
Process Related (15)	**Product Related (10)**	**Total (25)**	

Practical No.12: Assign IP address to the PC connected to the internet.

I Practical Significance

An IP address is an address used in order to uniquely identify a device on an IP network. The address is made up of 32 binary bits, which can be divisible into a network portion and host portion with the help of a subnet mask. The 32 binary bits are divided into four octets (1 octet = 8 bits). Each octet is converted to decimal and separated by a period (dot). For this reason, an IP address is said to be expressed in dotted decimal format (for example, 172.16.81.100). The value in each octet ranges from 0 to 255 decimal, or 00000000 - 11111111 binary. The student will be able to assign Static and Dynamic IP addresses to the machine.

II Relevant Program Outcomes (POs)

- **Discipline knowledge**: Apply Electronics and Telecommunication engineering knowledge to solve broad-based Electronics and Telecommunications engineering related problems.
- **Experiments and practice:** Plan to perform experiments and practices to use the results to solve broad-based Electronics and Telecommunication engineering problems.
- **Individual and team work:** Function effectively as a leader and team member in diverse/ multidisciplinary teams.

III Competency and Practical skills

This practical is expected to develop the following skills for the industry identified competency

'Maintain Computer Network systems'

Assign IP address to computer.

IV Relevant Course Outcome

Use the relevant network model for the specified data communication system.

Configure the network component and assign IP address.

V Practical Outcome

Assign IP address to the PC connected to the internet.

VI Relevant Affective domain related Outcomes

- Follow ethical Practices
- Handle equipment carefully.
- Follow safety practices.

VII Minimum Theoretical Background

Internet Protocol address (IP address) is a numerical label assigned to each device connected to a computer network that uses the Internet Protocol for communication. An IP address serves two main functions: host or network interface identification and location addressing**.** Internet Protocol version 4 (IPv4) defines an IP address as a 32-bit number. However, because of the growth of the Internet and the depletion of available IPv4 addresses, a new version of IP (IPv6), using 128 bits for the IP address, is developed. IP addresses are assigned to a host either dynamically as they join the

network, or persistently by configuration of the host hardware or software. Persistent configuration is also known as using a static IP address.When a computer's IP address is assigned each time it restarts, this is known as using a dynamic IP address.

Static IP Address: It is manually configured for a device. Routers, phones, tablets, laptops, desktops can be configured to have a static IP address.

Dynamic IP Address: It is a temporary IP address assigned to a computing device or node when it is connected to a network. A dynamic IP address is an automatically configured IP address assigned by a DHCP server to every new network node. They are normally implemented by internet service providers and network that have a large number of connecting end nodes. The dynamic IP address is assigned to a node until it is connected to the network and hence a device may have different IP address every time it is connected to the network.

VIII IP address Classes

IP Address Class	IP Address Range (First octet decimal value)
Class A	1-126 (00000001 to 01111110) *
Class B	128-191 (10000000 to 10111111)
Class C	192-223 (11000000 to 11011111)
Class D	224-239 (11100000 to 11101111)
Class E	240-255 (11110000 to 11111111)

Class A Extremely large network, 16,777.000 available host address.

Class B Large network, 16,384 networks,each supporting more then 65,000 hosts.

Class C small networks, more than 2 million networks,each supporting up to 256 host.

Fig. 12.1 Classes of IP adress

IX Resources required

Sr. No.	Instrument /Components	Specification	Quantity
1.	Personal computers with Internet connectivity	Standard computers with Broad specifications with 32 bit with 2GB RAM	1

X Precautions to be Followed

- Handle equipment with care
- Avoid the repeatation of similar IP addresses to two or more different PCs. It may cause IP conflict error in networking.
- Try use address for same range for one computer network and preferably in sequence to manage network easily

XI Procedure

To set a static IP address on windows computer

1. Click Start menu> control panel>Network and Internet >network and sharing center.

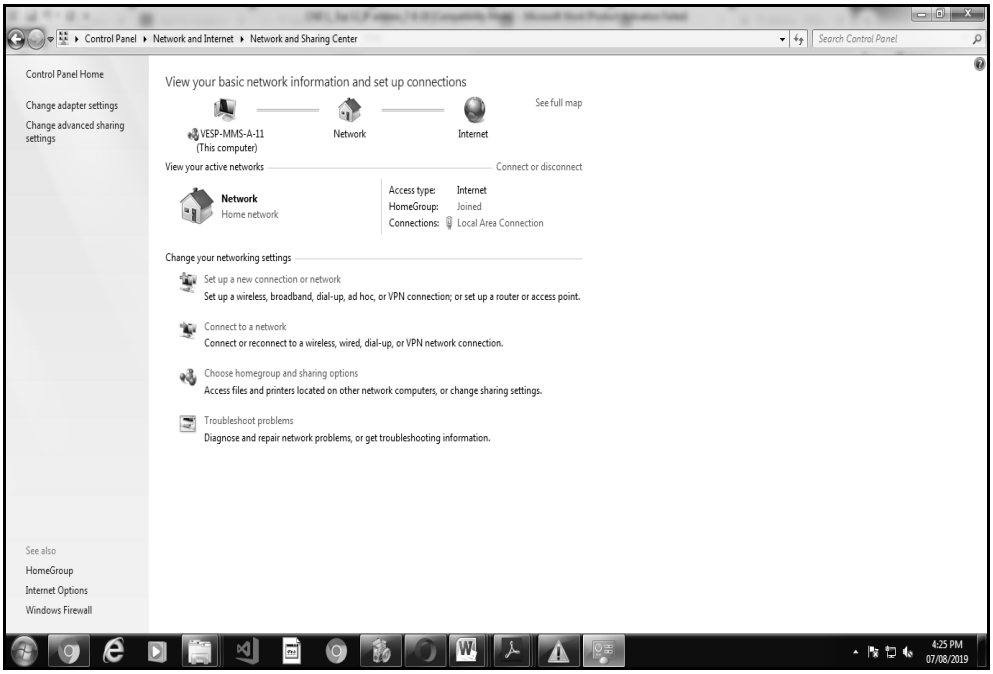

Fig. 12.2 Setting ►Control Panel►Media and sharing center Menu

2. Click " Change Adapter Settings". Right Click "Local Area Connection" and then click on " Properties"

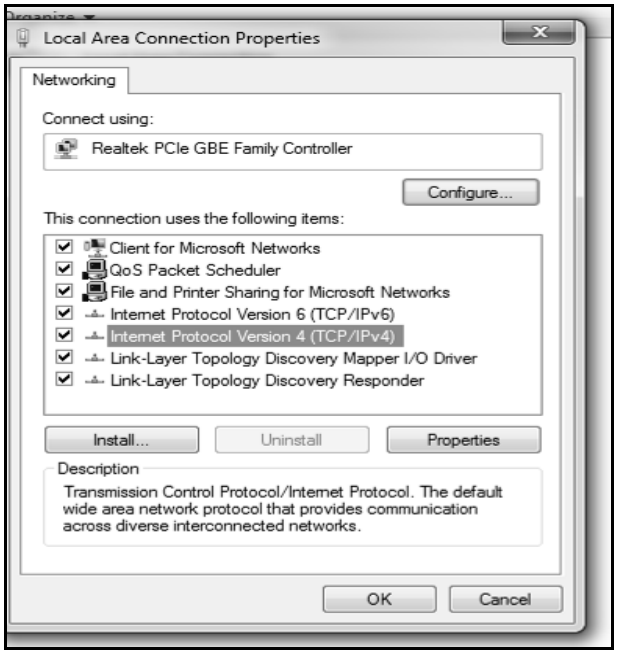

Fig. 12.3 Setting Control Panel ►Media Center…►Local a connection Properties Menu

3. Select Internet Protocol Version 4(TCP/IPv4). Click on " Properties"
4. Select " Use the following IP address" and enter the IP address, Subnet Mask, Default Gateway and DNS server. Click"OK" and Close the Local Area Connection properties window.

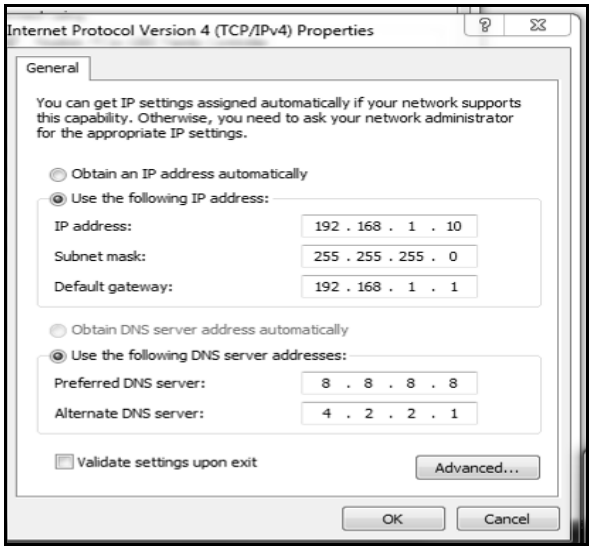

Fig. 12.4 Setting ►Media ►Local a connection Properties►Internet Protocol Version 4 (TCP/IPV4) Properties Menu

To set a dynamic IP address

1. Open Control Panel.
2. Click on the Network and Sharing Center icon.
3. In the View your active networks section, click the Local Area Connection link.
4. In the *Local Area Connection Status* window, click the Properties button.
5. Highlight the Internet Protocol Version 4 option and click the Properties button. Perform the following steps for the *Internet Protocol Version 6* option as well.
6. If you want to enable DHCP, make sure Obtain an IP address automatically is selected, as well as Obtain DNS server address automatically
7. Note the IP allocated in the observation.

XII Resources used

Sr. No.	Instrument /Components	Specification	Quantity
1.			

XIII Actual procedure followed

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XIV Precautions followed (use blank sheet provided if space not sufficient)

1. Avoid IP conflict.
2. Give ranges of addresses of same class of address.

XV Observations (use blank sheet provided if space not sufficient):

The static IP address assigned is……..
Subnet Mask Assigned is ……
The dynamic IP address assigned is ……
Range of Addresses allotted…….

XVI Result

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XVII Interpretation of Results

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XVIII Conclusions and Recommendations (Actions/decisions to be taken based on the interpretation of results).

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XIX Practical Related Questions

Note: Below given are few sample questions for reference. Teacher must design more such questions so as to ensure the achievement of identified CO.

1. State the number of networks allowed under Class C addresses in the IPv4 addressing format.
2. State the size of an IP address.
3. Suggest class of IP address for a computer lab. Network.
4. Set www.google.com as default page in internet explorer.

[Space for Answers]

XX References / Suggestions for further Reading

1. https://www.youtube.com/watch?v=aVs5QJUDsM0
2. https://www.youtube.com/watch?v=rspWwGqmsWI
3. https://www.youtube.com/watch?v=NGe2Zg3mWv0

XXI Assessment Scheme

Performance indicators		Weightage
Process related: (15 Marks)		**60%**
1	Proper handling of the equipment and making proper connections	20%
2	Use of various commands	20%
3	Assigning proper IP addresses	20%
Product related: (10 Marks)		**40%**
4	Results	20%
5	Practical related questions	10%
6	Submission of report in time	10%
	Total (25 Marks)	**100 %**

Name of Team Members

1. ……..
2. ……..
3. ……..
4. ……..

Marks Obtained			Dated signature of Teacher
Process Related (15)	**Product Related (10)**	**Total (25)**	

Practical No.13: Configure/Test Internet connectivity.

I Practical Significance

The term Internet access is the ability of individuals and organizations to connect to the Internet using computer terminals, computers, and other devices; and to access services such as email and the World Wide Web. Internet access is supplied by Internet service providers (ISPs) providing connectivity at a wide range of data transfer rates via various networking technologies. It is used by many organizations; also provide cost-free wireless access

The internet plays a vital role in ensuring that people stay in contact regardless of the physical barriers. The Internet era is started from network access servers supporting the Serial Line Internet Protocol (SLIP) and later the point-to-point protocol (PPP) extended the Internet protocols and made the full range of Internet services available to dial-up users; although slower, due to the lower data rates available using dial-up.

Broadband Internet access, or broadband, is defined as "Internet access that is always on, and faster than the traditional dial-up access" and covers a wide range of technologies. Broadband connections are typically made using a computer's built in Ethernet networking capabilities, or by using a NIC expansion card.

Most broadband services provide a continuous "always on" connection; there is no dial-in process required, and it does not interfere with voice use of phone lines.

Broadband provides improved access to Internet services such as:

- Faster world wide web browsing
- Faster downloading of documents, photographs, videos, and other large files
- Telephony, radio, television, and videoconferencing
- Virtual private networks and remote system administration
- Online gaming, especially massively multiplayer online role-playing games which are interaction-intensive

  The student will be able to configure and test internet connection.

II Relevant Program Outcomes (POs)

- **Discipline knowledge**: Apply Electronics and Telecommunication engineering knowledge to solve broad-based Electronics and Telecommunications engineering related problems.
- **Experiments and practice:** Plan to perform experiments and practices to use the results to solve broad-based Electronics and Telecommunication engineering problems.
- **Individual and team work:** Function effectively as a leader and team member in diverse/ multidisciplinary teams.
- **Life-long learning:** Engage in independent and life-long learning activities in the context of technological changes also in the Electronics and Telecommunication engineering and allied industry.

III Competency and Practical skills

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences**:**

Maintain computer network systems.

Able to configure and access internet.

Able to rectify basic problems in internet access.

IV Relevant Course Outcome

Use the relevant network model for the specified data communication system.
Configure the network component and assign IP address.

V Practical Outcome

Configure/Test Internet connectivity.

VI Relevant Affective domain related Outcomes

- Demonstrate working as a leader/a team member. .
- Follow ethical practices.
- Handle equipment carefully.
- Follow safety practices.

VII Minimum Theoretical Background

Different Types of Internet Connections

- Dial-Up
- DSL stands for Digital Subscriber Line/ ADSL
- Cable-net provides an internet connection through a cable modem and operates over cable TV lines
- Wireless, or Wi-Fi, as the name suggests, does not use telephone lines or cables to connect to the internet. ...
- Satellite.
- Cellular/ Smart phone

To connect to the Internet following four things are required:

1. A computer / Laptop
2. A modem and telephone line (for dial up access) A data line of some sort (if not using dial up access)
3. An Internet browser (software) and software to connect you to the ISP
4. An account with an Internet Service Provider (ISP)

Following terms must be known to Internet user for accessing Internet through ISP.

Domain Name: The name of ISP's domain.
Communications Port: to which modem is attached. It is usually called COM1 or COM2. This information is only needed by PC users (not by Mac users).
Modem Speed: The slower speed of modem and ISP's modem. This is measured in Kbps/Mbps (Kilo Bytes per Sec./Mega Bytes per second.
Modem: The type of modem available.
Phone Number: The Telephone number to connect to ISP.
Username or login name: The name of the account with ISP. Example MSBTE
User password: This is password for user account, given by ISP. It will be further updated by users time to time for safety.
Domain Name Server addresses (DNS): Domain name server is a computer that works on all addresses in the domain. It translates English addresses into their number addresses, and vice versa. The address of this computer is the DNS address, and it is a string of numbers. Example: 192.168.67.89
Interface Type: Provided between user and the Internet. Some user choices are PPP, CSLIP and SLIP, ADSL.

User's Own Numeric Internet Address: received from ISP. Some ISP's use dynamic addressing, in which they allocate an Internet address for every log in. This address is not a permanent number.

Your Own Host Name: Some ISP's will give your computer a name. Example: Kevin /

The type of Internet access will determine the type of modem needed.

1. Dial-up access uses a telephone modem
2. DSL service uses a DSL modem or ADSL
3. Cable access uses a cable modem
4. Satellite service uses a satellite adapter.

To connect to the internet, there is need of computing device, a connection device and an Internet Service Provider (ISP). An ISP is a company that provides internet connectivity to individuals, businesses and organisations. It may also provide additional services such as storage space to store personal data. The computing device can be a personal computer, a laptop computer, a tablet or a handheld device such as a smart phone.

VIII a) Connection Diagram

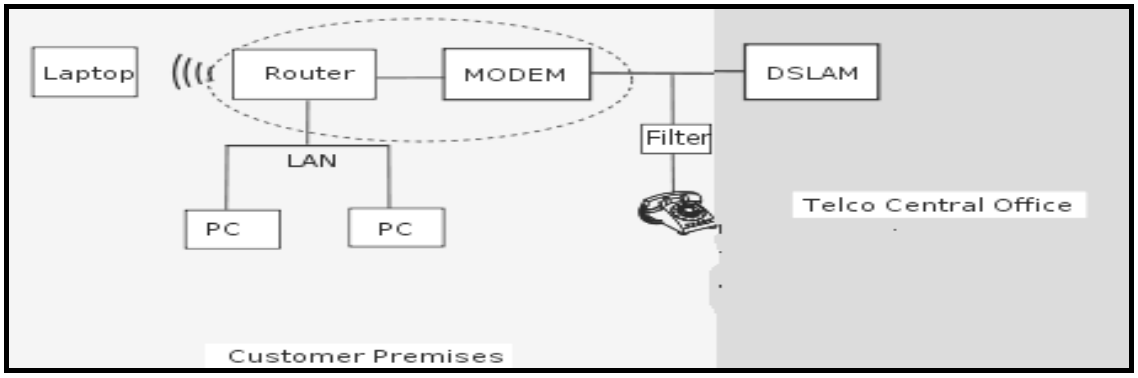


Fig. 13.1: DSL Connection schematic

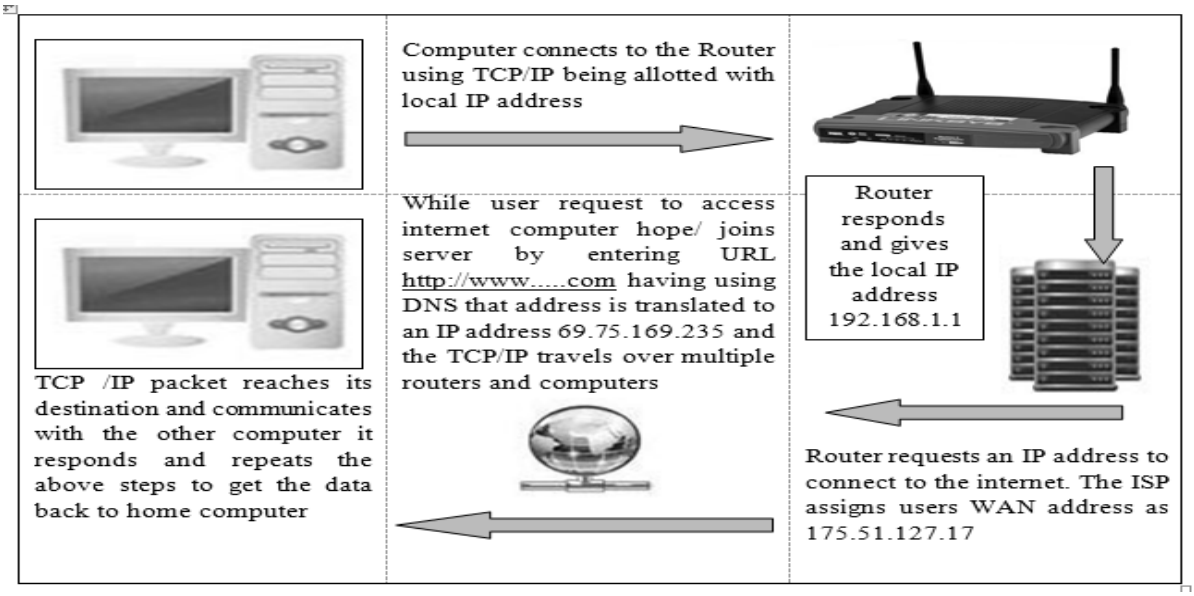


Fig 13.2 : Connection diagram for configuring Internet access using Router

Connecting to the Internet with a modem

Using dial-up to connect to the Internet requires user's computer to have an internal or external modem as well as a home phone line or landline.

After selecting a modem user need to find an ISP(Internet service provider). In most areas, Users can connect to the Internet using a local ISP. Or User may want to consider a large ISP, such as AOL or MSN, which provide Internet service in many areas all over the world.

Connect to the Internet with broadband

Internet using broadband is much faster than a modem. Having more bandwidth allows do more using of the Internet, such as watch movies, listening to music, and playing games, as well as better load times for websites. Most broadband services are provided by a phone or cable company.

If broadband service is available in area, the company can provide with the hardware (e.g., cable modem) required to connect to their service. This hardware usually connects to a Network card (RJ-45 connector). If provider does not offer a wireless router, or user can purchase a own router to share Internet connection with multiple computers and devices.

Connect to the Internet using a smartphone

User may also use smartphone to connect to the Internet by tethering, either by Bluetooth or Portable Wi-Fi hotspot or USB tethering. It is a process that allows it to act as a wireless access point for a computer.

Configuring Smart phone and computer for Internet service differs depending on which operating system phone uses, as well as the type of phone the user has. Check and follow online for specific instructions for the tethering software and smartphone being used.

b) Actual Circuit used in laboratory

IX Resources required

Sr. No.	Instrument /Components	Specification	Quantity
1	Personal Computers (For additional Terminals)	Intel P-IV , 2Gbyte , DDR2 , 500Gbyte HDD, Keyboard onwards Installed with Windows 7 onwards and internet connectivity	01
2	Router		01
3	Smartphone	May use Students handset of mobile	01
4	Cables	Straight cable (with RJ-45 connector)	02
5	Cables	RJ-11 for Telephone line	01

X Precautions to be Followed

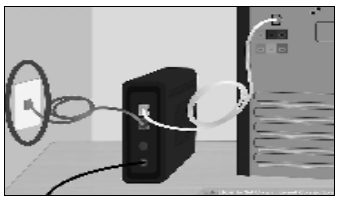
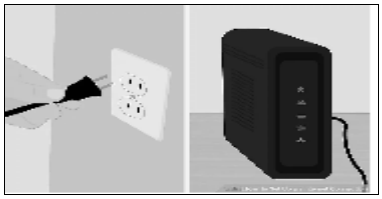
- Most new computers don't have a modem. If the computer has a modem, it should have an RJ-11 connection (not to be confused with an RJ-45 connection).
- A dial-up modem should not be confused with a broadband or cable modem.
- User shall follow instructions provided by ISP to connect modem to Internet service, as well as troubleshooting support for connectivity issues.
- Before tethering the smartphone, we recommend contacting the phone carrier to see if it supported and how much they charge.

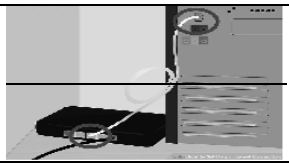
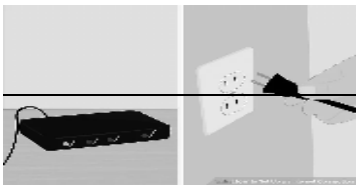
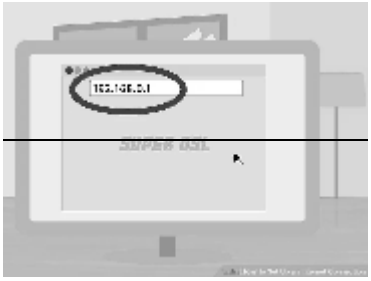
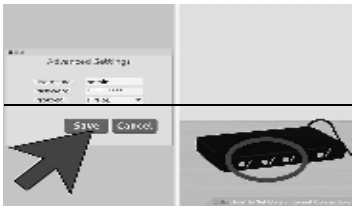
XI Procedure

To setup internet connection will be different ways.

- Cable internet connection.
- DSL internet connection.
- If user is not sure for type of internet connection they need to contact Internet Service Provider (ISP).

Different ways of Internet access	
Wired	**Wireless**
Cable	Bluetooth
Dial-up	Li-Fi
Ethernet	LTE
ISDN	Muni Wi-Fi
Power-line Broadband	Satellite
	Wi-Fi

Steps for Cable internet connection		
Step No.	**Activity**	**Diagram or observation**
1	Plug the cable modem into computer. Make sure computer is near a wall cable socket	
2	Plug the cable modem into the wall cable socket.	
3	Plug in the cable modem's power cord. Most of the modem's don't have an On/Off switch. Plugging and unplugging them is how turn them on and off.	
4	When the cable modem is turned on, it has to go through a boot up process. This makes process is done when most of the lights have turned on and stopped blinking. There is usually one light that will keep blinking. It usually takes about 30-60 seconds for a modem to finish turning on. User needs modem's serial number and its MAC address, both of which should be printed on the bottom or side of the modem while setup is going on.	
	To test internet connection. Open a web browser and go to a new website. If user visit to a website that has been recently visited, browser may load it from its cache. If the new website loaded, then you're connected to the internet. If not, it needs to troubleshoot. Try any other program that requires internet. Like visit social web site.	

Steps for DSL internet connection		
Step No.	**Activity**	**Diagram or observation**
1	Plug the DSL modem into computer. Make sure computer is near a wall cable socket.	
2	Plug the DSL modem into the wall cable socket.	
3	Plug in the DSL modem's power cord. Most modem's don't have an On/Off switch. Plugging and unplugging them will turn them on and off. When the cable modem is turned on, it has to go through a boot up process. This makes process is done when most of the lights have turned on and stopped blinking. It usually takes about 30-60 seconds for a modem to finish turning on. User needs modem's serial number and its MAC address, both of which should be printed on the bottom or side of the modem while setup is going on.	
4	Log in to the modem's administrative screen. Open a web browser. In the address field, type the modem's IP address. It's often printed on the modem itself. If not, it will be in the modem's manual. Common modem IP addresses are 192.168.0.1 and 192.168.1.1. Different modem has their specific IP addresses.	
5	Enter your DSL account username and password. Once connected to the modem's administrative screen, Enter DSL account username and password into text box available. The username usually is an email address. If don't know account username and password, contact DSL ISP.	
6	Save the settings. When the setup is complete, save the settings. The internet light on your modem should turn green to indicate that you are online.	
	Test Connection same as for Cable internet connection	

XII Resources used

Sr. No.	Instrument / Components	Specification	Quantity
1.			
2.			
3.			
4.			

XIII Actual procedure followed

Write steps for cable internet connection:

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Write steps for DSL internet connection:

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XIV Precautions followed (use blank sheet provided if space not sufficient)

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XV Observations (use blank sheet provided if space not sufficient

1. Internet is performing properly or not…….

XVI Result

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XVII Interpretation of Results

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XVIII Conclusions and Recommendations

(Actions/decisions to be taken based on the interpretation of results).

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XIX Practical Related Questions

Note: Below given are few sample questions for reference. Teacher must design more such questions so as to ensure the achievement of identified CO.

1. Label components/connection elements shown in the diagram given below.

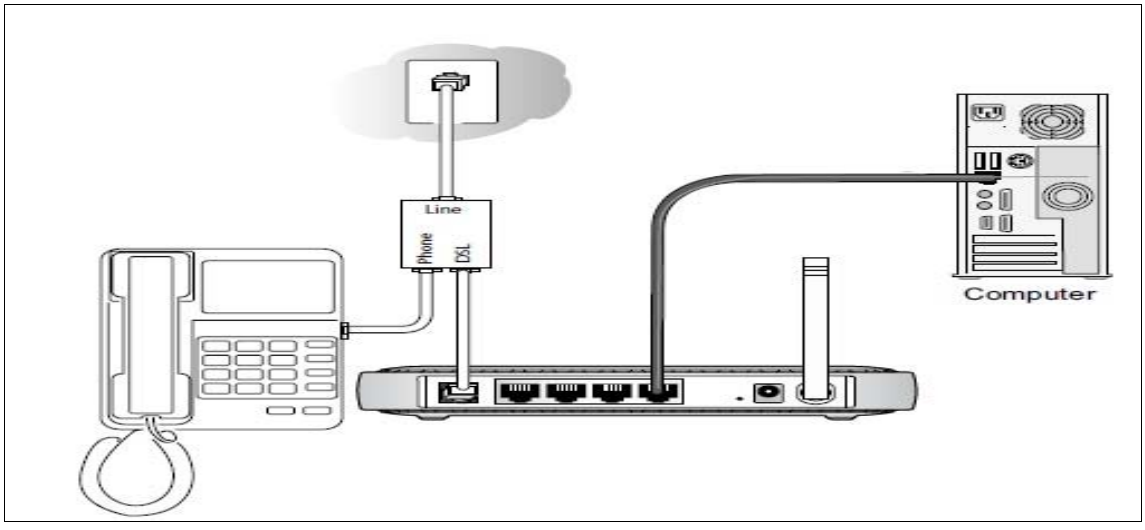

Figure for Question 1.

2. Suddenly switching OFF the Router will the user get Internet Access?
3. Restarting Computer next time will user get proper internet connection?
4. Is there effect on internet access, if the range /signal of the router is fluctuating?
5. If cablenet signal is weak what will be the effect on internet access?

[Space for Answers]

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XX References / Suggestions for further Reading

1. https://www.computerhope.com/issues/ch000720.htm
2. https://www.wikihow.com/Set-Up-an-Internet-Connection
3. http://www.tech2u.com.au/training/tech2u/internet/information.html

XXI Assessment Scheme

Performance indicators		Weightage
Process related: (15 Marks)		**60%**
1	Proper handling of the equipment	20%
2	Configure Internet connection.	20%
3	Establish Internet connection and troubleshoot error in connection (if any).	20%
Product related: (10 Marks)		**40%**
4	Results	20%
5	Practical related questions	10%
6	Submission of report in time	10%
	Total (25 Marks)	**100 %**

Name of Team Members

1. ……..
2. ……..
3. ……..
4. ……..

Marks Obtained			Dated signature of Teacher
Process Related (15)	**Product Related (10)**	**Total (25)**	

Practical No.14: Use FTP protocol to transfer file from one system to another system.

I Practical Significance

It is required in any organization to share files and resources as it simplifies the access to these resources from anywhere. It also reduces the cost of equipment as they are shared among multiple users. By sharing files, it reduces the storage cost. The student will be able to share files using File transfer protocol.

II Relevant Program Outcomes (POs)

- **Discipline knowledge**: Apply Electronics and Telecommunication engineering knowledge to solve broad-based Electronics and Telecommunications engineering related problems.
- **Experiments and practice:** Plan to perform experiments and practices to use the results to solve broad-based Electronics and Telecommunication engineering problems.
- **Individual and team work:** Function effectively as a leader and team member in diverse/ multidisciplinary teams.

III Competency and Practical skills

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences**:**
Maintain computer network systems.

IV Relevant Course Outcome

Use the relevant network model for the specified data communication system.
Configure the network component and assign IP address.

V Practical Outcome

Set up FTP client server and transfer files using FTP

.

VI Relevant Affective domain related Outcomes

- Installation of software .
- Follow ethical practices.

VII Minimum Theoretical Background

The file transfer protocol (FTP) is a standard network protocol used to transfer computer files between a client and server on a computer network. FTP is built on a client server architecture and uses separate control and data connections between the client and the server. FTP users may authenticate themselves with a clear- text sign- in protocol, normally in the form of username and password, but can connect anonymously if server is configured to allow it. For secure transmissions it protects the username and password and encrypts the contents.FTP is often secured with SSL/TLS (FTPS). SSH file transfer(SFTP) is also used sometimes.They are technologically different.

A client makes a TCP connection to the server's port 21. This connection , called the control connection, remains open for the duration of the session, with the second connection called the data connection, opened by the server from its port 20 to client port (specified in the negotiation dialog) as required to transfer file data

VIII a) Block Diagram

Filezilla is a powerful tool and a free software for transferring files over the internet

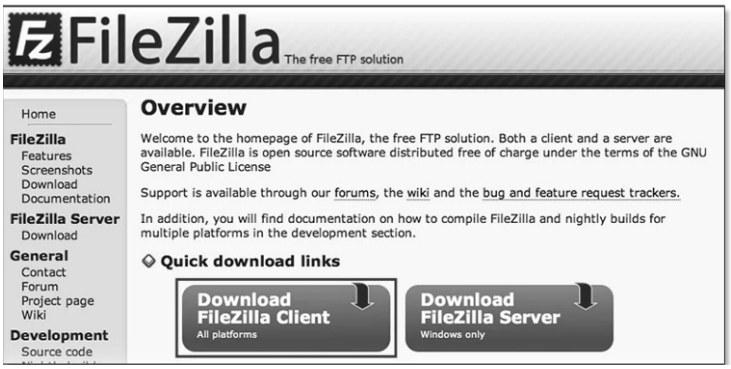


Fig 14.1. Filezilla download

IX Resources required

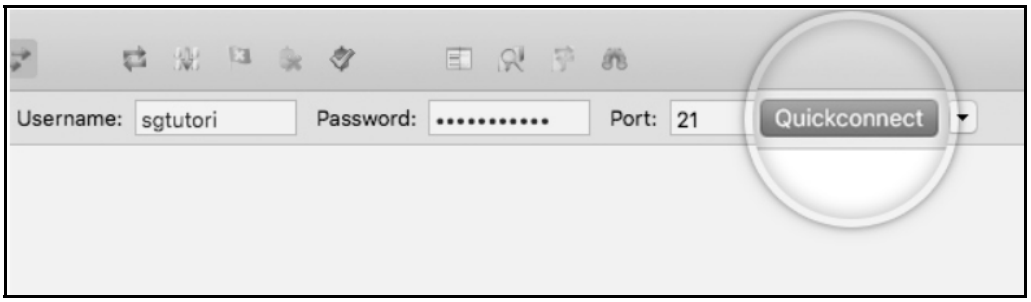
Sr. No.	Instrument /Components	Specification	Quantity
1	Personal Computer	Standard Specifications with internet connection	01
2	Filezilla software	Open source software	

X Precautions to be Followed

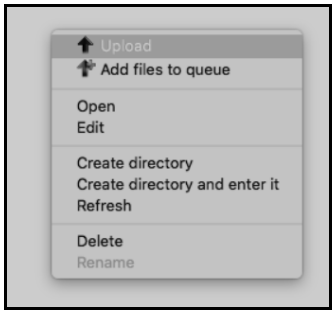
- Ensure compatibility of computer system with software.
- Install the software following the instructions carefully

XI Procedure

1. The FileZilla client is downloaded and activated on your computer. Enter domain name in the **Host** field or one can use the account's IP address. The **username** and the **password** that has to be entered are the same as that which used to log in. The **FTP port** is 21. Then, to connect, press the **Quickconnect** button.

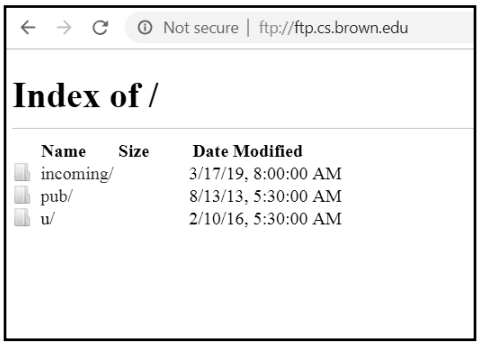


2. The user will get connected to hosting account and on the right side of the FTP client window a list of all the files and folders on your account will be displayed.
3. From the right panel of the FTP client navigate to the folder on the account in which the new files are to be uploaded.for example - **public_html**.



4. Then, select one or more files from the left side panel (from the computer from which files are to be transferred) to be uploaded and right click on them. From the menu that shows up, click the **Upload** button.
5. The transfer will automatically be initiated, which will be indicated at the bottom panel of the application.
6. Wait for the upload to complete, after which the uploading of these files will be logged in the **Successful Transfers** tab at the bottom panel.
7. Sample Exercise:

8. Access a Public FTP site



A public FTP site ftp://ftp.cs.brown.edu/is accessed using a browser is as given on the right.

A public FTP site ftp://ftp.cs.brown.edu/is accessed using command prompt:
At the Command prompt type "ftp"
ftp> open ftp.cs.brown.edu
Connected to ftp.cs.brown.edu.
220---------- Welcome to Pure-FTPd [privsep] [TLS] ----------
220-You are user number 7 of 50 allowed.
220-Local time is now 12:18. Server port: 21.
220-IPv6 connections are also welcome on this server.
220 You will be disconnected after 15 minutes of inactivity.
User (ftp.cs.brown.edu:(none)):
230 Anonymous user logged in
ftp>dir
200 PORT command successful
150 Connecting to port 55624
drwxrwxrwt 2 0 0 524288 Mar 6 03:30 incoming
drwxr-xr-x 33 0 2 8192 Aug 13 2013 pub
drwxr-xr-x 52 0 2 8192 Feb 10 2016 u
226-Options: -l
226 3 matches total
ftp: 204 bytes received in 57.17Seconds 0.00Kbytes/sec.
ftp>

9. After successful file transfer and completion of practical shut down the PC and switch off the supply

XII Resources used

Sr. No.	Instrument /Components	Specification	Quantity
1.			
2.			

XIII Actual procedure followed

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XIV Precautions followed (use blank sheet provided if space not sufficient)

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XV Observations (use blank sheet provided if space not sufficient)
Actual output observed / Perform any other exercise given by the teacher apart from the sample exercise
(Student should paste the output)

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XVI Result

1. …… (Public/ Private) FTP sites can be accessed without any authentication, and hence not secure.
2. In TCP/IP model, FTP makes use of TCP protocol with two ports, namely ……. and ……...
3. Files can be uploaded and downloaded ……..(faster/ slower) using FTP.

XVII Interpretation of Results

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XVIII Conclusions and Recommendations

(Actions/decisions to be taken based on the interpretation of results).

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XIX Practical Related Questions

Note: Below given are few sample questions for reference. Teacher must design more such questions so as to ensure the achievement of identified CO.

1. 1. FTP is built on _____ architecture
   a) Client-server b) P2P c) Both of the mentioned
   d) None of the mentioned
2. Full form of FTP is _____.
3. State the number of parallel TCP connections used to transfer a file in FTP? _____
4. TCP connections to transfer a file are _____ and _____ connection.
5. If 5 files are transferred from server A to client B in the same session.
6. State the number of TCP connection required between A and B .

[Space for Answers]

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XX References / Suggestions for further Reading

1. https://youtu.be/Xm1SvFuDnw0
2. https://youtu.be/6fBF19zYdd0
3. https://youtu.be/COSdHb-uSPA

XXI Assessment Scheme

Performance indicators		Weightage
Process related: (15 Marks)		**60%**
1	Installation of Filezilla software	30 %
2	Program execution	30%
Product related: (10 Marks)		**40%**
3	Results	20%
4	Practical related questions	10%
5	Submission of report in time	10%
	Total (25 Marks)	**100 %**

Name of Team Members

1. ……..
2. ……..
3. ……..
4. ……..

Marks Obtained			Dated signature of Teacher
Process Related (15)	**Product Related (10)**	**Total (25)**	

Practical No.15: Install and configure a Firewall for the network security.

I Practical Significance

A Firewall is a program that protects computer from malicious hackers that try to access computer from the internet. Use of firewall is highly recommended for all computer users. Many users are interested in either enabling or disabling their Windows Firewall for various reasons. Some users want to utilize a different firewall, and some may have turned theirs off by accident. Firewalls are tools that can be used to enhance the security of computers connected to a network, such as a LAN or the Internet. A firewall separates a computer from the Internet, inspecting packets of data as they arrive at either side of the firewall to determine whether it should be allowed to pass or be blocked. In this practical students will be able to install and configure firewall.

II Relevant Program Outcomes (POs)

- **Discipline knowledge**: Apply Electronics and Telecommunication engineering knowledge to solve broad-based Electronics and Telecommunications engineering related problems.
- **Experiments and practice:** Plan to perform experiments and practices to use the results to solve broad-based Electronics and Telecommunication engineering problems.
- **Individual and team work:** Function effectively as a leader and team member in diverse/ multidisciplinary teams.
- **Life-long learning:** Engage in independent and life-long learning activities in the context of technological changes also in the Electronics and Telecommunication engineering and allied industry.

III Competency and Practical skills

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences**:**

Maintain computer network systems.

Able to configure , enable and disable firewall

IV Relevant Course Outcome

Use the relevant network model for the specified data communication system.

Configure the network component and assign IP address.

V Practical Outcome

Install and configure a Firewall for the network security.

VI Relevant Affective domain related Outcomes

- Demonstrate working as a leader/a team member. .
- Follow ethical practices.
- Handle equipment carefully.
- Follow safety practices.

VII Minimum Theoretical Background

A firewall is designed to prevent unauthorized access to or from a private network. Firewall is implemented in either hardware or software form, or a combination of both. Firewalls prevent unauthorized internet users from accessing private networks connected to the internet, especially intranet.

Firewalls act as guards at the computer's entry points also called ports ; where the computer exchanges data with other devices on the network. Firewalls ensure that packets that are requesting permission to enter the computer meet certain rules that are established by the user of the computer. Firewalls operate in two ways, by either denying or accepting all messages based on a list of designated acceptable or unacceptable sources, or by allowing or denying all messages based on a list of designated acceptable or unacceptable destination ports.

Firewalls are relatively easy to install, setup and operate. There are different types of firewall technology and their suitability for small office/ home office and personal computer users.

Basic steps to Install a Firewall

Some operating systems have built-in firewalls that may be shipped in the "off" mode. Therefore:

1. Start >> Control Panel >> Administrative Tools >> Windows Firewall with Advanced Settings.
2. From the Actions pane (right-pane) click on Properties.
3. Select the appropriate firewall profile (Domain, Private or Public).

Drawbacks to Using Firewalls

For optimal protection against the variety of security threats that exist, firewalls should be used in conjunction with other security measures such as anti-virus software and encryption packages. As well, a well-thought out and consistently implemented security policy is vital to attaining optimal effectiveness of any security software.

Selecting Firewalls

Firewall applications vary in sophistication and cost. When selecting firewalls, the following considerations should be taken into account:

- Ease of installation/configuration
- Can firewall run without user intervention?
- Ease of configuration.
- Availability of help or technical support.
- Firewall cost shall be appropriate to the size of business/office?
- Requirement of maintenance/ monitoring
- Need of training requirement for usage.
- Reports , logs, audits generation

VIII a) Block Diagram

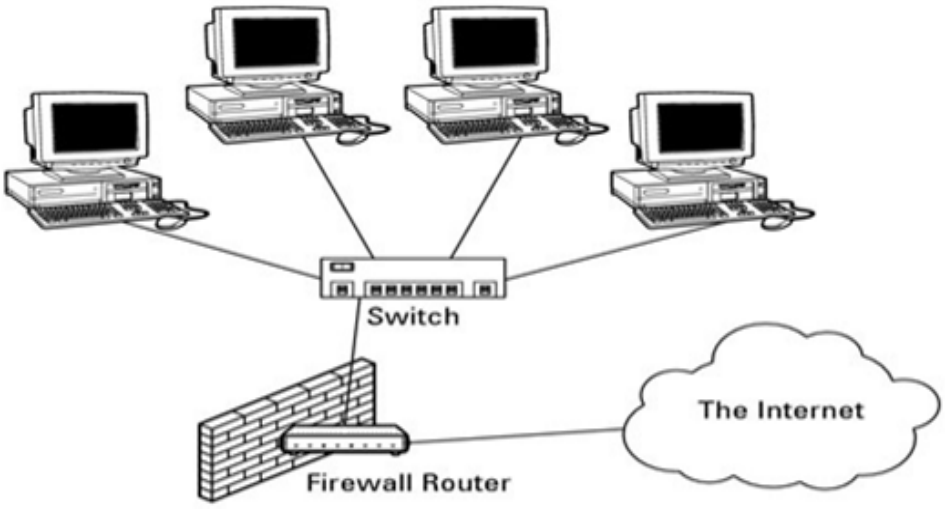

Fig 15.1: Concept diagram of firewall

b) Actual Circuit used in laboratory

IX Resources required

Sr. No.	Instrument /Components	Specification	Quantity
1	Personal Computers (For additional Terminals , Windows Operating system Installed	Intel P-IV , 2Gbyte , DDR2 , 500Gbyte HDD, Keyboard onwards Installed with Windows 7 onwards and internet connectivity	01
2	Any Freeware	Refer Given List of free Firewall	01

X Precautions to be Followed

1. Be sure to turn the firewall on.
2. Ensure that firewall is set up properly and updated regularly.
3. Check the online "Help" feature for specific instructions.

XI Procedure

Installation process of Firewall:

1. Chose a Firewall
   - Selection of the right Firewall is an important step. Either a simple and easy-to-use firewall or a firewall where user can configure everything it does.

Following are some of the free firewalls: (select any suitable from this)

i. Sophos XG Firewall Home Edition
ii. ZoneAlarm Free Firewall 2019 (but needs (Dot).Net Framework)
iii. AVS Firewall
iv. Avast Free Antivirus
v. Comodo Free Firewall
vi. TinyWall
vii. Outpost Firewall
viii. GlassWire
ix. Privatefirewall
x. OpenDNS Home

2. After choosing a suite install it according to the company's instructions. These instructions can normally be found from the firewalls website in Help.
3. After the firewall installs it will most likely require a reboot. Reboot the computer and watch for any pop-ups from the firewall during installation.
4. Read any pop-ups that appear on the computer after the restart, accept all of them from programs you use and trust.
5. If any pop-ups appear and don't know what they are for. Then go to a favorite search engine and type in the name of the program.
6. Computer should now be secure with the firewall, when it blocks any hacker attacks it will pop-up and alert the user.

How to Configure a Firewall in 5 Steps

Step 1: Secure the **firewall**. ...
Step 2: Architect the **firewall** zones and IP addresses. ...
Step 3: Configure access control lists. ...
Step 4: Configure other **firewall** services and logging. ...
Step 5: Test **firewall** configuration.

Fig. 15.2: Some popups may appear during firewall installation:

Microsoft Windows 8 and 10 both come with a pre-installed firewall utility, although it may be disabled by default.

Enabling Windows 8 or 10 firewall

Only one software firewall should be enabled at a time. If you have an antivirus or other security program installed with its own firewall, make sure it is disabled first.

1. Open the Control Panel
2. Click on System and Security
3. Click on Windows Firewall.
4. If the Windows Firewall is disabled, the Windows Firewall state will be Off. To turn it on, in the left navigation pane, click on Turn Windows Firewall on or off.
5. In the Customize Settings window, select Turn on Windows Firewalland click OK.

Disabling the Windows 8 or 10 firewall

- Unless any troubleshooting is done or any plan to install another firewall is there, it is recommended that the Windows Firewall is not disabled.
- If the user is disabling the firewall because a program can't be accessed by computer or the Internet, try to allow the program through the firewall first.
  1. Open the Control Panel
  2. Click on Windows Firewall.
  3. If the Windows Firewall is enabled, the Windows Firewall state will be On. To turn it off, in the left navigation pane, click on Turn Windows Firewall on or off.
  4. In the Customize Settings window, select Turn off Windows Firewall and click OK.

XII Resources used

Sr. No.	Instrument /Components	Specification	Quantity
1.			
2.			

XIII Actual procedure followed

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XIV Precautions followed (use blank sheet provided if space not sufficient)

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XV Observations (use blank sheet provided if space not sufficient)

Observe the performance of computer to launch applications and access to other computers or external devices

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XVI Result

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XVII Interpretation of Results

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XVIII Conclusions and Recommendations

(Actions/decisions to be taken based on the interpretation of results).

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XIX Practical Related Questions

Note: Below given are few sample questions for reference. Teacher must design more such questions so as to ensure the achievement of identified CO.

1. If a Firewall is left disabled, state the issues need to be handled.
2. Does the firewall have a significant impact on the operation of the system? State the performance of the system with and without firewall.
3. Firewall shall provide audit reports identifying time, location and type of attack etc. document the content of the audit report.

[Space for Answers]

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XX References / Suggestions for further Reading

1. https://www.computerhope.com/issues/ch000551.htm
2. https://www.computerhope.com/issues/ch000551.htm
3. https://www.wikihow.com/Protect-Your-Computer-With-a-Firewall
4. https://docs.microsoft.com/en-us/azure/firewall/overview
5. https://www.zonealarm.com/software/free-firewall (Free downloadable Firewall)

XXI Assessment Scheme

Performance indicators		Weightage
Process related: (15 Marks)		**60%**
1	Proper handling of the equipment	20%
2	Installation of firewall	20%
3	Testing of firewall	20%
Product related: (10 Marks)		**40%**
4	Results	20%
5	Practical related questions	10%
6	Submission of report in time	10%
	Total (25 Marks)	**100 %**

Name of Team Members

1. ……..
2. ……..
3. ……..
4. ……..

Marks Obtained			Dated signature of Teacher
Process Related (15)	**Product Related (10)**	**Total (25)**	

Practical No.16: Interconnect two PCs using RS232 cable and transfer data as null modem configuration.

I Practical Significance

Null modem: This term used to describe a communications method that does not utilize a modem. For example, two computers joined directly by a null modem cable utilizing the RS-232 port are said to be a null modem setup because they do not use modem to communicate. The practical will enable the student to use RS-232 cable to assess the speed of transfer of data in null modem configuration.

II Relevant Program Outcomes (POs)

- **Discipline knowledge**: Apply Electronics and Telecommunication engineering knowledge to solve broad-based Electronics and Telecommunications engineering related problems.
- **Experiments and practice:** Plan to perform experiments and practices to use the results to solve broad-based Electronics and Telecommunication engineering problems.
- **Individual and team work:** Function effectively as a leader and team member in diverse/ multidisciplinary teams.
- **Life-long learning:** Engage in independent and life-long learning activities in the context of technological changes also in the Electronics and Telecommunication engineering and allied industry.

III Competency and Practical skills

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences**:**

Maintain computer network systems.

To be able to establish connection between two computers using RS-232 cable/ Null Modem.

To be able to share data /files among the two computers connected using RS-232 cable.

IV Relevant Course Outcome

Configure the network component and assign IP address.

V Practical Outcome

Interconnect two PCs using RS232 cable and transfer data as null modem configuration.

VI Relevant Affective domain related Outcomes

- Demonstrate working as a leader/a team member. .
- Follow ethical practices.
- Handle equipment carefully.
- Follow safety practices.

VII Minimum Theoretical Background

Null modem is a communication method to directly connect two DTEs(Data Terminal Equipment) like computer terminal, printer, etc. using RS-232 serial cable. Null modem communication refers to using a crossed-over RS-232 cable to connect the teleprinters directly to one another without the modems. It is also used to serially connect a computer to a printer, since both are DTE, and is known as a Printer Cable.

The RS-232 (Recommended Standard) is asymmetric as to the definitions of the two ends of the communications link, assuming that one end is a DTE and the other is a DCE (Data Communication Equipment), e.g. a modem. With a null modem connection transmit and receive lines are cross-linked. Depending on the purpose, sometimes also one or more handshake lines are cross-linked. Several wiring layouts are in use because the null modem connection is not covered by the RS-232 standard.

A serial port complying with the RS-232 standard was once a standard feature of many types of computers. Personal computers used them for connections not only to modems, but also to printers, computer mice, data storage, uninterruptible power supplies, and other peripheral devices.

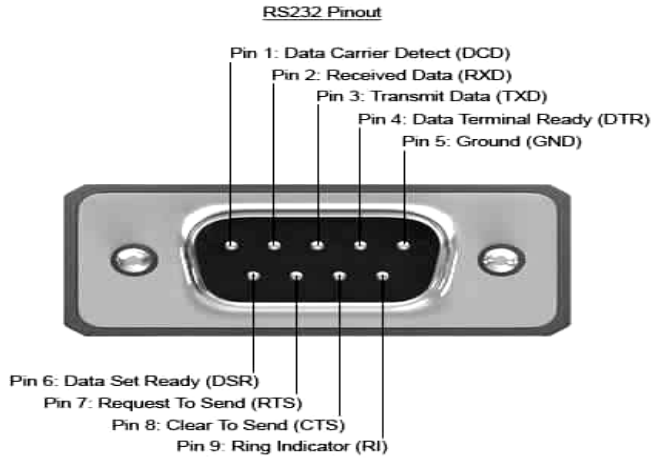

Fig 16.1: RS-232-(9-pin connector) details

Fig. 16.2: RS-232 (25 pin) to USB Connector/Convertor

Table 16.1: X-21 Cable Specification (For RS-232-connector)

SPECIFICATIONS	**RS232**
Total Number of Drivers and Receivers on One Line	1 DRIVER 1 RECVR
Maximum **Cable** Length	50 FT.
Maximum Data Rate	20kb/s
Maximum Driver Output Voltage	+/-25V

Table 16.2: 9 Pin Connector on a DTE device (PC connection)	
Male RS232 DB9	
Pin Number	**Direction of signal:**
1	Carrier Detect (CD) (from DCE) Incoming signal from a modem
2	Received Data (RD) Incoming Data from a DCE
3	Transmitted Data (TD) Outgoing Data to a DCE
4	Data Terminal Ready (DTR) Outgoing handshaking signal
5	Signal Ground Common reference voltage

Table 16.3: 9 Pin Connector on a DTE device (PC connection)	
Male RS232 DB9	
Pin Number	**Direction of signal:**
1	Carrier Detect (CD) (from DCE) Incoming signal from a modem
2	Received Data (RD) Incoming Data from a DCE
3	Transmitted Data (TD) Outgoing Data to a DCE
4	Data Terminal Ready (DTR) Outgoing handshaking signal
5	Signal Ground Common reference voltage
6	Data Set Ready (DSR) Incoming handshaking signal
7	Request To Send (RTS) Outgoing flow control signal
8	Clear To Send (CTS) Incoming flow control signal
9	Ring Indicator (RI) (from DCE) Incoming signal from a modem

Table 16.4: Characteristics of RS-232	
Parameter	**RS-232**
Cabling	Single Ended
Numbers of devices	1 transmitter 1 receiver
Mode of operation	Simplex or Full duplex
Maximum cable length	50 feet
Maximum data rate	20/kbits/sec
Signaling	Unbalanced
Typical logic levels	+/-5 ~+/-15V
Minimum receiver input impedence	3 ~ 7k-ohm
Receiver sensitivity	+/- 3V

VIII a) Block Diagram

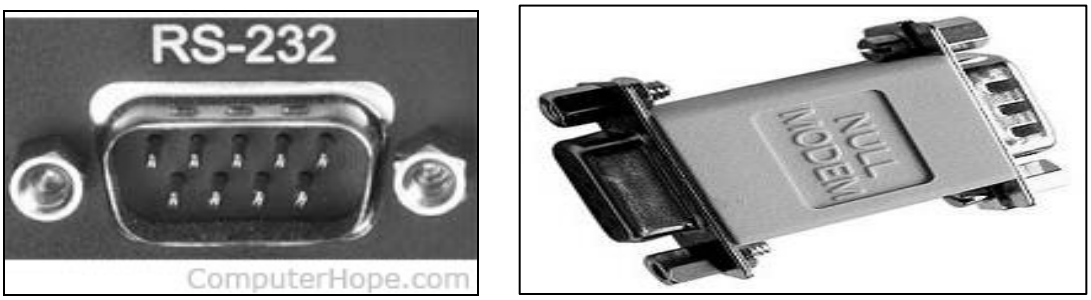

Fig 16.3: 9-pin RS-232 connectors and NULL MODEM Adaptor

Fig.16.4: A null modem cable

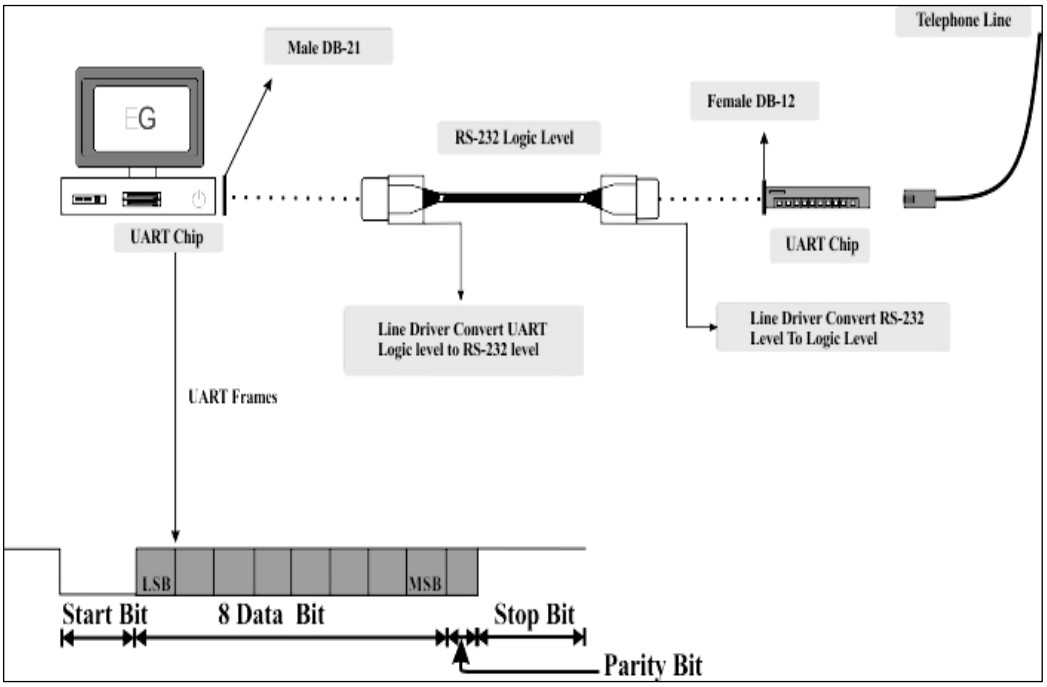

Fig. 16.5: Diagram Explaining Serial Data Exchange Between PC and Device Using RS232

Table 16.5: Common wiring diagram for a null modem

Below is a very common wiring diagram for a null modem cable to interconnect two DTEs (e.g. two PCs) providing full handshaking, which works with software relying on proper assertion of the *Data Carrier Detect* (DCD) signal:[1]

One side				Signal direction	Other side		
Signal and abbreviations		DB-25 pin	DE-9 pin		DE-9 pin	DB-25 pin	Signal
Frame Ground	FG	1	N/A	Common	N/A	1	FG
Transmitted Data	TxD, TD	2	3	→	2	3	RxD
Received Data	RxD, RD	3	2	←	3	2	TxD
Request To Send	RTS	4	7	→	8	5	CTS
Clear To Send	CTS	5	8	←	7	4	□TS
Signal Ground	SG	7	5	Common	5	7	SG
Data Set Ready	DSR	6	6	←	4	20	DTR
Data Carrier Detect	□CD, CD	8	1				
Data Terminal Ready	DTR	20	4	→	1	8	DC□
					6	6	DSR

b) Actual Circuit used in laboratory

IX Resources required

Sr. No.	Instrument /Components	Specification	Quantity
1	Personal Computers (For additional Terminals , Windows Operating system Installed	Intel P-IV , 2Gbyte , DDR2 , 500Gbyte HDD, Keyboard onwards Installed with Windows 7 onwards and internet connectivity	02
2	Null Modem cable	RS-232 with 9 -pin	01

X Precautions to be Followed

1. Using null modem cable there is the possibility of hardware flow control without being incompatible with the original way flow control was used with DTE/DCE communication.
2. Make sure serial ports are enabled in CMOS setup.
3. Because of cross connection, the DTR output line can be used for simple flow control. Incoming data is allowed when the output is set, and blocked if the output is not set.
4. The null modem cable with partial handshaking works in most cases. If user is developing software which must work with all kinds of cables, it is best to use software flow control only and ignore all modem control inputs.

XI Procedure

Setting up direct cable connection in Windows :

Step-by-step instructions for setting up direct cable connection in Windows 95 and Windows 98. The Null modem cable is required for these steps to work properly.

1. Null Modem Cable must be connected directly to each of the computers user want to connect, which means no other serial devices can be connected to either computer.
2. Make sure serial ports are enabled in CMOS setup.
3. For Direct Cable Connection to work, First install the software used for the communication.

To install Direct Cable Connection,

- Click Start, Settings ► Control Panel, and double-click on Add Remove Programs. Then click ►the Windows Setup tab, double-click the Communications icon,
- check the Direct Cable Connection box. If this box is already checked, it is recommended that uncheck the box and then place the check back in the box to ensure that the complete program is installed into the computer.
- Once completely installed, reboot the computer.

4. Once back in Windows click Start ►Settings ►Control Panel, double-click on Network, and then ►click File and Print Sharing.

- In File and Print Sharing, check the box next to "I want to be able to give others access to my files" also while in this window enable Print sharing.
- Click Ok,
- if Windows attempts to locate the drivers but is not able to, do this two times and reboot the computer again to ensure these settings are updated.

5. Once back into Windows, ►double-click My Computer, right-click on the drive you want to share your information on (e.g., C: drive) and click Properties.
   Once in Properties click the Sharing tab, click ►the option for Shared As, enter a Share Name, click ►the Apply, and then reboot the computer.
6. Once the above steps have been completed, Then decide which computer will be host and which computer will be guest. Once this is determined,
   first set up the host computer by clicking on Start► Programs► Accessories► Communications► click on Direct Cable Connection.
   In Direct Cable Connection choose the option for ►host, ►select the port, if so desired ►specify a password, and then click► Next.
   Computer should then wait for the guest computer to send signal to the host computer.
7. Once the above steps have been completed, on the second computer follow the above steps 1-5 again. Once done, click ►Start, ►Programs, ►Accessories, Communications, ►click on ►Direct Cable Connection.
   In the Direct Cable Connection box choose ►Guest, choose the ►communications port, click ►Next to have the computer start searching.
8. Once the Host and the Guest have been set up you should establish a connection; Now user can browse the hard drive that was shared through Network Neighborhood.

Alternative procedure /Similar way to share resources.

To connect two computers with an Ethernet cable:

Step 1: Connect both computers to a LAN cable. Use any LAN cable (crossover cable or Ethernet cable); it doesn't matter on a modern computer.

Step 2: OK, Turn on the sharing options on both computers.

Search for Control Panel in the start menu and open it. Here, go to "Network and Internet > Network and Sharing Center > Advanced sharing settings."

Select the radio option "turn on network detection" under public folder sharing.

Select the radio option "turn off password protected sharing."

type in password each and every time to access shared folders from another computer.

However, this is also a significant security risk. So, make sure to select "Turn on password protected sharing" for transferring the files via ethernet cable.

Step 3: Now bring both the computers on to the same network.

a. Open Control Panel > Network and Sharing Center.
b. Select Local Area Connection or Ethernet.
   Right-click it and go to its properties.
c. Select TCP/ IPv4 option there. Then Select it and then click on the Properties button.
d. In the properties window, select the option "Use the following IP address." Now, put the following values on 1st computer

- IP Address: 192.168.1.1
- Subnet mask: 225.225.225.0
- Default gateway: 192.168.1.2

It is not necessary if using the IP addresses are in same range,

On the second computer:

Open the IPv4 properties and enter the following values.

- IP address: 192.168.1.2
- Subnet mask: 225.225.225.0
- Default gateway: 192.168.1.1

Testing Connectivity: Need to keep the subnet mask same and changing the IP address. If everything works right, the two computer names are displayed in the Networks panel.

XII Resources used

Sr. No.	Instrument /Components	Specification	Quantity
1.			
2.			

XIII Actual procedure followed

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XIV Precautions followed (use blank sheet provided if space not sufficient)

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XV Observations (use blank sheet provided if space not sufficient

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XVI Result

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XVII Interpretation of Results

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XVIII Conclusions and Recommendations

(Actions/decisions to be taken based on the interpretation of results).

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XIX Practical Related Questions

Note: Below given are few sample questions for reference. Teacher must design more such questions so as to ensure the achievement of identified CO.

1. Share file from first computer to second computer.
2. Can user share files/folder from second to first computer?
3. Can user share printer from second computer?
4. Compare the speed of communication in LAN and in RS-232 communication.

[Space for Answers]

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XX References / Suggestions for further Reading

1. https://www.taltech.com/datacollection/articles/serial_intro#232c
2. https://www.lammertbies.nl/comm/info/RS-232_null_modem.html
3. https://www.computerhope.com/jargon/r/rs232.htm
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7. https://en.wikipedia.org/wiki/Serial_communication
8. https://www.wikihow.com/Connect-Two-Computers
9. https://www.computerhope.com/issues/ch000600.htm
10. https://www.electronics-notes.com/articles/connectivity/serial-data-communications/rs232-cables.php

XXI Assessment Scheme

Performance indicators		Weightage
Process related: (15 Marks)		**60%**
1	Proper handling of the equipment	20%
2	Identifying the various blocks	20%
3	Inserting the SIM card properly	20%
Product related: (10 Marks)		**40%**
4	Results	20%
5	Practical related questions	10%
6	Submission of report in time	10%
	Total (25 Marks)	**100 %**

Name of Team Members

1. ……..
2. ……..
3. ……..
4. ……..

Marks Obtained			Dated signature of Teacher
Process Related (15)	**Product Related (10)**	**Total (25)**	